

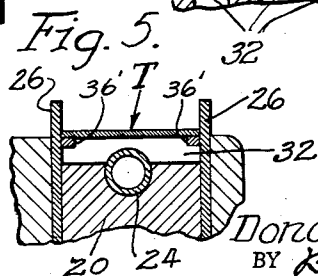
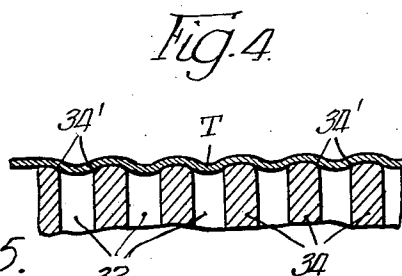
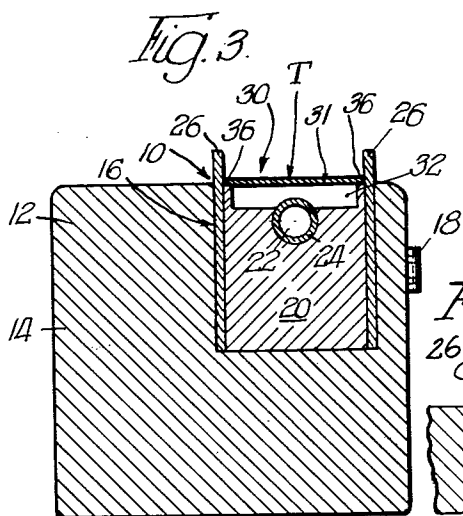
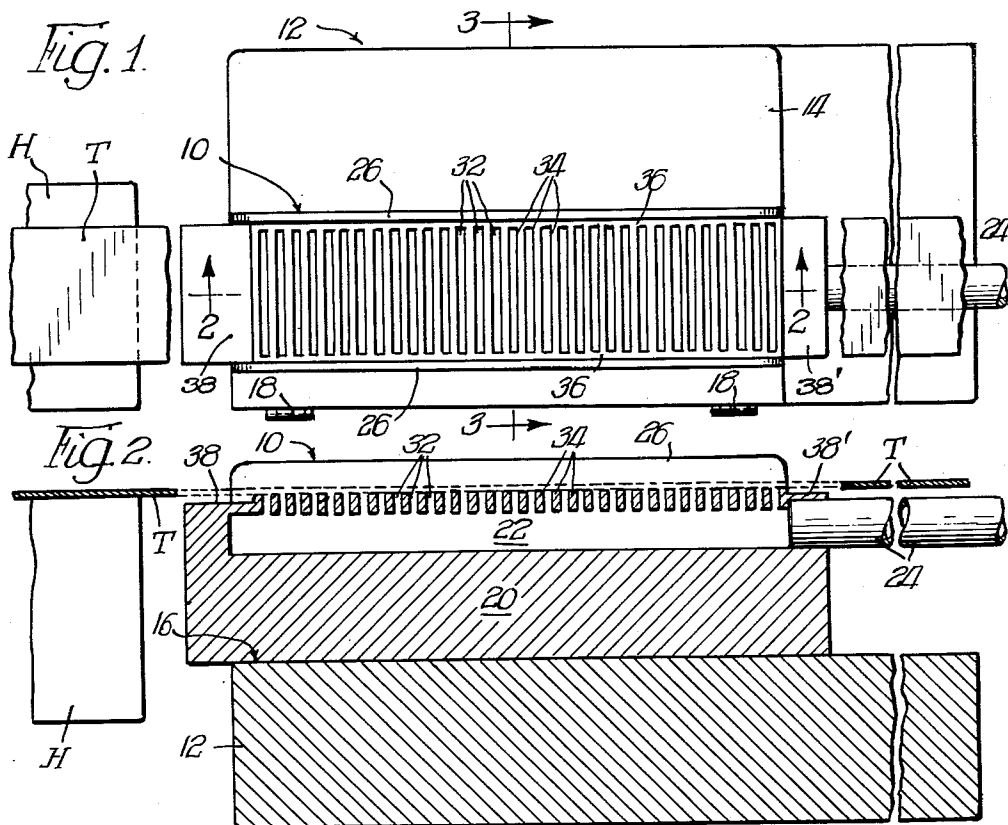
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VACUUM FRICTION PAD FOR TAPE RECORDERS

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VACUUM FRICTION PAD FOR TAPE RECORDERS

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The present invention relates to improvements in vacuum friction pads for tape recorders.

In the design of modern magnetic tape record-reproduce machines, particularly those designed for the storage of analog and digital data, the problem of adequate control of the tape, both as to tension and position, has become increasingly important. The earlier methods of using the tension produced by the reel motors themselves are no longer adequate, particularly when it is important to divorce any possible tape disturbance due to the reels from the section of tape just before and after it passes over the record-reproduce head. Further, the use of slack loop systems, in which the tape is more or less uncontrolled in some part of its path, requires that a friction or similar tensioning device be used in the vicinity of the head itself. Finally, in the case of high speed start-stop systems, where it is vital that the flow of the tape be started and stopped in a few milliseconds without any creep, has led to the design, in some cases, of rather elaborate tensioning systems. Among the tensioning systems in use for this type of machine are such things as a felt pad which will hold the tape against a metal block or another similar pad, idlers whose high friction surfaces which drive a shaft which is affected by either viscous or coulomb friction, as well as a rather large variety of vacuum tensioning pads.

These vacuum friction pads comprise tape guiding surfaces having suction apertures therein through which the vacuum or suction acts to hold the tape pressed against the guiding surface.

Much difficulty has heretofore been encountered with prior vacuum friction pads because of the tendency of these pads to clog by reason of particles of the oxide coating on the magnetic tape, together with other foreign particles on the tape, tending to build up accumulations on the vacuum pad, with the resulting failure of the pad to act properly on the tape, or to damage the tape. This build-up of oxide coating starts as a small point deposit, and then proceeds to build up by accretions of oxide coating, together with other foreign particles, to this point deposit. Such build-up of coating from the tape commonly causes improper guidance and inadequate tension on the tape, together with damage to the tape; and necessitates frequent stopping of the machine for cleaning or substituting vacuum pads.

As a result of extensive experimentation and development, I have devised an improved vacuum friction pad which avoids or greatly reduces the above difficulties. The construction and proportions of this improved vacuum pad will now be explained in connection with the following preferred embodiment of the invention, as illustrated in the accompanying drawing in which:

FIGURE 1 is a plan view of the improved vacuum friction pad, on a greatly enlarged scale;

FIGURE 2 is a longitudinal sectional view taken approximately on the plane of the line 2—2 of FIGURE 1;

FIGURE 3 is a transverse sectional view taken approximately on the plane of the line 3—3 of FIGURE 1;

FIGURE 4 is a fragmentary sectional view, similar to FIGURE 2, but on a considerably magnified scale to illustrate the up and down undulations of the tape in its travel as it passes over the slots and lands of my improved vacuum pad; and

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FIGURE 5 is a fragmentary transverse sectional view, similar to FIGURE 3, but illustrating a modified embodiment.

In these figures, my improved vacuum friction pad is designated 10 in its entirety, and the magnetic tape which is guided and tensioned thereby is designated T, these parts being shown on a considerably enlarged scale. These vacuum pads are usually mounted in proximity to a recording, reproducing or erasing head, one of which is fragmentarily indicated at H in FIGURE 1. The vacuum pad is usually secured in a mounting block 12 which is readily removable and replaceable in the recording and reproducing machine, in order to facilitate ready mounting and removal of the vacuum pad. The mounting block 12 is shown as having an upwardly projecting portion 14 which is provided with a channel-shaped mounting slot 16 extending longitudinally therethrough. The vacuum friction pad 10 is releasably held in this channel-shaped mounting slot 16 by set screws 18 (preferably of the Allen head type), which screw through threaded holes in one side wall of the mounting slot 16.

The pad 10 comprises a long rectangular block of metal 20, in which is cored or drilled a longitudinally extending vacuum duct 22. One end of this duct is closed, but secured to the other end, as by soldering, brazing or threading is a vacuum tube 24, preferably metallic, which extends to a source of suction in the machine. The degree of suction or vacuum may be varied, depending upon the thickness of the tape, the degree of tension desired, etc., being generally of the order of approximately 3 to 12 inches of mercury.

Interposed between the side walls of the channel-shaped mounting slot 16 and the adjacent side walls of the pad block 20 are thin vertical plates 26 which have their top edges projecting slightly above the top edges of the pad block 20 so as to define a tape guiding channel 30 extending longitudinally of the pad block. These plates 26 also function as shim plates for accommodating different thicknesses of pad block within the channel-shaped mounting slot 16.

Formed in the longitudinal tape guiding surface 31 of the pad block 20 are a series of transversely extending suction slots 32, which are spaced apart by transversely extending intervening lands 34. The suction slots 32 extend down into the pad block 20 sufficiently to intersect the suction duct 22, from which they all derive suction transmitted through tube 24. As shown in magnified scale in FIGURE 4, the upper opposite corners or edges of each transverse land 34 are rounded or curved, as indicated at 34', so as to enable the tape T to depress or cup downwardly more readily into each suction slot 32, as will be later described in greater detail.

In the preferred embodiment of the invention the suction slots 32 do not extend out to the full width of the tape T, or to the full width of the tape guiding channel 30. Instead, the opposite ends of these suction slots terminate slightly short of the side walls of the tape guiding channel 30, so as to leave narrow longitudinally extending lands 36 along which the side edges of the tape T can bear in the travel of the tape through the guide channel 30. These longitudinally extending lands 36 may be formed integral with the pad block 20; or as an alternative construction, illustrated in FIGURE 5, the slotted portion of the pad block 20 may be made slightly narrower than the width of the guide channel 30, with the ends of the suction slots 32 extending out to the sides of the pad block, and with the longitudinal lands 36 in the form of strips 36' secured over the open ends of the suction slots, and with their top edges lying flush with the top edges of the transverse lands 34.

As a result of extensive research and experimentation, I have found that the build-up of oxide coating on the

vacuum pad 10 can be entirely prevented, or reduced by a very large percentage over prior constructions, when the suction slots 32, transverse lands 34 and longitudinal lands 36 bear a certain approximate dimensional relationship to the tape T and to each other. For example, for the standard magnetic tape having a conventional width of approximately $\frac{1}{4}$ inch and a conventional thickness ranging from $\frac{1}{2}$ to $1\frac{1}{2}$ mil (mylar or acetate backing), I have found that optimum results are obtained when the transverse lands 34 have a width or thickness substantially as small as $\frac{1}{64}$ of an inch (0.015 inch), and the suction slots 32 have substantially the same width. The narrowness of such transverse lands 34 does not afford adequate surface area for the build-up of oxide coating to start, or to progress to the point where an objectionable accumulation can occur. For example, the narrowness of the lands 34 results in accumulations of oxide coating breaking off at the trailing edges of these lands, before they can assume any objectionable size, and being then instantly sucked into the suction slots 32. The above preferred or optimum thickness of the transverse lands (approximately .015 inch) avoids the previous tendency of accumulating objectionable accretions of oxide coating from the tape T, without producing objectionable wear on the tape. That is to say, if, on the other hand, these transverse lands 34 are made excessively thin, they result in upper knife-like edges which produce undue wear on the tape.

With regard to the suction slots 32, optimum results appear to be attained when the slots have substantially the same ratio of width as the lands 34, i.e. approximately .015 or $\frac{1}{64}$ of an inch. This width allows the tape T to depress or cup down slightly under the action of suction in its travel over each suction slot, as shown in greatly magnified scale in FIGURE 4. Thus, the tape goes through a series of very slight up and down undulations in traveling across the series of lands and slots, which is desirable for augmenting the tension on the tape. Making the slots too wide makes the undulations too pronounced for high running speeds of the tape, and making the slots too narrow diminishes the tension on the tape objectionably. In keeping with this undulating travel of the tape, the corners or edges of each land 34 are rounded or curved at 34' to minimize wear on the tape, both corners or edges being rounded where the tape is intended to be under vacuum tension in each direction of travel. The radius of curvature of each rounded edge 34' is preferably so proportioned to the extremely thin width of each land 34 that the convex curvatures at the opposite edges of each land intersect at the top of the land, as shown in FIGURE 4, whereby no flat surface remains on the top of each transverse land 34, but instead each of these lands presents to the under face of the tape T a completely curved convex surface having no shoulders or angular edges. The absence of such shoulders or angular edges aids in minimizing the build-up of oxide particles, which do not start to adhere as readily to a curved surface as they do to a right angle shoulder or angular edge.

Referring now to the lands 36 extending longitudinally along the sides of the guide channel 30, I find that optimum results are obtained if these lands have a width of the order of 0.010 inch. If these longitudinal lands 36 are substantially narrower than this there is some tendency to deform and draw in the edges of the tape; and there is also a tendency for considerable oxide to build up in the longitudinal corners between the side walls 26 and the pad block 20. If the longitudinal lands are made considerably wider than this optimum dimension there is an objectionable loss of effective tape width for the suction to act on in producing the desired tape tension.

Any tendency to accumulate oxide coating at the leading and trailing end surfaces of the pad block 20 is prevented by depressing or recessing these surfaces below

the top level of the slots 32 and lands 34, as indicated at 38, 38' in FIGURE 2.

I have obtained very satisfactory performance over long periods of time when using vacuum friction pads of substantially the foregoing dimensions, wherein the active area of each pad was approximately 1 inch long and $\frac{1}{4}$ inch wide, with approximately thirty-two suction slots 32 to this 1 inch of length—when using magnetic tape of $\frac{1}{4}$ inch width and $\frac{1}{2}$ to $1\frac{1}{2}$ mil thickness. It will be understood that these dimensions may be subject to appreciable change when using other widths of tapes, and possibly other thicknesses of tapes.

I claim:

1. A vacuum friction pad for tensioning and guiding a run of magnetic tape, comprising a mounting block having a mounting channel therein, a pad block in said channel, a vacuum chamber in said pad block, a tape guide surface defining one side of said pad block, said tape guide surface comprising a plurality of alternating slots and lands extending transversely of the direction of travel of the tape across said pad, said slots transmitting suction from said vacuum chamber to the underside of the tape, said lands being relatively narrow, of a width of approximately 0.015 inch to prevent objectionable accumulations of oxide coating from the tape upon the pad, said lands also having rounded upper edges to facilitate the downward depression of the tape into each slot under the action of suction, whereby the tape makes a series of up and down undulations as it passes across the slots and lands, and guide plates interposed between the sides of said mounting channel and the sides of said pad block for defining the side edges of the tape guiding channel.

2. A vacuum friction pad for tensioning and guiding a run of magnetic tape, comprising a mounting block having a mounting channel therein, a pad block in said channel, a vacuum chamber in said pad block, a tape guide surface defining one side of said pad block, said tape guide surface comprising a plurality of alternating slots and lands extending transversely of the direction of travel of the tape across said pad, said slots transmitting suction from said vacuum chamber to the underside of the tape, said slots and lands both being relatively narrow and of substantially the same width of approximately 0.015 inch to prevent objectionable accumulations of oxide coating from the tape upon the pad, said transverse slots extending out to the sides of the pad block, and longitudinally extending lands in the form of strips secured over the open ends of said transverse slots and having their top edges lying flush with the top edges of said transversely extending lands.

3. A vacuum friction pad for tensioning and guiding a run of magnetic tape, comprising a vacuum chamber, a tape guide surface defining one side thereof, said tape guide surface comprising a plurality of alternating suction slots and lands extending transversely of the direction of travel of the tape across said pad, said slots transmitting suction from said vacuum chamber to the underside of the tape, and said lands being relatively narrow, of a width of approximately 0.015 inch to prevent objectionable accumulations of oxide coating from the tape upon the pad.

4. A vacuum friction pad for tensioning and guiding a run of magnetic tape, comprising a vacuum chamber, a tape guide surface defining one side thereof, said tape guide surface comprising a plurality of alternating suction slots and lands extending transversely of the direction of travel of the tape across said pad, said slots transmitting suction from said vacuum chamber to the underside of the tape, and said slots and lands being substantially the same width, of approximately 0.015 inch to prevent objectionable accumulations of oxide coating from the tape upon the pad.

5. A vacuum friction pad for tensioning and guiding a run of magnetic tape, comprising a vacuum chamber,

a tape guiding channel in one side thereof, said tape guiding channel comprising a plurality of alternating suction slots and lands extending transversely of the direction of travel of the tape through said channel, said suction slots transmitting suction from said vacuum chamber to the underside of the tape, said suction slots and transversely extending lands both being relatively narrow, said transversely extending lands being of a width of approximately 0.015 inch to prevent objectionable accumulations of oxide coating from the tape upon the pad, and longitudinally extending lands between the ends of said suction slots and the sides of said tape guiding channel, said longitudinally extending lands also being relatively narrow.

6. A vacuum friction pad for tensioning and guiding a run of magnetic tape, comprising a vacuum chamber, a tape guiding channel in one side thereof, said tape guiding channel comprising a plurality of alternating suction slots and lands extending transversely of the direction of travel of the tape through said channel, said suction slots transmitting suction from said vacuum chamber to the underside of the tape, said suction slots and transversely extending lands both being relatively narrow, and longitudinally extending lands between the ends of said suction slots and the sides of said tape guiding channel, said longitudinally extending lands being of a narrow width of the approximate order of 0.010 inch, and said transversely extending lands also being of a narrow width

of approximately 0.015 of an inch and having convexly rounded upper edges over which the magnetic tape travels, whereby to prevent objectionable accumulations of oxide coating from the tape upon the pad.

7. A vacuum friction pad for tensioning and guiding a run of magnetic tape, comprising a mounting block having a mounting channel therein, a pad block in said channel, a vacuum chamber in said pad block, a tape guide surface defining the outer side of said pad block, said tape guide surface comprising a plurality of alternating slots and lands extending transversely of the direction of travel of the tape across said pad, said slots transmitting suction from said vacuum chamber to the underside of the tape, said transversely extending slots extending out to the side surfaces of the pad block, and removable shim plates interposed between the sides of said mounting channel and the sides of said pad block, said transversely extending slots and lands both being relatively narrow, and of substantially the same width of approximately 0.015 inch to prevent objectionable accumulations of oxide coating from the tape upon the pad.

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