United States Patent

Kuntz

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[45] **Oct. 31, 1972**

[54] **CASSETTE TAPE CLEANER**

[72] Inventor: **Jonathan C. Kuntz,** 63 Elm St., North Reading, Mass. 01864

[22] Filed: **Dec. 2, 1970**

[21] Appl. No.: **94,453**

[52] **U.S. Cl.**.....**15/308,** 15/93 R, 15/100, 15/319, 242/199, 274/47

[51] **Int. Cl.**.....**A47l 5/38**

[58] **Field of Search**..15/93 R, 100, 306 A, 308, 309; 274/47

[56] **References Cited**

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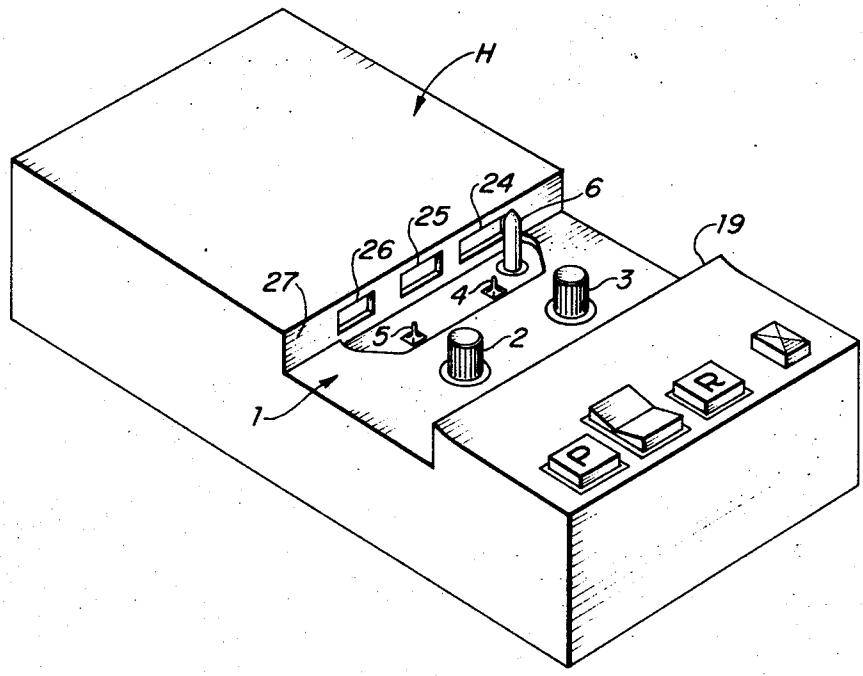
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Primary Examiner—Walter A. Scheel
Assistant Examiner—C. K. Moore
Attorney—Joseph S. Iandiorio and Dos T. Hatfield

[57] **ABSTRACT**

Apparatus for cleaning magnetic tape in a cassette has a plurality of scraping blades which project into the standard openings in the cassette when the cassette is inserted in the apparatus and a drive mechanism which engages the take-up reel in the cassette to pull the tape past the blades while a flow of air past the blades and away from the cassette removes the scrapings from the blades.

7 Claims, 15 Drawing Figures



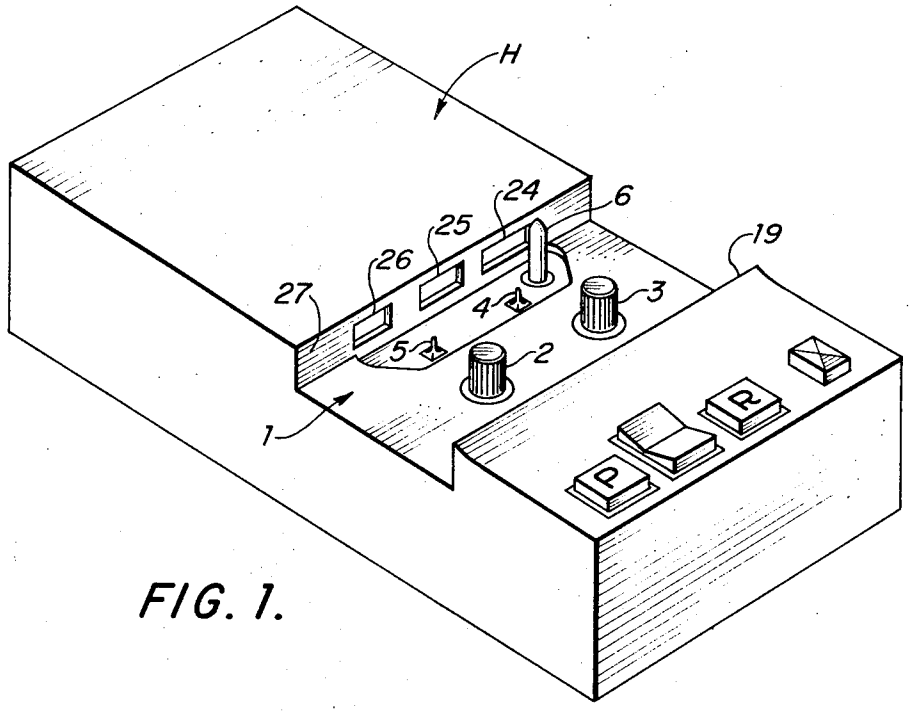


FIG. 1.

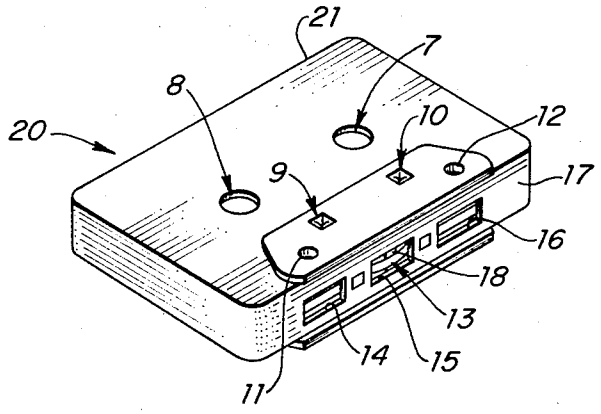


FIG. 2.

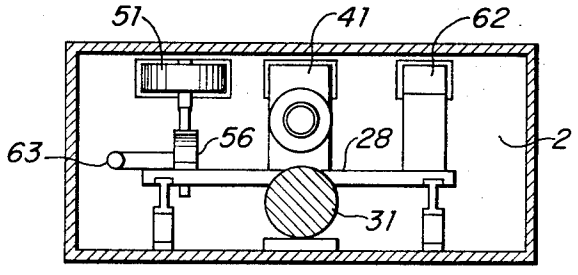


FIG. 7.

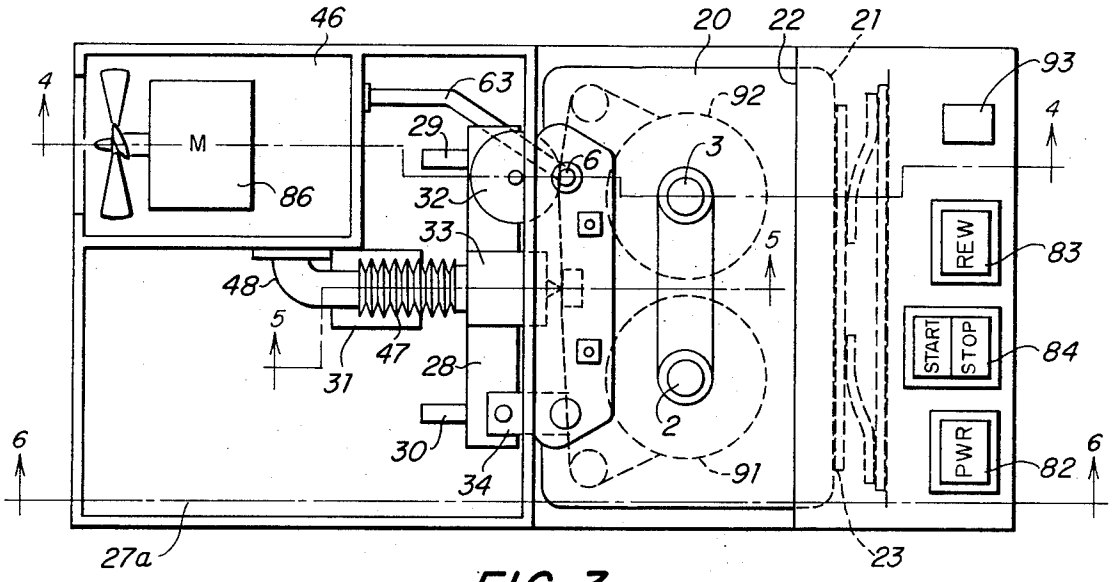


FIG. 3.

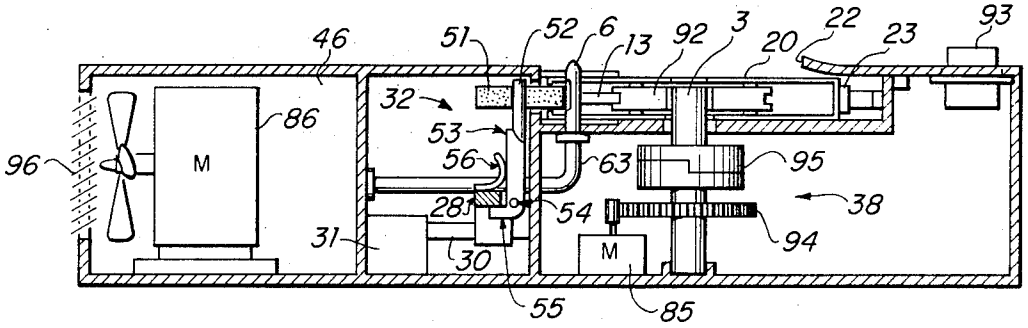


FIG. 4.

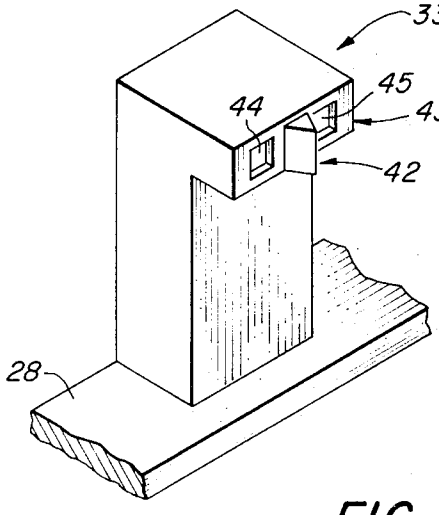


FIG. 8.

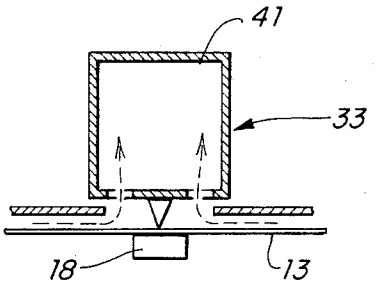


FIG. 9.

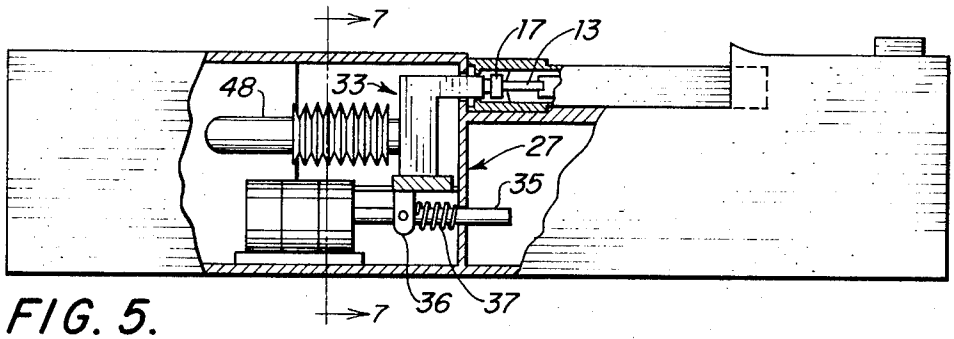


FIG. 5.

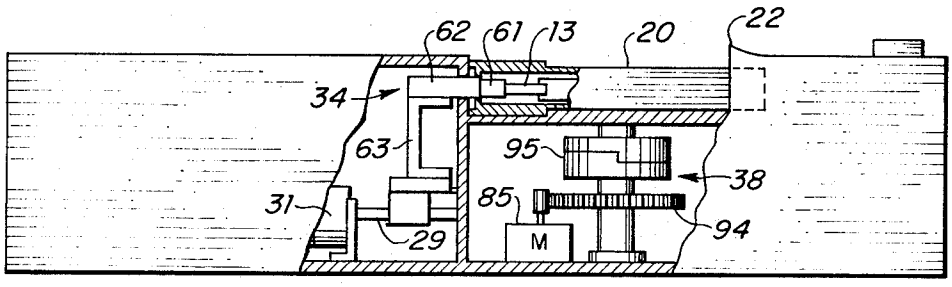


FIG. 6.

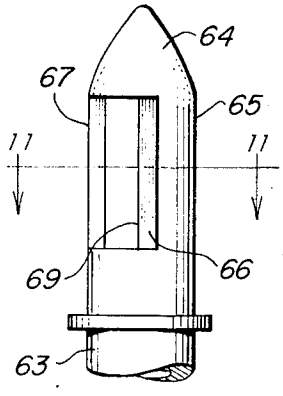


FIG. 10.

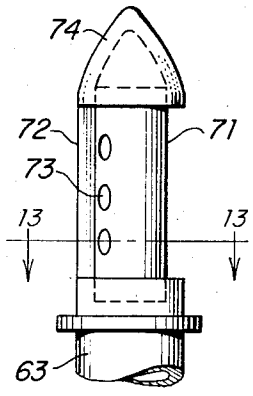


FIG. 12.

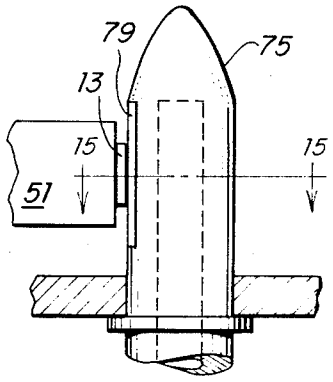


FIG. 14.

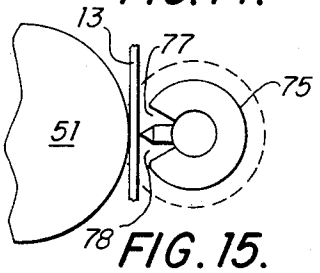


FIG. 15.

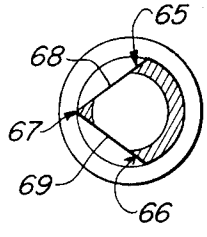


FIG. 11.

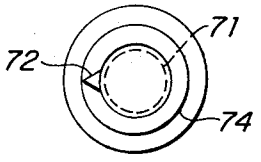


FIG. 13.

CASSETTE TAPE CLEANER

FIELD OF INVENTION

This invention relates generally to magnetic tape cleaning devices and more particularly to apparatus for cleaning magnetic tape in a cassette.

BACKGROUND OF INVENTION

Magnetic tapes used in conjunction with analog and digital computers as well as audio and video recordings must be cleaned regularly to remove particles of dirt and oxide from the surfaces of the tape and particularly from the oxide or recording surface of the tape which plays against a magnetic recording or read head when the tape is used. Any dirt, oxide or other material which accumulates on the tape can prevent the tape from making proper contact with the reading or recording head with the result that the information is not properly read or recorded. In addition such accumulations can also interfere with magnetic interaction between the heads and the tape by which interaction reading and recording is accomplished. This problem is particularly critical with tape used in conjunction with digital computers. In this application, the tapes are used to store high density fields of bits, each bit of which occupies but a small area of the tape so that a very small particle accumulation can cause an erroneous reading or recording of the bit. A bit is represented by a magnetic field flux change recorded on the ferric oxide tape surface.

Heretofore, apparatus of various kinds have been proposed and used for cleaning both sides of magnetic tape. In such apparatus the tape is carried on a single reel and is threaded through feed rollers, past cleaning devices of various kinds and then to a take-up reel. While apparatus of this sort has served a purpose to clean a tape that can be threaded through the apparatus, it is of no use to clean a tape contained in a cassette. There has been an increase in the use of cassettes in conjunction with digital computers as well as in conjunction with sound reproduction equipment and so there has arisen the necessity to clean tape in a cassette.

An additional problem with prior art apparatus resides in the fact that the blades used to clean the tape also accumulate the dirt and oxides cleaned from the tape making the tape ride unevenly over the blades so that their subsequent cleaning action may be sporadic and ineffective.

SUMMARY OF INVENTION

It is therefore an object of the present invention to provide apparatus for cleaning magnetic tape in a cassette without removing the tape or a portion thereof from the cassette.

It is a further object of the present invention to provide apparatus for cleaning both sides of the tape in a cassette.

It is a further object of the present invention to provide means for continually cleaning the blades while they scrape the tape.

It is a further object to provide such apparatus which cleans the tape while the tape is moving in either direction within the cassette.

It is a further object that the apparatus be compact and operated by merely inserting a cassette into the apparatus and actuating switches.

These and other objects are accomplished by the apparatus which is adapted to receive a standard tape cassette. The standard cassette is a plastic case containing two spools on which the magnetic tape is wound. Between the spools the tape is presented at openings along the edges of the cassette for contact by the magnetic head. Large transverse holes in the cassette concentric with he spools permit engagement of the spools by drive spindles. Other smaller transverse holes in the cassette normally provided for engaging and holding the cassette when it is used are employed in the present invention to provide access to the tape inside the cassette by the cleaning blades.

In accordance with the present invention, the cassette is inserted in the apparatus so that drive spindles engage the spools, at least one cleaning blade projects into one of the transverse holes next to the non-recording side of the tape and alignment pins project into other transverse holes to hold the cassette in place. Then the apparatus is actuated which simultaneously moves another blade into one of the side openings in the cassette against the oxide or recording side of the tape and also moves a pressure roller into another side opening pressing the tape against the first-mentioned cleaning blade to engage the tape. Thereafter, one of the spindles is driven turning a spool in the cassette which pulls the tape past the blades. At the same time, air is drawn across all the blade surfaces to remove the scrapings from the blade keeping the blades clean. One or more wiping pads can be provided which move against the tape through a third side opening in the cassette at the same time the cleaning blade and pressure roller move against the tape.

DISCLOSURE OF PREFERRED EMBODIMENT

Other objects, features and advantages will occur from the following description of a preferred embodiment and the accompanying drawings, in which:

FIG. 1 is an axonometric view of the cassette tape cleaning apparatus;

FIG. 2 is a perspective view from the end of a typical tape cassette showing the openings in the side for access to the tape, openings to accommodate spindles and other standard openings provided for aligning and holding the cassette when it is engaged with a tape reader/recorder;

FIG. 3 is a top view of the apparatus with the top cover removed;

FIG. 4 is a side sectional view of the apparatus taken through the pressure roller as shown in FIG. 3;

FIG. 5 is a partial side sectional view taken through the center blade apparatus that cleans the oxide side of the tape as shown in FIG. 3;

FIG. 6 is a partial side sectional view taken along side the cleaning pad as shown in FIG. 3;

FIG. 7 is a rear sectional view of the apparatus taken as shown in FIG. 5;

FIG. 8 is a perspective view of the oxide side blade and holder;

FIG. 9 is a top view illustrating engagement of the oxide side blade with the tape and the flow of air over the blade which cleans the blade;

FIGS. 10 and 11 are side and top views, respectively, of one embodiment of the cleaning blade probe;

FIGS. 12 and 13 are side and top views, respectively, of another embodiment of the cleaning blade probe; and

FIGS. 14 and 15 are side and top views of a third embodiment of the cleaning blade probe.

In one embodiment the cassette tape cleaning apparatus, FIG. 1, includes a generally rectangular shaped housing H containing a recessed platform 1 to accommodate the cassette and hold it for cleaning. Platform 1 contains a drive spindle 2, an idler spindle 3, aligning pins 4 and 5 and a cleaning blade probe 6 all of which project upward from the platform 1 and are located to engage corresponding openings in the cassette.

A typical cassette 20, FIG. 2, includes openings 7 and 8 which are engaged by the drive and idler spindles 2 and 3, respectively; openings 9 and 10 which are engaged by the aligning pins 4 and 5, respectively; and circular opening 11 which is engaged by the cleaning blade probe 6. Another circular opening 12 in the cassette 20 symmetrical with hole 11 is provided to accommodate a second cleaning blade probe if desired. Openings 7 and 8 in cassette 20 permit access to the hubs of reels contained within the cassette on which the tape 13 is wound. Access to the oxide side or recording side of tape 13 is provided through openings 14, 15 and 16 in the front edge 17 of cassette 20. A spring pressure pad 18 inside cassette 20 in back of tape 13 at center opening 15 holds tape 13 forward for engagement with a magnetic head.

Cassette 20 is shown in housing H, FIG. 3, with its rear edge 21 under lip 22 so that the rear edge 21 engages spring 23 which urges cassette 20 toward the opposite wall 27 of platform 1, FIG. 1. Windows 24, 25 and 26 in the wall 27, FIG. 1, align substantially with the openings 14, 15 and 16, FIG. 2, respectively, along edge 17 of cassette 20. Through these windows are moved parts which project into the openings in cassette 20 to clean tape 13. These parts are all located on a carriage 28 that is moved along tracks 29 and 30 by solenoid 31, FIG. 3.

The cleaning parts mounted on carriage 28 include a pressure roller assembly 32, oxide cleaning blade and holder assembly 33 and cleaning pad assembly 34. The functioning parts of these assemblies are thrust through the windows 24, 25 and 26, FIG. 1, respectively, when the carriage 28 is moved by solenoid 31. Solenoid shaft 35, FIG. 5, engages an arm 36 beneath carriage 28, FIG. 3, and spring 37, FIG. 5, on the shaft 35 connected between arm 36 and wall 27 tends to move carriage 28 away from cassette 20 removing assemblies 32, 33 and 34, FIG. 3, from engagement with tape 13, FIG. 2. A hole is provided through the wall 27 to permit play of the solenoid shaft as shown in FIG. 5.

The oxide cleaning blade assembly which is revealed particularly in FIGS. 8 and 9 includes a blade holder 33 and blade 42. The blade holder is mounted to carriage 28, FIG. 3, and includes a projecting part 43, FIG. 8, on which the blade is mounted and which fits easily through the window 25 in the wall 27, FIG. 1, of the apparatus and also through the opening 15, FIG. 2, in the cassette. Thus, the projecting part 43, FIG. 8, brings the blade through these openings to the tape 13 inside cassette 20 when carriage 28 is moved toward cassette 20.

On each side of the blade 42, FIG. 8, is an opening into the hollow interior of the holder 33. These openings 44 and 45 are part of an air conduit that draws air past the blade 42 for cleaning the blade and into a vacuum chamber 46, FIG. 4, at the back of the apparatus. This conduit includes a flexible hose 47, FIG. 3, that connects the holder 33 to the interior of the vacuum chamber 46.

The pressure roller assembly 32 shown principally in FIGS. 3, 4 and 7 includes a pressure roller 51 rotatably mounted on a spindle 52 that connects rigidly to an arm 53, FIG. 4. The arm 53 extends through the base and is pivotally pinned to the base at 54. A part of this arm 53 engages the bottom of carriage 28 and stops the clockwise rotation of arm 55 as viewed in FIG. 4. This rotation is urged by a spring 56 which tends to rotate the arm clockwise and thus carry roller 51 toward cassette 20. The function of the spring 56 when carriage 28 is moved fully toward cassette 20, as when the solenoid is energized, is to provide a slight pressure tending to hold the tape in cassette 20 between the roller 51 and the scraping blade on the cleaning post 6. The details of the cleaning post 6 and the scraping blade on it will described more fully with respect to FIGS. 10 through 15.

The wiping pad assembly 34 revealed most fully in FIG. 6 includes a wiping pad 61 adjustably mounted in a holder 62 on a stand 63 mounted to the platform 28. The cleaning pad 61 lightly engages the tape 13 inside the cassette and wipes from the tape any loose scrapings which may be clinging to the tape surface.

Turning next to FIGS. 10 through 15, there are illustrated three embodiments of the cleaning blade probe 6 that projects inside the cassette and carries a scraping blade that scrapes the back side or non-oxide or non-recording side of the tape. The probe 6 projects into the opening 11, FIG. 2, through the cassette which is just to the rear of the tape 13 inside the cassette and so the opening places the cleaning blade probe right in back of the tape. The blade in this probe is against the back of the tape and the tape is held against the blade by the pressure roller 51 as shown in FIG. 14. In the three embodiments of the probe, an air flow passage is provided alongside the blade carried by the probe for entraining air past the blade to clean the blade. This air flow through the probe leads to a conduit 63 (shown in FIG. 3) into the vacuum chamber 46.

The embodiment of the cleaning blade probe shown in FIGS. 10 and 11 illustrates a relatively simple structure preferably made from a piece of stainless steel tubing. One end 64 of the tubing 65 is pinched close and sealed. Then the tube is ground at two surfaces 65 and 66, FIG. 11, to define the blade point 67 and slot apertures 68 and 69 alongside the blade point. Scrapings from the tape are quickly removed from the blade by air flow into the slots and are carried through the tubing into the vacuum chamber 46, FIG. 3.

A second embodiment of the cleaning blade probe shown in FIGS. 12 and 13 includes a section of tubing 71 which may be stainless steel, a blade 72 fastened to the tubing parallel to the axis and a series of holes such as 73 in the tubing on each side of the blade. A bullet-shaped cap 74 seals one end of the tube and the other end connects to the conduit 63.

A third embodiment, FIGS. **14** and **15**, of the cleaning blade probe which is particularly suitable for molding from plastic includes a plastic body **75**, bullet-shaped at one end and which is hollow inside. Slots **77** and **78** parallel to the axis of the body are formed as shown and between these is attached a cleaning blade **79**. The cleaning blade **79** in this embodiment and blade **72** in FIG. **12** can be made of tungsten carbide, alumina, stainless steel, chrome steel or other relatively hard materials. In all three embodiments air is drawn in through the holes or slots alongside the blade tending to remove any particles or scrapings that accumulate on the blade and so maintain blade cleanliness while it is being used. Thus, the particles or scrapings are removed from the cassette and exhausted through a vent on the back of the case **96**, FIG. **4**.

A suitable power supply is provided to operate the drive motor **85**, FIG. **4**, fan motor **86** and the solenoid **31**. A pilot light **93**, FIG. **3**, is provided to show power on condition. Switches **82**, **83** and **84** are provided for "power on", "rewind" and "stop/start" functions, respectively, for tape control. It is noted that sprocket **7**, FIG. **2**, is powered through spindle **2**, FIG. **1**, by motor **85**, FIG. **4**. A slip clutch **95** is utilized to prevent tape damage when the cleaning pass is complete. This method of tape drive is used since maintaining a constant tape velocity by the cleaning head is not mandatory as is the case in tape players and recorders.

In operation, the cassette is inserted into the apparatus as already described so that the spindles **2** and **3** engage reels **91** and **92**, FIG. **3**, inside the cassette, the pins **4** and **5**, FIG. **1**, engage holes **9** and **10** in the cassette, FIG. **2**, and the cleaning blade probe **6** sticks into the hole **11** in the cassette with the blade on this probe just behind the tape **13**. At this point the platform **28** is disposed away from the cassette by the action of the spring **37**, FIG. **5**. Next, the power switch is closed turning on the pilot light and energizing the main power bus. Then the start/stop switch is actuated to the start position causing the solenoid to be energized which moves the platform **28** toward the cassette until it abuts the wall **27**. This positions the roller **51** into the cassette as shown in FIG. **3** so that the roller holds the tape **13** against the blade in the cleaning blade probe **6** (see also FIG. **14**). Also, the blade **42** for cleaning the oxide side of the tape is projected into the cassette against the oxide (recording side) of the tape as shown in FIGS. **3** and **9**. Similarly, the cleaning pad **61**, FIG. **6**, projects into the cassette against the tape. At the same time the fan motor **86**, FIG. **4**, is energized producing a flow of air past each of the blades and into the vacuum chamber **46**. The drive motor **85** is also energized driving the spindle **2** via a reducing pulley and belt **94** and clutch **95**. This turns the spool **91** which winds up the tape drawing the tape past the blades and off the spool **92**. When the spool **92** has spilled all the tape, a peak load is produced on the spindle which disengages the clutch. Thereafter, the start/stop switch **84** is positioned to stop, the cassette is removed from the apparatus reversed and reinserted into the apparatus and the rewind switch **83** is actuated to wind the tape again on spool **92**. During rewind platform **28** remains in detent. And so the tape in the cassette is cleaned and ready again for use.

The tape cleaning apparatus described herein is specifically designed for cleaning tape inside a cassette without removing any portion of the tape from the cassette. The apparatus and embodiments of parts of the apparatus are described in considerable detail. It is to be understood that this is intended for purposes of illustration and example of the best known use of the invention.

Other embodiments will occur to those skilled in the art and are within the following claims.

What is claimed is:

1. Apparatus for cleaning magnetic tape in a cassette comprising:

means for holding the cassette,

a plurality of scraping blades for engaging both sides of the tape inside the cassette,

means for producing air flow proximate the blades for removing from the blades material scraped from the tape, and

means for driving the tape inside the cassette causing the tape to move past the blades.

2. The apparatus of claim **1** in which said means for holding includes means for aligning a cassette relative to the apparatus.

3. The apparatus of claim **2** in which said means for holding includes spring loaded means for steadying a cassette during operation.

4. The apparatus of claim **1** in which each of said scraping blades is mounted on a probe which projects through a hole in a cassette for engaging the tape in the cassette.

5. The apparatus of claim **4** in which each of said probes includes at least one port proximate each blade for conveying air past that blade to remove tape scrapings therefrom.

6. The apparatus of claim **5** in which said means for producing air flow includes a vacuum chamber and means for interconnecting said chamber to each said port.

7. The apparatus of claim **1** in which means for driving includes two spindles for engaging the two hubs of the tape reels within a cassette for the purpose of providing prime tape motion.

* * * * *