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2,987,956 6/1961 Planert et al. 242/200 X
 3,408,017 10/1968 Hashimoto 242/200
 3,497,157 2/1970 Hanes et al. 242/200

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[54] **TAPE RECORDER HAVING A TAPE CARTRIDGE**
13 Claims, 5 Drawing Figs.

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[51] **Int. Cl.** **G03b 1/04,**
G11b 15/32, G11b 23/04

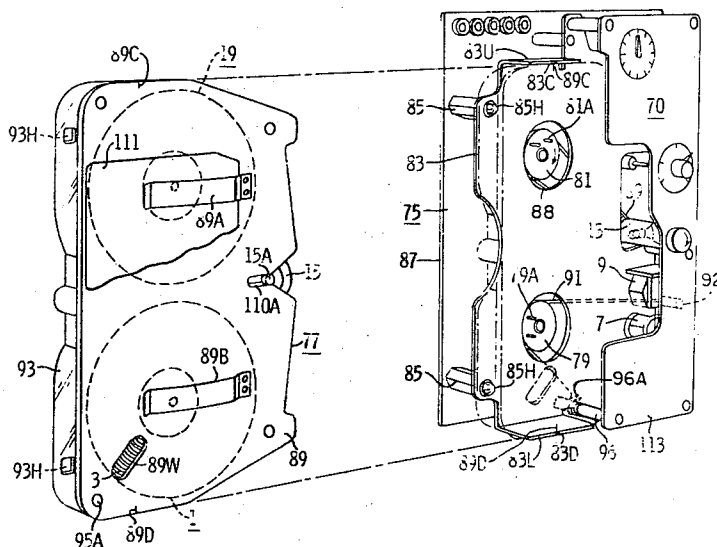
[50] **Field of Search** **242/197,**
200; 40/20, 23, 306, 308, 312; 206/DIG. 29, 46

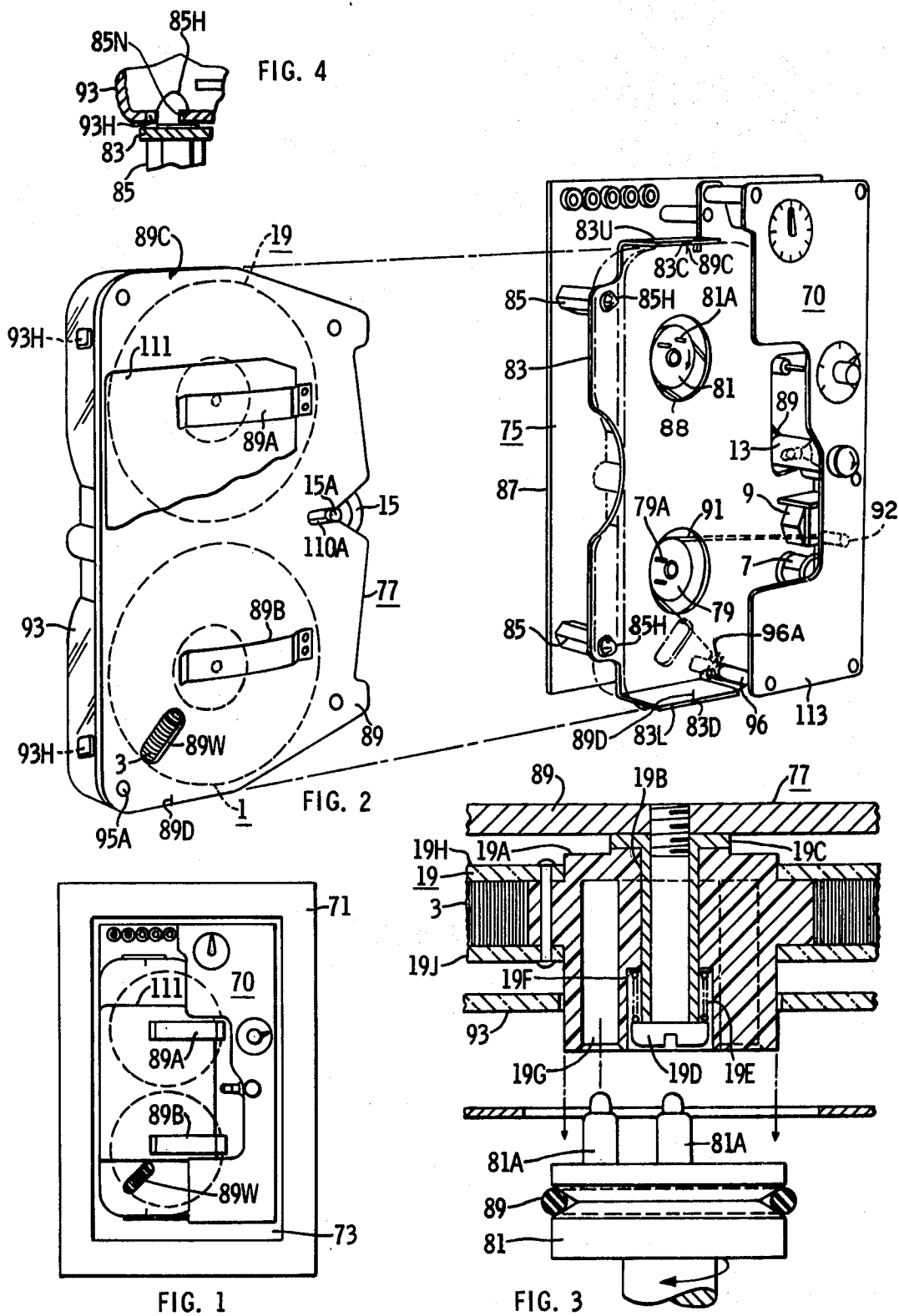
[56] **References Cited**

UNITED STATES PATENTS

1,975,173 10/1934 Pennock et al. 206/46

ABSTRACT: A tape recorder is provided with a tape cartridge unit wherein a payout or supply reel and a takeup reel are mounted side-by-side on parallel-spaced axes. When the cartridge unit is in its operating position, the reels are in a plane adjacent to, and parallel to, the front of the tape recorder. A pressure roller presses the tape against a capstan which is mounted separately from the cartridge unit. A single spring provides this pressure and also holds the cartridge unit releasably in operating position and further operates a brake to inhibit movement of the reels when the cartridge unit is removed from its operating position. The tape is directed from the pressure roller to the inner sides of the reels.





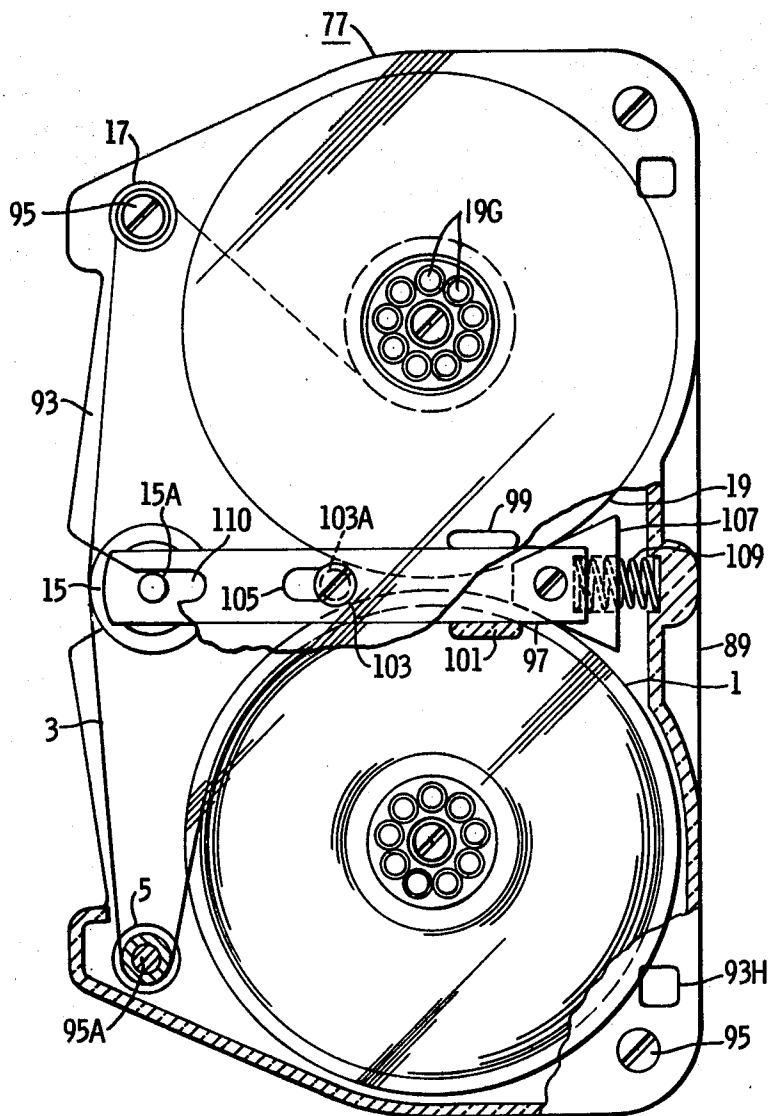


FIG. 5

WITNESSES

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TAPE RECORDER HAVING A TAPE CARTRIDGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to tape-recording devices and it has particular relation to tape-recording devices for recording pulses representing magnitudes of a variable quantity.

Although the invention may be employed for recording various quantities in relation to time, it is particularly suitable for a tape recorder which is utilized to record the consumption of an electric quantity, such as watt-hours over a long period of time such as one month.

2. Description of the Prior Art

In order to conduct a survey showing the consumption of a variable quantity such as watt-hours of electric energy it has been the practice to record a series of pulses on survey magnetic tape each of the pulses representing the consumption of a predetermined amount of electric energy. A series of timing pulses occurring at regular intervals also was applied to the magnetic tape. At the end of a survey period the survey magnetic tape was removed from the survey device and the information thereon was transferred to 1/2-inch magnetic tape or cards or was analyzed by a computer. The survey magnetic tape was run from a payout or supply reel to a takeup reel and these components required separate handling in the field. Examples of the prior art practice will be found in the Snyder U.S. Pat. No. 3,059,239 and the Lenehan U.S. Pat. No. 3,148,329.

In some cases a plurality of tracks were recorded on a tape each representing a different function of a variable quantity. For example one track sometimes was provided for recording watt-hours whereas a second track was provided for recording var hours supplied to the same load. Such an arrangement is disclosed in the application of Carl J. Snyder entitled "Multiple Track Magnetic Pulse Recording of Related Quantities," Ser. No. 301,504 filed Aug. 12, 1963, and assigned to the same assignee as the present patent application, which is now U.S. Pat. No. 3,470,470.

SUMMARY OF THE INVENTION

In accordance with the invention, tape for a recorder is supplied by a cartridge unit having a payout or supply reel and a takeup reel arranged side-by-side in the same plane. The tape passes over a pressure roller which is part of the cartridge unit and extends from the pressure roller to the inner sides of the reels.

The cartridge unit is releasably mounted on a support frame having a capstan for driving the tape. A spring in the cartridge unit biases the pressure roller towards the capstan when the cartridge unit is in operating position. The spring also holds the cartridge unit releasably in its mounted position and activates a brake to inhibit movement of the reels when the cartridge unit is removed from its mounted position.

The cartridge unit is mounted parallel to the front of the recording device to facilitate inspection and manipulation of the cartridge unit. An information card is clipped to the front of the cartridge unit for inspection from the front of the recording device.

It is therefore an object of the invention to provide a recording device having a cartridge unit which is readily accessible and readily visible from the front of the recording device.

It is also an object of the invention to provide a recording device having a cartridge unit of simple and trouble-free construction.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects of the invention will be apparent from the following description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a view in front elevation of a recording device embodying the invention;

FIG. 2 is an exploded view in perspective showing a recording device having a cartridge unit displaced from its mounted position;

FIG. 3 is a detail exploded view in cross section with parts broken away showing a releasable coupling between a pulley and a tape reel;

FIG. 4 is a detail view showing a latch construction employed in the embodiment of FIGS. 1 and 2; and

FIG. 5 is a view in elevation with parts broken away of a cartridge unit embodying the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, FIG. 1 shows a recording device 15 70 mounted behind a cover represented by a rectangular frame 71 having a central window 73 which may be covered by a transparent sheet of material such as glass. This cover may be opened in any conventional manner to provide access to the recording device.

The recording device 70 is composed essentially of two main parts, a support frame 75 and a cartridge unit 77. The support frame has mounted thereon an erase or bias head 7, a record head 9 and a capstan 13 which is arranged to rotate at a uniform rate in the direction of the arrow (clockwise in FIG. 2). These components 7, 9 and 13 correspond functionally to the components bearing the same reference characters in the aforesaid Lenehan patent.

The support frame 75 also has mounted thereon for rotation about spaced horizontal axes two V-grooved pulleys 79 and 81. These pulleys have one or more pins respectively 79A and 81A which are readily coupled to the payout or supply reel 1 and the takeup reel 19 when the cartridge unit is in mounted position.

It will be noted that the pulleys are exposed through windows in a middle plate 83 which is secured by posts 85 to a base plate 87. An endless belt 88 couples the pulley 81 to the capstan 13 for rotation in the direction of the arrow.

A drag is applied to the pulley 79 for the purpose of inhibiting free rotation thereof. This drag may take the form of a nylon cord 91 having a portion located in the groove of the pulley. One end of the cord is secured to a post 92 and the remaining end of the cord is secured to a post 96 through a spring 96A. The spring maintains a suitable tension in the cord which assures a proper drag action on the pulley.

The cartridge unit 77 mounts a supply reel 1 and a takeup reel 19 for rotation about spaced axes which correspond to the axes of the pulleys 79 and 81 when the cartridge unit is in mounted or operating position. The reels are mounted on a front plate or frame 89 which may be constructed of any suitable rigid material such as aluminum and are covered by a cover 93 which may be constructed of any suitable rigid material such as aluminum or preferably a transparent plastic. The cover is secured to the front plate by means of screws 95 and posts 95A. The posts 95A are riveted to the plate 89.

The mounting of the reels on the front plate 89 will be understood by consideration of the reel 19 as shown in FIG. 3. It will be noted that the reel 19 includes a hub 19A of any suitable rigid material such as a moldable plastic material. For example a phenolic resin or an acetal compound may be employed. The hub is rotatably mounted on a sleeve bearing 19B which has a flange 19C at one end and which is secured to the front plate 89 by means of a headed screw 19D. The hub is biased towards the flange 19C by means of a coil spring 19E which is compressed between the head of the screw 19D and a washer 19F which bears against a surface of the hub. It will be noted that the hub has a plurality of holes 19G distributed uniformly around the axis of the hub and positioned to receive the pins 81A. The reel is completed by two rigid flanges 19H and 19J which are riveted to the hub and between which the tape 3 is wound. It will be noted that the cover 93 has an opening through which the hub 19A extends.

In FIG. 3 if the cartridge unit 77 is moved downwardly the pins 81A are received in two of the holes 19G for the purpose

of coupling the pulley 81 to the reel 19. When the cartridge unit thereafter is moved upwardly the coupling is broken.

As shown in FIG. 5 the tape 3 moves over the pressure roller 15 and is guided by the guide rollers 5 and 17 between the inner sides of the reels 1 and 19. Thus the tape leaves the supply or payout reel 1 at the upper side of the reel and enters the take-up reel 19 at the lower side of the reel. The rollers 5, 15 and 17 correspond in function to the rollers bearing the same reference characters in the aforesaid Lenehan patent. It will be noted that the rollers 5 and 17 are mounted for rotation on two of the posts 95A.

The pressure roller 15 is mounted for rotation on a slide 97. The slide is mounted for reciprocation to the right or left as viewed in FIG. 5 for a limited distance between two guide ribs 99 and 101 which form part of the cover 93 and which may be constructed during the molding operation as integral parts of the cover. A headed screw 103 is screwed into a post 103A which is riveted to the plate 89 and which extends through an elongated slot 105 formed in the slide 97. The head of the screw overlies the cover 93 to retain the cover in its position on the plate 89. The screws 95 and 103 are similar in construction and function.

At its right-hand end in FIG. 5 the slide carries a brake block 107 which engages the rims of the reels 1 and 19 to prevent or inhibit movement of the reels when the cartridge unit is displaced from its support frame. A coil spring 109 is compressed between the brake block 107 and a portion of the cover 93 for the purpose of biasing the brake block and slide towards the left as viewed in FIG. 5. Thus the spring urges the brake block into braking engagement with the reels.

As a further guide for the slide 97 and its associated components, the axle 15A of the pressure roller projects into guide notches 110 and 110A formed in the cover 93 and in the plate 89.

As shown in FIG. 2 the plate 89 has a window 89W through which the reel may be inspected for the purpose of determining the amount of tape on the supply reel. To facilitate such inspection the flanges of the reels preferably are constructed of transparent material.

For identification purposes the plate 89 carries two spring clips 89A and 89B for the purpose of clipping an identification card 111 to the plate.

For facilitating the releasable mounting of the cartridge unit 77 the support frame carries an outer plate 113 with which the middle plate 83 forms a nest for receiving and locating the leading end of a cartridge unit when a cartridge unit is inserted in operating position. In addition the middle plate 83 has upper and lower flanges 83U and 83L bent forwardly from its upper and lower ends for the purpose of locating the cartridge unit vertically.

In order to latch releasably a cartridge unit in operating position the posts 85 are provided with domed heads 85H which project from the middle plate 83. As shown in FIG. 4 each domed head 85H projects through a hole 93H formed in the cover 93. Each domed head has a notch 85N for receiving an edge or lip of the cover 93.

In order to mount the cartridge unit 77 in FIG. 2, the unit is moved to the right and the leading edge is nested between the outer and middle plates 113 and 83. As the cartridge unit is moved to the right the pressure roller 15 forces the magnetic tape passing thereover against the capstan 13 and compresses the spring 109 (FIG. 5). This moves the brake block 107 away from the reels 1 and 19 to prepare the reels for subsequent operation.

The movement of a cartridge unit carries the holes 93H into alignment with the domed heads 85H. The cartridge unit now may have its trailing end forced against the middle plate 83 and this movement causes the domed heads 85H to enter the holes 93H. When the cartridge unit is released the spring 109 forces the cartridge unit to the left as viewed in FIG. 2 and this movement causes the notches 85N (FIG. 4) to receive edges of the cover 93. This releasably latches the cartridge unit in operating position. The cartridge unit may be released from its

operating position by following a reverse sequence of the mounting movements.

In order to facilitate proper installation of the cartridge unit 77 the plate 89 is provided with upper and lower alignment marks 89C and 89D. Companion alignment marks 83C and 83D are provided respectively on the flanges 83U and 83L. When the cartridge unit is properly installed the alignment marks 89C and 89D are aligned respectively with the alignment marks 83C and 83D.

With the orientation of the cartridge unit essentially parallel to the front of the instrument a large identification card 111 is visible not only when the cartridge unit is displaced from the support frame but when the cartridge unit is in its operating position. Similarly the window 89W always exposes the amount of tape on the supply reel 1. The alignment marks 89C, 89D, 83C and 83D are always visible to indicate proper alignment of the cartridge unit.

As previously noted the spring 109 not only provides proper pressure of the tape 3 against the capstan 13, but also provides proper pressure of the brake block 107 against the rim of the reels 1 and 19. The spring also provides latching pressure for maintaining the cartridge unit in its proper operating position.

The guiding of the tape 3 from the pressure roller 15 around the guide rollers 5 and 17 to the inner sides of the reels 1 and 19 permits the rotation of the pulley 81 and the capstan 13 in the same direction by a simple endless belt 89. This eliminates a gear which otherwise normally would be employed for reversing the direction of rotation of the pulley relative to the capstan. Moreover the section of the tape between the guide roller 17 and the reel 19 and between the guide roller 5 and the reel 1 are displaced from the wall of the enclosure for the cartridge unit and assures absence of rubbing of the tape against such wall.

We have embodied our invention in apparatus offered commercially by our assignee and described in a descriptive bulletin DB 42-565 WR dated Jan. 1969 and instruction leaflet I.L. 42-565 WR-1 dated Jan. 1969 and published by the Westinghouse Electric Corporation, Raleigh, North Carolina.

We claim as our invention:

1. In a tape-recording device having an accessible front, a cartridge unit comprising a cartridge frame and first and second tape reels mounted side-by-side on said cartridge frame for rotation about spaced, parallel first and second axes when the cartridge unit is in operating position, one of said reels serving as a tape supply reel and the other of the reels serving as a tape take-up reel, said cartridge frame and tape reels in operating position being located directly behind the front with said axes extending through the front, a support frame for detachably holding said cartridge unit in said operating position, said cartridge frame and reels being manually movable as a unit from the support frame through the front of said device, first and second members mounted for rotation on said support frame about the first and second axes respectively, means responsive to movement of the cartridge unit to and from said position for coupling and decoupling the center portions of said first and second reels relative to the first and second members respectively, a tape-recording head being mounted on said support frame, a capstan mounted on said support frame for rotation about an axis parallel to the first and second axes for driving magnetic tape between said reels, a pressure roller, mounting means mounting the roller for rotation on said cartridge frame, resilient means effective when said cartridge unit is in said operating position for biasing the pressure roller to press magnetic tape extending between the reels against the capstan, whereby said capstan can move the magnetic tape past the recording head, a brake block coupled to the pressure roller for movement therewith towards and from the capstan between a first position when the cartridge unit is in operating position and a second position when the cartridge unit is displaced from operating position, said reels having rims, said brake block in the second position engaging said rims to inhibit reel movement and in the first position being clear of the rims, and means responsive

to the bias exerted by said resilient means for releasably maintaining said cartridge unit in operating position.

2. A device as claimed in claim 1 wherein said cartridge unit includes recording tape having its ends wound respectively on said reels and having its center portion extending over the pressure roller, said reels having inner sides adjacent each other, said tape extending from the pressure roller to the inner side of each of said reels, and relating means coupling the capstan and the reel serving as a tape takeup reel for rotation in the same direction.

3. In a tape-recording device having an accessible front, a cartridge unit comprising a cartridge frame and first and second tape reels mounted side-by-side on said cartridge frame for rotation about spaced, parallel first and second axes when the cartridge unit is in operating position, one of said reels serving as a tape supply reel and the other of the reels serving as a tape takeup reel, said cartridge frame and tape reels in operating position being located directly behind the front with said axes extending through the front, a support frame for detachable holding said cartridge unit in said operating position, said cartridge frame and reels being manually movable as a unit from the support frame through the front of said device, first and second members mounted for rotation on said support frame about the first and second axes respectively, means responsive to movement of the cartridge unit to and from said position for coupling and decoupling the center portions of said first and second reels relative to the first and second members respectively, a tape-recording head being mounted on said support frame, a capstan mounted on said support frame for rotation about an axis parallel to the first and second axes for driving magnetic tape between said reels, a pressure roller, mounting means mounting the roller for rotation on said cartridge frame, resilient means effective when said cartridge unit is in said operating position for biasing the pressure roller to press magnetic tape extending between the reels against the capstan, whereby said capstan can move the magnetic tape past the recording head, a brake block coupled to the pressure roller for movement therewith towards and from the capstan between a first position when the cartridge unit is in operating position and a second position when the cartridge unit is displaced from operating position, said reels having rims, said brake block in the second position engaging said rims to inhibit reel movement and in the first position being clear of the rims, wherein said cartridge unit includes recording tape having its ends wound respectively on said reels and having its center portion extending over the pressure roller, said reels having inner sides adjacent each other, said tape extending from the pressure roller to the inner side of each of said reels, and relating means coupling the capstan and the reel serving as a tape takeup reel for rotation in the same direction, wherein said relating means comprises an endless belt coupling said capstan to the tape takeup one of said members for causing said capstan and said last-named member to rotate in the same direction.

4. A device as claimed in claim 3, wherein said support frame has guide means for releasably guiding the capstan end which is the leading end of the cartridge unit into operating position, said support frame having a fastening device releasably engaging the cartridge unit to hold the cartridge unit in operating position, said resilient means acting between the pressure roller and the cartridge frame to maintain yieldably the cartridge unit in engagement with the fastening unit.

5. A device as claimed in claim 4, wherein one of the units has a pair of spaced lips and the other of said units comprises a pair of spaced elements having notches for respectively receiving the lips when the lips are urged into the notches by the resilient means.

6. A device as claimed in claim 5, wherein the center portions of the reels each has a plurality of holes parallel to, and spaced uniformly around, the axis of the associated reel, each of said members having a pin parallel to said axes and disposed for releasable reception in one of the holes in the associated

reel.

7. A device as claimed in claim 6, wherein said pressure-roller-mounting means comprises a slide mounted for limited reciprocation relative to the cartridge frame along a line disposed perpendicular to a plane containing the axes of the reels and equidistant from the reels, said resilient means comprising a spring acting between the cartridge frame and the slide to bias the slide in the direction of the capstan when the cartridge unit is in operating position.

8. A cartridge unit for a tape-recording device which comprises a cartridge frame, and first and second tape reels mounted side-by-side on said cartridge frame for rotation about parallel first and second axes, one of said reels serving as a tape supply reel and the other of said reels serving as a tape takeup reel, a pressure roller, mounting means mounting the pressure roller for rotation about a third axis parallel to, and equidistant from, the first and second axes, said mounting means comprising a slide mounted for limited reciprocation relative to the cartridge frame along a line disposed perpendicular to a plane containing the first and second axes and equidistant from the reels, spring means acting between the cartridge frame and the slide to bias the slide in one direction along said line, said reels having rims, brake means secured to said slide for movement into engagement with said rims by the bias of said spring to inhibit rotation of the reels, said slide in response to a force exerted on the pressure roller in opposition to the spring bias acting to move the brake means clear of said rims, each of said reels having a coupling device located on the axis of the associated reel with both coupling devices accessible from the same face of said cartridge unit, whereby each of said coupling devices may be engaged in reel-rotating relationship by a drive control means rotatable about the axis of the associated reel.

9. A cartridge unit as claimed in claim 8 wherein said cartridge unit includes recording tape having its ends wound respectively on said reels and having its intermediate portion extending over the pressure roller, said tape extending from the pressure roller to the inner side of each of said reels.

10. A cartridge unit as claimed in claim 8 wherein said slide is mounted on said cartridge frame for said reciprocation, and cover means releasably secured to said cartridge frame, said cover means forming with the cartridge frame a casing substantially surrounding the reels.

11. A cartridge unit as claimed in claim 8 in combination with a support frame, and a capstan mounted on the support frame for rotation about an axis parallel to the first and second axes for driving magnetic tape between said reels when the cartridge unit is in operating position, said spring means acting to bias the roller towards the capstan when the cartridge unit is in operating position, whereby the capstan acts to drive recording tape positioned between the capstan and the pressure roller, said support frame having fixed positioning means engaging the cartridge unit to prevent movement of the cartridge unit away from the capstan due to reaction to said bias, said cartridge unit being movable in a release direction having a substantial component parallel to said axes to clear said positioning means for permitting movement of the cartridge frame and pressure roller away from the capstan.

12. A combination as claimed in claim 11 in combination with first and second drive control means rotatable respectively about the first and second axes when the cartridge unit is in operating position, and coupling means coupling the coupling devices respectively to the first and second drive control means when the cartridge unit is in operating position, said coupling devices being releasable from the drive control means in response to movement of the cartridge frame in said release direction.

13. A cartridge unit as claimed in claim 8 wherein said cartridge frame comprises a plate, said reels being mounted on said plate, and a cover member secured to said plate and forming with the plate a casing substantially enclosing said reels, said cover member having openings exposing said coupling devices.