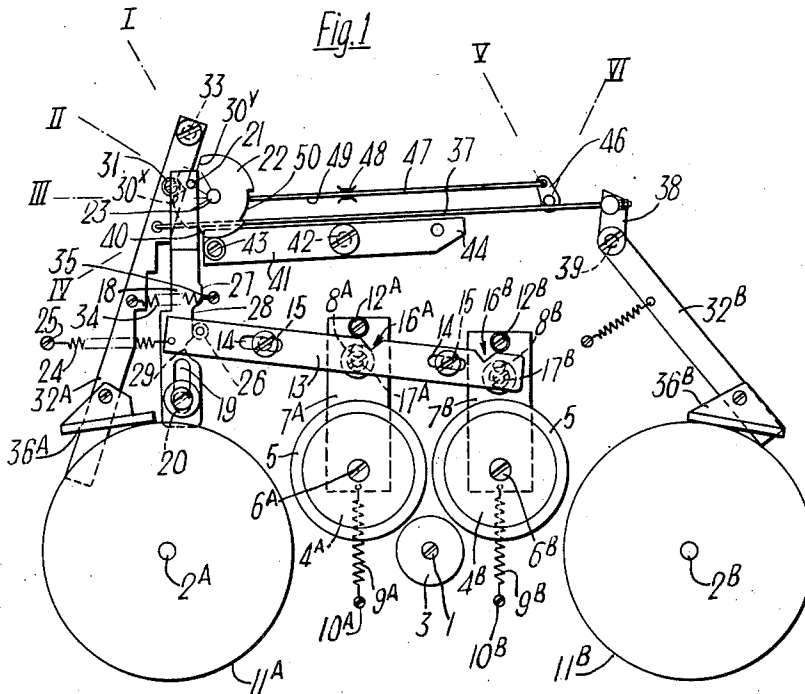


3,038,348

3 Sheets-Sheet 1



Inventors
FREDERICK C. STOVOLD
WILFRED P. LEADLEY
ROBERT C. WILSON
By
Watson, Cole, Grindle & Watson
Attorney

June 12, 1962

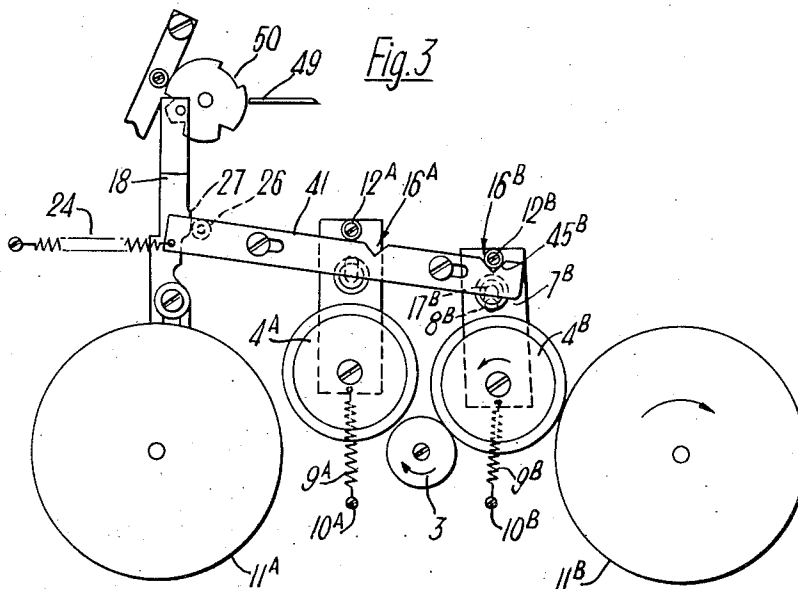
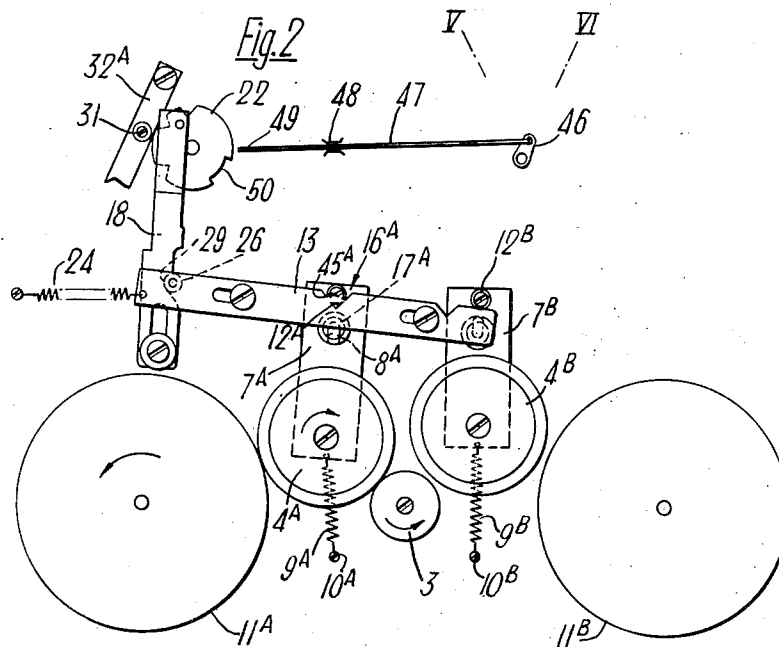
F. C. STOVOLD ETAL

3,038,348

TAPE RECORDERS

Filed Nov. 25, 1960

3 Sheets-Sheet 2



Inventors
 FREDERICK C. STOVOLD
 WILFRED P. LEADLEY
 ROBERT C. WILSON
 By
 Watson, Cole, Grindle & Watson
 Attorney

June 12, 1962

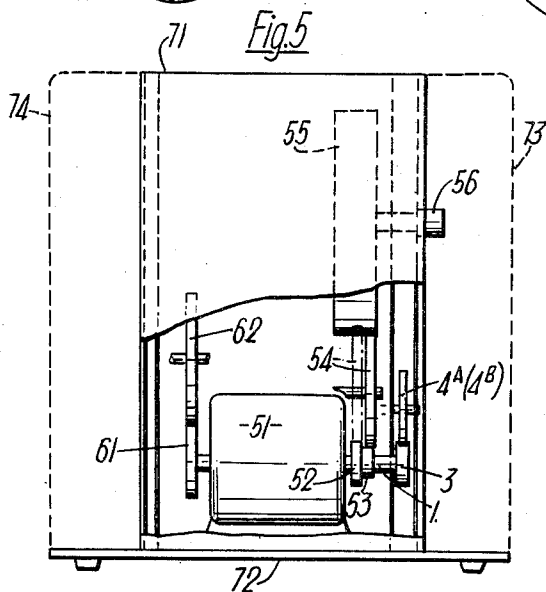
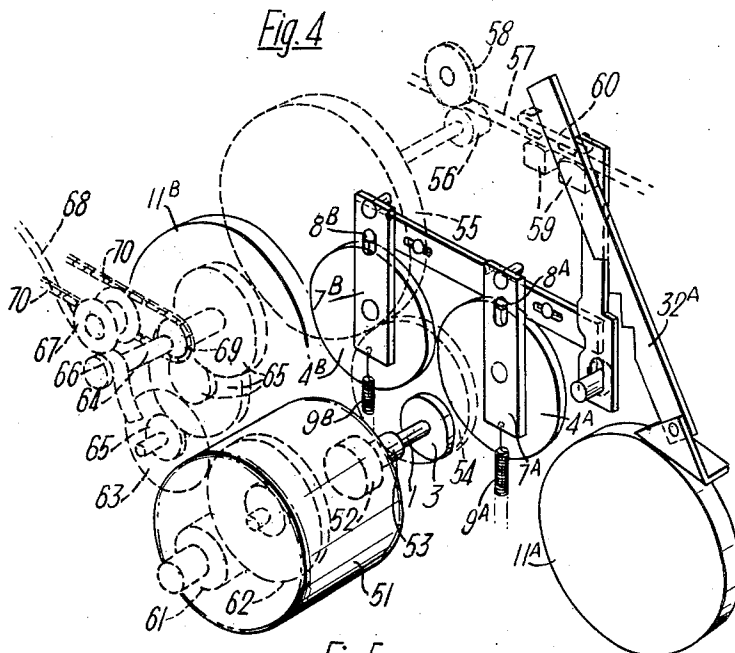
F. C. STOVOLD ETAL

3,038,348

TAPE RECORDERS

Filed Nov. 25, 1960

3 Sheets-Sheet 3



Inventors
FREDERICK C. STOVOLD
WILFRED P. LEADLEY
ROBERT C. WILSON
By
Waters, Cole, Grindle & Waters
Attorney

1

3,038,348

TAPE RECORDERS

Frederick C. Stovold and Wilfred P. Leadley, both of Hemel Hempstead, and Robert C. Wilson, Luton, England, assignors to Dominus (England) Limited, London, England

Filed Nov. 25, 1960, Ser. No. 71,805

Claims priority, application Great Britain Dec. 11, 1959
6 Claims. (Cl. 74—249)

This invention relates to tape recorders and is particularly concerned with reversing means for tape spools driven by a single reversible motor, at the high speeds required for "Re-winding" in one direction and "Fast Forward" in the other direction.

It is known to drive the respective spool drums by intermediate friction pulleys, each of which is driven by a single pulley driven by the one reversible motor, and to move a common support on which the two intermediate pulleys are mounted in one direction or the other about the axis of the driving pulley so that when one intermediate pulley makes driving contact with its spool drum the other is out of driving contact with the other spool drum, the motor being reversed during the operation of moving the support from one driving position to the other. It has been found that the effective driving action of the intermediate friction pulleys is of relatively short duration (perhaps a matter of a few hours only) when they are mounted on a common support, possibly because of the tendency for a driven spool drum to urge its particular pulley out of driving engagement, and possibly because of difficulty in making appropriate contact of each pulley with both the motor pulley (of small diameter) and the spool drum (of substantially greater diameter) for the necessary avoidance of slip at the two points of contact. Avoidance of slip is particularly important if the tape recorder is used synchronously with a film projector, e.g. a projector driven by the same single motor as used for the tape recorder, and the usefulness of the equipment is seriously impaired if faulty reversing means necessitate adjustment every few hours.

The object of the invention is to provide a tape recorder with reversing means by which effective drive is transmitted to either of the spools required to be driven, and can be transmitted over very many hours without the need for adjustment or replacement of the elements of the reversing means.

According to the present invention, a tape recorder of the type having a single reversible motor for driving the tape spool drums selectively in the "Re-wind" and "Fast Forward" directions from a single friction pulley driven by the motor and rotatable about an axis parallel to and between the axes of the two spool drums, is provided with two intermediate friction pulleys mounted on axes parallel to those of the single pulley and the drums but on independent lever supports, each intermediate pulley having a diameter greater than the distance between the single pulley and one of the drums and its lever support having limited sliding freedom at its pivot sufficient to permit the intermediate pulley by combined sliding and rocking of the support to make contact with the single pulley and the drum, with a tension spring acting on the support in its general lengthwise direction to urge the intermediate pulley towards both such contact positions, together with a V-notched member slidable transversely with respect to the support between a position in which a projection on the support on the side of the support pivot remote from the intermediate pulley pivot descends into the notch under the urge of a spring, and a position in which the projection is forced out of the notch against the urge of the spring, one side of the notch in the first of these positions so engaging the projection as to urge the support and the intermediate pulley towards the drum, and to

2

carry the spring out of line with the support, while still urging the intermediate pulley towards the drum, the out-of-line spring then serving to urge the intermediate pulley away from the drum in the second of these positions.

A single slidable member is preferably used to control both supports, the member having two appropriately located V-notches such that when one projection can descend into its notch, the other projection is held out of its notch. The spacing of the notches is preferably such that both projections can be held out of their notches to provide that neither intermediate pulley transmits any drive in an interval while the motor is brought to rest and reversed.

Advantageously, when contact is broken between an intermediate pulley and its drum, contact is also broken with the single pulley.

The invention will now be further described with reference to the accompanying drawings, as applied to equipment with the axes of the motor, pulleys, and drums horizontal, the single motor serving also for driving a synchronised film projector, as well as for driving the tape for "Record" and "Play."

In the drawings—

FIGURE 1 is a front elevation of the spool driving and controlling mechanism in "stop" position.

FIGURES 2 and 3 are similar views (with some parts shown in FIGURE 1 now omitted) of the mechanism in "Re-wind" and "Fast Forward" positions respectively;

FIGURE 4 is a diagram showing in perspective the driving connections between the single motor and the reversing means for "Re-wind" and "Fast Forward," the tape drive for "Record" and "Play," and the film drive; and

FIGURE 5 is a diagrammatic end elevation of a combined tape recorder and film projector provided with the single motor drive.

In FIGURE 1, a horizontal motor shaft 1 lies symmetrically between and at the same level as spool drum shafts 2A, 2B parallel to it. The shaft 1 carries a small pulley 3 to make driving contact with either of two intermediate pulleys 4A, 4B having tyres 5 suitable for friction drive by the pulley 3. In the "Stop" position shown in FIGURE 1, the pulley 3 is out of driving contact with both of pulleys 4A, 4B, a condition also found in the "Play" position of the mechanism, to be explained later.

The pulleys 4A, 4B are rotatable about horizontal axes at 6A, 6B on lever supports 7A, 7B respectively depending from pivots at 8A, 8B, and each connected at its bottom end to a tension spring 9A or 9B anchored at 10A or 10B at a position vertically below the pivot 8A or 8B. The tendency of each spring 9A, 9B is to bring the corresponding pivot 6A, 6B into the direct line between 8A, 10A and 8B, 10B respectively. In such in-line position, the pulleys 4A, 4B are out of driving contact with the peripheries of spool drums 11A, 11B on the shafts 2A, 2B.

The support levers 7A, 7B extend a little above their pivots 8A, 8B and there each carries a projecting roller 12A, or 12B rotatable about a horizontal axis. These rollers are engaged by a slightly inclined slider 13 with slots 14 to permit movement in the direction of its length with respect to support pins 15 engaging the slots. The upper edge of the slider 13 has V-notches 16A, 16B spaced closer together than are the rollers 12A, 12B, so that in the "Stop" position shown each roller rests on the edge of the slider to the left and right respectively of the notches. The pivots 8A, 8B of the lever supports 7A, 7B are now raised in vertical guide slots 17A, 17B, so that the springs 9A, 9B are put under extra tension, ready to urge either of the rollers 12A, 12B into a notch 16A, 16B when movement of the slider 13 permits. The raising of the supports 7A, 7B is sufficient to bring the pulleys 4A, 4B clear of the pulley 3.

The slider 13 is controlled by a crank-operated slider

3

rod 18, the lower end of which has a lengthwise slot 19 engaged by a support pin 20 and the upper end of which is pivoted at 21 to a cam disc 22 rotatable about a horizontal axis 23 by a knob (not shown) to four angular positions I, II, III, and IV representing "Re-wind," "Stop," "Play," and "Fast Forward" respectively. The radius of operation of the pivot 21 about the axis 23 provides for crank actuation of the slider rod 18 to move the latter substantially in the direction of its own length, with but slight rocking about the pin 20. The slider 13 is urged to the left by a tension spring 24 anchored at 25 and this causes a follower roller 26 on the slider to bear on the right-hand edge of the slider rod 18 over a length forming a 3-step cam. The top 27 of the first step is a slight projection to the right and corresponds to the "Fast Forward" control position; the intermediate step 28 is a depression, of an extent in the lengthwise direction of the slider rod 18 sufficient to serve both the "Play" position and the "Stop" position; and the bottom 29 of the third step is a still deeper depression to correspond to the "Re-wind" position.

In FIGURE 1, the follower roller 26 on the slider 13 bears on the intermediate step 28 of the cam, so that the slider is in the position for both rollers 12A, 12B to be held out of the notches 16A, 16B. Rotation of the cam disc 22 from the "Stop" position shown to the "Play" position still leaves the roller 26 on the step 28, so that no movement of the slider 13 results.

The cam disc 22 has two notches 30X, 30Y into which is urged a follow roller 31 on a brake lever 32A pivoted at 33 and urged by a tension spring 34 anchored at 35. The lever 32A carries a brake pad 36A to bear against the periphery of the spool drum 11A. The lever 32A is connected by a link 37 to the short upper arm 38 of a second brake lever 32B pivoted at 39 and carrying a brake pad 36B to bear against the periphery of the spool drum 11B. In the "Stop" position shown, the follower roller 31 lies in the notch 30X, so that the spring 34 brings both brake pads 36A, 36B into braking position. However, when the cam disc 22 is rotated counter-clockwise to "Play" position the roller 31 leaves the notch 30X and the notch 30Y does not quite reach the roller, so that the brake pads are held out of action.

Further counter-clockwise rotation of the cam disc 22 brings the notch 30Y to the roller 31, which momentarily applies the brake pads in a "Pause" position, before the "Fast Forward" position in which the roller 31 remains on the periphery of the cam disc 22 and maintains the brake pads out of action. At the same time, the rotation of the cam disc 22 has so far moved the slider rod 18 that the step top 27 has engaged the follower roller 26 on the slider 13, to push the slider to the right (FIGURE 3), with a result to be explained below.

Rotation of the cam disc 22 clockwise from the "Stop" position of FIGURE 1 brings the notch 30X clear of the follower roller 31 (FIGURE 2) and brings the deeper depression 29 of the slider rod 18 into engagement with the follower roller 26 on the slide 13, so that the spring 24 moves the slider to the left (FIGURE 2), with a result to be explained below.

The cam disc 22 has a further notch 40 for the operation of a pressure bar in the form of a lever 41 pivoted at 42 and carrying at one end a follower roller 43 that lies on the periphery of the disc 22 except in the "Play" position, when entry of the roller 43 into the notch 40 allows the other end 44 of the bar 41 to depress, to lift the tape pressure pad assembly (see FIGURE 4) from the recording heads in the usual way.

FIGURE 2 shows the position of the slider 13 in the "Re-wind" position of the cam disc 22, which has lifted the slider rod 18 to its uppermost position to allow the spring 24 to draw the follower roller 26 into the deep depression 29. The resultant movement of the slider 13 to the left allows the roller 12A on the lever support 7A to enter the notch 16A, so that the spring 9A draws the

4

support 7A down, the freedom of the support to rock about its pivot 8A in the slot 17A enabling the pulley 4A to come into "equalised" driving contact with both the motor pulley 3 and the left-hand spool drum 11A.

The spring 9A is now out of the direct line between the pivot 8A and the anchorage. The pulley 3 and the drum 11A rotate anti-clockwise for re-winding. Any tendency for the drum 11A to move the pulley 4A out of contact with itself is counteracted by the reaction of one side 45A of the notch 16A on the roller 12A, which produces a servo effect in the lever support 7A to maintain good driving contact and to minimise slip.

The roller 12B of the lever support remains on the edge of the slider 13, so that the lever support 7B, intermediate pulley 4B, and spring 9B remain as in FIGURE 1, with the pulley 4B clear of both the motor pulley 3 and the right-hand drum 11B.

FIGURE 2 shows the follower roller 31 of the brake lever 32A clear of the notch 30X of the cam disc 22, so that the brake pads 36A, 36B (FIGURE 1) are out of action during "Re-wind."

Upon a return of the slider 13 from the "Re-wind" position of FIGURE 2 to the "Stop" position of FIGURE 1, the lifting of the lever support 7A by the forcing of the roller 12A from the notch 16A is accompanied by an urge of the bottom of the support 7A to the right as the spring 9A comes into "in-line" position, so that not only is the pulley 4A lifted, but it is also urged to the right to assist in clearing the left-hand drum 11A.

In the "Fast Forward" position shown in FIGURE 3, the cam disc 22 has brought the slider rod 18 to its lowest position, for the engagement of the cam step 27 on the follower roller 26 to push the slider 13 to the right. This leaves the lever support 7A unaffected, its roller 12A remaining on the edge of the slider, but the roller 12B of the lever support 7B drops into the notch 16B, for the spring 9B to draw the support 7B down and to rock it about its pivot 8B in the slot 17B, so that the intermediate pulley 4B comes into "equalised" driving contact with the motor pulley 3 and the right-hand drum 11B. The two latter rotate clockwise in this position, and any tendency for the drum 11B to urge the intermediate pulley 4B away from itself is countered by the servo effect of the lever support 7B under the reaction of the side 45B of the notch 16B on the roller 12B.

Upon a return of the slider 13 to the "Stop" position of FIGURE 1, the out-of-line position of the spring 9B with respect to the direct line between its anchorage 10B and the pivot 8A causes the intermediate pulley 4B to be urged to the left as it is lifted to ensure that it is clear of the drum 11B.

In FIGURE 1, a crank 46 is rotatable by a control knob (not shown) between two positions V and VI representing "Record" and "Play" respectively. The crank 46 operates a rod 47, guided at 48, so that the free end 49 of the rod is urged towards the periphery of the cam disc 22 in the "Record" position, but the crank can only be moved to "Record" position if the cam disc 22 has been rotated to a position in which an arcuate notch 50 in its periphery is opposite the end 49 of the rod 47. This ensures (a) that with the cam disc 22 in either the "Fast Forward" position or the "Re-Wind" position it is impossible to move the crank 46 to "Record" position, and (b) that with the crank 46 in "Record" position, it is impossible to move the cam disc 22 to either the "Fast Forward" position or the "Re-wind" position. In this way, the possibility of accidentally erasing a pre-recorded tape is eliminated.

In FIGURE 4 is shown the single reversible motor 51, on the shaft 1 of which is carried the pulley 3 for driving one or the other of the intermediate pulleys 4A, 4B in opposite directions. Between the pulley 3 and the motor 51, the shaft 1 carries two pulleys 52, 53 of different diameters for selective engagement by an intermediate pulley 54 that makes frictional contact with a flywheel

5

pulley 55 that drives a capstan pulley 56 for the tape 57, the tape being held to the capstan pulley by a pressure wheel 58. Near the capstan pulley 56 are the recording and erasing heads 59 below a pressure pad assembly 60. This is the assembly controlled by the pressure bar 41 shown in FIGURE 1. The 2-step drive of the pulley 54 by the pulleys 52, 53 enables the tape 57 to be moved over the heads 59 at two different speeds.

At the other end of the motor 51 is a pulley 61 for frictional drive of an intermediate pulley 62, which in turn drives a pulley 63. From the pulley 63 a shaft 64 is driven through reduction gears 65. The shaft 64 carries a film sprocket 66 and a guide roller 67 for the film 68 and also a sprocket 69 for a chain 70. The film 68 drawn from one spool (not shown) passes from the sprocket 66 and the roller 67 to the projector (not shown) driven by the chain 70, as also are a further film sprocket and guide roller (not shown) leading the film to a take-up spool (not shown).

In FIGURE 5, the motor 51 is shown located in a central compartment 71 of a portable combined tape recorder and film projector provided with a base 72 wider than the compartment 71, with removable covers 73, 74 provided to enclose the operative parts of the recorder and projector respectively. The operation of the motor is controlled by the control knobs for the cam disc 22 and the crank 46 by appropriate switches, as also are controlled the recording circuit, the projector lamp, and associated electrical devices, as for providing synchronous driving of the recorder and the projector and independent driving of either of these.

What we claim is:

1. A tape recorder having a single reversible motor for driving its two tape spool drums selectively from a single friction pulley reversibly driven by the motor and rotatable about an axis parallel to and between the axes of the drums, comprising two intermediate friction pulleys with axes parallel to the drum axes, an independent lever support for the axis of each intermediate pulley, with provision for sliding at the lever pivot, a spring acting on each lever support and generally in line with such support to urge the lever support to slide in a direction to bring the intermediate pulley into contact with both a spool drum and the single friction pulley, aided by the ability of the lever support to rock about its pivot, a projection from each lever support at the side of the pivot remote from the intermediate pulley axis, and a control member transversely movable with respect to the projection and containing a V-notch to be brought by movement of the member into and out of register with the projection, which member permits the spring to slide the lever when the projection enters the notch, and overcomes the spring when it forces the projection out of the notch.

2. A tape recorder as in claim 1, wherein a single transversely movable member has the V-notches for the projections of both lever supports, the notches being so spaced such that when one projection is in its V-notch, the other projection is withdrawn from its V-notch, and also that both projections can be simultaneously withdrawn from the notches.

3. A tape recorder as in claim 1, wherein the V-notched member is movable to a position to receive the projection in the notch in which one side of the notch provides a fulcrum to resist movement of the lever support about its pivot in a direction away from that in which the intermediate pulley is urged by the spring towards the tape spool.

4. A tape recorder of the type having a single reversible motor for driving two tape spool drums selectively in the "Re-wind" and "Fast Forward" directions from a single friction pulley driven by the motor and rotatable about an axis parallel to and between the axes of the two spool drums, provided with two intermediate fric-

6

tion pulleys mounted on axes parallel to those of the single pulley and the drums, comprising independent lever support for each intermediate pulley, each lever support having limited sliding freedom at its pivot sufficient to permit the intermediate pulley by combined sliding and rocking of the support to make contact with the single pulley and one of the drums, with a tension spring acting on the support in its general lengthwise direction to urge the intermediate pulley towards both such contact positions, a projection on the support on the side of the support pivot remote from the intermediate pulley pivot, together with a control member slidable transversely with respect to the support and containing a V-notch to be brought by movement of the member alternatively into a position in which the projection descends into the notch under the urge of the spring, and a position in which the projection is forced out of the notch against the urge of the spring, one side of the notch in the first of these positions so engaging the projection as to urge the support and the intermediate pulley towards the drum, and to carry the spring out of line with the support, while still urging the intermediate pulley towards the drum, the out-of-line spring then serving to urge the intermediate pulley away from the drum in the second of these positions.

5. A tape recorder of the type having a single reversible motor for driving two tape spool drums selectively in the "Re-wind" and "Fast Forward" directions from a single friction pulley driven by the motor and rotatable about an axis parallel to and between the axes of the two spool drums, provided with two intermediate friction pulleys mounted on axes parallel to those of the single pulley and the drums, comprising an independent lever support for each intermediate pulley, each lever support having limited sliding freedom at its pivot sufficient to permit the intermediate pulley to make contact with the single pulley and one of the drums by combined sliding and rocking of the support, a tension spring acting on the support in its general lengthwise direction to urge the intermediate pulley towards both said pulley and one of said drums, a projection on the support on the side of the support pivot remote from the intermediate pulley pivot, and a control member slidable transversely with respect to the support and containing two V-notches selectively to be brought by movement of the member into a position in which a projection on one only of the supports descends into that notch under the force of the spring acting on the support, and a position in which the projection is forced out of the notch against the force of the spring, one side of the notch in the first of these positions so engaging the projection as to move the support and the intermediate pulley towards the drum, and to carry the spring out of line with the support, while still forcing the intermediate pulley towards the drum, the out-of-line spring then serving to urge the intermediate pulley away from the drum in the second of these positions, the notches being so located along the control member that when one projection can descend into one V-notch the other projection is held out of the other V-notch and that both projections can also be held simultaneously out of the V-notches.

6. A tape-recorder as in claim 5, comprising a slide rod operatively connected to said control member, and a three-step cam coupled to said rod for bringing the control member to any of three positions in which either one or the other projection is in its notch, or neither projection is in a notch.

References Cited in the file of this patent

UNITED STATES PATENTS

431,636	Whitman	July 8, 1890
2,711,104	Shields	June 21, 1955
2,935,879	Morrison et al.	May 10, 1960