Dec. 10, 1946. M. CAMRAS 2,412,318

SAFETY DRIVE, BRAKING, AND CONTROL MECHANISM FOR MAGNETIC RECORDING DEVICES

Filed Aug. 10, 1942 3 Sheets-Sheet 1

Fig. 1.

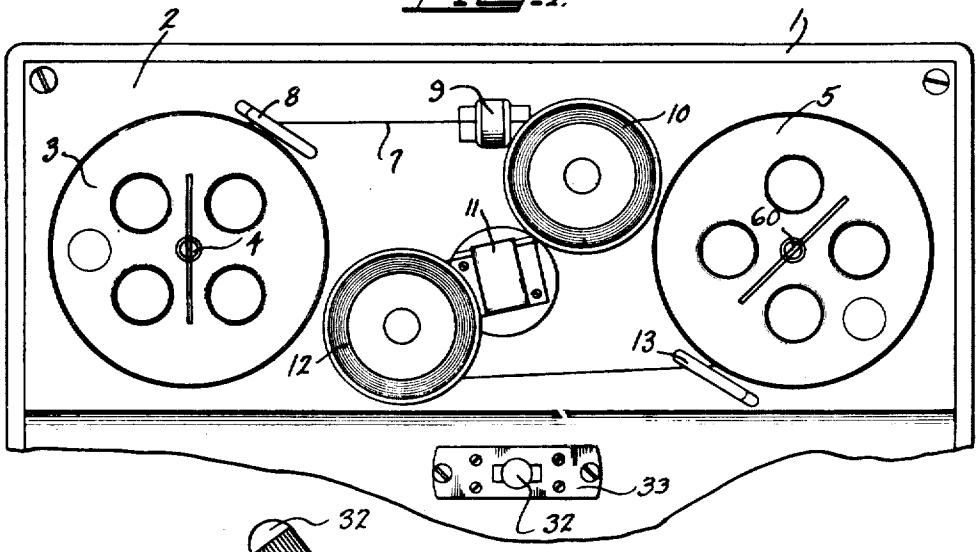

Fig. 4.

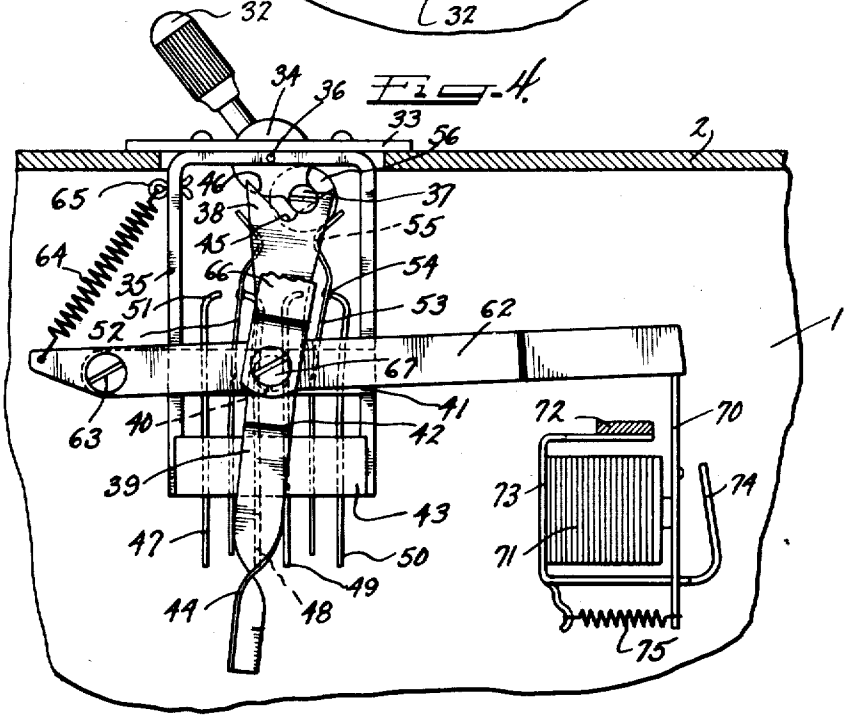

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Fig. 2.

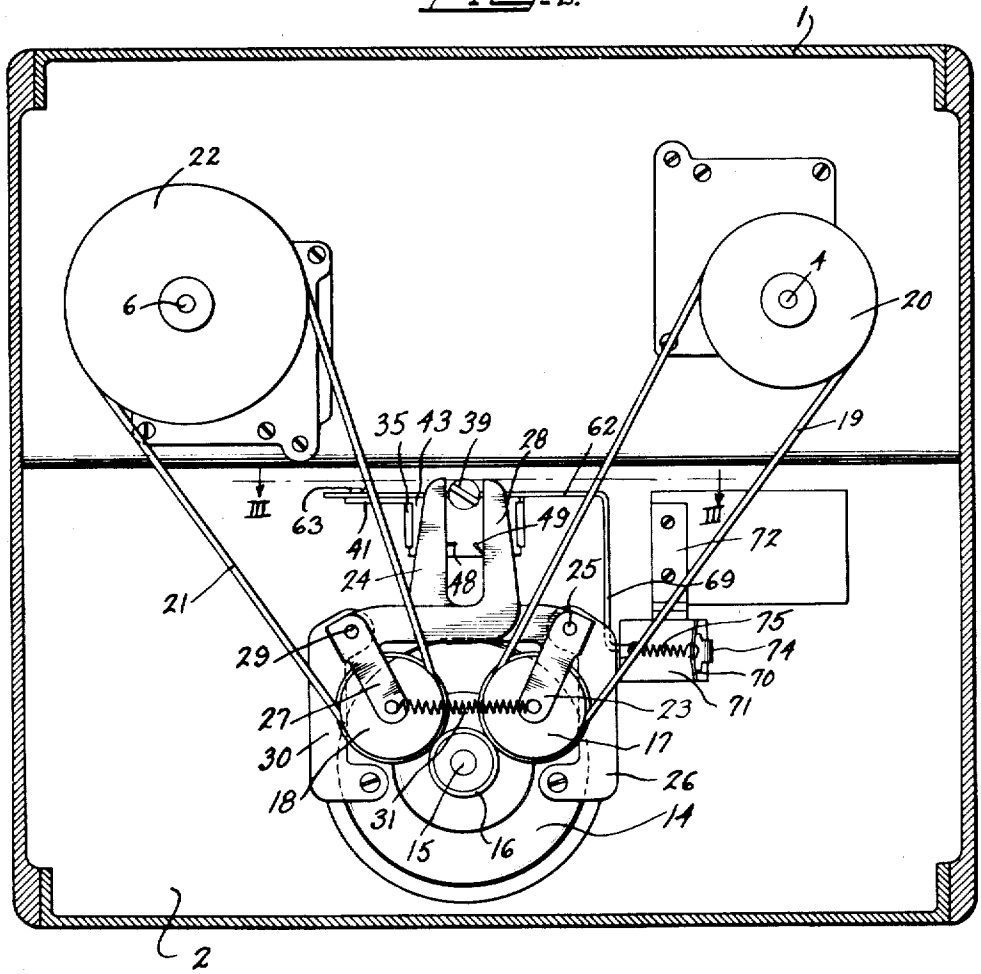

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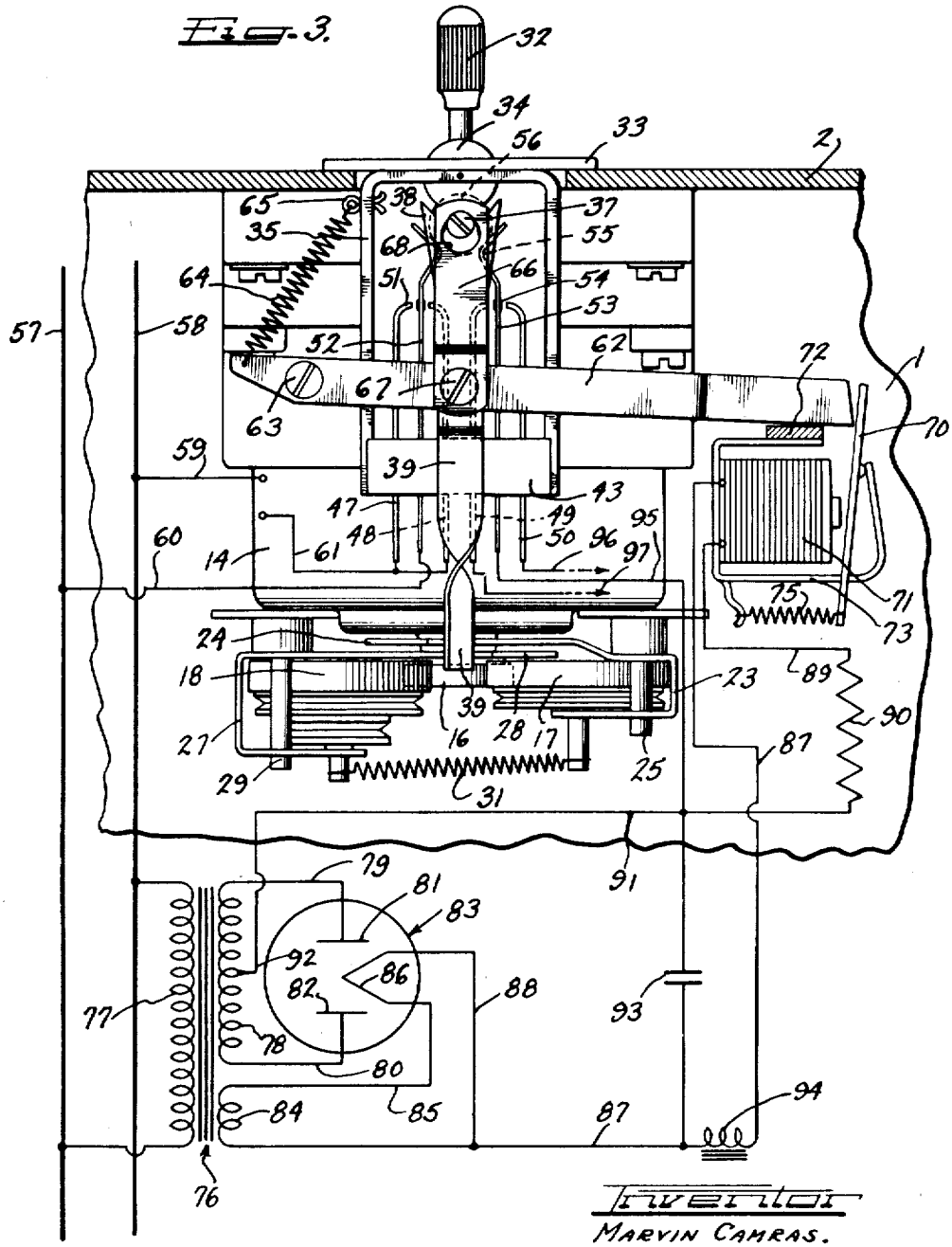
Fig. 3.



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UNITED STATES PATENT OFFICE

2,412,318

SAFETY DRIVE, BRAKING, AND CONTROL MECHANISM FOR MAGNETIC RECORDING DEVICES

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Application August 10, 1942, Serial No. 454,216

15 Claims. (Cl. 179—100.2)

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This invention relates to improvements in safety drive, braking and control mechanism arranged to facilitate proper operation of a machine or other device in which the invention is embodied, and insure that operation in a manner tending to prevent any injury to the machine or device, the invention being highly desirable for use in connection with magnetic recording devices, although the invention will have other uses and purposes as will be apparent to one skilled in the art.

For the purpose of clarity, by way of example only and not by way of limitation, the present invention will be described herein in association with a magnetic recording device, the invention, of course, being built in as a part of the operating mechanism of the recording device. It will be appreciated, however, that mechanism of the character comprising this invention may be used as a salient part of other devices, especially those utilizing electrical apparatus and wherein reverse motion is frequently desired.

In magnetic recording devices, wherein an elongated recording medium such as a paramagnetic wire or tape is wound from one reel to another, and frequent reversals in the direction of travel of the recording medium are desired, it is highly desirable to have suitable braking means so that when a stop is made, motion of the recording medium ceases as expeditiously as possible. Likewise, when a quick reversal in direction is desired, it is essential that the various moving parts in the apparatus come to rest or substantially to rest before the reverse drive takes effect so as to eliminate jerking which might cause injury to the apparatus.

In magnetic recording devices of this character, rectifying and other forms of vacuum and thermionic tubes are frequently utilized in the magnetizing and reproduction circuit. Such tubes require a warming up period before they are adequately effective to produce the required results. It is therefore desirable in a device of this character to provide means to prevent proper operation of the device before the tubes are hot so as not to waste the magnetic medium and probably ruin a recording or a reproduction.

With the foregoing in mind, it is an important object of the instant invention to provide safety mechanism including a braking arrangement which stops all operating parts of a device very quickly and without undue jerks.

Another object of the invention resides in the provision of safety mechanism involving a braking arrangement which requires no extra parts to effect a positive braking action.

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A further feature of the invention resides in the provision of safety mechanism including a reverse drive mechanism in which the drive connections are automatically utilized as braking means when the mechanism is stopped.

It is also an object of this invention to provide a switching arrangement for use in connection with a device involving vacuum tubes, the arrangement being such that the device cannot be operated until the tubes are ready to perform their functions.

A further feature of the invention resides in the provision of a switching arrangement for use in a magnetic recorder involving vacuum tubes, and employing locking means responsive to the passage of current through one of the tubes to hold the switch means in position to effect operation of the entire device.

Still another feature of the invention resides in the provision of a switching arrangement including a double-throw switch with means associated to automatically lock the switch in closed position, and the switch being so constructed that it may be opened and closed in the opposite direction without affecting the locking means.

A further object of the invention resides in the provision of safety mechanism involving a control switch which is held in closed position by means responsive to the energization of a power tube, and which automatically resumes zero or open position upon the breaking of the electrical circuit through the apparatus.

The invention also seeks the provision of a control switch for a magnetic recorder or other device, which switch effects the movement of the mechanical parts of the device, and which switch automatically assumes open position when the current to the device is opened by a master switch or otherwise.

Still another feature of the invention resides in the provision of safety mechanism involving a switching arrangement coupled with a braking arrangement so that the braking arrangement automatically operates when the switch is open so as to stop all of the movable parts of the mechanism as expeditiously as possible.

Also a feature of the invention resides in the provision of a switching and braking arrangement for use in a magnetic recorder of a device where reverse motion is frequently desired, which arrangement makes it impossible to acquire reverse motion by throwing a switch to the opposite side without substantially stopping all

moving parts by automatic action of braking means.

Further, the invention seeks the provision of a safety arrangement embodied in a magnetic recording device where reverse motion is available, which arrangement is designed to prevent proper operation of the device in either direction before the vacuum tubes utilized in the device are ready to perform their functions, and which arrangement automatically provides a positive and exceedingly rapid but gentle braking action whenever the moving parts of the apparatus are stopped or reversed in direction.

While some of the more salient features, characteristics and advantages of the instant invention have been above pointed out, others will become apparent from the following disclosures, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a fragmentary front elevational view of a magnetic recording device in which the present invention is embodied for illustrative purposes;

Figure 2 is a vertical sectional view cutting off the rear wall of the casing housing the magnetic recording device, and illustrating in rear elevation mechanism embodying principles of the present invention;

Figure 3 is a fragmentary plan sectional view, with parts omitted, illustrating the salient features of the mechanism of Figure 2 in plan, and taken substantially as indicated by the line III—III of Figure 2, looking in the direction of the arrows, a schematic wiring diagram salient to the instant invention being illustrated in conjunction with the mechanical parts in this figure; and

Figure 4 is a fragmentary plan sectional view taken in substantially the same location as Figure 3, but illustrating the switch mechanism in a different stage of operation.

As shown on the drawings:

The illustrated embodiment of this invention is shown in integral association with a magnetic recording device, including a casing 1 having a front panel 2, upon which front panel the major portion of the mechanism embodied in this invention is supported within the casing 1. Of course, most of the mechanism is carried on the back of this front panel within the casing 1, and a small amount is disposed on the front of the panel so as to be readily accessible to an operator.

With reference now to Figure 1, it will be seen that the illustrated magnetic recording device includes a reel 3 mounted on a shaft 4 at one side of the front panel 2, and a similar reel 5 mounted on a shaft 6 on the opposite side. On these reels 3 and 5 is an elongated recording medium, in the illustrated instance in the form of a relatively thin wire 7, preferably only a few thousandths of an inch in diameter so as to provide substantial recording time capacity and still maintain the apparatus generally compact and of small overall size.

The wire, of course, may be wound off the reel 3 on to the reel 5 in the forward or recording and reproducing direction, and likewise off the reel 5 and on the reel 3 in the rewind direction. For example, in the use of the device the wire may be run forwardly, that is, on to the reel 5, a recording being made, and the wire may be rewound on the reel 3 to the length used in the recording, and again run forwardly to have the recording reproduced.

Assuming that the wire is moving forwardly, it first passes through a level winding member 8 associated with reel 3, through an erasing or demagnetizing head 9, thence around a guide pulley 10 through a magnetizing or recording head 11, and then around a guide pulley 12 and through a level winding member 13 to the reel 5.

The reels 3 and 5 are driven by an electric motor 14 as seen best in Figures 2 and 3, which may be supported in any desired manner on the top of the front panel 2. The shaft 15 of this motor carries on its inner end a friction drive disk 16. A pair of drive pulley members 17 and 18 are arranged to bear against the friction disk 15 and be driven thereby. These pulley members, as best seen in Figure 2, contact the drive disk 16 from opposite sides so that drive connections to operate the reels for forward and reverse movement of the recording medium can conveniently be made. The pulley 17 is connected through a suitable chain or belt 19 to a pulley 20 carried on the inner end of the aforesaid shaft 4 carrying the reel 3. Likewise, the drive pulley 18 is connected to a belt or chain 21 with a pulley 22 on the inner end of the shaft 6 carrying the reel 5.

The pulley 17 is rotatably mounted in the channel end 23 of a dog leg lever 24 pivoted as at 25 to a supporting socket 26 mounted on the housing of the motor 14. Likewise, the pulley 18 is carried in the channel portion 27 of a dog leg lever 28 pivoted as at 29 to a similar supporting bracket 30 on the housing of the motor. A cross spring 31 connected between the shafts of the pulleys 17 and 18 tends at all times to hold both pulleys in inward position bearing against the friction disk 16, as seen in Figure 2.

Of course, when both pulleys are against the friction disk 16 as seen in Figure 2, the apparatus will not operate since the reels 3 and 5 will be driven in the same direction, and other parts of the apparatus will tend to turn in the opposite direction at the same time. Consequently, there will be a dead stop of the reels and associated apparatus when the drive pulleys 17 and 18 are both in contact with the friction disk 16. However, when the drive pulley 18 only is in contact with the friction disc and the drive pulley 17 is held away from the disk, as later described herein, the shaft 6 and the reel 5 are positively driven direct from the motor and the machine is operated forward in recording or reproducing direction. Likewise, when the drive pulley 18 is held away from the disk 16 and the drive pulley 17 is permitted to contact the disk, the shaft 4 and consequently the reel 3 are positively driven from the motor in the reverse or rewind direction. Suitable gearing may be provided between the shafts 4 and 6 so as to make a positive drive from one to the other, if so desired, or the tension upon the recording medium 7 may be relied upon to operate the other reel when one reel is being positively driven by the motor.

Selective operation of the reels 3 and 5 is controlled by a switch arrangement including a double-throw operating handle 32 extending through a decorative mounting plate 33 on the front of the panel 2, as seen in Figures 1 and 4. This switch arm carries an integral disk 34 thereon which is pivoted to a U-shaped relatively heavy supporting frame 35 as indicated at 36. The supporting frame is, of course, attached to the plate 33 and held stationary by virtue of the attachment of the plate to the front panel 2. The disk 34 is provided with an outwardly

extending lug carrying a pivot pin 37 which extends a distance on either side of the lug. Above the lug the pivot pin is in position to engage the flared end 38 of a lever 39 which is pivoted as indicated at 40 (as seen in dotted lines in Figure 4) to a fixed cross member 41 on the frame 35. This lever 39 is bent upwardly as indicated at 42 so that it projects outwardly over the top of an insulation block 43 carried by the frame 35. In its projecting portion, the lever is twisted as seen at 42 so as to lessen the width of the lever in that portion thereof which extends between the upper ends of the aforesaid dog leg levers 24 and 28. The forward end of the lever 39 is provided with a centrally disposed notch 45 for engagement with the pivot pin 37 when the lever is in a neutral position. On each side of this notch the lever is provided with an obliquely disposed cam surface 46 around which the pivot pin 37 may ride when the arm 32 is thrown in either direction to cause a corresponding pivotal movement of the lever 39 about the pivot point 40. By virtue of the relatively free engagement between the pivot pin 37 and the flared end 39 of the lever, and the pivot point 40, the outer end of the lever beyond the twist 44 is moved in the same direction as the handle 32.

Assuming now that the handle 32 is pushed to the right from the position seen in Figure 1 to the position seen in Figure 4. The inner end of the lever 39 also moves to the right, and with reference to Figure 2 it will be seen that this lever then will push the upper end of the dog leg lever 24 and elevate the drive pulley 17 from the friction disk 16, permitting the machine to be positively driven forward by engagement with the friction disk 16 with the drive wheel 18. Likewise, if the handle 32 is moved beyond center in the opposite direction, the lever 39 will push the upper end of the dog leg lever 28 and elevate the drive pulley 18 off the friction disk 16, permitting the machine to be positively driven in the reverse direction by virtue of the engagement of the friction disk 16 with the drive pulley 17.

Assuming now that the machine is operating forwardly, namely with the switch handle 32 in the position seen in Figure 4, and it is desired to reverse the direction of the machine, it is a simple expedient to move the handle 32 through the neutral position and throw it in the opposite direction. A sudden reversal of motion of the parts of the apparatus, it being realized that there are many more operating parts to the magnetic recorder than there are illustrated in the drawings, may result in injury to some part of the device. It is obviously desirable to stop or very nearly stop the operation of all moving parts before they are driven in the reverse direction, and obviously such stopping should not be by virtue of a suddenly applied reverse drive alone. To avoid any injury caused by sudden reverse driving action on the moving parts, and likewise to avoid any unnecessary winding of the recording medium 7, my novel braking arrangement automatically comes into action upon a movement of the handle 32 to neutral position. It will be especially noted, however, that the instant the handle 32 and likewise the lever 39 reaches neutral position the spring 31 pulls both drive pulleys 17 and 18 into engagement with opposite portions of the friction disk 16. Consequently, there is an instantaneous braking action which very quickly, but nevertheless gently, slows

all moving parts of the machine to a stop or very nearly to a stop before the drive pulley 18 is elevated away from the friction disk 16 to permit a positive drive through the drive pulley 17 in a reverse direction. If the switch handle 32 is moved in a normal reasonable manner, there will be a dead stop of the moving parts by virtue of the braking action prior to any drive action in the reverse direction.

It will further be especially noted that the braking arrangement is so coupled with the driving arrangement that no extra parts whatever are needed to effect the braking action. Such action occurs automatically whenever the switch handle 32 reaches neutral position.

The switch arrangement governs the energization of the motor 14. With reference to Figures 3 and 4, it will be seen that a plurality of contact members, in the illustrated instance four, indicated by numerals 47, 48, 49 and 50, are carried by the insulation block 43 and project through both sides of the block. Each of these numbers has an inwardly turned outer end as indicated at 51 on member 47 so as to extend toward an adjacent switch arm. Two switch arms of the leaf spring type are provided, a switch arm 52 extending between contact members 47 and 48, and another switch arm 53 extending between contact members 49 and 50. These switch arms are also carried by the insulation block 43 and project on both sides of the block. Each switch arm carries a contact stud 54 therein for abutment with either one of its respective pair of contact members. As indicated at 55, each of the switch arms is bent inwardly in the form of a lateral V to provide a flow between the switch arms of sufficient width to accommodate a roller 56 carried by the pivot stud 37 on the opposite side of the lug holding that stud from the lever 39.

It will be seen from Figure 3 that when the switch handle 32 is in neutral position the roller 56 rests between the flared end portions of the switch members 52 and 53 and both of these switch arms are out of contact with any of the contact members 47, 48, 49 and 50. The switch arms are held in that open circuit position by virtue of the roller 56 bearing against the upper end of these arms. The arms themselves are in the nature of leaf springs, and tend to move inwardly so that were it not for the roller 56 the switch arm 52 would always be in contact with the upper end of the contact member 48 and the switch arm 53 would always be in contact with the upper end of the contact member 49.

When the switch handle 32 is thrown in the position seen in Figure 4, the roller 56 forces the switch arm 53 into contact with the contact member 50, and leaves the switch arm 52 free to contact with the contact member 48, as clearly seen in Figure 4. If the switch handle 32 is thrown in the opposite direction, the switch arm 52 will be forced into contact with the member 47, and the switch arm 53 will be permitted by its own resiliency to contact the member 49. With reference to Figure 3, wherein a schematic wiring diagram is shown, it will be seen that the motor is connected to the switch arrangement with a pair of line conductors 57 and 58 which may lead from any suitable source of electrical energy. Line wire 58 is connected directly to a motor terminal by conductor 59. Line wire 57 is connected by a conductor 60 to the switch arm 52. A conductor 61 leads from the outer motor terminal to both contact members 47 and 48.

With the switch handle 32 in the forward position as seen in Figure 4, current may travel through conductor 60, the switch arm 52, contact member 48, conductor 61 to the motor, and out of the motor through conductor 59 to line wire 58. When the switch handle 32 is thrown in the opposite direction, contact will be made between the switch arm 52 and the contact member 47, and the current will flow through conductor 60, the switch arm 52, contact member 47, conductor 61 to the motor, and from the motor to line wire 58 through conductor 59. It will thereupon be seen that the motor is operated at all times in the same direction regardless of which direction the switch handle 32 may be thrown.

It will also be noted from Figure 3 that the circuit through the motor 14 is closed by the switch arm 52 at about the same time that one or the other of the drive pulleys 17 and 18 is elevated off the friction disk 16. In other words, it is impossible to operate the motor 14 more than an instant with both drive pulleys in contact with the friction disk 16. As soon as the handle 32 is moved sufficiently to establish contact between the switch arm 52 and either of the members 47 or 48, one of the dog leg levers 24 and 28 must be pivoted so as to elevate its respective drive pulley by means of the lever 39 which will be operated in unison with the switch arm 52 by movement of the handle 32.

The magnetic recording device illustrated in the drawings preferably embodies a compound electrical circuit including a number of vacuum tubes in association with the recording and the loud speaker elements, not shown in the drawings. The use of such tubes necessitate a slight warming up period for the device before it is ready to either record or reproduce a previously made recording. It is not desirable, therefore, to have the moving parts, especially the reels 3 and 5, operating until the machine is ready for either recording or reproduction. Otherwise, a recording might be partially omitted, the reproduction partially omitted, and a definite wastage of recording medium 7 due to unnecessary winding, as well as a wastage of time. It is therefore desirable to prevent energization of the motor 14 until the tubes embodied in electrical circuit of the recording device are sufficiently hot to adequately perform their function.

To this end, means are provided to restore switch handle 32 to neutral circuit open position until the tubes in the magnetic recording device are sufficiently hot. These means include a transversely disposed lever 62 pivoted as at 63 to the end of the fixed cross bar 41 which projects beyond the frame 35. The pivot point is near but spaced inwardly from one end of the lever 62 as seen clearly in Figures 3 and 4. A tension spring 64 is anchored at one end to the projecting end of the lever 62, and at the upper end to a suitable anchoring member 65 attached to the frame 35. This tension spring tends to pivot the lever so that the larger portion on the opposite side of the pivot point 63 is thrown inwardly to the position seen in Figure 3. Such pivotal movement is limited by the engagement of a link 66 pivoted at one end to the lever 62 as indicated at 67, and provided with an enlarged aperture 68 (Figure 3) adjacent its other end, through which aperture the aforesaid stud 37 projects. This aperture 68 is preferably considerably larger than the stud 37 so that there is play of the link 66 relative to the shank of the stud 37.

When the switch handle 32 is thrown from neutral position, the stud or pin 37 carries the end of the link 66 along therewith and consequently pivots the major portion of the lever 62 outwardly to the position seen in Figure 4. The lever 62 will assume the position seen in Figure 4 regardless of which direction the switch handle 32 may be thrown. Any movement of the switch handle 32 out of neutral position is, of course, in opposition to the action of the spring 64, and if there is nothing to hold the lever 62 in its pivoted position as seen in Figure 4, the spring 64 will promptly pivot the lever back to its position seen in Figure 3, and the link 66 by virtue of its engagement with the pin or stud 37 will promptly hold the switch handle 32 back to neutral position and prevent its remaining in either of its circuit closing positions.

Means are provided, however, to hold the lever 62 in its pivoted position as seen in Figure 4, so that the handle 32 may remain in either circuit closing position, and these means are directly responsive to the functioning of a vacuum tube associated with the magnetic recording device. Unless that tube is hot the holding means do not function.

With reference to Figure 2 it will be seen that the lever 62 is stepped downwardly as indicated at 69 so that the end of this lever projects into the short oscillatory path of a pivoted armature 70 responsive to the energization of a relay 71 supported on a bracket 72. This relay may be of any suitable construction, including a frame 73, the usual coil and iron core, with a portion of the frame 74 bent as seen in Figures 3 and 4 to limit the outward movement of the armature 70 when the relay is de-energized. This outward movement of the armature is caused by a spring 75 anchored at one end to a part of the frame and at the other to a projecting portion of the armature 70 which is pivotally associated with the frame.

The entire electrical circuit of the magnetic recording device is not necessary to be illustrated herein. Therefore, in Figure 3 that portion of the electrical circuit essential to the operation of this invention is diagrammatically illustrated in association with the mechanical parts.

The electrical circuit and apparatus includes a suitable power transformer 76 with the primary 77 thereof connected across the line wires 57 and 58. A secondary winding 78 in the transformer 76 is connected at opposite ends through conductors 79 and 80 to the plate 81 and 82 of a power tube 83 which, in the illustrated instance, is in the form of a full wave rectifying tube. A second secondary winding 84 is connected through conductor 85 to the cathode 86 of the tube 83 from one end, and from the other end of this winding a conductor 87 leads to a terminal of the coil in relay 71. Of course, the cathode 86 is connected across the coil 84, such connection being completed by conductor 88 leading from the upper side of the cathode to the conductor 87. The other terminal on the coil of relay 71 is connected through conductor 89 to a load 90, which load in the illustrated instance is shown merely diagrammatically in the nature of a resistance, but in actual practice this load may be other electrical elements in a complete compound circuit of the magnetic recording device. A conductor 91 leads from the load 90 to a tap 92 on the secondary transformer winding 78. A condenser 93 is preferably connected between the conductors 87 and 91, and a choke coil 94 is pro-

vided in the conductor 87 to insure smooth and direct current reaching the relay.

The aforesaid switch arm 53 is connected through conductor 95 to conductor 91, and a conductor 96 leads from the contact member 50 to recording apparatus so that when the circuit is closed between the switch arm 53 and the contact member 50 the recording apparatus is energized. This same circuit may provide energization also for a loud speaker system to reproduce a previous recording, and it is not necessary to show such circuit connections in connection with the instant invention. In similar fashion, a conductor 97 leads from the contact member 49 preferably to a speaker short arrangement, so that the loud speaker will be shorted out during rewinding of the recording medium 7.

It will also be seen that when current is flowing through the line wires 57 and 58, and the power tube 83 or other tubes in the load 90 become sufficiently hot to perform its functions, the relay 71 will be energized and drive the armature 70 toward the relay coil, which will be to the left as seen in Figure 3. With all of the other apparatus in the position seen in Figure 3, the armature will abut the end of the lever 62 and not be able to reach the coil on the relay. After the power tube is heated and the relay is energized, a throwing of the switch handle 32 in either direction results in a pivotal movement of the lever 62 toward the panel 2, and this pivotal movement takes the lever out of the path of the relay armature 70 permitting this armature to engage the relay coil and fall in behind the end of the lever 62 to the position seen in Figure 4. Thus, the switch arrangement is held by the relay in closed position. It will be noted, as explained above, that the switch handle 32 cannot be left in either forward or reverse position without the relay preventing the lever 62 from jerking the switch handle 32 back to neutral position by virtue of the action of the spring 64. In this way, it is impossible in ordinary operation to energize the apparatus and cause a travel of the recording medium 7 before the magnetic recording device is capable of performing a recording or reproducing function.

Another feature of the operation of the mechanism embodied in this invention should be especially noted. As long as the power tube 83 is energized, the relay will be energized and the amature 70 will be held over in the position seen in Figure 4 after the switch handle 32 has once been thrown in either direction. Now, even though the lever 62 is held in its pivoted position by the relay armature 70, the switch handle 32 may be moved to neutral position and thrown in the opposite direction without disturbing the lever 62. This movement of the handle 32 is enabled by virtue of the flared head portion 38 of the lever 39, and also by virtue of the enlarged aperture 68 in the lever 66, this aperture being sufficiently large to permit relative movement between itself and the inner stud 37 on the end of the lever 32 sufficiently for the lever to be thrown completely in either direction, regardless of the fact that the lever 62 is held by the relay in pivoted position. By virtue of the inclined edge surfaces 46 on the lever head 38 and by the pressure exerted on the roller 56 by the switch arms 52 and 53, the switch handle 32 will remain in either operating position until it is manually moved through neutral position to the other operating position.

For a short résumé of the operation of the present invention, let it be assumed that it is desired to start the magnetic recording device and move the recording medium 7 in the forward direction for the purpose of taking a recording. Line wires 57 and 58 may be energized by the throwing of any suitable master switch. The switch handle 32 may then be moved from neutral position to the position seen in Figure 4, but if sufficient time has not elapsed for the power tube 83 or other tubes in the load 90 to become hot, the relay 71 will not be energized, and the action of the control lever 62 will immediately throw the switch handle 32 back to neutral position and prevent operation. However, if sufficient time has elapsed for the vacuum tubes to become hot, the relay will lock the lever 62 in its pivoted position, as seen in Figure 4, and the mechanism will operate forwardly.

After a suitable recording has been made, it may be desirable to listen back to the recording. To this end, the switch arm 32 is then moved to neutral position and thence onwardly to reverse position opposite to that seen in Figure 4. This movement may be accomplished, as above explained, despite the fact that the lever 62 is still being held in pivoted position by the relay armature.

It should be noted, however, that as the handle 32 is moved from the position in Figure 4 to the opposite position for reverse winding, that handle will, by virtue of the notch 45 in the head of the lever 39, hesitate in neutral position if it is reasonably actuated by the operator, and if the operator moves the lever with excess rapidity, nevertheless the lever must pass through neutral position. At the time the lever reaches neutral position the springs 31 pull both drive pulleys 17 and 18 into contact with the friction disk 16 and the automatic brake action takes effect almost instantaneously to rapidly but gently slow down the moving parts, so there will be no injurious jerk when the parts start moving in the reverse direction. Likewise, there will be no material winding of the recording element 7 in the forward direction due to momentum, if the handle 32 is moved very slowly from forward position to reverse position.

If after rewinding has been accomplished, it is desired to listen to the rewound recording, it is a simple expedient to again move the switch handle 32 to forward position, and again as the handle reaches intermediate position the automatic braking action takes effect and the parts are slowed down so that any injurious jerk is eliminated, and the machine may be operated forwardly to reproduce the recording. The forward motion, likewise, may be made despite the fact that the relay armature is still holding the lever 62 in pivoted position.

It should be further noted that if at the end of a forward or reverse of the recording medium 7, the source of power to the machine is cut off by opening the circuit through line wires 57 and 58, the relay will automatically become deenergized. Therefore, if the handle 32 has been locked in either forward or reverse position, that handle will be immediately snaped back to neutral position by the action of the relay armature and the lever 62, the automatic braking action will at once take effect, and only a negligible amount of the wire 7 will move after the circuit has been broken.

From the foregoing, it is apparent that I have provided novel safety mechanism for use in a device having operating parts in general like those

of a magnetic recording device, as well as other devices wherein reverse motion may frequently be desired. The mechanism effectively prevents operation of the entire device before that device is ready to perform its function by virtue of the heating of tubes or for some other reason. It should be noted that upon failure of the line voltage for any reason the switch is returned to neutral position and the automatic braking action become effective at once. The mechanism also provides an instantaneous braking action whenever the device is stopped or whenever it is desired to reverse direction. No extra parts are utilized in order to afford that braking action. The mechanism also includes a novel arrangement between switch means and drive means operating in conjunction to provide the braking action, and to prevent any movement of the apparatus prior to the time when the apparatus is ready to perform its functions. It will further be noted that the invention is simple in construction, economical, highly durable, positive in its action, and may be manipulated with extreme facility.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention, and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In a device having movable parts operable both in forward and reverse directions and embodying an electrical circuit, a vacuum tube in said electrical circuit, means for driving said parts, a control handle movable to cause operation of said means, resilient means tending to hold said control handle in inoperative position, and mechanism directly responsive to current flow through said tube for holding said handle in operative position against the action of said resilient means.

2. In a device having movable parts operable both in forward and reverse directions, a driving arrangement for forward movement, a driving arrangement for reverse movement, a main drive for actuating both said arrangements, means urging both said arrangements toward engagement with said main drive at all times, and a double-throw lever for selectively moving either of said arrangements out of engagement with said main drive against the action of said means.

3. In a device having movable parts operable both in forward and reverse directions, a main drive, a forward driving arrangement, a reverse driving arrangement, a double-throw control to selectively cause operation of either drive arrangement by said main drive, and means arranged to automatically bring both said arrangements into operative connection with said main drive whenever said control reaches neutral position.

4. In a device having a pair of spaced reels with an elongated member therebetween to be wound from one to the other in either direction, a main drive member, a forward drive member operatively connected with said reels, a reverse drive member operatively connected with said reels, a control element arranged to selectively cause operation of either the forward or reverse drive members by said main drive member, and resilient means constantly and automatically urging both the forward and reverse drive members toward engagement with said main drive member at all times, said resilient means becoming fully effective to establish engagement between said forward and reverse drive members with the main drive member when said control element reaches neutral position.

5. In a magnetic recording device wherein a recording medium travels in either direction between a pair of spaced reels, a friction drive member, a forward drive member operatively connected to actuate said reels and move the recording medium forwardly, a reverse drive member arranged to actuate the reels in the opposite direction, resilient means constantly urging both said forward and reverse drive members into engagement with said friction drive member, and a control element arranged to selectively move either of said forward or reverse drive members out of engagement with said friction drive against the action of said resilient means.

6. In a magnetic recording device wherein a recording medium travels in either direction between a pair of spaced reels, a friction drive member, a forward drive member operatively connected to actuate said reels and move the recording medium forwardly, a reverse drive member arranged to actuate the reels in the opposite direction, resilient means constantly urging both said forward and reverse drive members into engagement with said friction drive member, a control element arranged to selectively move either of said forward or reverse drive members out of engagement with said friction drive against the action of said resilient means, an electrical circuit including a vacuum tube governing the entire operation of the recording device, means constantly tending to hold said control element in neutral or inoperative position, and holding means directly responsive to current flow through said tube to lock said control element in either operative position.

7. In a magnetic recording device wherein a recording medium travels in either direction between a pair of spaced reels, a friction drive member, a pair of drive pulleys engageable with said friction drive member, one of said pulleys being connected to actuate the reels in one direction and the other pulley being connected to actuate the reels in the opposite direction, resilient means connecting said pulleys and constantly urging both pulleys into engagement with said drive member, and a control element arranged to selectively move either pulley out of engagement with said drive member against the action of said resilient means.

8. In a device having movable parts operated by an electric motor and including a circuit involving a vacuum tube, a control handle for governing the energization of said motor, means tending to hold said handle in inoperative position, and holding mechanism directly responsive to current flow through said tube for locking said handle in operative position against the action of said means.

9. In a device having operating parts controlled by an electrical circuit including a vacuum tube, a drive motor, a switch member for controlling the energization of said motor, means tending to hold said switch member in inoperative position, and a relay lock in said circuit directly responsive to current flow through said tube to hold said switch in circuit closing position against the action of said means.

10. In a device having movable parts operable in both forward and reverse directions and controlled by an electrical circuit including a vacuum tube, driving mechanism, a switch arrange-

ment of the double-throw type to selectively operate the driving mechanism for forward or reverse operation, means associated with said switch arrangement tending at all times to hold the switch arrangement in neutral position, and an electrical holding device directly energizable by current flow through said vacuum tube to hold said switch arrangement in either operative position against the action of said means.

11. In a device having movable parts operable in both forward and reverse directions and controlled by an electrical circuit including a vacuum tube, driving mechanism, a switch arrangement of the double-throw type to selectively operate the driving mechanism for forward or reverse operation, means associated with said switch arrangement tending at all times to hold the switch arrangement in neutral position, an electrical holding device directly energizable by current flow through said vacuum tube to hold said switch arrangement in either operative position against the action of said means, and the connection between said switch arrangement and said means being such that the switch arrangement may be thrown in the opposite direction while said holding device remains in effective operation.

12. In a device having movable parts operable in both forward and reverse directions and controlled by an electrical circuit including a vacuum tube, driving mechanism, a double-throw control handle, a pivoted switching lever having a flared end for loose engagement with said handle to be operated thereby to govern the operation of said driving mechanism in either direction, a spring urged member tending at all times to hold said control handle in neutral position, and an electrical holding device energizable by current flow through said tube to lock said spring urged member in inoperative position to permit said handle to be thrown in either direction and reversed while said holding device remains in effective operation.

13. In a device embodying movable parts operable both in forward and reverse directions and having an electrical control circuit including a vacuum tube, driving mechanism operable in either forward or reverse directions, a braking arrangement tending at all times to prevent operation of said driving mechanism, control means to negative the braking arrangement, and electrical means responsive to current flow through said tube arranged to prevent effective operation of said control means until such current flow is established.

14. In a magnetic recording device, a pair of spaced reels, a recording medium on said reels, means including an electrical circuit embodying an element which must first become heated before operating efficiently for magnetizing said medium, drive means for said reels, a control member to cause actuation of said driving means, means tending to hold said control member at all times in inoperative position, and an electrical holding device responsive to said element when heated for efficient operation to lock said control member in operative position against the action of the second said means.

15. In a magnetic recording device, a pair of spaced reels carrying an elongated recording medium which may travel from one reel to the other in either direction, drive means to actuate said reels in either direction, a movable control for governing the operation of said drive means, restraining means tending to hold said control in inoperative position, means to effect a recording on said medium including an electrical circuit, a vacuum tube in said circuit, and holding means responsive to current flow through said vacuum tube to lock said control in operative position against the action of said restraining means.

MARVIN CAMRAS.

Disclaimer

2,412,318.—*Marvin Camras*, Chicago, Ill. SAFETY DRIVE, BRAKING, AND CONTROL MECHANISM FOR MAGNETIC RECORDING DEVICES. Patent dated Dec. 10, 1946. Disclaimer filed Mar. 19, 1948, by the assignee, *Armour Research Foundation of Illinois Institute of Technology*.

Hereby enters this disclaimer to claims 9, 14 and 15 of said patent.

[*Official Gazette May 4, 1948.*]

ment of the double-throw type to selectively operate the driving mechanism for forward or reverse operation, means associated with said switch arrangement tending at all times to hold the switch arrangement in neutral position, and an electrical holding device directly energizable by current flow through said vacuum tube to hold said switch arrangement in either operative position against the action of said means.

11. In a device having movable parts operable in both forward and reverse directions and controlled by an electrical circuit including a vacuum tube, driving mechanism, a switch arrangement of the double-throw type to selectively operate the driving mechanism for forward or reverse operation, means associated with said switch arrangement tending at all times to hold the switch arrangement in neutral position, an electrical holding device directly energizable by current flow through said vacuum tube to hold said switch arrangement in either operative position against the action of said means, and the connection between said switch arrangement and said means being such that the switch arrangement may be thrown in the opposite direction while said holding device remains in effective operation.

12. In a device having movable parts operable in both forward and reverse directions and controlled by an electrical circuit including a vacuum tube, driving mechanism, a double-throw control handle, a pivoted switching lever having a flared end for loose engagement with said handle to be operated thereby to govern the operation of said driving mechanism in either direction, a spring urged member tending at all times to hold said control handle in neutral position, and an electrical holding device energizable by current flow through said tube to lock said spring urged member in inoperative position to permit said handle to be thrown in either direction and reversed while said holding device remains in effective operation.

13. In a device embodying movable parts operable both in forward and reverse directions and having an electrical control circuit including a vacuum tube, driving mechanism operable in either forward or reverse directions, a braking arrangement tending at all times to prevent operation of said driving mechanism, control means to negative the braking arrangement, and electrical means responsive to current flow through said tube arranged to prevent effective operation of said control means until such current flow is established.

14. In a magnetic recording device, a pair of spaced reels, a recording medium on said reels, means including an electrical circuit embodying an element which must first become heated before operating efficiently for magnetizing said medium, drive means for said reels, a control member to cause actuation of said driving means, means tending to hold said control member at all times in inoperative position, and an electrical holding device responsive to said element when heated for efficient operation to lock said control member in operative position against the action of the second said means.

15. In a magnetic recording device, a pair of spaced reels carrying an elongated recording medium which may travel from one reel to the other in either direction, drive means to actuate said reels in either direction, a movable control for governing the operation of said drive means, restraining means tending to hold said control in inoperative position, means to effect a recording on said medium including an electrical circuit, a vacuum tube in said circuit, and holding means responsive to current flow through said vacuum tube to lock said control in operative position against the action of said restraining means.

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