

June 21, 1955

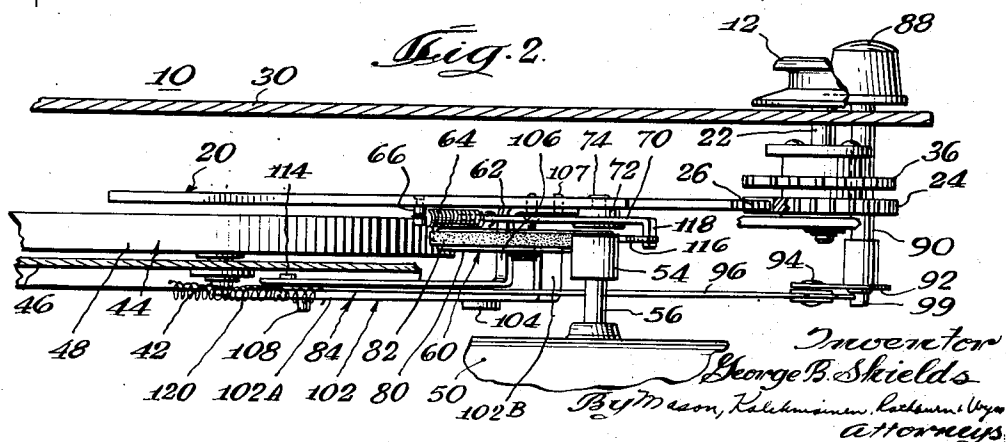
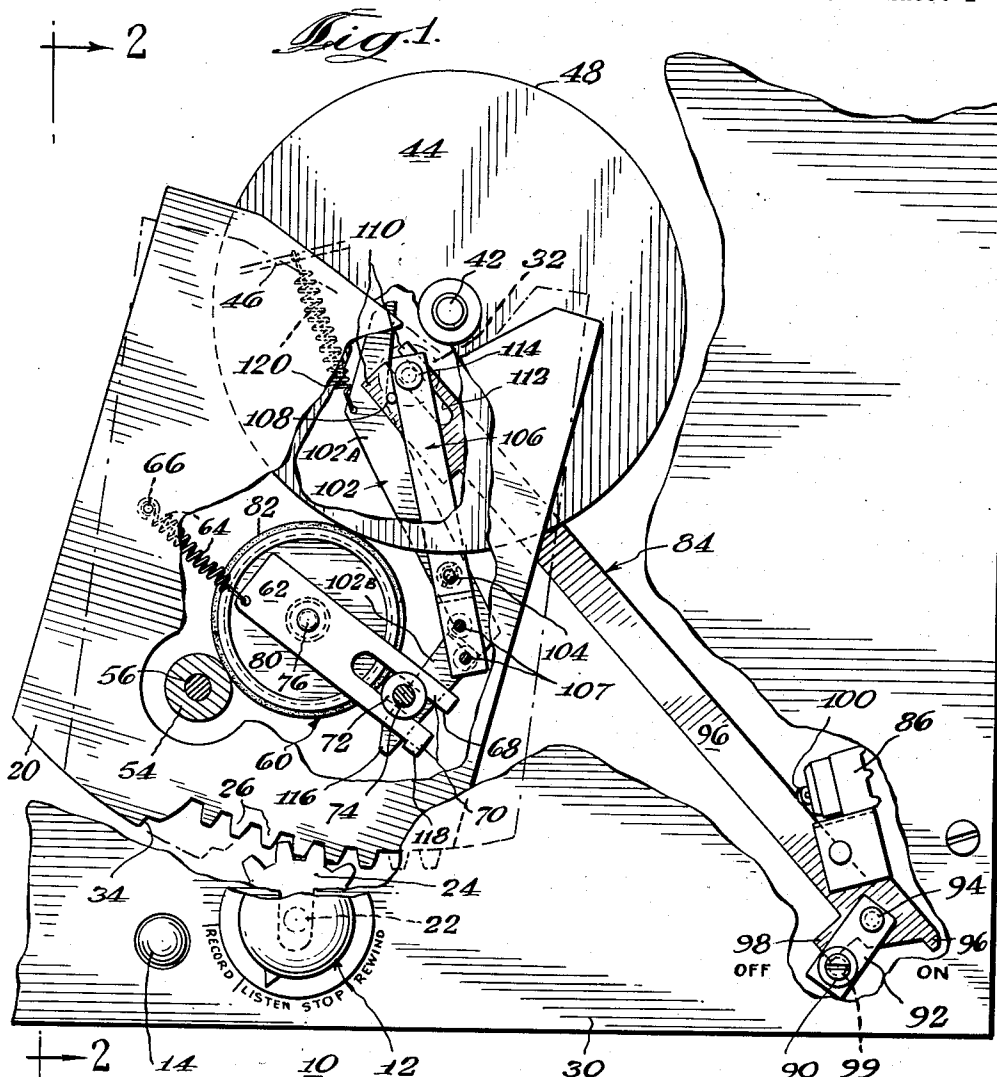
G. B. SHIELDS

2,711,104

RECORDER-REPRODUCER APPARATUS

Filed March 11, 1950

3 Sheets-Sheet 1



June 21, 1955

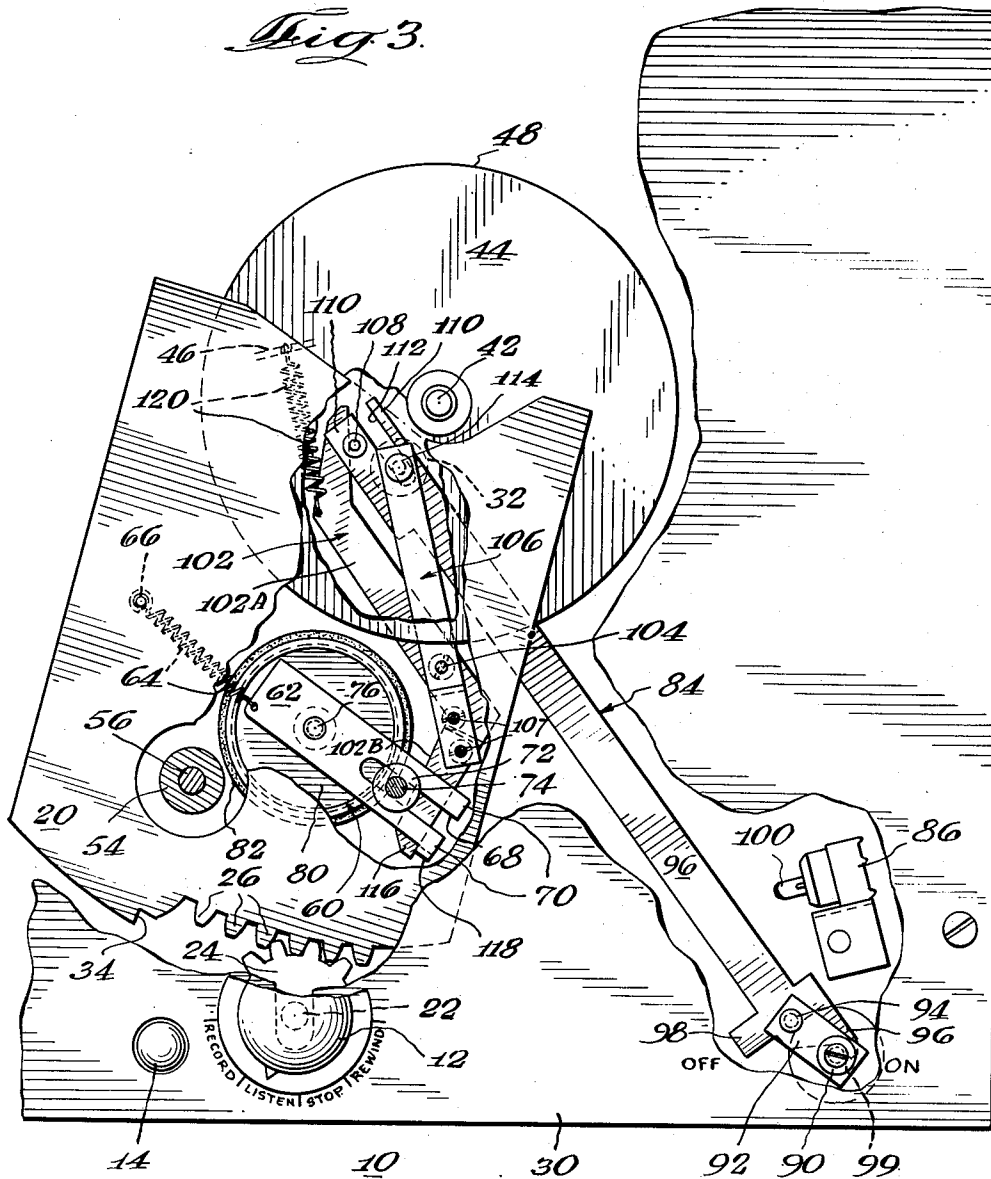
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3 Sheets-Sheet 2



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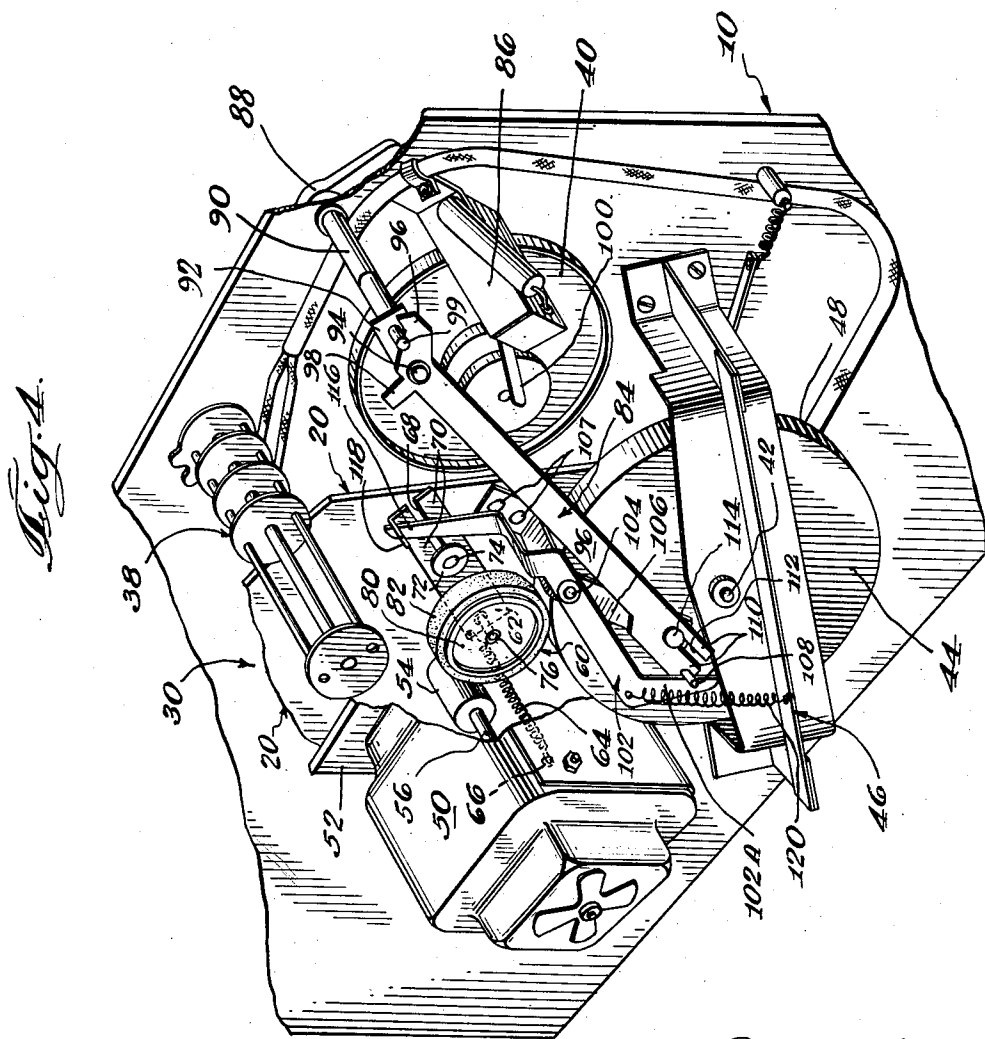
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3 Sheets-Sheet 3



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2,711,104

RECORDER-REPRODUCER APPARATUS

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Application March 11, 1950, Serial No. 149,057

9 Claims. (Cl. 74-472)

The present invention relates to recorder-reproducer apparatus and especially apparatus of this type utilizing an elongated record medium such as a magnetic wire or tape and has for its primary object the provision of new and improved record medium driving apparatus.

Recorder-reproducer apparatus of the type to which the present invention pertains ordinarily utilizes an elongated record medium in the form of wire or tape which will hereinafter be referred to as tape for uniformity and simplicity of description. It comes wound upon a supply spool or reel adapted to be placed on the apparatus and from which it is unwound and wound or reeled upon a take-up reel or spool or rewound upon the supply spool. In recording or reproducing it is essential that the tape be moved at a constant speed and this is customarily done by what is called a capstan type of drive. The drive comprises a capstan driven at a constant speed and against which the tape is held so as to be moved by the capstan at a constant longitudinal speed when it is desired either to record or reproduce. In known types of apparatus the capstan is driven through a flywheel, an idler in continuous driving engagement with the flywheel, and a motor driven drive pulley in continuous driving engagement with the idler.

In the copending application of David J. Munroe, application Serial No. 79,663, filed March 4, 1949, there is disclosed an arrangement in which such a drive is utilized. The motor drives a drive pulley that is in continuous driving engagement with an idler wheel that is in continuous driving engagement with the flywheel, which forms, in substance, a part of a capstan assembly. Actually, the idler wheel is mounted upon a spring biased guide plate so that it will be in continuous engagement with the drive pulley and flywheel, this being desirable because the idler wheel is part of a drive assembly mounted upon an index plate that is moved into different positions in the selective operation of the apparatus to record, listen, rewind, etc.

In order to provide a more efficient drive, the idler wheel has at least a rubber or other resilient frictional driving portion. This is eminently satisfactory but it results in making the drive objectionably noisy and also has a tendency to detract from the quality of the recording under certain conditions. These disadvantages result from the fact that when the apparatus stands idle for a relatively long time, the rubber on the idler wheel "cold flows" with the result that one or more flat spots are formed on the idler. These disadvantages are, however, avoided by the present invention, according to which the idler wheel is disengaged whenever the driving motor is not supplied with power or not rotating.

It is, accordingly, one of the objects of the present invention to provide a new and improved drive for recorder-reproducer apparatus.

A further object of the present invention is the provision of a new and improved recorder-reproducer apparatus in which the engagement of an idler wheel is controlled conjointly with the effectiveness of the drive

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and, more specifically, the idler wheel is moved to engage driving and driven members before the driving motor is energized.

Another object of the present invention is the provision of a new and improved recorder-reproducer apparatus in which the motor energization and engagement of the drive are conjointly controlled, the drive being first engaged after which the motor is rendered operative so that the moving parts of the apparatus are accelerated gradually. Also, the arrangement is such that the motor is first rendered inoperative and then the drive is disengaged.

In brief, the present invention avoids creation of flat spots in a rubber or other resilient tired driving element, such as an idler wheel interconnecting a drive pulley and a driven flywheel, by disengaging the idler wheel when the drive is rendered inoperative, as when the motor is deenergized. This disengagement is effected conjointly with the control of supply of energy to the motor which may be readily accomplished by control means, such as a motor on-off switch. The arrangement is preferably such, also, that the drive is engaged before the motor is energized and is disengaged after the motor is deenergized. The arrangement is also such that it is effective in the various positions of a multi position control mechanism.

Other objects and advantages of the present invention will become apparent from the ensuing description of an illustrative embodiment thereof, in the course of which reference is had to the accompanying drawings, in which:

Fig. 1 is a fragmentary top plan view, partly broken away, of a recorder-reproducer apparatus embodying the present invention; the view illustrating the apparatus in an operative condition, i. e., the motor energized and the idler wheel engaged so that the drive is effective;

Fig. 2 is a fragmentary vertical cross-sectional view taken along the line 2-2 of Fig. 1;

Fig. 3 is a view similar to Fig. 1 but illustrating the motor deenergized and the idler wheel disengaged; and

Fig. 4 is a somewhat diagrammatic and fragmentary bottom perspective view of the apparatus, also with the motor deenergized and the idler wheel disengaged.

The present invention, as already noted, is applicable to recorder-reproducer apparatus, especially of the type employing magnetic wire or tape. It relates particularly to the drive and control of such apparatus, with the result that an understanding of the invention does not require the illustration or description of a complete apparatus. For this reason it will be described in connection with but a portion of the apparatus, but a portion which will, it is believed, give a complete understanding of the invention, its construction, mode of operation and advantages. This portion of the apparatus with which the invention is described is similar to apparatus shown in the aforementioned Munroe application to which reference may be had for additional details.

The apparatus in conjunction with which the invention is described includes a recorder-reproducer 10 having a selectively operable control knob 12 which is manually movable into a number of different positions to condition the apparatus to (1) record, (2) listen, (3) stop, and (4) rewind. Associated with it is an interlock button 14 which must be depressed before knob 12 can be moved into its record position, whereby accidental operation to this position with attendant undesired erasing is prevented.

The control knob is operatively connected to an index plate 20 movable into different selected positions corresponding to those of the knob. This connection is effected through a control knob shaft 22 and a gear 24 affixed to the shaft and meshing with gear teeth 26 at one end of the index plate. The knob is mounted above a main base plate 30 and the shaft extends below

the plate. The index plate, which is somewhat rectangular in shape, is supported for pivotal movement below the base plate 30 by a pivot pin 32, shown only in phantom, which extends a short distance below the base plate. The interlock button 14 has associated with it mechanism (not shown) cooperating with a shoulder 34 on the index plate to prevent the plate, and the control knob, from being moved into the record position unless the button is depressed. The control knob shaft 22 has a second gear 36 affixed to it for operating a switch assembly 38 selectively to establish the requisite circuits for listening, reproducing, etc.

The apparatus includes tape supply and take-up spools of which only a part associated with the latter is shown, this part being indicated by reference character 40. The tape is selectively driven at a constant speed in a forward direction in the listen and record positions of the control knob by a capstan type of drive including a flywheel-capstan shaft 42 to which the flywheel 44 is affixed and the lower end of which is rotatably supported in a supporting bracket 46 affixed to the under side of the base plate 30. The capstan has a tape engaging portion above the base plate and has associated with it a selectively operable rubber tired pinch roller (not shown) whereby the tape can be held against the capstan and driven at constant speed. The flywheel is conventionally made of some heavy metal, such as brass and it has a smooth periphery 48 through which it is driven at a constant speed.

The flywheel (and other portions not of importance as far as the present invention is concerned) is driven by a motor 50, as of the synchronous type, mounted upon a mounting plate 52 secured to the underside of the index plate 20. The motor rotates a driving wheel assembly comprising a drive pulley 54 which may be secured to the motor shaft 56. The pulley may be of metal and have a smooth peripheral driving portion.

In accordance with present invention, the drive pulley 54 is drivably connected to the flywheel to drive the latter and the capstan in all positions of the control knob and index plate, but only if the motor is energized. Assuming for the time being that the motor is energized and the control knob is in the listen position, as shown in Fig. 1, then an idler wheel 60 is in engagement with both the drive pulley and the flywheel and operatively connects them to render the drive operative. It remains in engagement with these in the other positions of the index plate, because it is mounted upon a slidable and angularly movable guide plate 62 which is spring biased to the left, as shown in the various figures, by a spring 64 connected at one end to the plate and at its other end to a post 66 secured to the index plate. The right end of plate 62 is longitudinally slotted at 68 to provide spaced fingers 70 slidably received in a grooved idler guide plate pivot 72 below the index plate to which it is secured by a pin 74. The idler wheel itself is journaled upon a shaft 76 secured to an intermediate portion of the idler plate.

The spring 64 thus pulls the plate 62 and idler wheel 60 to the left and in a direction to engage the idler with the drive pulley and flywheel and the idler does so engage the pulley and flywheel in various positions of the index plate and control knob. One of the other positions of the index plate, the record position, is shown in phantom in Fig. 1. While the motor and drive pulley are shown moving with the index plate, this is not essential for, if desired, the motor may be stationary.

In order to provide an efficient drive at least the peripheral portion of the idler wheel should be made of rubber or other resilient frictional material. In the illustrated construction the wheel comprises a metal wheel-like portion 80 and a solid rubber tire portion 82, although different arrangements could be used. Thus, if the present invention were not utilized, flats would

develop in the tire because of "cold flow" when the apparatus stands unused for longer periods of time.

In order to prevent the development of undesired flats in the idler wheel, it is moved out of engagement, or at least the biasing pressure is considerably reduced, during those times that the motor is deenergized. This is preferably accomplished through mechanical linkage means operatively connecting the idler wheel with a motor energization control switch and with means, such as a control member or lever, operable manually to different positions to supply or cut off the power to the motor. In the present embodiment the linkage is indicated generally by reference character 84, the switch by 86, and the manually operable control lever by 88. These are so constructed and arranged that when lever 88 is operated to energize the motor the idler is first shifted into engagement with the drive pulley and flywheel so that all the moving parts conditioned for drive at that time will be accelerated gradually. The arrangement is also such that the motor will be deenergized prior to disengagement of the drive, whereby the motor inertia is used to assist in braking.

The control member 88 is illustrated as a lever located above the base plate and attached to a shaft 90 pivotally mounted upon and extending below the plate. A crank arm 92 is fixedly secured to the lower end of the shaft. Its free end is pivotally secured by a pin 94 to an elongated link 96 forming part of the linkage mechanism. The crank arm is movable by the lever 88 between "on" and "off" positions that are determined by engagement of the bifurcations 96 and 98 at its end with the reduced diameter end 99 of shaft 90, as shown in Figs. 1 and 3, respectively. In the off position depicted in Figs. 3 and 4, the link 96 is seen to be some distance from switch 86 and its operating member 100 so that the switch is open; in the on position of Fig. 1 the member 100 has been engaged by the link and operated to close the switch.

The link 96 is operatively connected to the idler guide plate 62 by a double armed lever 102 pivoted at an intermediate point upon pin 104 mounted upon a bracket 106 secured to the index plate 20 as by screws or the like 107 and depending below the index plate. One arm 102A of the lever extends generally parallel to the outer end of link 96 and has its outer angular end in engagement with an operating pin 108 secured to one of a pair of spaced arms 110 at the end of the link. These arms define a slot 112 slidably receiving a guide post 114 mounted at the end of the bracket 106. The other lever arm of lever 102 is indicated by 102B and it extends upwardly toward the index plate (see Figs. 3 and 4), and then angularly toward the idler guide plate, where its end 116 cooperates with a dependent lug 118 at the end of one of the bifurcations 70 on the plate. The guide plate spring 64 holds the plate lug 118 against lever arm 102B in the "off" position of lever 88 whereas the lug is clear of arm 102B in the "on" position so that spring 64 is effective to hold the idler wheel in engagement with the drive pulley and flywheel. A second spring 120 is connected to lever 102A and to the flywheel supporting bracket 46 so as to bias lever 102 in a clockwise direction as viewed in Figs. 1 and 3. This, coupled with the illustrated location of the shaft 90 and pin 94, results in the link 96 being urged toward shaft 90 and held with arm 96 or 98 abutting against extension 99 of the shaft in both limit positions. The spring 120 thus serves to hold the linkage 84 and lever 88 in either of its limit positions, the link 96 being operable, in effect, "over-center" into two positions wherein it is held by the spring 120.

The movement of the index plate into its various selected positions with the lever 88 in either its off or on position does not disturb the relation of the idler wheel relative to the drive pulley and fly wheel. This results from the fact that the bracket 106 and lever 102, as well as the guide plate 62, are mounted on the index

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plate and because the guide post 114 associated with the link 96 is located substantially at the pivotal axis of the index plate and the operating pin 108 is located near that axis. There is a slight change in the tension of spring 120 and in the position of pin 108 relative to the free end of lever 102A as the position of the index plate changes, but these do not affect the operation.

The relative strengths of springs 64 and 120 are of no particular moment, the spring 64 being designed to provide the desired bias force holding the idler wheel against the drive pulley wheel, while spring 120 is of desired strength to hold the link 96 and control lever 88 in its limit position.

It is believed that the operation of the invention will be clear from the foregoing detailed description, but it will be reviewed briefly. Assuming that the recorder-reproducer control knob is in the listen position and the lever 88 is in its off position, then the apparatus will be in the positions illustrated in Figs. 3 and 4. At this time the motor is deenergized, the switch 86 being open and the circuits and other apparatus are conditioned for performance of the listening function. The idler wheel 80 is out of engagement with the drive pulley 54 and fly wheel 44, it being so held by engagement of end portion 116 of lever arm 102B with the lug 118 on the idler wheel guide plate 62. The position of the lever arm 102B is determined by engagement of pin 108 on link 96 with the other end of lever arm 102A and the position of the link is determined by engagement of its bifurcation 96 with the reduced end 99 of the shaft 90 to which the lever 88 is affixed. The arrangement is such that the idler wheel remains out of driving engagement with the drive pulley and fly wheel in the various positions of the index plate 20 and idler wheel.

When it is desired to initiate operation of the apparatus, the lever 88 is operated to its on position. When this is done the crank arm 92 rotates pivot pin 94 from the position in which it is shown in Fig. 3 to the position of Fig. 1. When this occurs, the guide plate lug 118 is freed from the end 116 of lever arm 102B with the result that spring 64 maintains the idler wheel in engagement with the drive pulley and fly wheel and in the various positions of the index plate. This engagement of the idler wheel with its associated parts occurs before the switch 86 is closed by the link 96 engaging and moving the switch operating member 100. As a result, the motor is energized after the drive is made effective so that the motor and the driven parts of the recorder-reproducer accelerate gradually.

When it is desired to stop the motor, the lever 88 is moved from its on to its off position. When this is done the motor is first deenergized because link 96 first moves away from the switch operating member 100 after which the idler wheel is moved away from the drive pulley and fly wheel by movement of the lever arm 102 so that the end portion 116 of lever arm 102B engages lug 118 of the idler guide plate and moves the plate back to the position of Fig. 3.

It will be noted therefore that the present invention provides a conjoint control of the motor energization and effectiveness of the drive. Also, the idler wheel is moved out of engagement with the drive pulley and fly wheel whenever the motor is stopped so that flat spots are not created in the rubber driving portion thereof no matter how long the apparatus stands idle. While the idler is shown as moved entirely out of engagement in the "off" position, it should be understood that this is not always necessary as the movement could be such as to decrease the pressure on the idler to such an extent that flats are not produced in it.

While the present invention has been described in connection with the illustrative details of an embodiment thereof, it should be understood that these details are not intended to be illustrative of the invention except in so far as set forth in the accompanying claims.

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Having thus described my invention, what I desire to secure and claim as new in United Letters Patent is:

1. An elongated record medium driving apparatus including record medium driving means comprising a flywheel, a drive pulley spaced from the flywheel, an idler wheel having at least a resilient frictional driving portion engageable with said driving pulley and flywheel, a motor for driving said drive pulley, a movable support for said idler wheel, a multiposition index plate supporting said movable support and electromechanical control means controlling the energization of said motor and effecting the engagement of said idler wheel with said drive pulley and said flywheel in a plurality of positions of said plate, said control means including a switch controlling the energization of said motor, a movable mechanical link movable into two positions to operate said switch to energize and deenergize said motor and to effect movement of said support and the idler wheel toward and away from said drive pulley and flywheel.

2. An elongated record medium driving apparatus including in combination, record medium driving means comprising an idler wheel having at least a resilient frictional driving portion and a driven element, a movable multi-position index plate, means movably supporting said idler wheel on said index plate, and means including idler wheel control means associated with said last mentioned means and controlling the engagement of said idler wheel with said driven element for effecting engagement of said idler wheel in a plurality of positions of said index plate.

3. An elongated record medium driving apparatus including in combination, a motor, a drive pulley driven by said motor, a flywheel spaced from said drive pulley, an intermediate idler wheel, means movably supporting said idler wheel for movement into and out of engagement with said drive pulley and flywheel, means including a switch operating lever for connecting said motor to and from a source of power, and means including a linkage mechanism interconnecting said lever and the idler wheel supporting means for moving the latter to effect engagement of said idler wheel with said drive pulley and flywheel when the motor is energized and for moving said idler wheel away from them when the motor is deenergized, the engagement of said idler wheel with said drive pulley and said flywheel being effected prior to energization of said motor, and said movement of the idler wheel away from the drive pulley and flywheel effecting disengagement thereof subsequent to deenergization of said motor.

4. An elongated record medium driving apparatus including a drive pulley, a flywheel spaced from said pulley, an intermediate idler wheel, a slidable guide plate supporting said idler wheel and movable to effect engagement and disengagement of said wheel with said drive pulley and flywheel, spring means biasing said guide plate in a direction to effect engagement of said idler wheel with said pulley and flywheel, and means including a pivotally movable control lever, and a linkage mechanism interconnecting said control lever and slide plate for controlling the position of said guide plate, said linkage mechanism including a link associated with said control lever and a double armed lever interconnecting said link and guide plate, a crank arm secured to and movable with said control lever and pivotally connected to said link, said link having a bifurcated end adjacent said control lever, stop means engageable by said end to limit movement of that end of the link, means including spaced fingers at the other end of said link and a guide pin between said fingers for guiding that end of the link, a pin on one of said fingers, said double armed lever including one arm engageable with said pin, said guide plate having a lug engageable with the other arm of said double armed lever, and spring means acting on said first arm of the lever for biasing the lever and link so that one or the other of the bifurcations of the link engages said stop means.

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5. An apparatus as claimed in claim 4 wherein said drive pulley, idler guide plate, idler wheel, double armed lever and guide pin are mounted upon a movable index plate.

6. An apparatus as claimed in claim 5 wherein said index plate is pivotally movable about an axis, said guide pin is located substantially at said axis, and the pin on said one finger is close to said axis.

7. An elongated record medium driving apparatus including in combination, record medium driving means comprising an idler wheel, movable idler wheel supporting means, a driven element normally out of engagement with said idler wheel, means for driving said idler wheel, and means associated with said last mentioned means and idler wheel supporting means operative to effect engagement of said idler wheel with said driven element and then to render operative said idler wheel driving means.

8. An elongated record medium driving apparatus including record medium driving means comprising a flywheel, an idler wheel engageable with said flywheel, a movable idler wheel supporting plate supporting the wheel, an index plate movable about a pivot axis supporting said plate, a double armed pivotally movable lever having one arm operatively connected to said supporting plate, a longitudinally and pivotally movable link associated with the other end of said lever, means including a guide pin located substantially at said pivotal axis for supporting and guiding said link, means including an operating pin on said link located near said pivotal axis for operatively connecting said link to said other

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arm of the lever, and means for operating said link to move said operating pin into different positions thereby to move said lever and idler wheel into different positions to effect engagement and disengagement of the latter with said flywheel.

9. An elongated record medium driving apparatus including in combination, record medium driving means comprising an idler wheel, movable idler wheel supporting means, a driven element normally out of engagement with said idler wheel, an electric motor for driving said idler wheel, a switch controlling the energization of said motor, a lever for operating said switch and for moving said idler wheel supporting means, and a two position control element for operating said lever to effect engagement of said idler wheel with said driven element and then operating said switch to energize said motor and render operative said idler driving means.

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