# United States Patent [19]

**Schoettle et al.**

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[54] **TAPE RECORDER AND MAGNETIC TAPE CASSETTE WITH MOVABLE TENSIONING AND BRAKE MEANS**


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**Related U.S. Patent Documents**

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Filed: **Aug. 24, 1971**

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[51] **Int. Cl.²** ..... **G11B 23/04;** G11B 19/22

[58] **Field of Search** ..... 360/96, 128, 130, 71, 360/85, 93, 132; 226/89; 242/199, 75, 75.4, 75.42, 75.43



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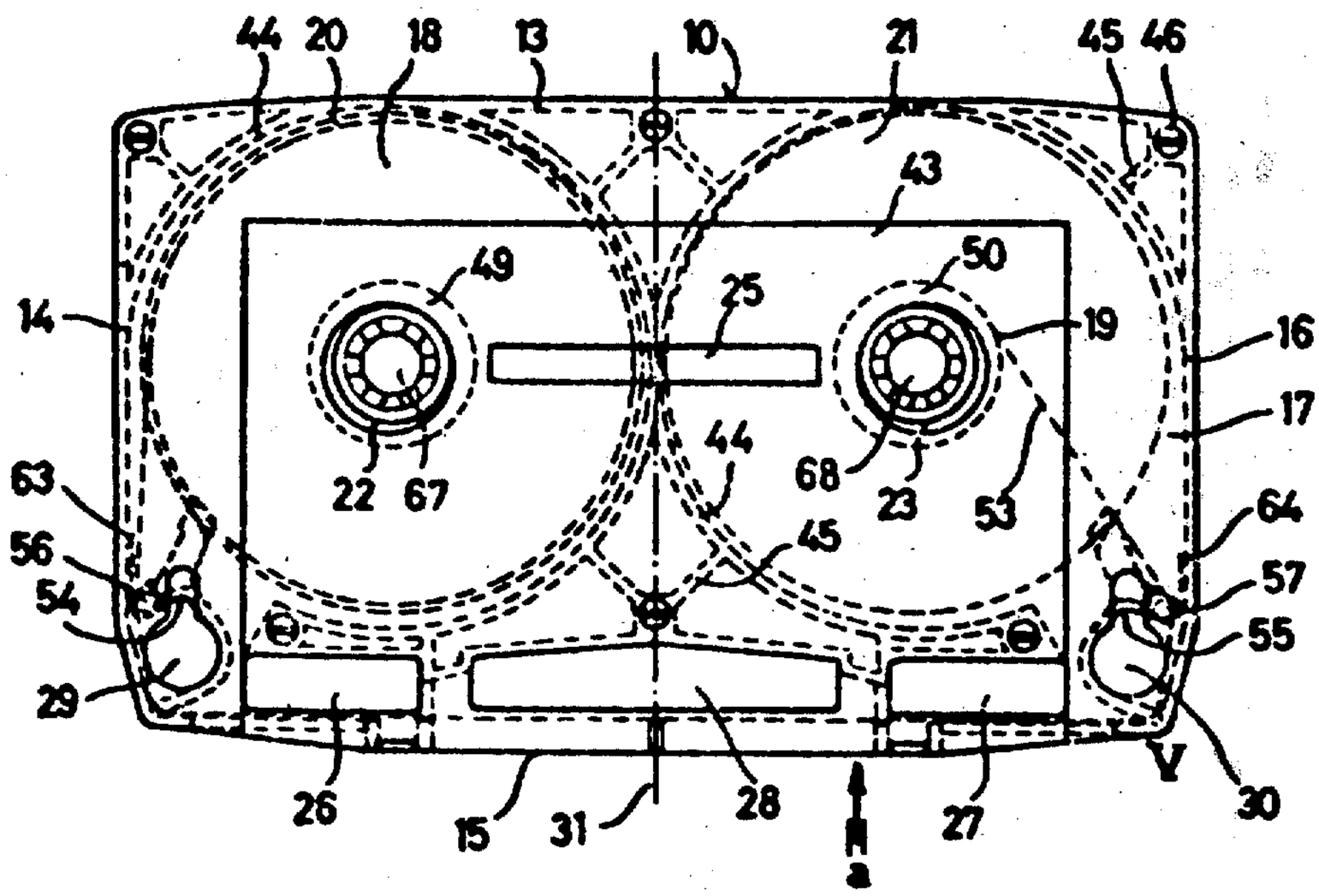
[57] **ABSTRACT**

The invention relates to a magnetic tape cassette and a tape recorder for use with such a cassette. More specifically, the invention relates to the provision of movable means within the cassette, which means—in a first position—hold the magnetic tape taut and prevent movement of the reels in the cassette and—in a second position—release the magnetic tape and the reels, which may then be rotated by the tape recorder, the tape being guided only by means attached to the recorder. Magnetic head positioning means provided on the recorder are adapted to adjust the position of magnetic heads, which are rigidly mounted on a head plate which is movable relatively to the tape, to the desired position for recording and reproduction.


**14 Claims, 8 Drawing Figures**



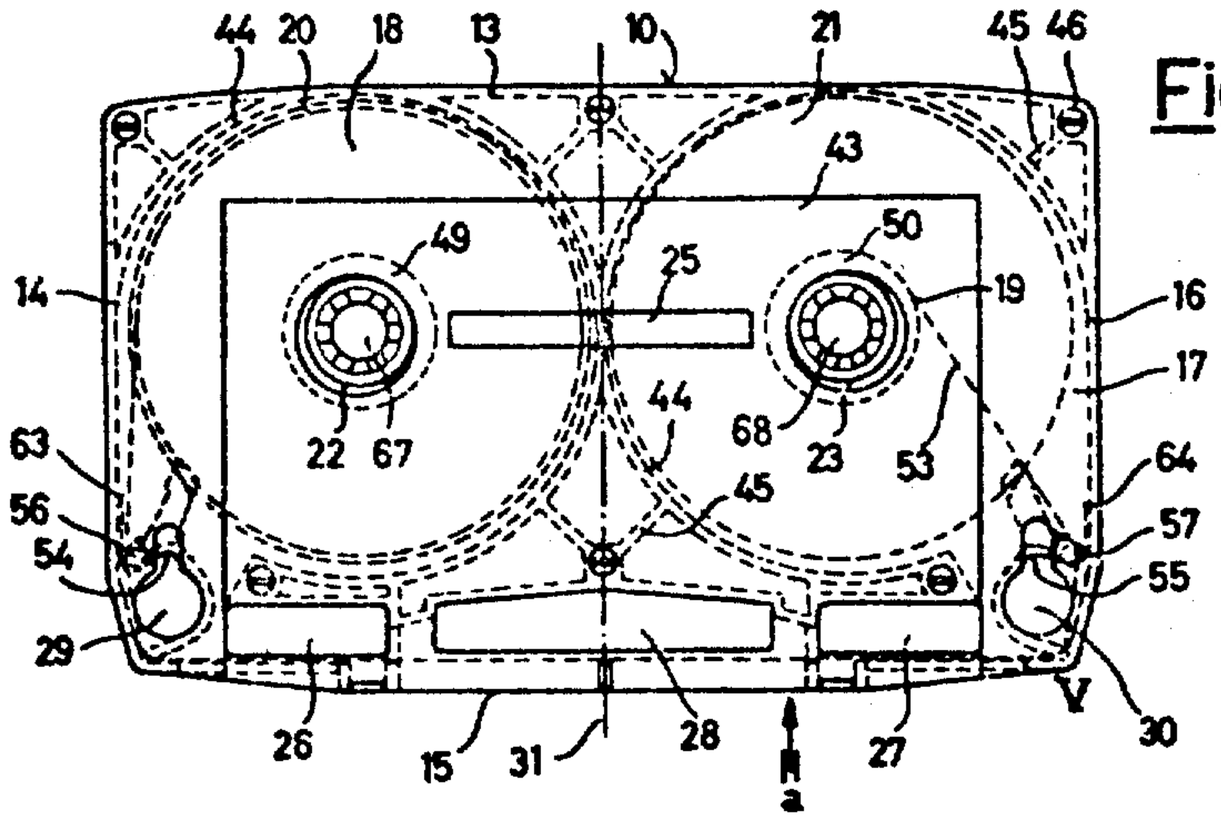



Fig.1

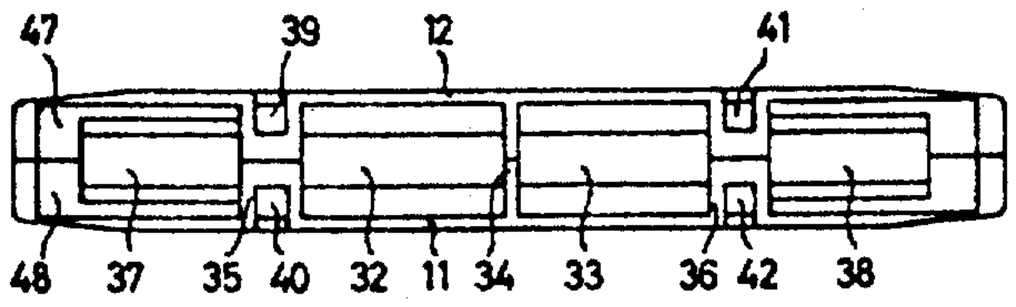



Fig.2

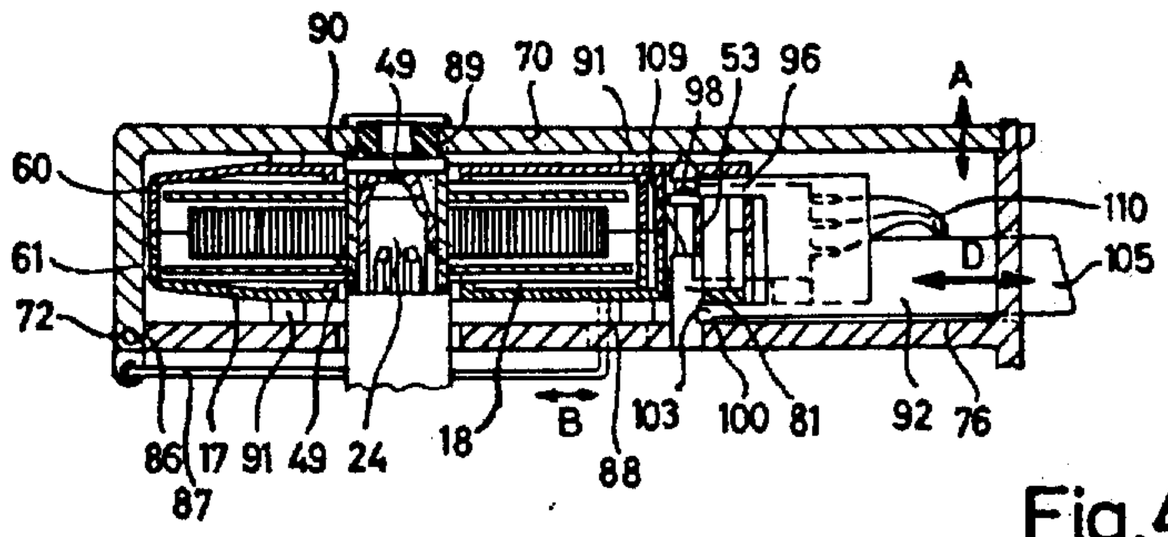



Fig.4

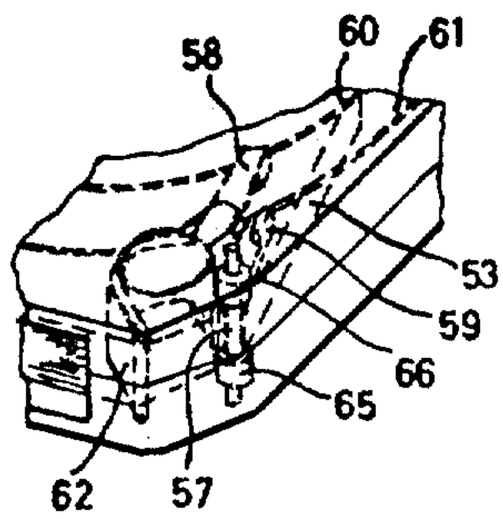
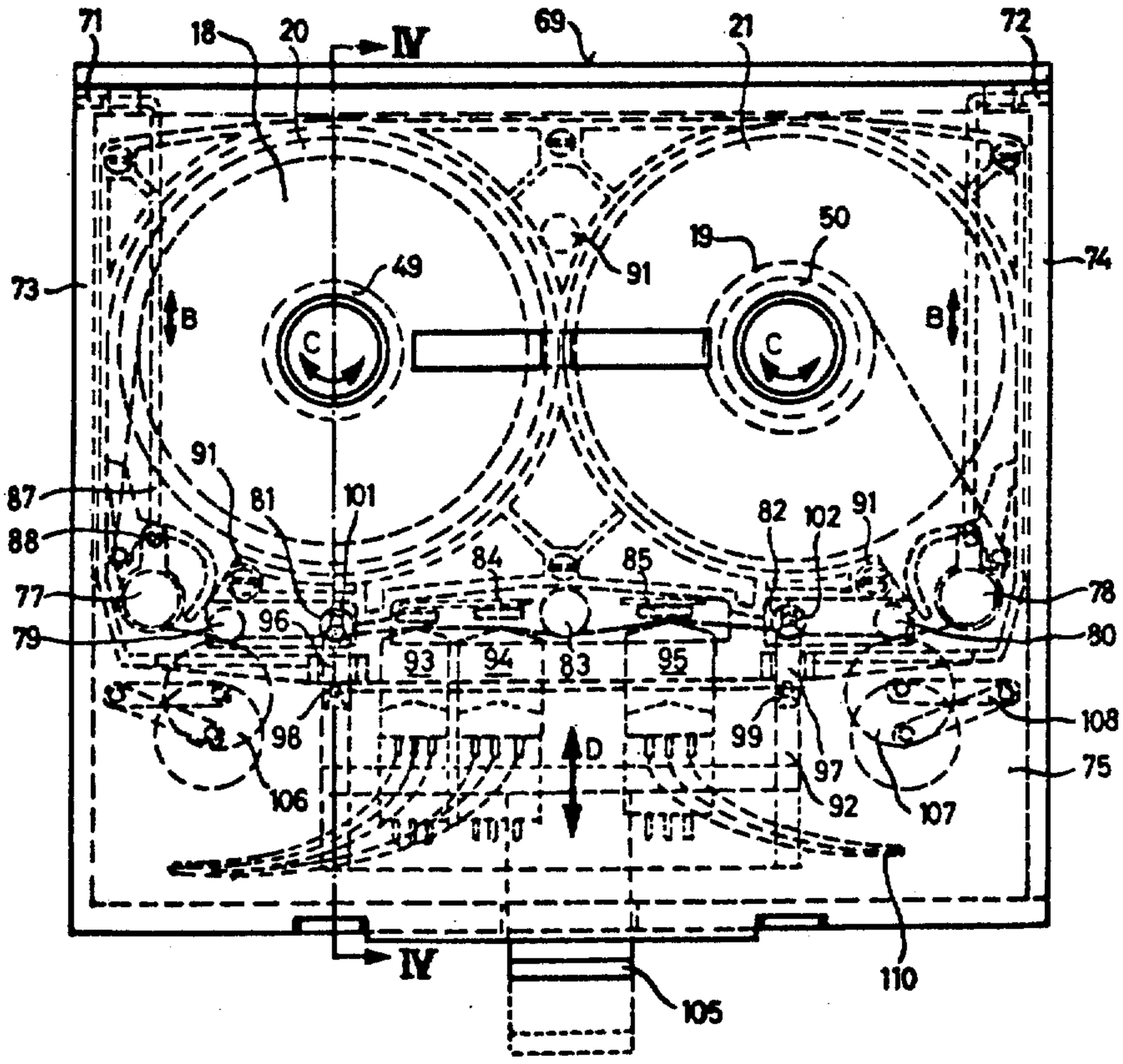



Fig.5

Fig.3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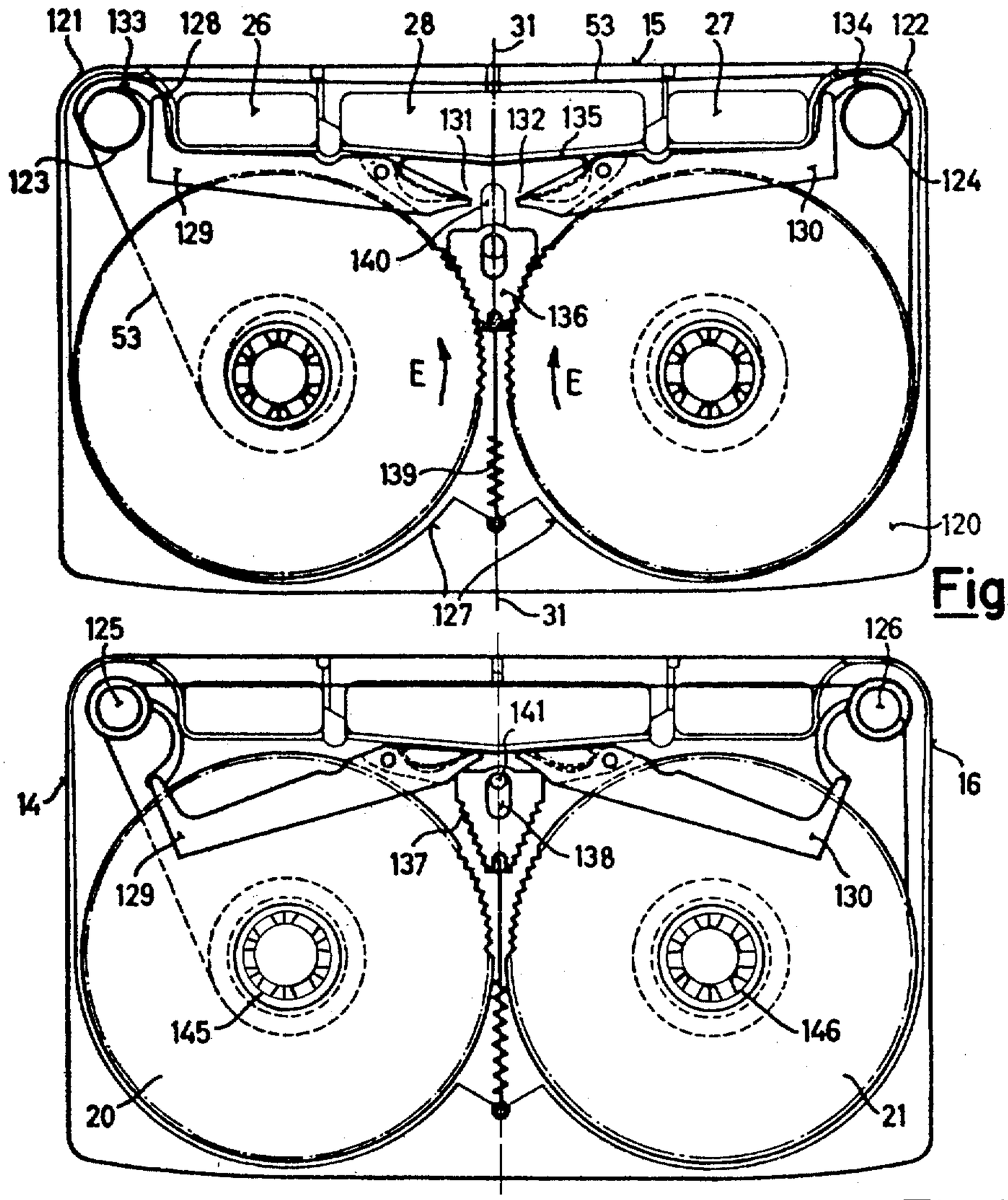


Fig. 6

Fig. 7

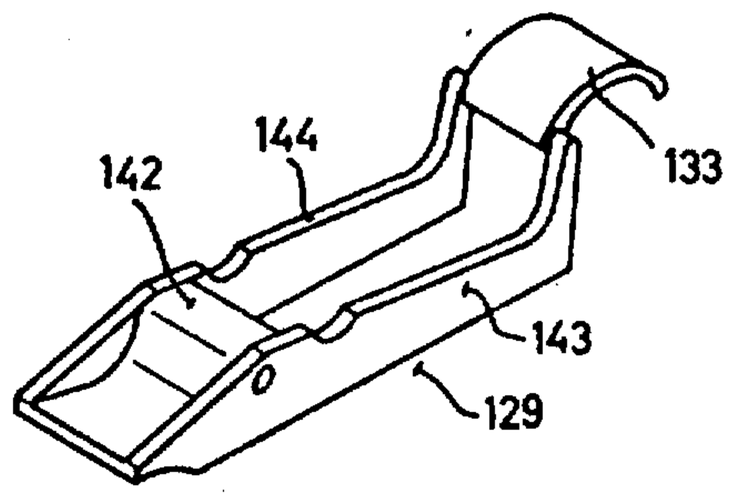


Fig. 8

# TAPE RECORDER AND MAGNETIC TAPE CASSETTE WITH MOVABLE TENSIONING AND BRAKE MEANS

**Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.**

This invention relates to a tape recorder with a magnetic tape cassette, the latter consisting of a substantially rectangular housing having a bottom wall, a top wall and side walls and containing one or more reels adapted to carry packs of magnetic tape, the reels and magnetic tape being driven by spindles and capstans provided on the tape recorder and adapted to pass through openings in the bottom and/or top walls of the cassette, the recording and reproduction of signals after the cassette has been placed in position on the recorder being effected by means of recording or reproducing heads which are provided on the recorder and which, together with at least one pressure roller, are adapted to enter at least one opening in the front wall of the cassette to bear against the magnetic tape passing along said front wall on the inside thereof.

Tape recorders using cartridges enable magnetic tapes to be handled more simply and safely than tape recorders employing reels of tape or tape packs, the handling of which is troublesome and time-consuming and almost inevitably leads to damage to the tape.

The *requirements placed on* high-quality tape recorders used in the studio or for data processing are very exacting as regards tape pace and tape guidance. Desirably, such equipment should be operable by unskilled personnel without the quality of the recording or playback results being impaired.

The prior art includes tape recorders which use reels or packs of magnetic tape and which ensure adequate tape guidance, thus making the recorders suitable for all applications, by the provision of all of the means for guiding and driving the tape in or on the recorder, the magnetic tape being transported between stationary tape guides and magnetic heads. As mentioned above, the disadvantage of such units resides in the time-consuming and difficult handling of the tape, calling for the services of experienced operators.

Cassette recorders are also known, in which the cassette contain the essential tape guide elements such as tape guide rolls and tape guide pins, the hub bearings and the pressure pads. The cassette housing is usually made of thermoplastics material which is not dimensionally stable to the required high degree when subjected to changes of temperature and humidity, with the result that the tape guide means, which are directly or indirectly connected to the cassette housing, alter their predetermined position in relation to the tape so that the position of the magnetic tape relative to the magnetic heads is also changed. The result of such changes in the position of the heads is poor or even useless recordings so that such cassette recorders are not very suitable for studio or data-processing applications.

Metal-reinforced plastic cassettes are also known. As is well known, the mass production of metal parts within narrow limits of tolerance can only be carried out on precision equipment and is thus very expensive. Subsequent machining of metal parts is hardly practicable on a mass-production scale and is even more expensive.



Summarizing, it can be said that prior art cassettes are not capable of meeting the high requirements as regards the accuracy and reliability of tape guidance, unless produced at great expense and in relatively small numbers.

It is an object of the invention to provide, whilst avoiding the aforementioned drawbacks of known magnetic tape recording systems, a cassette which can be mass-produced economically and a tape recorder for use with such a cassette, the combination ensuring optimum tape guidance and simplicity of operation with minimum tape damage.

It is a further object of the invention to provide simple means of locating the magnetic heads in a specific position relative to the magnetic tape, said magnetic heads being mounted on a head plate capable of movement towards said magnetic tape, and to ensure the accuracy of such positioning.

According to the invention, the said object is achieved by arranging for the reel guidance and/or tape guidance to be effected exclusively by guide elements mounted on the recorder and independently of the cassette housing, once the cassette has been placed in position on the recorder and the spindles have engaged the reel hubs in preparation for rotation thereof.

The resulting advantages are that the cassette constitutes a protective container for the tape reels right up to the point at which the reels are engaged by the spindles, this protective capability continuing after the cassette has been placed in position on the recorder, and that optimum tape guidance is achieved with only slight structural alterations to conventional tape recorders.

In an advantageous embodiment of the invention, the reels and the tape, when not engaged by the recorder, are held immovable in the cassette housing by holding means, the reels being prevented from turning in at least one direction.

The said holding means prevent the reels from moving freely in the cassette housing during transportation and thus prevent the tape from unwinding, becoming jammed or being damaged in some other manner.

According to a further embodiment of the invention, when the cassette has been placed in position on the recorder and the spindles have engaged the reel hubs in preparation for rotation thereof, the said holding means may be actuated by devices provided on the recorder and entering the cassette through openings in its bottom wall and/or top wall with the result that the reels and the magnetic tape are released.

The devices on the recorder provide a simple way of actuating the holding means such that the reels and tape are not released until just before movement of the reels and tape is possible.

In a further embodiment of the invention, the holding means are in the form of spring-mounted two-armed or three-armed levers located near the front wall of the cassette housing symmetrically with respect to the transverse center axis thereof and adapted to pivot in the plane of the cassette, by means of which levers the reels are held at their flanges and the magnetic tape is held taut in a position parallel to the front wall of the cassette housing.

This measure of holding the magnetic tape taut effectively prevents looping of the tape. Consequently, the tape cannot be damaged by external influences whilst it

is also protected from damage within the cassette housing due to jamming.

In an advantageous embodiment of the invention, the tape tensioning levers are each in the form of two hingedly interconnected levers, and a brake member, common to both reels, is located relative to the said interconnected levers such that when the brake member is displaced by means of a pin on the recorder both levers are actuated. This embodiment constitutes a reliable and particularly advantageous solution giving a minimum of tape wear and characterized by ease of production.

In an advantageous design of the movable means in the cassette of the invention, the ratio of the spring load on the tape tensioning levers to that on the brake member as well as the spatial arrangement of the tensioning levers, brake member and actuating pin on the recorder are so selected that when the tape tensioning levers and brake members are moved to their second position the reels are released before the magnetic tape is released by the tensioning levers.

When the means are dimensioned and arranged in this manner, the magnetic tape is readily changed from a taut state to a relatively tensionless state ready for operation in a simple manner and without damage.

In another embodiment of the invention, the said devices on the recorder are rolls, pegs or pins which are arranged relatively to the levers in such a manner that when the cassette is placed in position on the recorder and the reel hubs have been engaged by the spindles of the recorder in preparation for rotation thereof, the levers are actuated so as to release the reels and the tape.

The actuation of the levers may be effected in a very simple manner without any need for expensive mechanisms.

In a further embodiment of the invention, the cassette housing consists, in known manner, of identical halves joined together, the front wall being provided with two openings situated symmetrically on either side of the transverse center axis of the cassette and separated from each other by a reinforcing web and serving to admit the magnetic heads, whilst on the sides of said openings remote from the transverse center axis and separated from said openings by further reinforcing webs containing recesses for the accommodation of magnetic head adjusting means, there are provided, in symmetrical relationship to the transverse center axis of the cassette, further openings for admitting at least one pressure roll mounted on the recorder.

Accordingly, the magnetic heads and pressure rolls may enter the cassette without it being necessary for the cassette housing to be locked to the magnetic heads.

According to a further embodiment of the invention, the bottom wall and the top wall of the cassette housing are provided with openings for the insertion of capstans mounted on the recorder, near which openings further openings are provided for the admission of at least one tape guide element mounted on the recorder and one device for detecting the beginning and end of the tape, and further, a keyhole-shaped opening is provided in each of the bottom and top walls of the cassette above the levers for the accommmodation of a tape guide roll mounted on the recorder, the device connected to the recorder for actuating the levers also being located at said point, and a number of small openings or one large opening is provided parallel to the front wall for the



accommodation of one or more of the following recorder parts: a tape damping roll, a magnetic head screening shield and a spring-mounted pressure pad.

These features clearly show how simple the design of the cassette can be when the reel guidance and tape guidance are effected by means mounted on the recorder.

According to another embodiment of the invention, the magnetic head screening shields and pressure pads are adapted to conform to any position of the gap in the magnetic head.

In this way, the same cassette may be used on different tape recorders, and the screening shields and pressure pads can be optimally adapted to the number and gap positions of the magnetic heads used.

According to a further embodiment of the invention, the spindles are provided with compression springs in known manner, which springs are compressed in the splined holes in the reel hubs when the cassette is placed in position on the recorder, or, when the cassette has been placed in position, holding means on the recorder are applied to or inserted in the splined holes in the reel hubs, which holding means press down on the reels. These measures constitute a simple way of preventing the reels from changing position relatively to each other and from rubbing against the cassette housing.

It is an important feature of the recorder according to the invention that the magnetic heads are mounted on a head plate which may be moved toward and away from the cassette in known manner and which, after the magnetic heads have entered the casstte, bears against at least two points above and/or below the magnetic tape or tape guide elements mounted on the recorder, thus providing automatic positioning of the magnetic heads relative to the tape.

In this manner, the position of the magnetic head or heads in relation to the tape is fixed simply and reliably. The head gap is thus always in the optimum position in relation to the tape in all three of the possible planes.

It is also proposed that members rigidly mounted on the head plate pass through at least one recess in the front wall of the cassette housing and bear against the tape guide elements at points above and/or below the bottom wall or top wall of the cassette housing.

In a further embodiment of the invention, members rigidly mounted on the head plate pass through recesses in the front wall of the cassette housing to bear against the tape guide elements at points above the magnetic tape, whilst that edge of the head plate which faces the cassette bears against the tape guide elements below the magnetic tape.

The invention is described in detail below with reference to the accompanying drawings, in which

FIG. **1** is a plan view of the magnetic tape cassette of the invention,

FIG. **2** is a side view of the cassette shown in FIG. **1**, as seen in the direction of the arrow a,

FIG. **3** is a plan view of a tape recorder showing the cassette of FIG. **1** in the "tape-released" state,

FIG. **4** is a cross-section of the top portion of the tape recorder of FIG. **3**, taken along the line IV—IV,

FIG. **5** is a perspective view of a corner of the cassette of FIG. **1**,

FIG. **6** is a plan view of the bottom portion of one embodiment of a cassette in the "tape-arrested" state,

FIG. **7** is a plan view similar to FIG. **6** but with the cassette in the "tape-released" state, and

FIG. **8** is a perspective view, on a larger scale, of a tape tensioning lever as shown in FIGS. **6** and **7.**

A cassette **10** comprising a substantially rectangular housing **17** having bottom and top walls **11** and **12** respectively and side walls **13** to **16** and made of a polystyrene or some other suitable plastics material, contains reels **20** and **21** carrying magnetic tape packs **18** and **19.** The side walls **14** and **16** are partially bevelled toward the front wall **15** when viewed in plan. Each of the bottom and top walls **11** and **12** has circular holes **22** and **23** for the insertion of the winding spindles **24** on the recorder, a rectangular window **25** between said holes **22** and **23,** approximately rectangular slots **26, 27** and **28** near the front wall **15** and parallel thereto, and keyhole-shaped openings **29** and **30** in the neighborhood of the bevelled portions of the side walls **14** and **16.** The window **25,** the holes **22** and **23,** the slots **26** to **28** and the openings **29** and **30** are arranged symmetrically with reference to the transverse center axis **31** of the cassette **10,** the window **25** and the slot **28** extending on both sides of said axis **31.** The front wall **15** has openings **32** and **33** which are also arranged symmetrically with reference to the transverse axis **31** and which are separated from each other by a narrow reinforcing web **34.** On the sides of the openings **32** and **33** remote from the axis **31** there are further openings **37** and **38** which are separated from the said openings **32** and **33** by webs **35** and **36.** These webs **35** and **36** have recesses **39** to **42** disposed symmetrically relative to the longitudinal center axis of the front wall **15.** The area enclosed by line **43** on both the bottom and top walls **11** and **12** is flat, whereas the surfaces outside said area slope gently toward the side walls **13, 14** and **16.** Within the cassette housing **17** there are contained reels **20** and **21** located within arcuate ribs **44** integral with the bottom and top walls **11** and **12,** the diameter of the ribs being somewhat larger than that of the reels. These ribs **44** meet in the center plane of the cassette housing **17** and serve, as do other ribs **45,** to keep the reels in position and to stiffen the housing. Bores are provided at junctions of the ribs **44** and **45** and screws **46** fit in said bores to hold identical halves **47** and **48** of the housing together. The reels **20** and **21** carry, on hubs **49** and **50,** the packs of magnetic tape **18** and **19** with the magnetic tape **53** extending therebetween. Three-armed levers **54** and **55** are pivotally mounted near the keyhole-shaped openings **29** and **30** on metal shafts **56** and **57** held by the bottom and top walls **11** and **12.** Two arms **58** and **59** located one above of the other in spaced relationship serve to grip the reel flanges **60** and **61,** whilst a third arm **62** which is curved round the opening **29** or **30** presses the magnetic tape **53** into the corners of the housing formed between the side walls **14** and **16** and the front wall **15.** The pressure required for this purpose is provided by springs **63** and **64** which press against the side walls **14** and **16.** Thus the magnetic tape **53** passes from the tape packs **18** and **19** over the shafts **56** and **57,** which exhibit a low coefficient of sliding friction, to the arms **62** of the levers **54** and **55** and is held taut between the latter in a position parallel to the front wall **15** of the cassette housing. The shaft **56** passes through cylindrical extensions **65** and **66** (located one above the other in spaced relationship) of the levers **62,** which also form guides for the magnetic tape **53,** as may be seen in FIG. **5.** The arms **58** and **59** of the levers **54** and **55** press the reels **20** and **21** against the arcuate ribs **44** near the side wall **13** in such a way that when the cassette **10** is moved, the magnetic



tape **53** cannot unwind and thus form loops which could emerge through the openings **37, 38** and **32, 33** in the front wall **15.** The action of the levers **54** and **55** on the position of the reels **20** and **21** can be seen from the position of the splined holes **67** and **68** in the reel hubs **49** and **50** with relation to the circular holes **22** and **23.** In this state, the cassette can be transported and stored, etc., as there is no risk of the tape **53** being damaged in any way. FIG. **3** shows the cassette **10** in position on the deck of a tape recorder **69.** The reels **20** and **21** and the tape **53** are in the operating position, being engaged by the driving elements of the recorder **69.** In order to bring the cassette **10** into this position, a cover-plate **70,** which is attached to side walls **73** and **74** of the recorder housing **75** by means of hinges **71** and **72,** is swung upwardly (see double arrow A). The cassette **10** may then be placed on a surface **76** of the recorder housing **75,** during which process the following parts of the recorder enter the holes, slots and openings of the cassette housing **17:** tape guide rolls **77** and **78** enter the keyhole-shaped openings **29** and **30,** capstans **79** and **80** enter the rectangular slots **26** and **27** (in which there is also room for tape guide pins **81** and **82** and for means (not shown) for detecting the beginning and end of the tape), a tape damping roll **83** and, on each side thereof, magnetic head screening shields **84** with spring-mounted pressure pads **85** enter the slot **28,** and the spindles **24** enter the splined holes **67** and **68** in the reel hubs **49** and **50.** Rods **87** are hingedly connected to a bottom edge **86** of the cover-plate **70,** the free ends of said rods being bent at right-angles to form vertical pins **88.** The latter enter the keyhole-shaped openings **29** and **30** together with the guide rolls **77** and **78,** the position of said pins being at the lower end of the slotted portion of the opening such that the pins engage the arms **62** and levers **54** and **55.** When the cover-plate is swung from one position to the other, the rods **87** move horizontally in slots (not shown) in the surface **76.** When, after insertion of the cassette, the cover-plate **70** is closed, each of the pins **88** is drawn to the top end of the elongated portions of the openings **29** and **30** so that the levers **54** and **55** are moved out of their holding position and the reels **20** and **21** and the tape **53** are released. The operations taking place when the cassette **10** is placed on the recorder are arranged to occur successively to prevent the magnetic tape **53** from being damaged by the elements on the recorder when they enter the openings in the cassette **10.** The cover-plate **70** carries ball bearings **89** disposed centrally over the splined holes **67** and **68** in the reels **20** and **21;** pin **90** tapered at its end rotates within said ball bearings and extends into the upper part of the splined holes **67** and **68** and rotates therewith when the reels are rotated. This counterbearing prevents the reels **20** and **21,** which are freely movable in the cassette housing **17** independently thereof when the levers **54** and **55** have been released, from rubbing against parts of the cassette housing **17** and altering their position relative to each other. The same effect is also achieved by the mere weight of the cover-plate acting on the reels without the counterbearings. The flat surface of the bottom and top walls **11** and **12** of the cassette housing **17,** as defined by the line **43,** is supported on the recorder **69** by three projections **91.** In FIG. **4,** two such projections are visible on the cover-plate **17** and two on the baseplate **76.**

The double arrows B and C indicate the directions of movement of the rods **87** and thus of the pins **88** and also the directions of rotation of the reels.

The recorder **69** has magnetic heads **93** to **95** mounted on a head plate **92.** From the two positions of the head plate **92** and magnetic heads **93** to **95** shown in FIG. **3** in dashed lines it can be seen that the head plate **92** may be moved toward or away from the cassette **10,** these movements, which are sliding movements in the present example, being indicated by the double arrow D. Two members **96** and **97** are mounted vertically on the head plate **92** and are parallel thereto. The tips of members **96** and **97** are in the form of pins **98** and **99** which project beyond the front edge **100** of the head plate **92.** The vertical distance between these pins **98** and **99** and the head plate **92** is such that when the head plate **92** is urged against the cassette **10,** the said pins pass through the recesses **39** and **41** in the cassette housing **17** above the tape **53** to engage in bores **101** and **102** provided in the tape guide pins **81** and **82** on the recorder. In this position of the head plate **92,** its front edge **100** rests on grooves **103** in the tape guide pins **81** and **82** below the tape **53.** The head plate **92** thus assumes an aligned position with reference to the tape guide pins **81** and **82** on the recorder and automatically positions the magnetic heads **93** to **95** in relation to the tape **53.** In this simple manner, the gaps of the magnetic heads **93** to **95** assume optimum positions relative to the tape **53** in all possible planes. When the head plate **92** is pushed toward the cassette **10,** as may be readily effected manually by actuation of a sliding member **105** or which may be effected automatically, pressure rollers **106** and **107** are moved into the openings **37** and **38** of the cassette housing **17** by means of levers (not shown) within the recorder **69.** The tape **53** in the cassette is thus ready for recording or reproduction. The pressure rollers **106** and **107,** each having a swivel arm **108,** are also shown in their two positions.

The reference numeral **93** designates an erasing head, **94** a recording head and **95** a reproducing head. The electric leads connected to the magnetic heads are designated by the reference numeral **110.**

The tape guide pins **81** and **82** are provided with guides **109.** When the cassette **10** is in the position shown in FIG. **3,** tape guidance is effected exclusively by guide means on the recorder. If necessary, openings may be made in walls **14** and **16** of the cassette housing **17** near the openings **29** and **30** for the insertion of conventional tape tension sensors or swivelling arms for quick starting and stopping of the tape.

FIG. **6** shows another embodiment of a cassette whose bottom wall **120** is similar in shape to that of FIGS. **1** and **2.** In this case, however, the corners **121** and **122** between the side walls **14** and **16** and the front wall **15** are rounded (like parts in FIGS. **1** and **6** have like reference numerals). Circular holes **123** and **124** having a small lip are provided near the rounded corners **121** and **122** approximately concentrically therewith. These holes serve to admit guide rolls **125** and **126.** Arcuate ribs **127** serve to stiffen the housing and position the reels, as in FIG. **1.** Approximately L-shaped tape tensioning levers **129** and **130** are pivotally mounted on the bottom wall **120** of the cassette in the proximity of the slots **26** to **28.** Each of these tensioning levers has a pointed end portion **131** and **132** respectively. Associated with each corner **121** and **122** there is an arcuate guide edge **128** forming a continuation of



said corners. Between the holes **123** and **124** and the associated guide edges **128** there are situated comma-shaped levers **133** and **134** of approximately the same radius of curvature as the arcuate guide edges, said comma-shaped levers being hinged to the short limb of the L-shaped levers **129** and **130.** In the first position of the tensioning levers **129, 130,** as shown in FIG. **6,** the comma-shaped levers **133, 134** pass round the lips of the holes **123, 124** and thus hold the magnetic tape **53** away from the holes in a position parallel to the front wall. The pointed end portions **131, 132** of the levers **129, 130** extend to near the transverse center axis **31** of the bottom wall **120** of the cassette. The pivot pins of these levers are near said end portions **131, 132,** between the reels **20** and **21** and the slot **28.** The said end portions **131, 132** are engaged by the two limbs of a leaf spring **135** which bears against a rib provided along the slot **28,** the L-shaped levers thus being held in their first position. Opposite said leaf spring **135** there is located a wedge-shaped locking or brake member **136** with serrations **137** on each side thereof. This member **136** is situated between the flange of the reels **20** and **21,** and the upper flanges of said reels **20, 21** are provided with corresponding serrations around their edges, as partially indicated in the Figure. For reasons of tolerance and ease of production, the lower flanges of the reels **20, 21** are not provided with serrations but have a radius which is smaller than that of the upper flanges by the distance representing the height of the teeth. The locking member **136** whose height is slightly less than the internal height of the cassette is provided with a slot **138** and a tension spring **139** at its apex, the other end of said tension spring being attached to arcuate ribs **127.** In the first position, as shown in FIG. **6,** the brake member **136** is in the locking positions, in which the reels **20** and **21** are urged against the ribs **127** and the side walls **14** and **16.** In this position, the reels can move slightly in the direction of the arrow E but cannot rotate in the opposite direction and consequently the tape **53** cannot unwind. In the position shown in FIG. **6,** the slot **138** overlaps a slot **140** in the bottom wall **120** of the cassette to such an extent that a pin **141** on the recorder (see FIG. **7**) can enter said slots when the cassette is placed on the recorder. The pin **141** may be connected to a rod hinged to the cover-plate of the recorder like pins **88** in FIG. **4.** However, the cover-plate must be hinged to the recorder on the opposite side to that of the cover-plate **70** of FIG. **4.** When the cassette is placed on the recorder, guide rolls **125, 126** and spindles **145, 146** enter openings **123, 124** and **22, 23** respectively provided in the bottom and top walls of the cassette housing. The reels **20** and **21** are centered, the locking member **136** being pushed toward the front wall **15.** At the same time, the pin **141** enters the slots **138** and **140.** In this position therefore, the tape **53** is held slightly taut by the tensioning levers **129** and **130** and the locking member **136.** However, when the cover-plate or lid (not shown) of the recorder is closed, the pin **141** is moved a short distance toward the front wall **15** resulting in the reels being released followed by pivoting of the tensioning levers **133** and **134** from their first position due to actuation by the locking member **136.** When the lid is opened, the sequence of operations is reversed, i.e. the levers move back into their first position before the locking member **136** has reached its first position, in which it arrests the reels. The temporal spacing of these operations is achieved by using springs **135** and **139** of appropriate

force and appropriately dimensioning and arranging the slots **138** and **140** in spaced relationship. This ensures that a sufficient length of tape may be drawn from the reels **20** and **21** to avoid damage to the tape **53** when the levers **133, 134** are moved to their second position, as shown in FIG. **7.**

In the operating position of the cassette on the recorder, as shown in FIG. **7,** the tape **53** passes around the guide rolls **125, 126** of the recorder and along the tape guide means provided on the recorder and extending through the slots **26** to **28** in the cassette in the manner described with reference to FIG. **3.**

An important difference between the embodiments of the cassette **10** and that of the cassette incorporating the bottom wall **120** is that when the cassette is placed on the recorder, as shown in FIG. **7,** no part of the cassette influences tape guidance, whereas in the case of FIG. **3** tape guidance may be slightly influenced by the pivot pins **56** and **57** of the cassette.

Furthermore, the path of the tape in the cassette relative to the capstans **79** and **80** (see FIG. **3**) is better in FIG. **7,** as the tape is not permanently in contact with the capstans over an arc thereof. Moreover, the design of the cassette is such that production thereof is easier.

The tape tensioning lever **129** is shown on a larger scale in FIG. **8,** which shows the owing to the lack of room inside the housing the tensioning levers **129** and **130** comprise members **143** and **144** which are interconnected in spaced relationship by a web **142** such that said levers move above and below the flanges **60, 61** of the reels **20, 21.** The comma-shaped lever **133** hinged thereto is made in one piece and has a height which is greater than the width of the tape **53.**

In summary, then, the following can be said: The cassette according to the invention may be produced in a simple manner and in large numbers and is sufficiently rigid to be used to advantage for data processing or in the studio. The recorder shows only slight structural changes as compared with prior art recorders, with the result that the magnetic tape in the cassette, when in operation on the recorder, passes the magnetic heads in the optimum position as regards accuracy and reliability of tape guidance, this being enhanced by automatic magnetic head positioning means. This means that signals may be recorded and reproduced with great reliability. Further embodiments of the tape recorder and cassettes therefor are conceivable within the scope of the claims, which embodiments are also claimed.

We claim:

**1.** In combination, a tape recorder and a magnetic tape cassette, said cassette having a substantially rectangular housing having a bottom wall, a top wall and side walls and containing one or more reels adapted to carry packs of magnetic tape, the reels and magnetic tape being driven by spindles and capstans provided on the tape recorder and adapted to pass through openings in the bottom and/or top walls of the cassette, the recording and reproduction of signals after the cassette has been placed in position on the recorder being effected by tape-scanning means on the recorder and which, together with at least one pressure roller, are adapted to pass through at least one opening in the front wall of the cassette to bear against the magnetic tape passing along said front wall on the inside thereof, wherein there are provided in the cassette movable tensioning means for the tape and movable brake means for the reels, and said tensioning means and said brake means being spring-loaded towards a first position so as to assume said position when the cassette is removed from the recorder; said tape tensioning means having two tensioning levers which are hingedly mounted near the front wall of the cassette to pivot in the plane of the cassette, and said reel brake means having two brake portions opposite said two reels, respectively; each of said tensioning levers being located in the first position of said tensioning means, around a corresponding opening in the cassette housing for the admission of a corresponding guide roll on the recorder, in gripping relationship to said tape so as to hold said tape taut in a plane parallel to the front wall of the cassette, and each said brake portion being located, in the first position of said brake means, in flange-gripping relationship to the corresponding reel so as to prevent said reel from turning in at least one direction and wherein there are provided means on the recorder designed to pass through apertures in the bottom wall and/or top wall of the cassette for moving said tensioning means and said brake means, when the cassette is placed on the recorder, to a second position in which said tensioning levers release said tape and said brake portions release said reels and in which reel guidance, and also tape guidance at least along said front wall, are effected exclusively by means, including said guide rolls, provided on the recorder independently of the cassette housing.

**2.** A magnetic tape cassette as set forth in claim **1,** wherein openings are provided in the bottom and top walls of the cassette near its front wall for the joint admission of capstans and tape guide elements, a further opening being provided for the admission of at least one tape damping roll, one magnetic head screening shield and one pressure pad, and further openings are provided in the bottom and top walls for the admission of the tape guide rolls and the actuating pins on the recorder.

**[ 3.** A tape recorder as set forth in claim **1,** wherein said guide means for the reels consist of compression springs provided on the spindles of the recorder, said springs being compressed in the splined holes of the reel hubs when the cassette is placed in position on the recorder and remaining so until the cassette is removed. **]**

**4.** The combination as set forth in claim **1,** wherein said guide means comprise holding means provided on the recorder, which means press down on the reel hubs of the cassette after the latter has been placed in position on the recorder.

**[ 5.** A tape recorder for use with the magnetic tape cassette set forth in claim **1,** wherein members which are rigidly attached to a magnetic-head plate capable of movement toward the magnetic tape moved with said magnetic-head plate to bear against tape guide elements on the recorder, to which end they extend beyond the tape inside or outside openings in those parts of the cassette housing which are adjacent to the front wall of said housing and which protect the magnetic tape. **]**

**6.** The combination as set forth in claim **1,** wherein members rigidly attached to a magnetic-head plate are provided with pins on the recorder which are adapted to fit into bores in the tape guide pins after passing through recesses in the front wall of the cassette housing within parts of the cassette housing and above the magnetic tape, while that edge of the magnetic-head plate which faces the cassette is adapted to fit into

grooves in said tape guide pins below the magnetic tape and outside parts of the cassette housing.

7. A magnetic tape cassette which comprises a substantially rectangular housing having a bottom wall, a top wall and side walls and containing one or more reels adapted to carry packs of magnetic tape, said cassette further including openings for accommodating the spindles and/or capstans of a tape recorder, said cassette still further including at least one opening in its front wall for accommodating a tape scanning means and pressure roller carried by said tape recorder, said opening in the front wall being arranged so that said pressure roller bears against the magnetic tape passing along the front wall of said cassette and on the inside thereof; said cassette still further including tensioning means for the tape and brake means for the reels, both said means being movable between a first and second position, said tensioning means and said brake means being spring-loaded towards said first position; said tape tensioning means having two tensioning levers which are hingedly mounted near the front wall of the cassette to pivot in the plane of the cassette, and said reel brake means having two brake portions opposite said two reels, respectively; each of said tensioning levers being located, in the first position only of said tensioning means, in gripping relationship to said tape around a corresponding opening in the cassette housing for the admission of a corresponding guide roll on the recorder, so as to hold said tape in place, and each said brake portion being located, in the first position only of said brake means, in flange-gripping relationship to the corresponding reel so as to prevent said reel from turning in at least one direction.

8. A tape recorder for use with the magnetic tape cassette set forth in claim 7, wherein the tape tensioning levers and the brake portions are moved to their second position by means of pin-carrying rods attached to the cover-plate of the recorder, the pins thereof being adapted to pass through openings provided in the cassette in the bottom and top walls thereof above the tape tensioning levers and the brake member.

9. A magnetic tape cassette as set forth in claim 7, wherein the tape tensioning levers and brake portions are in the form of levers having two rigidly connected arms each, one of which arms is located, in the first position, round the openings for the guide rolls of the records, while the other arm, in said first position, bears against the flanges of the reels.

10. A magnetic tape cassette as set forth in claim 7, wherein the tape tensioning levers are each formed by two hingedly interconnected levers, and a brake member, common to both reels and including said two portions, is located relative to the said interconnected levers such that when the brake member is displaced by means of a pin on the recorder both levers are actuated.

11. A magnetic tape cassette as set forth in claim 10, wherein the ratio of the spring load on the tape tensioning levers to that on the brake member as well as the spatial arrangement of the tensioning levers, brake member and actuating pin on the recorder are so selected that when the tape tensioning levers and the brake member are moved to their second position the reels are released before the magnetic tape is released by the tensioning levers.

*12. In combination, a tape recorder and a magnetic tape cassette;*



*said cassette comprising a substantially rectangular housing with a top wall, a front wall and side walls and containing a pair of reels adapted to carry packs of magnetic tape, said bottom and/or top walls having therein apertures and said front wall at least one opening;*

*said recorder comprising spindles and capstans adapted to pass through said apertures for driving said reels and said tape, respectively, and comprising tape-scanning means and at least one pressure roller adapted to pass through said opening for bearing against the length of tape passing along said front wall on the inside thereof and effecting the recording and reproduction of signals after the cassette has been placed in position on said recorder;*

*wherein there are provided in said cassette abutment portions, resilient means, and control means, said resilient means being disposed in cooperating relationship to said control means, and said control means being actuable against the action of said resilient means and including reel-brake means cooperating with said abutment portions and tape-tensioning means controlled by said reel-brake means,*

*said brake means having an actuating portion and having two braking elements opposite said two reels, respectively, and said brake means being disposed in said cassette for longitudinal sliding movement, perpendicularly to said front wall, between a first, off-recorder position in which said braking elements clamp said reels against said abutment portions and a second, on-recorder position in which said braking elements release said reels from said abutment portions, and*

*said tensioning means having two tensioning elements disposed in cooperative relationship to said brake means for rocking movement, under the control of said brake means, in the plane of the cassette between first, off-recorder positions in which said tensioning elements render said length of tape taut along said front wall and second, on-recorder positions in which said tensioning elements release said length of tape; and*

*wherein there are provided on the recorder actuating means designed to pass through one of said apertures for cooperation with said acutating portion of said brake means;*

*said resilient means being effective, when the cassette is removed from the recorder, to longitudinally move said brake means in one direction to their first position, and hence cause said tensioning elements to rock to their first position, and*

*said actuating means being effective, when the cassette is placed in operative position on the recorder, to longitudinally move said brake means in the opposite direction to their second position, and hence cause said tensioning elements to rock to their second positions.*

*13. The combination as claimed in claim 12 wherein said cassette is designed to allow for relatively free translational movement of said reels while said brake means are in their second position; and wherein there are provided on the tape recorder, coaxially with said spindles, counterbearing means which, with the cassette in operative condition on said recorder and hence said reels at one end in place on said spindles, engage the other end of said reels to aid in the centering of said reels and hold said reels down so that they are kept from rubbing against the cassette housing.*

*14. The combination as claimed in claim 12 wherein said recorder has at least one pressure pad for admission into said cassette through one of said apertures in said bottom wall and/or top wall, said length of tape in operation being urged against said pressure pad by said scanning means which pass through said opening in the front wall of the cassette.*

*15. The combination as claimed in claim 12, wherein there are further provided on said recorder tape-locating means which, after said cassette has been placed in operative condition on the recorder, are passed through corresponding apertures in the bottom and/or top wall of the cassette adjacent the front corners thereof, for causing said length of tape to be accurately guided, independently of the cassette housing, in a plane parallel to said front wall.*

*16. A magnetic tape cassette which comprises a substantially rectangular housing having a bottom wall, a top wall, a front wall and side walls and containing a pair of reels adapted to carry packs of magnetic tape, said bottom and/or top walls having therein apertures for accommodating the drive spindles and capstans of a tape recorder, said front wall having therein at least one opening for accommodating tape-scanning means and at least one pressure roller carried by said tape recorder, said opening being arranged so that said pressure roller bears against the length of tape passing along the front wall of the cassette and on the inside thereof;*

*wherein there are provided in said cassette abutment portions, resilient means, and control means, said resilient means being disposed in cooperating relationship to said control means, and said control means being actuable against the action of said resilient means and including reel-brake means cooperating with said abutment portions and tape-tensioning means controlled by said reel-brake means,*

*said brake means having an actuating portion engagable through one of said apertures and having two braking elements opposite said two reels, respectively, and said brake means being disposed in said cassette for longitudinal sliding movement, perpendicularly to said front wall, between a first, off-recorder position in which said braking elements clamp said reels against said abutment portions and a second, on-recorder position in which said braking elements release said reels from said abutment portions, and*

*said tensioning means having two tensioning elements disposed in cooperative relationship to said brake means for rocking movement, under the control of said brake means, in the plane of the cassette between first, off-recorder positions in which said tensioning elements render said length of tape taut along said front wall and second, on-recorder positions in which said tensioning elements release said length of tape;*

*said resilient means being effective, when the cassette is removed from the recorder, to longitudinally move said brake means in one direction to their first position, and hence cause said tensioning elements to rock to their first position, and*

*said actuating portions being effective, when engaged upon the cassette being placed in operative condition on the recorder, to longitudinally move said brake means in the opposite direction to their second position, and hence cause said tensioning elements to rock to their second positions.*

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