

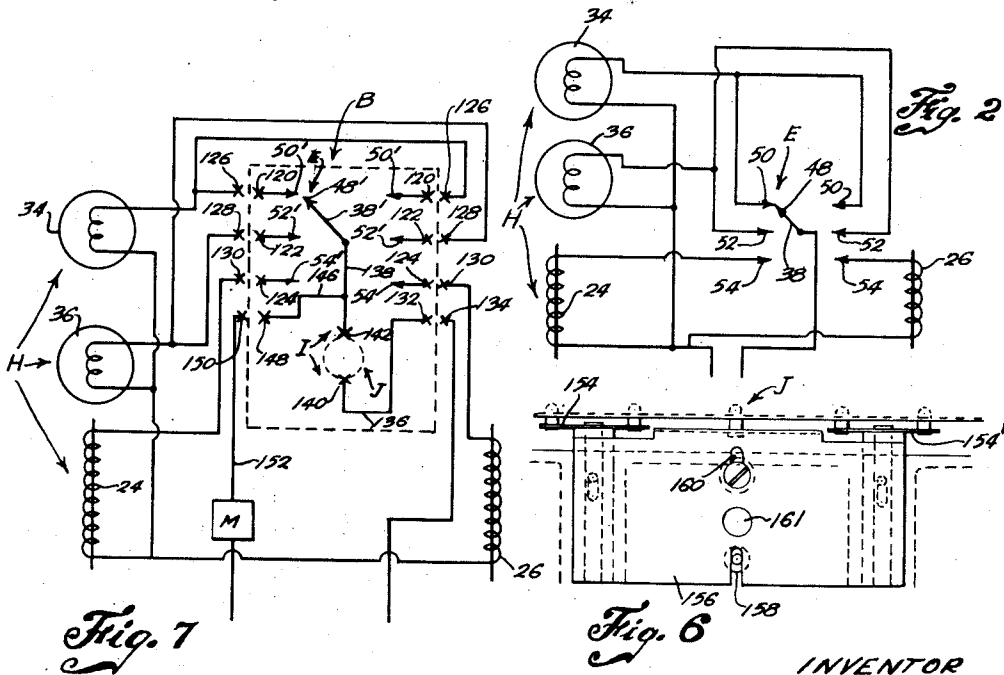
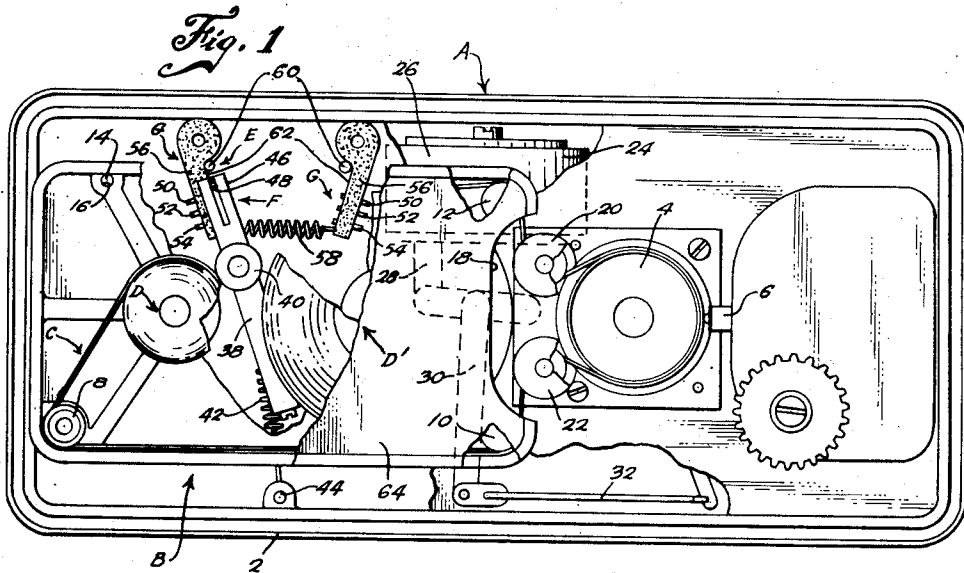
Feb. 5, 1952

F. H. OWENS
CONTROL MECHANISM

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Filed May 13, 1948

2 SHEETS—SHEET 1



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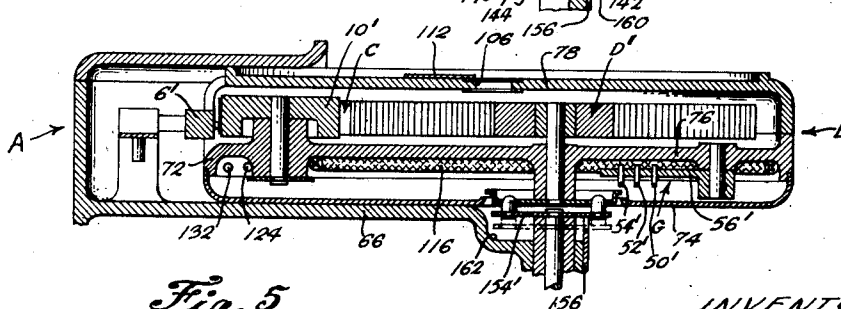
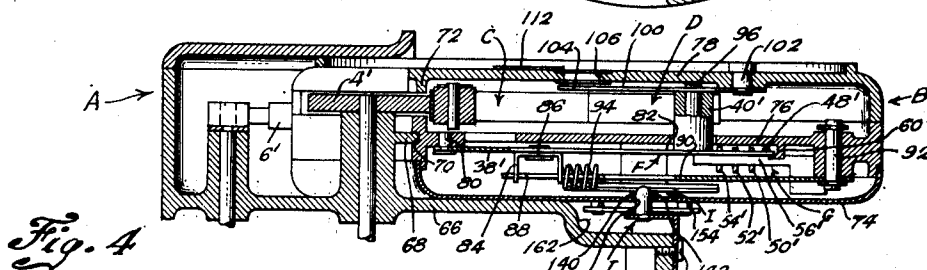
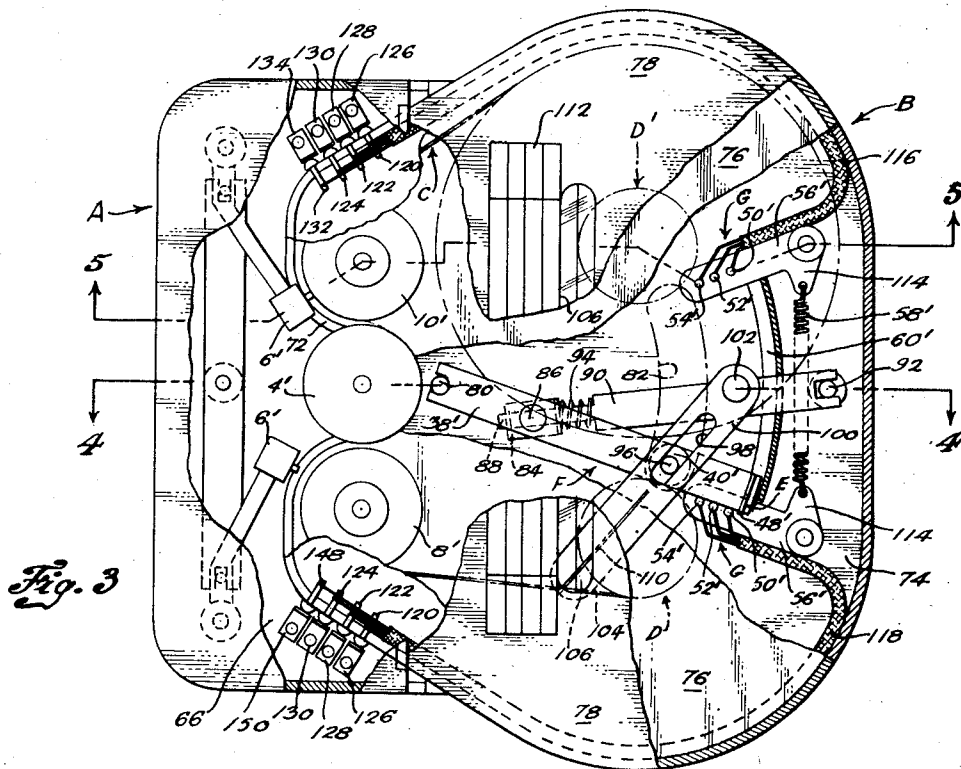
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2 SHEETS—SHEET 2



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UNITED STATES PATENT OFFICE

2,584,734

CONTROL MECHANISM

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Application May 13, 1948, Serial No. 26,735

21 Claims. (Cl. 242-57)

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The present invention relates to a control mechanism, and more particularly to a switch and electrical control mechanism particularly adapted for use with apparatus having an elongated medium which is carried on spools and is reeled from one spool to another.

This application is a continuation-in-part of my application, Serial No. 655,965, of March 21, 1946, entitled "Magnetic Tape Recording and Reproducing Apparatus," now Patent No. 2,513,423 dated, July 4, 1950, and other construction details of some of the apparatus herein disclosed are shown in my copending application, Serial No. 19,683, filed April 8, 1948, entitled "Magazine Having Spool Rotation Inhibiting Means."

While the invention is herein disclosed as applied to a magnetic tape recording and reproducing apparatus, the invention itself is of far broader application, being useable with other types of reproducing apparatus, with motion picture projecting machines or cameras, or with any other apparatus in which an elongated medium is wound or unwound, and is particularly adaptable for use with such apparatus in which the elongated medium is carried in a magazine which is removable from and replaceable on the apparatus itself.

In all such devices it is from a practical point of view necessary that the operator thereof be apprised when the winding or unwinding of the elongated medium is completed or nearly completed in order that he may guide himself with regard to the operation being carried out, whether it be recording, reproducing, photographing, or the like. It is also necessary in most applications that some means be provided for automatically terminating the winding or unwinding of the elongated medium at a point prior to the time when the medium has been completely wound or unwound so that rethreading of the medium on the spool from which it is unwound is not rendered necessary. This is particularly important when the elongated medium is contained within a replaceable magazine, since one of the main advantages of the magazine is that it provides a convenient means for manipulating the medium without having to handle it directly.

In apparatus of the type described where a magazine is employed it is also desirable that means be provided for positively preventing initiation of the winding or unwinding operation until the magazine is properly positioned on the apparatus. Failure to fulfill this requirement

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may result either in damage to the medium or in the winding or unwinding thereof without achieving proper reproduction, photography, or the like.

Various expedients have in the past been employed aimed at accomplishing these results but they have all suffered from the drawback of relative complexity, which in turn gives rise to the disadvantage of expensiveness and unavailability. Moreover, where two spools have been employed, the elongated medium being wound upon one spool as it is unwound from the other, the operation of the apparatus being reversible so that each spool will, at sometime in the operation of the apparatus, be the take-up spool, it has in the past been found necessary to employ duplicate control means, one associated with each spool, and to employ in addition a relatively complicated interconnecting system so as to render first one and then the other control means operative depending upon which spool is the take-up spool. It is also usual in such prior art mechanism that the control is effected from the take-up spool, so that resetting of the control means is made necessary if an additional amount of elongated medium is employed.

It is the prime object of the present invention to devise a control means of the type above described which in the main avoids the disadvantages set forth.

Another object of the present invention is to devise a control means which is active upon the supply spool, the control means being actuated when the amount of medium on the supply spool reaches a predetermined minimum, the control means being thereby rendered effective no matter what the total amount of elongated medium employed.

A more specific object of the present invention is to devise a control means which is not only effective to terminate unwinding of the elongated medium when it is substantially completely unwound from its spool but which is also effective to energize one or more warning circuits at predetermined intervals prior to the time of cessation of unwinding so as to warn the operator that the transducing cycle is drawing to a close.

Yet another object of the present invention is to devise a control means for use with a pair of spools between which the elongated medium is adapted to be wound and unwound, said control means including a single contact carrier active upon either of the spools, thus eliminating

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the necessity for a separate contact carrier for each spool. A more specific object is to so construct the control means that the contact carrier is always caused to engage the spool having the least elongated medium thereon, so that said single contact carrier is always controlled by the amount of medium on the supply spool and hence operates independently of the total amount of elongated medium employed.

Yet another object is to devise an apparatus upon which a magazine is adapted to be removably placed, the apparatus containing the contact carrier and all of the necessary electrical connections, said carrier being engageable with the medium within the magazine.

Another embodiment of my invention has as its object the devising of a magazine having the control means contained therein, electrical connection between said control means and the remainder of the apparatus being effected when the magazine is placed in proper position on the apparatus.

Yet another object of the present invention is to so construct an electrical circuit for the apparatus that it can be completed only when the magazine is locked in proper position on the apparatus, thus positively preventing energization of the apparatus or of a given element thereof when the magazine is not properly positioned.

To the accomplishment of the foregoing objects and such other objects as may hereinafter appear, the present invention relates to the construction of apparatus and magazine, and more particularly to the construction of control mechanism therein, as defined in the appended claims and as set forth in this specification, taken together with the accompanying drawings, in which:

Fig. 1 is a top view, partially broken away, of one embodiment of my invention;

Fig. 2 is a schematic diagram of the control and warning circuits employed therein;

Fig. 3 is a top view, partially broken away, of a second embodiment of the present invention;

Fig. 4 is a view taken along the line 4—4 of Fig. 3;

Fig. 5 is a view taken along the line 5—5 of Fig. 3;

Fig. 6 is a fragmentary view of a portion of the apparatus of Fig. 3; and

Fig. 7 is a circuit diagram illustrating the electrical connections employed in the embodiment of Figs. 3 through 6.

Generically described, my invention resides in a control mechanism particularly adapted for use with apparatus generally designated A upon which a magazine generally designated B is removably placeable, the magazine containing an elongated medium C here illustrated as a magnetic transducing tape but which may take a variety of other forms, the medium C being wound upon and between spools D and D' rotatably mounted within the magazine B.

A switch generally designated E is provided which acts as the control mechanism, the switch comprising a contact carrier F bearing a single contact and spring urged toward one of the spools D, D', and preferably toward that spool D or D' which has the least of the elongated medium C thereon, and one or more switch arms G preferably carrying a plurality of contacts with which the single contact on the contact carrier F is adapted to make successive electrical connection as the supply of elongated medium on the spool D becomes depleted, thereby ener-

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gizing a plurality of warning and actuating circuits generally designated H.

In addition, a portion I of an electrical circuit of the apparatus is, in one embodiment, located within the magazine, said interrupted electrical circuit I being adapted to be closed or completed by a locking pin J outside the magazine B when the magazine is in proper position on the apparatus A, the locking pin J thus serving the dual function of fixing the magazine B in proper position on the apparatus A and closing or completing the circuit I so that an appropriate part of the apparatus A may be energized.

The embodiment of Fig. 1 discloses a magnetic tape recording and reproducing apparatus described in greater detail in my aforementioned application, Serial No. 655,965 of March 21, 1946. Insofar as the present invention is concerned, it need only be explained that the apparatus A comprises a framework 2 upon which is mounted a driving roller 4 around which the elongated medium C is adapted to pass and be acted upon by a magnetizing means 6 which, through suitable electrical apparatus (not shown) will serve to record upon and reproduce from the magnetizable tape C. The tape C is contained within the magazine B and is wound upon the spools D and D' to form a continuous path between said spools via magazine rollers 8, 10 and 12. The magazine B is adapted to be placed in proper position upon the apparatus A by motion in a direction into the paper in Fig. 1, one or more upwardly projecting pins 14 fitting into appropriately located apertures 16 in the magazine B so as to properly fix the same in position. One end of the magazine is cut away as at 18 and the tape C therein is adapted to be grasped through the cut away portion 18 and threaded over the driving roller 4 and inside the guide rollers 20 and 22. A motor (not shown) is appropriately connected to the driving roller 4 so as to drive the same and is also connectable to whichever of the spools D or D' is to serve as the take-up spool for driving it in rotation.

Mounted in the apparatus A are a pair of solenoids 24 and 26 each having an armature 28 which is connected by means of a pivotal linkage generally designated 30 to a bar 32 which controls appropriate switching mechanism which may be effective to deenergize the motor so as to terminate its driving operation, to reverse the direction of rotation of the motor, to shift the position of the magnetizing means 6, or to perform any other function desired. In addition, the apparatus may be provided with one or more warning lights such as the yellow light 34 and the red light 36.

Mounted in the apparatus A below the position which the magazine B will assume is a pivotally mounted arm 38 which is provided with an upwardly projecting roller 40 adapted to be received through a suitable aperture in the bottom of the magazine B and to project into the magazine B between the two spools D and D' a sufficient distance so that the roller 40 is engageable with the elongated medium C on the spools D and D'. An overcenter spring 42 is anchored at one end 44 to the framework 2 and is secured at its other end to the arm 38, the spring 42 being active to constantly urge the roller 40 into engagement with the medium C on the spool D or D' having the least medium thereon. As illustrated in Fig. 1, the spool D has considerably less medium thereon than the spool D' and the roller 40 is in engagement with the medium on

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the spool D. If the spool D were made the take-up spool and if the apparatus A were energized, the spool D would rotate in a clockwise direction so as to accumulate more medium thereon while the spool D', rotating in the same direction, would progressively lose its medium and hence its effective diameter would become smaller. The roller will ride on the medium C as it accumulates on the spool D until the arm 38 is pivoted past its center position, at which time the spring 42 will snap it over into engagement with the medium on the spool D', that spool then having less medium on it than the spool D.

The free end 46 of the arm 38 carries a single electrical contact 48 which is adapted to make successive electrical connection with the plurality of contacts 50, 52 and 54 on the switch arm G corresponding to the spool D toward which the roller 40 is urged. As illustrated, two switch arms G are disclosed, each of which is in the form of an arm 56 pivotally mounted on the framework 2 and spring urged toward one another by the spring 58. Suitable stops 60 limit the pivotal motion of the arms 56 toward one another.

When the arm 38 is first urged toward one or the other of the spools D or D', the contact 48 will be held out of electrical connection with any of the contacts 50, 52 or 54. As the amount of medium C on the spool thereafter becomes depleted, the arm 38 will move so that the contact 48 carried thereby will make successive electrical connection with the contacts 50, 52 and 54. As the amount of medium C on the spool D, for example, becomes depleted, the contact 48 will slide across the inner face 62 of the arm 56 and will ultimately make electrical connection with the contact 50, the uppermost contact thereon, this leading to illumination of, for example, the yellow light 34, thus indicating to the operator that 5 minutes of operating time remains before the spool D will be substantially completely unwound. As operation of the mechanism continues and hence as the amount of the medium C on the spool D becomes further depleted, the contact 48 will make electrical connection with the middle contact 52 on the switch arm G, which may lead to illumination of the red light 36, indicating to the operator that only one minute of time remains. As the amount of medium C on the spool D becomes further depleted, electrical connection will be made between the contact 48 and the lowermost contact 54 on the switch arm G which, as illustrated, may energize the solenoid 24 so as to stop the motor, reverse it, or perform any other desired function.

The advantages of the embodiment of Fig. 1 as compared with the embodiment of Fig. 3 is that the magazine structure in Fig. 1 is of extreme simplicity, including only the magazine casing 64 and the spools D and D', all of the control mechanism being permanently a part of the apparatus A. However, the apparatus of Fig. 1 suffers from the disadvantage that, when the magazine B is placed thereon, care must be taken that the roller 40 be received between the spools D and D'. This often presents manipulative difficulties, particularly when the medium C is not substantially completely unwound from one of the spools D or D'.

The apparatus illustrated in Figs. 3 through 7 eliminates this difficulty because the control mechanism is largely a part of the magazine B itself. While this overcomes the manipulative drawbacks described above, it makes the maga-

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zine structure more complex and hence more expensive. However, it presents the additional advantage of ensuring that the apparatus cannot be energized until the magazine B is in proper position on the apparatus A and, in a preferred modification, until the magazine B is locked in its proper position.

Details of the apparatus of Figs. 3 through 7 not herein disclosed are described in my copending application, Serial No. 26,736, filed May 13, 1948, entitled Driving and Locking Means for Apparatus Having Removable Magazine. Insofar as the present invention is concerned, the apparatus A includes a wall 66 over which the magazine B is adapted to be slid to proper position, a projecting lug 68 on the apparatus A entering a slot 70 in the recessed front wall 72 of the magazine to limit the sliding motion thereof. When the magazine B is in proper position, a driving wheel 4' engages the magnetizing medium C so as to drive the same while a magnetizing means 6', two of which are shown, each adapted to be used in alternation with the other, cooperates with the tape C so as to record thereon or reproduce therefrom. The tape C passes within the magazine from spool D to spool D' via guide rollers 8' and 10'.

The magazine B is provided with a bottom wall 74 adapted to slide over the wall 66 of the apparatus A, with a central frame member 76 above which the spools D and D' are mounted, and with a top wall 78. The contact carrier F is in the form of a flat arm 38' mounted on the underside of the central frame member 76 so as to pivot about pin 80. The roller 40' projects up through an arcuate slot 82 in the central frame member 76 so as to be engageable with the medium C on either of the spools D or D'. A U-shaped bracket 84 is freely pivotally mounted on the underside of the arm 38' by means of rivet 86, the depending arms of the bracket receiving therethrough the narrowed end 88 of the arm 90 which is pivotally mounted about stud 92. A spring 94 is maintained in compression between the bracket 84 and the widened portion of the arm 90, the spring 94 thus acting as an overcenter spring so as to always urge the arm 38' in a direction such that the roller 40' makes engagement with the medium C on the spool D or D' which has the least medium thereon.

In order to indicate at all times the status of the medium C insofar as unwinding is concerned, the upper portion of the stud 96 about which the roller 40' is rotatable is received within an elongated slot 98 in the arm 100 mounted below the top wall 78 of the magazine B so as to be pivotable about pin 102. The free end 104 of the arm 100 is visible through a window 106 in the top wall 78, the arm 100 being provided with an index line 110 for accurate indications. A marking pad 112 may be secured to the top wall 78 of the magazine B adjacent the window 106 so that marks may be made thereon for future reference corresponding to any data desired, such as the position on the medium C of particular recorded intelligence.

The arm 38' and the switch arm G may be similarly constructed and arranged to those illustrated in Fig. 1 except that they will be contained within the magazine B rather than being mounted on the apparatus A. An alternative construction is specifically disclosed in Figs. 3, 4 and 5 in which the switch arms G are defined by arms 56' each carrying contacts 50', 52' and 54' which are disposed perpendicular to the plane of motion of

the contact carrier 38' rather than parallel thereto as was the case in Fig. 1. In addition, the spring 58' is active between opposing portions 114 on the arms 56' themselves, and an arcuate positive stop 60' extends between the arms 56' to limit their inward motion. The arm 38', in the embodiment here specifically illustrated, may itself be conductive. The contact carrier 38' carries a contact 48' adapted, as the amount of medium C on the spools D or D' toward which the contact carrier 38' is urged becomes depleted, to make successive electrical connection with the contacts 50', 52' and 54' on the appropriate switch arm G, thus, as in the previous embodiment, energizing a plurality of warning and actuating circuits.

The contacts 50', 52' and 54' are each connected, by means of the cables 116 and 118, to conductive pins 120, 122 and 124 respectively, there being two sets of these pins, each being connected to the contacts on one of the switch arms G and each set projecting out through the sides of the magazine B so as to make electrical connection with contacts 126, 128 and 130 respectively on the apparatus A, the positioning of the contacts 126, 128 and 130 being such that electrical connection is made only after the magazine B has been slid to proper position.

Electrical connection to the contact 48' carried by the contact carrier 38' is made via a contact pin 132 in the magazine B and a corresponding contact 134 on the apparatus A, these two pairs of contacts being here illustrated adjacent to the upper set of contacts 120 through 130 in Fig. 3. The circuit between the contact 132 in the magazine B and the contact 48' carried by the contact carrier 38' is defined by a pair of wires 136 and 138 (see Fig. 7), these two wires terminating at separated points 140 and 142 (see Figs. 4 and 7), these points being located just above the bottom wall 74 of the magazine B and on either side of an aperture 144 therein. The locking pin J which is movably mounted on the apparatus A in a manner hereinafter to be described is receivable within the aperture 144 when the magazine B is in proper position on the apparatus, the pin thus locking the magazine B in its proper position and also, since it is formed of conductive material, bridging the gap between the points 140 and 142 so as to complete the circuit to the contact 48'. A circuit is also completed through wire 146 to contact 143 in the magazine B, said contact 148 being adapted to make electrical connection with the contact 150 on the apparatus A and thence, via wire 152, to the driving motor M of the apparatus. By virtue of this method of connection, it will be apparent that neither the motor M nor any of the warning or actuating circuits H can be energized until the magazine B is in proper position on the apparatus A, since it is only at that time that the contacts 120, 122, 124, 132 and 148 in the magazine B make electrical connection with the corresponding contacts 126, 128, 130, 134 and 150 on the apparatus A, and that in addition neither the motor M nor the warning and actuating circuits H can be energized until the magazine B is locked in its proper position by entry of the locking pin J into the aperture 144 of the magazine B, since it is only at that time that electrical connection is bridged between the points 140 and 142.

The locking pin J, together with the driving means 154 and 154' engageable with each of the spools D and D', are mounted on plate 156 which is, by virtue of pin and slot connections 158 and

160, vertically movable to a limited degree on the side of the apparatus A, manual manipulation thereof being facilitated by operating knob 161. When the plate 156 is moved downward, both the locking pin J and the driving means 154 and 154' are housed within recess 162 in the wall 66 of the apparatus A so as not to interfere with the sliding movement of the magazine B to and from its proper position. When the plate 156 is moved upwardly, the driving means 154 and 154' are moved upwardly into driving engagement with the spools D and D' respectively and the locking pin J is moved upwardly into the aperture 144 in the magazine B for the purposes above described.

The functioning of the control mechanisms of the present invention will in the main be fully apparent from the above description. Insofar as the switch itself is concerned, the contact carrier 38 is spring urged into engagement with the medium C and as the medium C changes its position, the contact 48 carried by the carrier 38 comes into successive engagement with a plurality of contacts 50, 52 and 54 carried by a switch arm G, thus energizing a plurality of warning and actuating circuits. In the specific modification here disclosed, the carrier 38 is effective on both spools D and D', an overcenter spring 42 or 94 being provided so as to constantly urge it into engagement with the medium C on the spool D or D' having the least medium C thereon. When the carrier 38 is first urged into engagement with a given spool, its contact 48 makes no electrical connection, but as the medium C on the spool becomes depleted, the contact 48 moves over the face of the switch arm G, passing from contact 50 to contact 52 to contact 54 successively, the contact 50 energizing a yellow light 34, the contact 52 energizing a stop light 36, and the contact 54 energizing a stopping or reversing mechanism as here disclosed. It will be understood that the warnings may be audible as well as visual. The switch mechanism involved is simple, with a minimum number of moving parts. It is exceedingly effective, particularly when two spools D and D' are employed between which the medium C is adapted to be wound and unwound. In such a case, only a single contact carrier 38 is required, thus reducing the complexity and expense of prior art devices in which each spool required its own complete switching mechanism. Another important factor is that even though only a single contact carrier 38 is employed, that carrier functions independently of the total amount of medium C in the magazine B, since it works only on the spool D having the least medium thereon.

The embodiment of Fig. 1 has the advantage that all of the control mechanism is included in the apparatus A, so that the magazine B may be of exceedingly simple and consequently inexpensive construction. The first embodiment is, however, subject to the disadvantage that manipulation is sometimes required to ensure that the roller 40 on the carrier 38 fits between the spools D and D' as the magazine B is placed in position. This disadvantage is eliminated in the embodiment of Figs. 3 through 7 by incorporating the switch mechanism in the magazine B itself. This, however, has the drawback of increasing the cost of each magazine B. However, certain operational advantages are thought to overcome this drawback, these advantages being that, by virtue of the placement of the contacts 120, 122, 124, 132 and 148 in the magazine B, and the corresponding placement of the con-

tacts 126, 128, 130, 134 and 150 upon the apparatus A, electrical connection between the contacts is only made when the magazine B is in proper position on the apparatus A, thus adding a definite safety factor to the functioning of the mechanism.

In addition, means including the locking pin J are provided for ensuring that none of the apparatus, not even the motor M, can be energized until the magazine B is securely locked in its proper position. Since the warning and actuating circuits H are also energized only when the locking pin J is in operative position inside the aperture 144 in the magazine B, any possibility of accidental energization of any of the warning or actuating circuits H by accidentally connecting, for example, contact 124 on the magazine B with contact 150 on the apparatus A is positively prevented.

While only two embodiments of my invention are here illustrated, both in conjunction with magnetic tape reproducing apparatus, it will be clear that many variations may be made in the details of the control mechanisms of my invention and that my invention may be employed with many types of apparatus, all within the spirit thereof as defined in the appended claims.

I claim:

1. In a switch controlled by the position of a medium, a support, a contact carrier mounted in said support and spring urged into engagement with said medium and bearing an electrical contact, a switch arm pivotally mounted in said support and resiliently urged toward said carrier and bearing a plurality of electrical contacts with which said contact on said carrier is adapted to make successive electrical connection, said switch arm moving with said contact carrier as the latter moves in response to the position of said medium, and a plurality of circuits each connected to one of said plurality of contacts and successively energized as the position of said medium changes.

2. In an apparatus in which an elongated medium is carried on spools and is reeled from one spool to another, a switch controlled by the unwinding of said medium from said spools comprising a support, a contact carrier mounted on said support and spring urged into contact with the medium on the spool having the least of said medium thereon and bearing an electrical contact, and a pair of cooperating switch arms, one for each spool, each mounted on the support and bearing a plurality of electrical contacts with which said contact on said carrier makes successive electrical connection as the amount of medium on the spool corresponding to the cooperating switch arm with which said carrier is in contact becomes depleted, thereby successively energizing a plurality of circuits.

3. In an apparatus in which an elongated medium is carried on spools and is reeled from one spool to another, a switch controlled by the unwinding of said medium from said spools comprising a support, a contact carrier mounted on said support and spring urged into contact with the medium on the spool having the least of said medium thereon and bearing an electrical contact, and a pair of cooperating switch arms, one for each spool, each mounted on the support and resiliently urged toward said first switch arm and each bearing a plurality of electrical contacts with which said contact on said carrier makes successive electrical connection as the amount of medium on the spool corresponding

to the cooperating switch arm with which said carrier is in contact becomes depleted, thereby successively energizing a plurality of circuits.

4. In a recording and reproducing apparatus in which an elongated transducing medium is employed, a switch controlled by the amount of medium in said apparatus comprising a contact carrier mounted on said apparatus and spring urged into engagement with said medium and bearing a single electrical contact, and a switch arm pivotally mounted on said apparatus and resiliently urged toward said carrier and bearing a plurality of electrical contacts with which said single contact on said carrier makes successive electrical connection as the amount of medium in said apparatus becomes depleted, said switch arm moving with said contact carrier as the latter moves in response to the amount of medium in said apparatus, thereby successively actuating a plurality of warning and actuating circuits.

5. In a recording and reproducing apparatus in which an elongated transducing medium is employed, spools rotatable in said apparatus on which said medium is carried, and a switch controlled by the unwinding of said medium from said spools comprising a contact carrier mounted on said apparatus and spring urged into engagement with the medium on the spool having the least medium thereon and bearing a single electrical contact, and a pair of cooperating switch arms, one for each spool, each mounted on the apparatus and bearing a plurality of electrical contacts with which said single contact on said carrier makes successive electrical connection as the amount of medium on the spool corresponding to the switch arm with which said carrier is in contact becomes depleted, thereby successively energizing a plurality of warning and actuating circuits.

6. In a recording and reproducing apparatus in which an elongated transducing medium is employed, spools rotatable in said apparatus on which said medium is carried, a switch means controlled by the unwinding of the medium from said spools comprising a contact carrier bearing a single electrical contact pivotally mounted so as to engage the medium on either spool, an overcenter spring active on said carrier to urge it into contact with the medium on the spool having the least medium thereon, and a pair of cooperating switch arms, one for each spool, each mounted on the apparatus and bearing a plurality of electrical contacts with which said single contact on said carrier makes successive electrical connection as the amount of medium on the spool corresponding to the switch arm with which said carrier is in contact becomes depleted, thereby successively energizing a plurality of warning and actuating circuits.

7. In combination, an apparatus cooperable with an elongated medium and a magazine removable from said apparatus comprising a casing and a spool on which said medium is carried and from which it is adapted to be wound and unwound, said apparatus comprising a contact carrier and a cooperable switch arm, said magazine casing being elongatedly apertured, said contact carrier having a member receivable through said aperture and engageable with the medium on said spool, and a spring active on said carrier to urge said member into constant engagement with said medium, the contacts on said carrier and said switch arm making electrical connection to energize a suitable circuit as the amount of medium on said spool becomes depleted.

8. In combination, an apparatus cooperable with an elongated medium and a magazine removable from said apparatus comprising a casing and a spool on which said medium is carried and from which it is adapted to be wound and unwound, said apparatus comprising a contact carrier bearing an electrical contact and a cooperable switch arm bearing a plurality of electrical contacts, said magazine casing being elongatedly apertured, said contact carrier having a member receivable through said aperture and engageable with the medium on said spool, and a spring on said apparatus active on said carrier to urge said member into constant engagement with said medium, said carrier contact making successive electrical connection with the plurality of contacts on said switch arm as the amount of medium on said spool becomes depleted, thereby successively energizing a plurality of warning and actuating circuits.

9. In combination, an apparatus cooperable with an elongated medium and a magazine removable from said apparatus comprising a casing and a pair of spools on which said medium is carried and from and between which it is adapted to be wound and unwound, said apparatus comprising a contact carrier bearing an electrical contact, and a pair of cooperable switch arms, one for each spool, each bearing a second electrical contact, said magazine casing being elongatedly apertured, said carrier having a member receivable through said aperture and engageable with the medium on said spools, and an overcenter spring active on said carrier to urge said member into engagement with the medium on the spool having the least medium thereon, said carrier contact making electrical connection with the contact on the switch arm corresponding to the spool with which said member is in engagement so as to energize a suitable circuit as the amount of medium on said spool becomes depleted.

10. In combination, an apparatus cooperable with an elongated medium and a magazine removable from said apparatus comprising a casing and a pair of spools on which said medium is carried and from and between which it is adapted to be wound and unwound, said apparatus comprising a contact carrier bearing an electrical contact, and a pair of cooperable switch arms, one for each spool, each bearing a plurality of electrical contacts, said magazine casing being elongatedly apertured, said carrier having a member receivable through said aperture and engageable with the medium on either of said spools, and an overcenter spring active on said carrier to urge said member into engagement with the medium on the spool having the least medium thereon, said carrier contact making successive electrical connection with the plurality of contacts on the cooperable switch arm corresponding to the spool with which said member is in engagement as the medium on said spool becomes depleted, thereby successively energizing a plurality of warning and actuating circuits.

11. In combination, an apparatus cooperable with an elongated medium and a magazine removable from said apparatus comprising a casing and a pair of spools on which said medium is carried and from and between which it is adapted to be wound and unwound, said apparatus comprising a contact carrier bearing an electrical contact, and a pair of cooperating switch arms, one for each spool each bearing a plurality of electrical contacts on one face thereof, pivotally mounted and resiliently urged to-

ward one another to a limited degree, said carrier being movable between said cooperating switch arms, said magazine casing being elongatedly apertured, said carrier having a member receivable through said aperture and engageable with the medium on either of said spools, and an overcenter spring active on said carrier to urge said member into engagement with the medium on the spool having the least medium thereon, said carrier contact sliding over the contact-bearing face of the switch arm corresponding to the spool with which said member is in engagement and making successive electrical connection with the plurality of contacts carried by said cooperable switch arm as the medium on said spool becomes depleted, thereby successively energizing a plurality of warning and actuating circuits.

12. A magazine comprising a casing, a spool rotatably mounted therein upon which an elongated medium is adapted to be wound and unwound, a contact carrier movably mounted therein and resiliently urged into contact with the medium on said spool and bearing an electrical contact, and a cooperable switch arm pivotally mounted in said magazine and resiliently urged toward said carrier and bearing a plurality of electrical contacts, said carrier contact making successive electrical connection with the plurality of contacts on said switch arm as the amount of medium on said spool becomes depleted, said switch arm moving with said contact carrier as the latter moves in response to the amount of medium on said spool thereby successively energizing a plurality of warning and actuating circuits.

13. A magazine comprising a casing, a pair of spools rotatably mounted therein on and between which an elongated medium is adapted to be wound and unwound, a contact carrier movably mounted therein and resiliently urged into contact with the medium on the spool having the least medium thereon, and a pair of cooperable switch arms, one for each spool, each bearing a plurality of electrical contacts, said carrier contact making successive electrical connection with the plurality of contacts on the switch arm corresponding to the spool with which said carrier is in engagement as the amount of medium on said spool becomes depleted, thereby successively energizing a plurality of warning and actuating circuits.

14. A magazine comprising a casing, a pair of spools rotatably mounted therein on and between which an elongated medium is adapted to be wound and unwound, a contact carrier movably mounted therein and resiliently urged into contact with the medium on the spool having the least medium thereon, and a pair of cooperable switch arms, one for each spool, one on each side of said carrier and resiliently urged theretoward and each bearing a plurality of electrical contacts, said carrier contact making successive electrical connection with the plurality of contacts on the switch arm corresponding to the spool with which said carrier is in engagement as the amount of medium on said spool becomes depleted, thereby successively energizing a plurality of warning and actuating circuits.

15. A magazine comprising a casing, a pair of spools rotatably mounted therein on and between which an elongated medium is adapted to be wound and unwound, a contact carrier movably mounted therein so as to engage the medium on either spool, an overcenter spring active on said carrier to urge it into contact with the medium

on the spool having the least medium thereon, a pair of cooperable switch arms, one for each spool, each bearing a plurality of electrical contacts, said carrier contact making successive electrical connection with the plurality of contacts on the switch arm corresponding to the spool with which said carrier is in engagement as the amount of medium on said spool becomes depleted, thereby successively energizing a plurality of warning and actuating circuits.

16. A magazine comprising a casing, a pair of spools rotatably mounted therein on and between which an elongated medium is adapted to be wound and unwound, a contact carrier movably mounted therein so as to engage the medium on either spool, an overcenter spring active on said carrier to urge it into contact with the medium on the spool having the least medium thereon, a pair of cooperable switch arms, one for each spool, one on each side of said carrier and resiliently urged theretoward and each bearing a plurality of electrical contacts, said carrier contact making successive electrical connection with the plurality of contacts on the switch arm corresponding to the spool with which said carrier is in engagement as the amount of medium on said spool becomes depleted, thereby successively energizing a plurality of warning and actuating circuits.

17. In combination, an apparatus and a removable magazine comprising a casing having an aperture, an interrupted portion of an electrical circuit therein, and means for closing said circuit located in said casing in a position to be actuated by an element receivable through said aperture, and a locking pin movably mounted on said apparatus and insertable into said aperture in said magazine only when said magazine is in proper position on said apparatus, said locking pin constituting said element receivable through said aperture.

18. In combination, an apparatus and a removable magazine comprising a casing having an aperture and a portion of an electrical circuit in said casing including a pair of separated contacts on either side of said aperture, said contacts being adapted to make electrical connection with and be bridged by an element receivable through said aperture, and a locking pin movably mounted on said apparatus and insertable into said aperture in said magazine only when said magazine is in proper position on said apparatus, said locking pin constituting said element receivable through said aperture.

19. In combination, an apparatus and a removable magazine cooperable therewith and containing a medium to be driven by said apparatus, said apparatus comprising a driving means, a first portion of an electrical energizing circuit for said driving means, and a magazine locking pin, and said magazine comprising a casing having an aperture for receiving said locking pin, a second portion of said electrical energizing circuit including an interrupted portion thereof, and means for closing said interrupted portion located in said casing in a position to be actuated by said locking pin as it is received in said aper-

ture, said apparatus and said magazine including cooperable contacts for making electrical connection between said first and second portions of said electrical energizing circuit, whereby said driving means cannot be energized until said magazine is locked in proper position on said apparatus.

20. In combination, an apparatus and a removable magazine cooperable therewith and containing a medium to be driven by said apparatus, said apparatus comprising a driving means, a first portion of an electrical energizing circuit for said driving means, and a magazine locking pin, and said magazine comprising a casing having an aperture for receiving said locking pin, and a second portion of said electrical energizing circuit including a pair of separated contacts on either side of said aperture, said contacts being adapted to make electrical connection with and be bridged by said locking pin as it is received in said aperture, and said apparatus and said magazine including cooperable contacts for making electrical connection between said first and second portions of said electrical energizing circuit, whereby said driving means cannot be energized until said magazine is locked in proper position on said apparatus.

21. In combination, an apparatus and a removable magazine cooperable therewith and containing a medium to be driven by said apparatus, said apparatus comprising a driving means, a first portion of an electrical energizing circuit for said driving means, electrical contacts forming a portion of said circuit, and a magazine locking pin, and said magazine comprising a casing having an aperture for receiving said locking pin, a second portion of said electrical energizing circuit including separated contacts on either side of said aperture, said contacts being adapted to make electrical connection with and be bridged by said locking pin as it is received in said aperture, and electrical contacts on the exterior of said casing forming a portion of said circuit, said casing contacts and said apparatus contacts being so positioned as to make electrical connection only when the magazine is properly positioned on said apparatus, whereby said driving means cannot be energized until said magazine is in proper position on said apparatus and locked in said proper position.

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