United States Patent

Kobler et al.

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[45] **Oct. 17, 1972**

[54] ENDLESS LOOP TAPE RECORDER

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[52] **U.S. Cl.** .....**274/4 R**, 179/100.2 Z, 226/118, 274/11 R

[51] **Int. Cl.**.....**G11b 15/29**, G11b 23/12

[58] **Field of Search**.....179/100.2 Z; 274/4 R, 11 R; 226/118, 119, 195

[56] **References Cited**

UNITED STATES PATENTS

3,209,974	10/1965	Nye	226/118
2,730,309	1/1956	Baer	226/118
2,988,604	6/1961	Nye	179/100.2 Z
3,552,618	1/1971	Molnar	179/100.2 Z
3,596,818	8/1971	Curtis	226/118

FOREIGN PATENTS OR APPLICATIONS

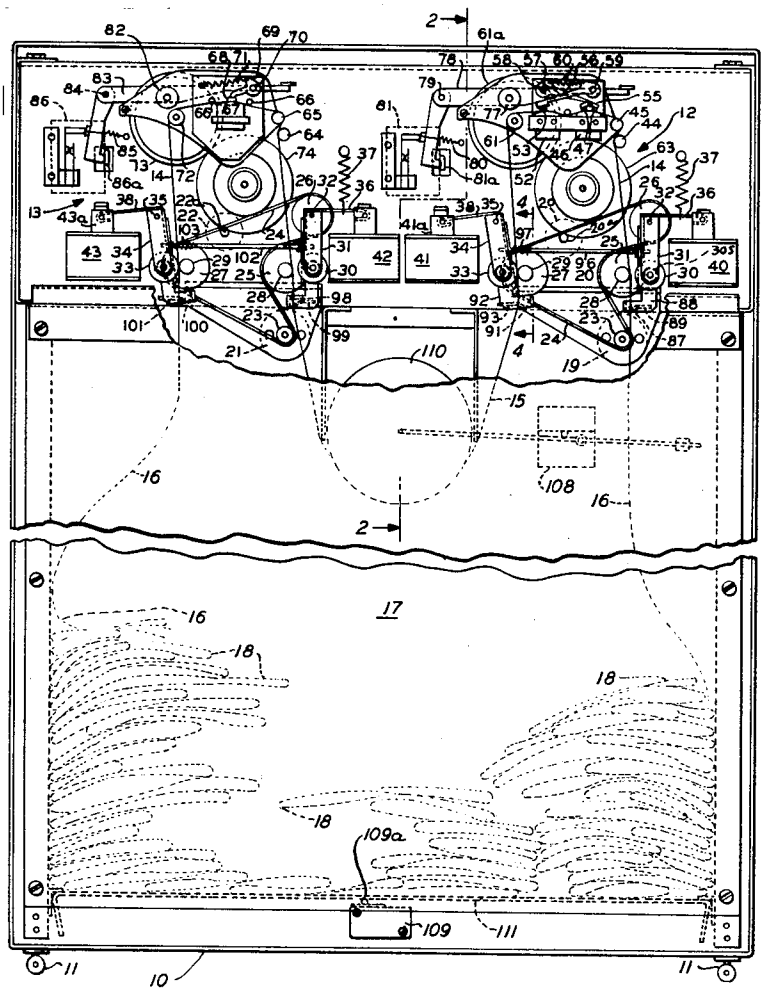
153,064	8/1951	Australia	179/100.2 Z
685,032	12/1952	Great Britain	179/100.2 Z

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[57] **ABSTRACT**

A combined dictating and transcribing machine uses an endless magnetic tape of a length sufficient for several hours recording. The machine — herein referred to as an "endless tape recorder" — comprises separate dictating and transcribing units with independent tape driving mechanisms and a single storage bin or tank below these units to receive the inner and outer runs of the tape. Each run may comprise multitudinous loops folded back and forth on itself. A tank vibrator serves to overcome friction and static effects to keep the tape loops settled in the storage bin. A safety drive control and warning system comprises a first switch operated when the inner run is drawn taut and a second switch operated when the outer run is tensioned. A feature of the invention is that as the outer run is tensioned it will pick up the looped mass or bundle of the tape then constituting the inner run to operate the second safety switch and that when it has lifted the bundle to the top of the storage bin it operates also the first safety switch.

17 Claims, 7 Drawing Figures



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SHEET 1 OF 3

FIG. 1

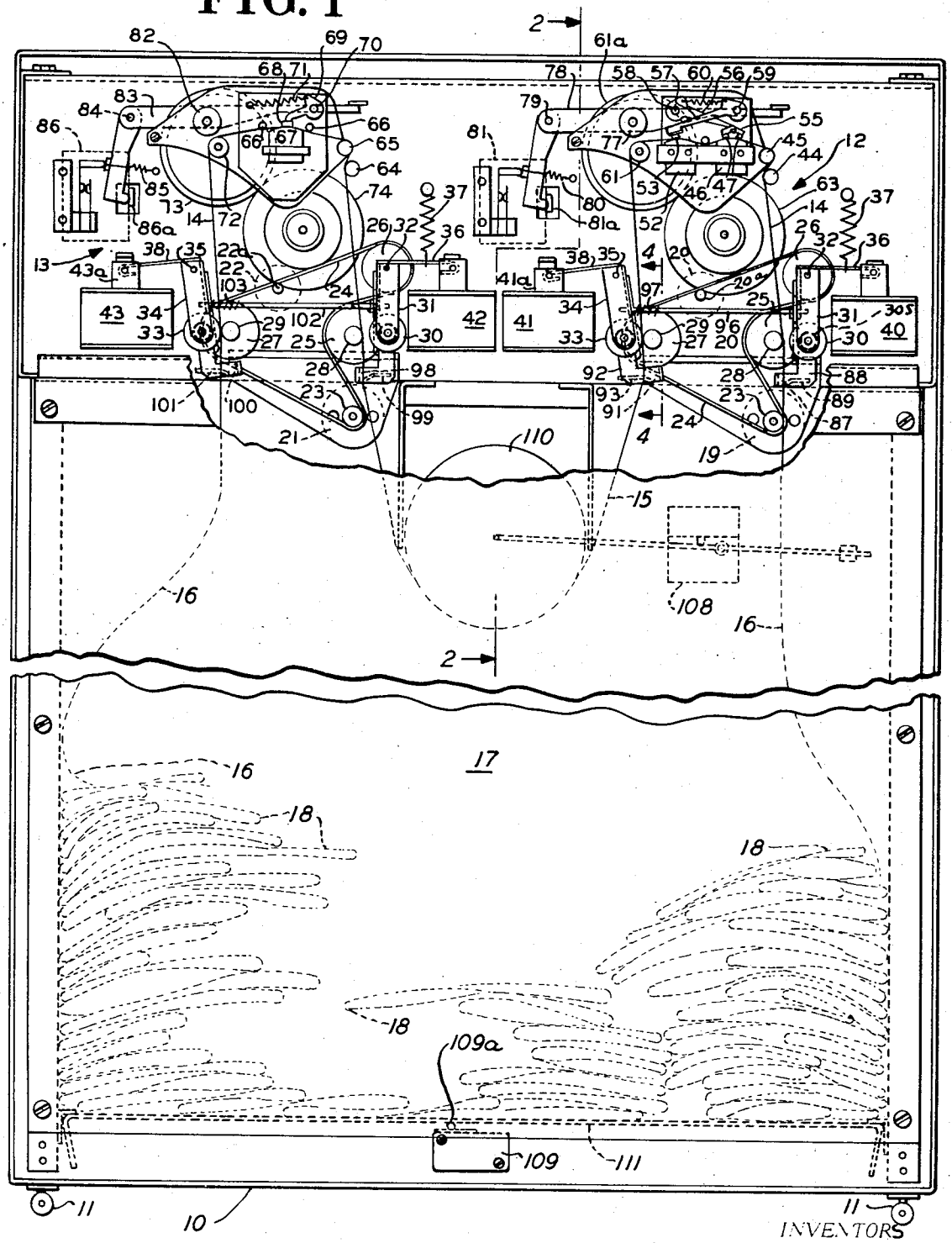


FIG. 2

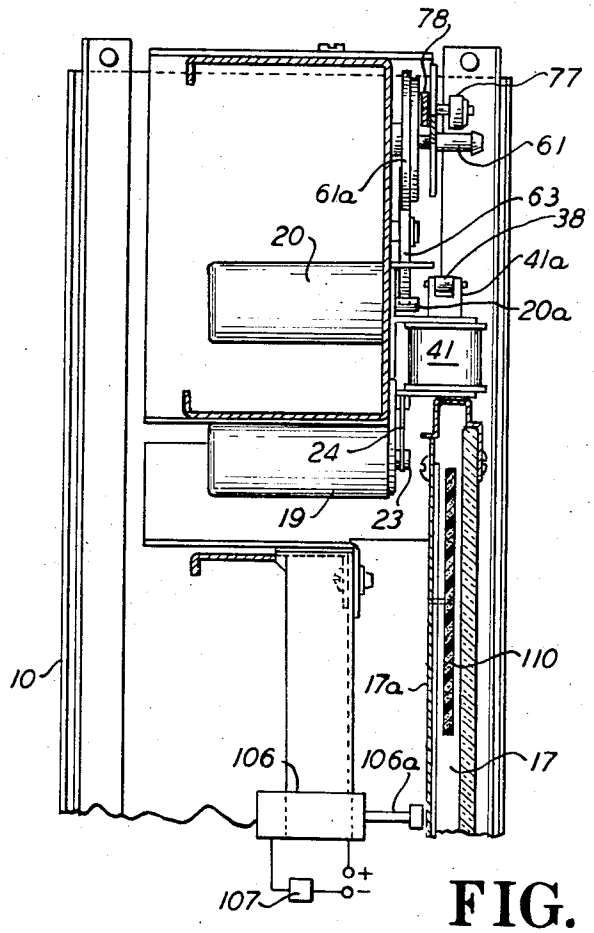


FIG. 4

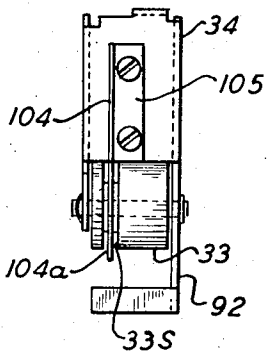


FIG. 5

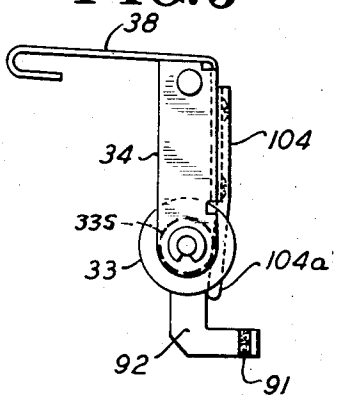


FIG. 3

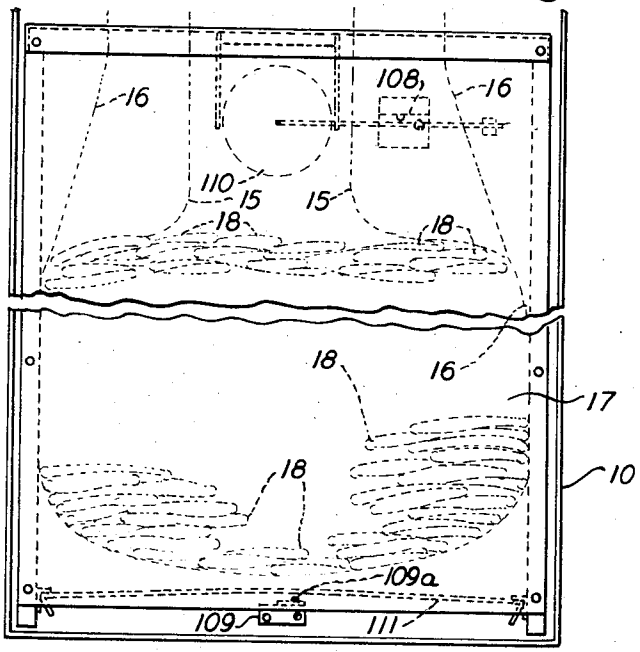
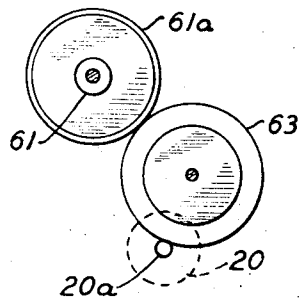
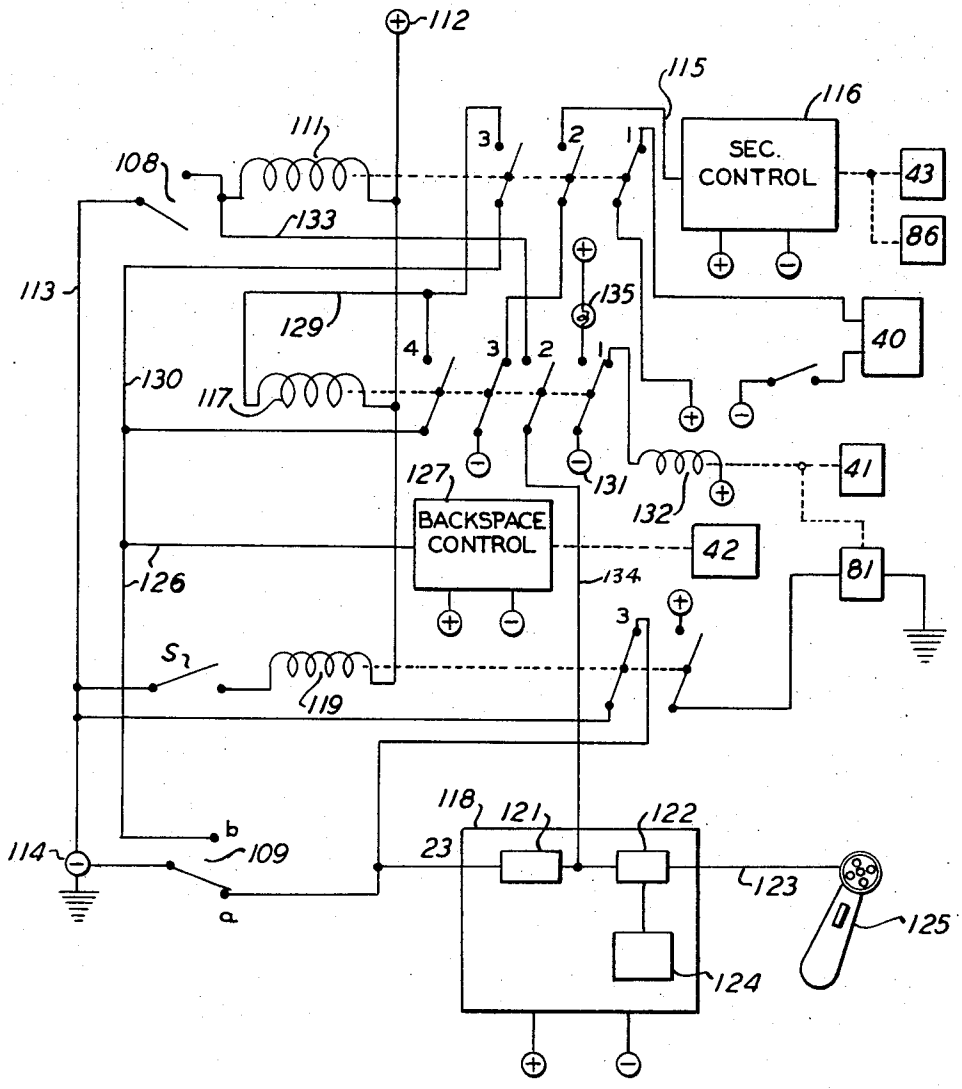


FIG. 6



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FIG. 7



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ENDLESS LOOP TAPE RECORDER

An object of the invention is to provide an endless tape recorder of the character mentioned using a single storage bin for both the inner and outer runs of the tape between the dictating and transcribing stations.

Another object of the invention is to provide such endless tape recorder with safeguarding features operated when either the inner run or the outer run of the tape reaches a tautened condition.

Another object of the invention is to provide a storage bin in which the tape has only a clearance fit to prevent snarling of the tape.

Another object is to provide such endless tape recorder wherein the outer run picks up the entire bundle of the looped mass constituting the inner run when the outer run reaches a tautened condition.

Another object is to provide a first control switch operated at the beginning of pick up of the inner run of the tape by the outer run and a second control switch operated with a delayed action when the outer run has lifted the inner run of the tape to the top of the storage bin.

Another object is to provide such endless tape recorder wherein the bin is subjected to a periodic vibration to overcome friction and static effects and allow the tape loops to settle in the bin.

These and other objects and features of the invention will be apparent from the following description and the appended claims.

In the description of our invention, reference is had to the accompanying drawings of which:

FIG. 1 is a front elevational view with the side cover removed showing all of the tape in the storage bin constituted in the outer run;

FIG. 2 is a fractional sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is a front view to smaller scale of the storage bin showing all of the tape in the bin constituted in the inner run and being lifted by the outer run;

FIG. 4 is a view of one of the pinch rollers and the mounting lever therefor of the scan drive mechanism as seen from the line 4—4 of FIG. 1;

FIG. 5 is a side view of this pinch roller and mounting lever as seen in FIG. 1;

FIG. 6 is a front view of the friction drive coupling between the drive motor and the tape feed roller at the dictator's station; and

FIG. 7 is a simplified schematic drawing of the control circuitry of the tape recorder.

The present recorder-reproducer has an upstanding rectangular cabinet **10** mounted for example on casters **11**. In the upper portion of the cabinet is mounted a recording or dictating unit **12** and a reproducing or transcribing unit **13**. These two units are mounted in line at the same level and operate in connection with an endless tape **14**. Looking at the machine from the front side, as shown in FIG. **1**, the tape **14** is led through the dictating unit **12** from right to left, then downwardly out of the dictating unit and across via an inner run **15** to the right side of the transcribing unit **13**, then through the transcribing unit from right to left and downwardly out of the transcribing unit at the left side of the machine, and then back via an outer run **16** to the input of the dictating unit. The inner and outer runs of the tape are stored in a bin **17** having a width accepting the tape with just a clearance spacing. Since the tape is sufficiently long — say 1,000 feet — to accept several hours recording the inner and/or outer runs comprise a "bundle" in the form of multitudinous loops **18** folded back and forth on themselves — a condition which the tape assumes naturally as it is fed into the storage bin **17** from the units **12** and **13**.

The dictating unit has a scan motor **19** and a recording drive motor **20**. Similarly, the transcribing unit has a scan motor **21** and a transcribing drive motor **22**. Each scan motor **19** and **21** is mounted below the lower right portion of the respective unit, and has a drive pulley **23** receiving a belt **24**. The belt is trained partially around a first driven pulley **25**, then up and around an idler pulley **26**, next downwardly and around a second driven pulley **27** and back to the motor drive pulley **23**. The two driven pulleys **25** and **27** are provided with concentric friction feed rollers **28** and **29**. At the right side of each feed roller **28** is an associated pressure or pinch roller **30** journaled on the lower end of a lever arm **31** itself pivoted on a stud **32** at its upper end. At the left side of each friction feed roller **29** there is a pressure or pinch roller **33** journaled on the lower end of a lever arm **34** itself pivoted on a stud **35** at its upper end. Each lever arm **31** has a right angle arm **36** to which a tension spring **37** is connected biasing the pressure roller **30** out of contact with the associated feed roller **28**, and each lever arm **34** has a right angle arm **38**. The spaces between the feed and pressure rollers **28–30** form tape inlet openings to the respective dictating and transcribing units, and the spaces between the feed and pressure rollers **29–33** form tape outlet openings from the respective dictating and transcribing units. Coupled to the arm **36** at the dictating unit is a reverse scan solenoid **40** and to the arm **38** at the dictating unit is a forward scan solenoid **41**. Likewise, coupled to the arm **36** at the transcribing unit is a reverse scan solenoid **42** and to the arm **38** at the transcribing unit is a forward scan solenoid **43**. The weight of the plungers **41a** and **43a** of the solenoids **41** and **43** serve to bias the pressure rollers **33** lightly against the feed rollers **29**.

The tape **14** is led from the space **28–30** upwardly in a circuitous path around the inner side of a guide stud **44** and the outer side of an adjacent guide stud **45** across a conventional magnetic head **46** of suitable design on which the tape is held by a pair of friction pads **47**. Next the tape is led across another magnetic head **52** on which it is held by a friction pad **53**. This head is provided only for recording a control signal. The two pads **47** are mounted on the ends of a rocker **55** fulcrumed at the center to a lever **56**. The pad **53** is mounted on a lever **57**. The levers **56** and **57** are crisscrossed and pivoted at their outer ends on studs **58** and **59**. A tension spring **60** between the short arms on the hubs of the levers serves to bias the levers so that the pads **47** and **53** are spring urged against the heads **46** and **52**. After leaving the head **52** the tape is led around a friction feed roller **61** on a flywheel **61*a***. This flywheel is coupled by a friction roller **63** to the drive roller **20*a*** of the motor **20**. From the drive roller **61** the tape is led downwardly through the space **29–33** to the inner run **15**.

The inner run **15** leads into the transcribing station through the space between the friction rollers **28–30** and then upwardly via a circuitous path around the

inner side of a guide stud 64 and the outer side of an adjacent guide stud 65. From there the tape is led under guide posts 66 and across an interventing magnetic head 67 which is of the audio playback type. The tape is retained frictionally on the head 67 by a pad 68 on a lever 69 pivoted at 70 and urged by a tension spring 71 to cause the pad to exert pressure on the magnetic head. From the head 67 the tape is led around a friction feed roller 72 on a flywheel 73. The flywheel is coupled by a friction clutch roller 74 to the drive roller 22*a* of the transcriber drive motor 22. The reason for leading the tape under the guide posts 66 is to add drag resistance to the feed of the tape. From the drive roller 72 the tape is led downwardly through the outlet space 29–33 of the transcribing unit to the outer run 16 of the tape.

At the dictating station there is a pressure roller 77 overlying the feed roller 61 which is journaled on a lever 78 itself pivoted on a stud 79. A tension spring 80 connected to the lever 78 normally holds the pressure roller disengaged from the feed roller but on actuation of a solenoid 81 an armature 81*a* thereof is activated against the lever 78 to engage the pressure roller 77 with the feed roller 61 and start an advance of the tape at a slow steady speed suitable for recording. Similarly, at the transcribing station there is a pressure roller 82 overlying the feed roller 72 which is journaled on a lever 83 itself pivoted on a stud 84. A tension spring 85 connected to the lever 83 normally holds the pressure roller disengaged from the feed roller but on actuation of a solenoid 86 an armature 86*a* thereof is activated against the lever 83 to engage the pressure roller 82 with the feed roller 72 and start an advance of the tape at a slow steady speed suitable for transcribing.

During recording the motor 20 is running and the solenoid 81 is energized to engage the pressure roller 77 with the feed roller 61 but the scan control solenoids 40 and 41 are both deenergized. However, the pressure roller 33 at the output end of the dictator's station is engaged lightly with the feed roller 27 by the weight of the plunger 41*a* to provide an over drive with light slippage to take up the tape ahead of the feed roller 61 and feed it into the bin 17. The pressure roller 30 at the input end of the dictator's station is held disengaged from the feed roller 28 by the spring 37 but by the same spring action a drag is placed on the tape by pressure of a shoe 87, as of felt padding, mounted on a right-angle extension 88 of the lever 31 against an anvil 89 on the frame portion 90 of the machine.

Similarly, there is a shoe 91 on a right angle extension 92 of the lever 34 which is operable against an anvil 93 on the frame 90. During forward scanning the drive solenoid 81 and the scan solenoid 40 are not energized and the scan solenoid 41 is energized. The shoe 87 is now engaged by the spring 37 to provide a drag on the tape at the input of the dictator's station. During reverse scanning the drive solenoid 81 and scan solenoid 41 are not energized and the scan solenoid 40 is energized. Through a coupling rod 96 secured at one end to the lever 31 and coupled to the lever 34 at the other end through a compression spring 97 the shoe 91 is held lightly against the anvil 93 to provide a drag on the tape at the point where the tape leads into the station.

At the transcriber's station the lever 31 has a shoe 98 operable against an anvil 99, the lever 34 has a shoe 100 operable against an anvil 101 and there is a yieldable coupling between the levers 31 and 34 by means of a rod 102 and compression spring 103, the same as at the recorder station.

Further, the pressure rollers 30 and 33 are provided with deep peripheral slots 30*s* and 33*s* as shown in FIGS. 1 and 4. Passing through these slots is a finger 104*a* extending from a guide strip 104 of a bracket 105 secured to the back side of each lever 31 and 34. These guide strips bow the tape crosswise thereof to give it rigidity so that it will not buckle between the scan drive rollers and the record-reproduce heads of the stations.

Because of friction of the the tape with the side walls of the bin 17 and of static effects the tape loops 18 will at times not settle down to allow storage of the whole run of the tape in the bin. These effects are overcome by a thumper solenoid 106 having an armature 106*a* which is actuated impulsively against the inner wall 17*a* of the bin each time the solenoid is energized. The solenoid 106 is energized intermittently at about 5 second intervals from a d. c. source as through an astable multivibrator 107 as shown in FIG. 2.

The advantage of an endless tape recorder-reproducer of the type above-described is that it permits independent recording and transcribing at the same time up to the points 1) where the dictator has caught up with the transcriber causing the outer run 16 of the tape to be drawn taut between the two stations, and 2) where the transcriber has caught up with the dictator causing the inner run 15 of the tape to be drawn taut between the two stations. Further, it will be understood the outer run 16 may be drawn taut by the transcriber backfeeding to the point of reaching nearly the dictator and the inner run 15 of the tape may be drawn taut by the dictator backfeeding to the point of nearly reaching the transcriber. In any of these events it is essential that suitable warning and drive control mechanisms be operated to safeguard the tape from breakage and to prevent either the dictator or the transcriber from inadvertently interfering with the operation of the other.

In accordance with the invention a safety warning and drive control system is provided comprising upper and lower safety control switches 108 and 109. The first safety control switch 108 is operated when the inner run 15 of the tape is drawn taut between the two stations. As the tape is so tautened it lifts a foam plastic disk 110 on the end of a leaf spring of the switch closing the switch. The second safety control switch 109 is a double throw micro switch located at the bottom of the storage bin 17 and is operable by a lever 111 resting normally on the push button 109*a* of the switch 109. The switch 109 is biased sufficiently so that it is not operated by the weight of the lever 111, but the weight of the lever plus that of the outer run 16 of the tape between the two stations is sufficient to hold the switch 109 operated. Thus, as soon as the outer run 16 of the tape is tensioned to the point where it begins to lift the inner run of the tape the switch 109 is released and thrown to its other position. With continued operation of the machine in the same manner the inner run of the tape is gradually lifted by the outer run to where it will reach the top of the bin at which point the switch 108

will be operated with a delayed action relative to the release of the switch **109**. These operations of the two safety switches provide the following warning and drive control operations with reference to FIG. **7**.

When the upper run **15** is drawn taut to close switch **108** a relay **111** is energized from plus terminal **112** via the switch **108**, line **113** and a negative or ground terminal **114**. When the relay **111** is operated ground is applied to a "forward inhibit" line **115** of a secretary control network **116** via No. **2** contacts of the relay **111** and normally closed No. **3** contacts of a relay **117**. This causes the network **116** to disable the solenoids **43** and **86** thereby preventing any forward drive of the tape at the secretary's station. Also, the No. **1** contacts of the relay **111** are now opened to disable the reverse scan solenoid **40** which prevents rewind of the tape by the dictator.

When the dictator has used all available tape the tautening of the outer run **16** operates the switch **109** from its "*a*" to "*b*" contacts. This removes ground **114** from a near end warning network **118** provided the dictator is then running the machine by depressing the start control S causing actuation of a relay **119** and opening of its No. **3** contacts to remove the alternative ground connection via the lines **120**. This network **118** includes as astable multivibrator **121** controlling a relay **122** which in turn controls the feedout on a line **123** of a "beep" signal from a tone generator **124**. The line **123** is connected to the dictator's handpiece **125** to give the dictator an intermittent warning signal that he is nearing the end of the available tape to the point where the outer run **16** is beginning to pick up the whole bundle of the inner run of the tape. Among other things being the same, the dictator can record only 15 seconds longer and the whole bundle of the tape will be raised to operate also the safety switch **108** — which stops then all further operation of the machine as is herein later described. Further, when the switch **109** is operated it sends ground via a line **126** to a backspace control network **127**. This disables the solenoid **42** to prevent rewinding by the transcriber or secretary. Normal operation is restored when either the secretary runs the tape forward or the dictator rewinds the tape.

If the dictator continues to run the tape forward after the "beep" signal comes on as until the bundle of the tape is raised to the top of the bin to operate also the safety switch **108**, the relay **111** is also energized closing its No. **3** contacts to operate the relay **117** from plus terminal **112** via lead wire **129**, No. **3** contacts of relay **111**, line **130** and "*b*" contacts of switch **109**. The relay **117** then locks on over its No. **4** contacts paralleling the No. **3** contacts of the relay **111**. When the relay **117** operates its No. **1** contacts break a ground **131** from a SE relay **132** which stops all dictator operations of advance solenoids **41** and **81**. Further, the No. **2** contacts of relay **117** are closed to apply steady ground **114** to the relay **122** of network **118** via lead wire **113**, switch **108**, lead wire **133**, No. **2** contacts of relay **117** and lead wire **134**. This produces a steady tone in the dictator's handset **125**. When the dictator hangs up there is no run-out of the tape because the SE relay **132** is held not operated by the No. **1** contacts of relay **117** being open. Further, operation of the No. **1** contacts applies power to a signal light **135** to keep the secretary's lamp turned on.

When the secretary runs the tape ahead the safety switch **108** is first returned and then the safety switch **109** is returned causing the relays **111** and **117** to drop out. This will reoperate the SE relay **132** to reable the machine for normal use.

The description of our invention herein particularly shown and described is intended to be illustrative and not necessarily limitative of our invention since the same is subject to changes and modifications without departure from the scope of our invention, which we endeavor to express according to the following claims.

We claim:

1. In a machine for recording on and/or reproducing from a single record medium: the combination of an endless magnetic tape, a recording station including a recorder-reproducer head and a drive means engageable with the tape to feed the tape in either direction, a separate reproducing station horizontally in line with said recording station including a reproducer head and a drive means engageable with the tape to feed the tape in either direction, said tape being led from the output of one of said stations via an inner run to the input of the other, and from the output of said other station via an outer run to the input of said one station, and said tape having a length causing said inner and/or outer runs to loop back and forth in the formation of bundles, a single bin for storing said inner and outer runs of the tape between said stations, said bin having a width greater only by clearance spacing than the width of said tape to confine said loops in a vertical formation, and safety control means comprising a first safety control switch operable by a tautening of the inner run of the tape between said stations and a second safety control switch operable by drawing the outer run of the tape taut sufficient to lift bodily the inner run of the tape.

2. The machine set forth in claim **1** including friction pads engaging said heads with a sufficient pressure to prevent slippage of the tape by the weight of said inner and/or outer runs when said drive means are disengaged from the tape.

3. The machine set forth in claim **1** including means operable by said second safety control switch for feeding an intermittent near-end warning signal to the recording station and for disabling a reverse drive of the tape at said reproducing station.

4. The machine set forth in claim **1** including means responsive to said safety control means at the start of pick up of said bundle of tape by a reverse drive of the tape at said reproducing station for generating a warning signal at said recording station.

5. The machine set forth in claim **1**, including means responsive to said safety control means at the start of pick up of said bundle of tape by a reverse drive of the tape at said reproducing station for stopping said reverse drive of the tape.

6. The machine set forth in claim **1**, including means responsive to said safety control means at the start of pick up of said bundle of tape by a forward drive of the tape at said recording station for generating a warning signal at said recording station.

7. The machine set forth in claim **1** wherein said bin has a height substantially greater than that required for storing said entire quantity of the tape, including means responsive to a lifting of said bundle of the tape to the upper portion of said bin by a forward drive of the tape

at said recording station for stopping said forward drive.

8. The machine set forth in claim 1 including means operable by said first safety control switch for disabling the forward drive of the tape at said other station and a reverse drive of the tape at said one station.

9. The machine set forth in claim 1 including means for operating also said first safety switch when the bundle of the tape constituting the inner run is lifted to the top of said bin by a continued tautening of the outer run of the tape.

10. The machine set forth in claim 9 including means rendered operable when both of said safety control switches are operated for feeding steady warning signals to the recording and reproducing stations.

11. The machine set forth in claim 9 including means rendered operable when both of said safety control switches are operated for disabling both the forward drive of the tape at said recording station and the reverse drive of the tape at the reproducing station.

12. In a machine for recording on and/or reproducing from a single record medium: the combination of an endless magnetic tape, a recording station including a recorder-reproducer head and a drive means engageable with the tape to feed the tape in either direction, a separate reproducing station horizontally in line with said recording station including a reproducer head and a drive means engageable with the tape to feed the tape in either direction, said tape being led from the output of one of said stations via an inner run to the input of the other, and from the output of said other station via an outer run to the input of said one station, and said tape having a length causing said inner and/or outer runs to loop back and forth in the formation of bundles, a single bin for storing said inner and outer runs of the tape between said stations, said bin having a width greater only by clearance spacing than the width of said tape to confine said loops in a vertical formation, and said bin having a depth greater than that required for storing the entire quantity of said tape between said stations looped on itself in a bundle, and a plurality of safety control switches respectively operable by a lifting of the inner run of the tape by said outer run to predetermined different heights in said bin.

13. In a machine for recording and/or reproducing from a single record medium: the combination of an endless magnetic tape, recording and transcribing stations each including a translating head, a drive motor having a drive capstan and a pressure roller for engaging the tape with said capstan to advance the tape in a forward direction at a recording speed, a scan motor, a pair of drive friction rollers coupled to said scan motor and pressure rollers for selectively engaging the tape with said drive rollers to advance or backspace the tape at a scanning speed, said tape being lead between said stations via inner and outer runs, a bin for holding the tape looped on itself in a bundle between said stations, said bin having a width sufficient only to receive the tape with a clearance fit whereby to confine the tape loops in a vertical formation, and control means for said machine operatively associated with the tape in said bin and differently operable by a tensioning of said inner run, by a lifting of the whole bundle of the tape from the bottom of said bin and by the lifting of the whole bundle of the tape to the top of said bin.

14. In a machine for recording and/or reproducing from a single endless magnetic tape medium: the combination of record and reproduce stations, each of said stations including a normal forward drive engageable at will with the tape and forward and reverse scan drives, each of said forward and reverse scan drives including forward and reverse drive wheels and respective pressure rollers for frictionally engaging the tape with said drive wheels, solenoids for engaging the reverse pressure rollers at said stations, spring means for holding said reverse pressure rollers disengaged when the respective solenoids are not energized, and solenoids for engaging the forward pressure rollers at said stations, said latter solenoids being vertically positioned to cause their armatures to weight bias the forward pressure rollers lightly to take up the tape ahead of said normal forward drives when the latter are engaged.

15. The machine set forth in claim 14 including an intercoupling between said reverse and forward scan drives at said stations for removing said bias on the forward scan pressure rollers when the respective reverse scan pressure rollers are engaged.

16. The machine set forth in claim 14 including friction means associated with each scan drive for placing a drag resistance on the tape when the respective scan drive is disengaged, each of said friction means being associated with the tape adjacent the respective scan drive at the side of the scan drive away from the respective station.

17. The machine set forth in claim 14 including means associated with each scan drive to bow the tape crosswise thereof and impart stiffness to the tape to cause the tape to be propelled positively from the respective scan drives.

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