

Nov. 8, 1949

H. NYGAARD

2,487,170

MAGAZINE TYPE MAGNETIC RECORDER

Filed April 16, 1947

5 Sheets-Sheet 1

Fig. 1.

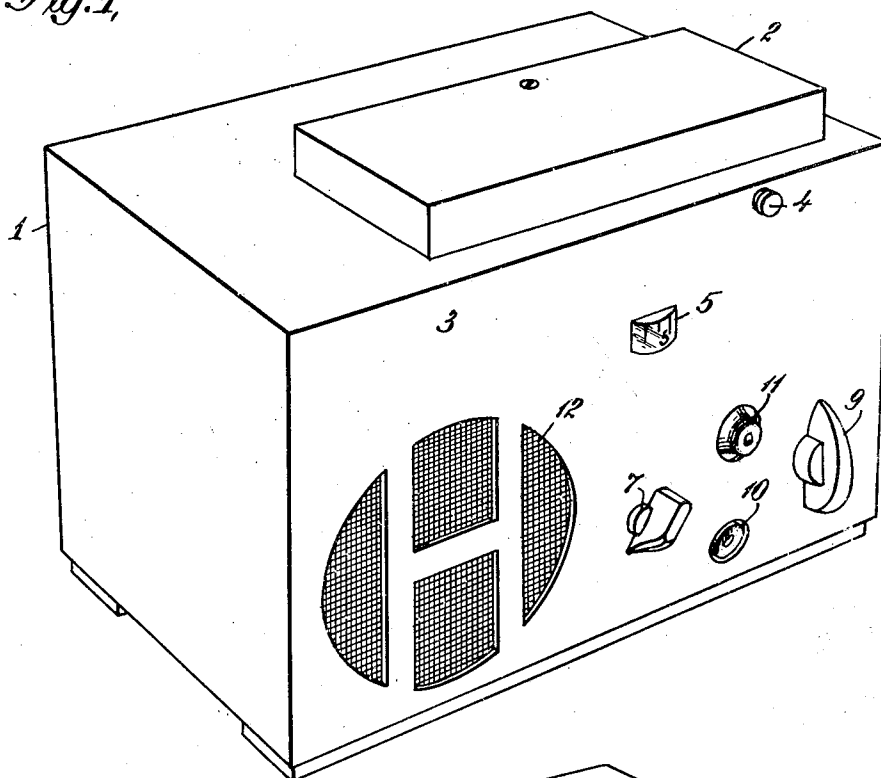
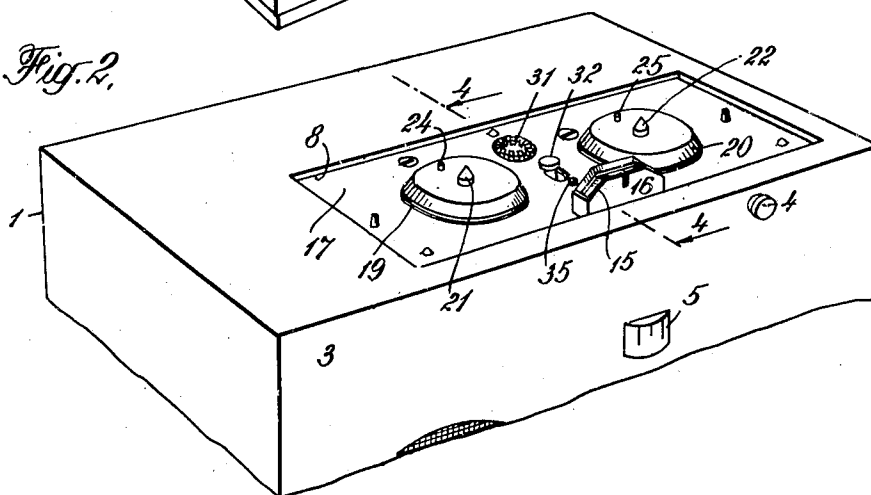


Fig. 2.



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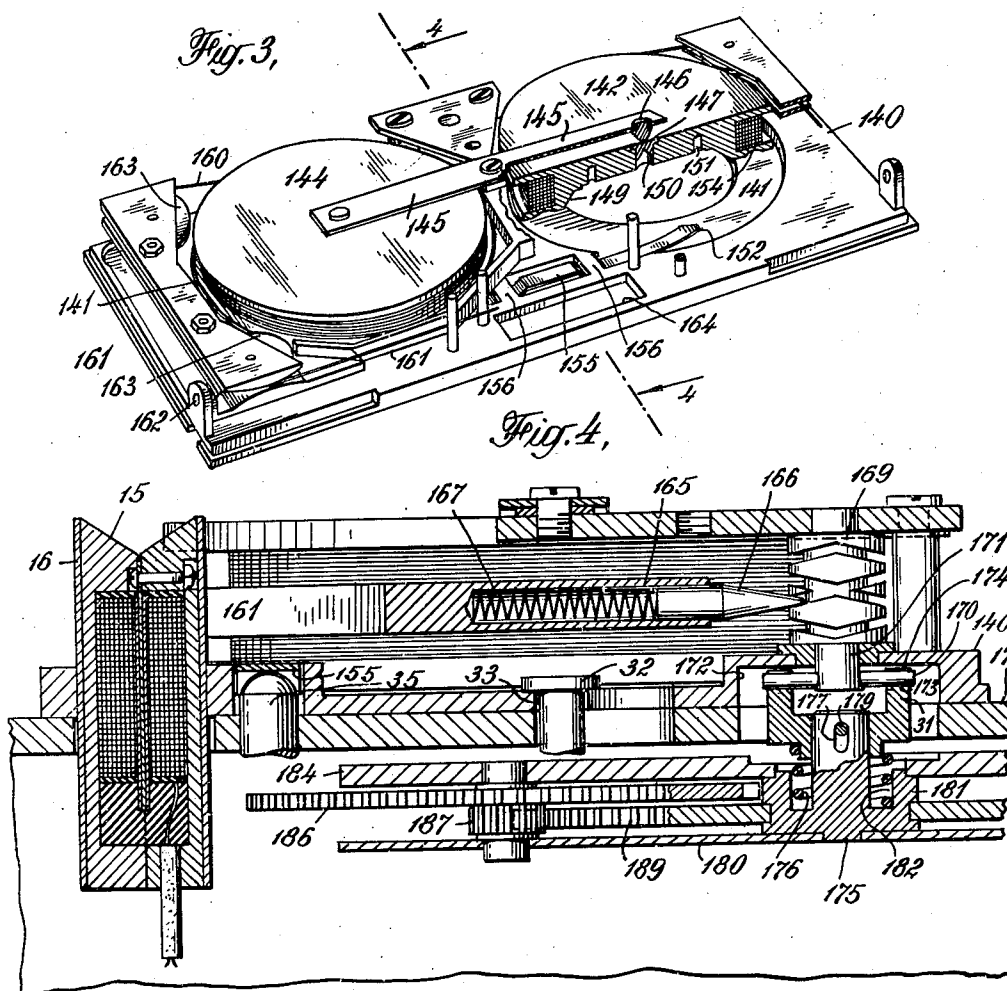
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5 Sheets-Sheet 2



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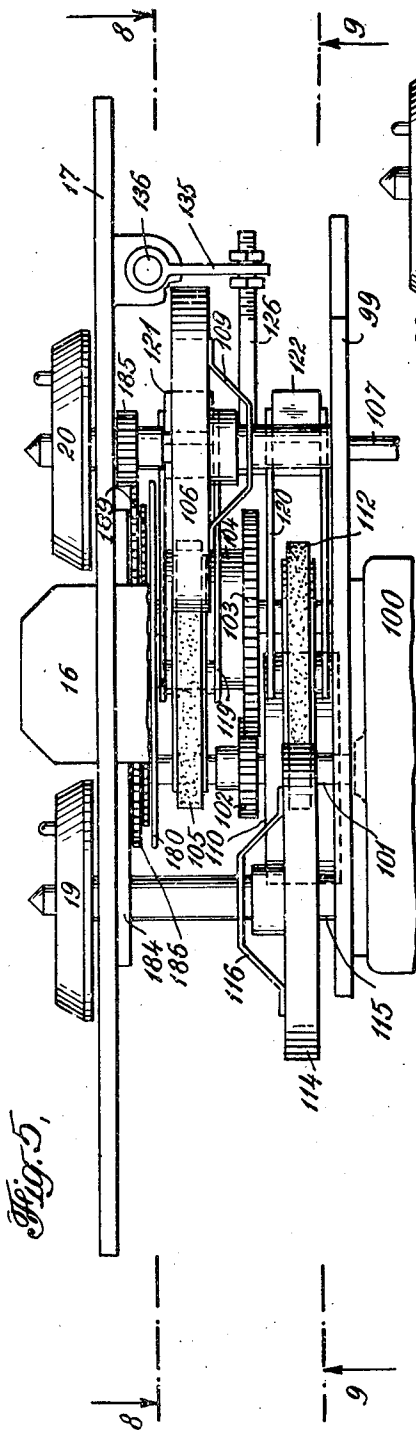
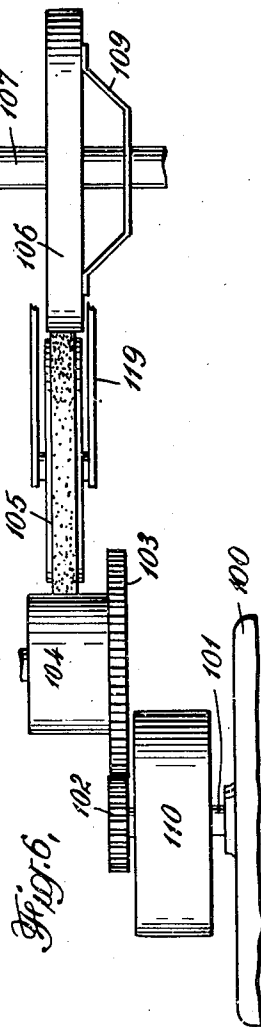
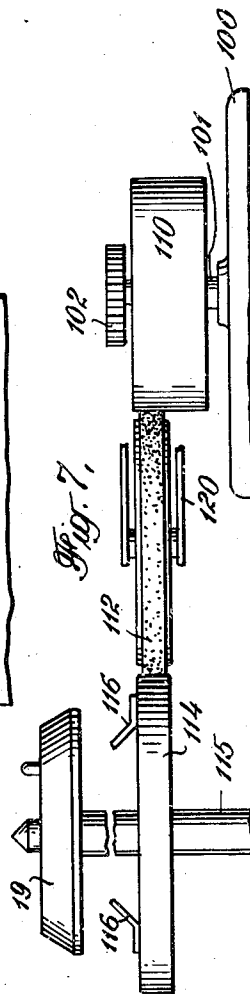
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MAGAZINE TYPE MAGNETIC RECORDER

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5 Sheets-Sheet 3



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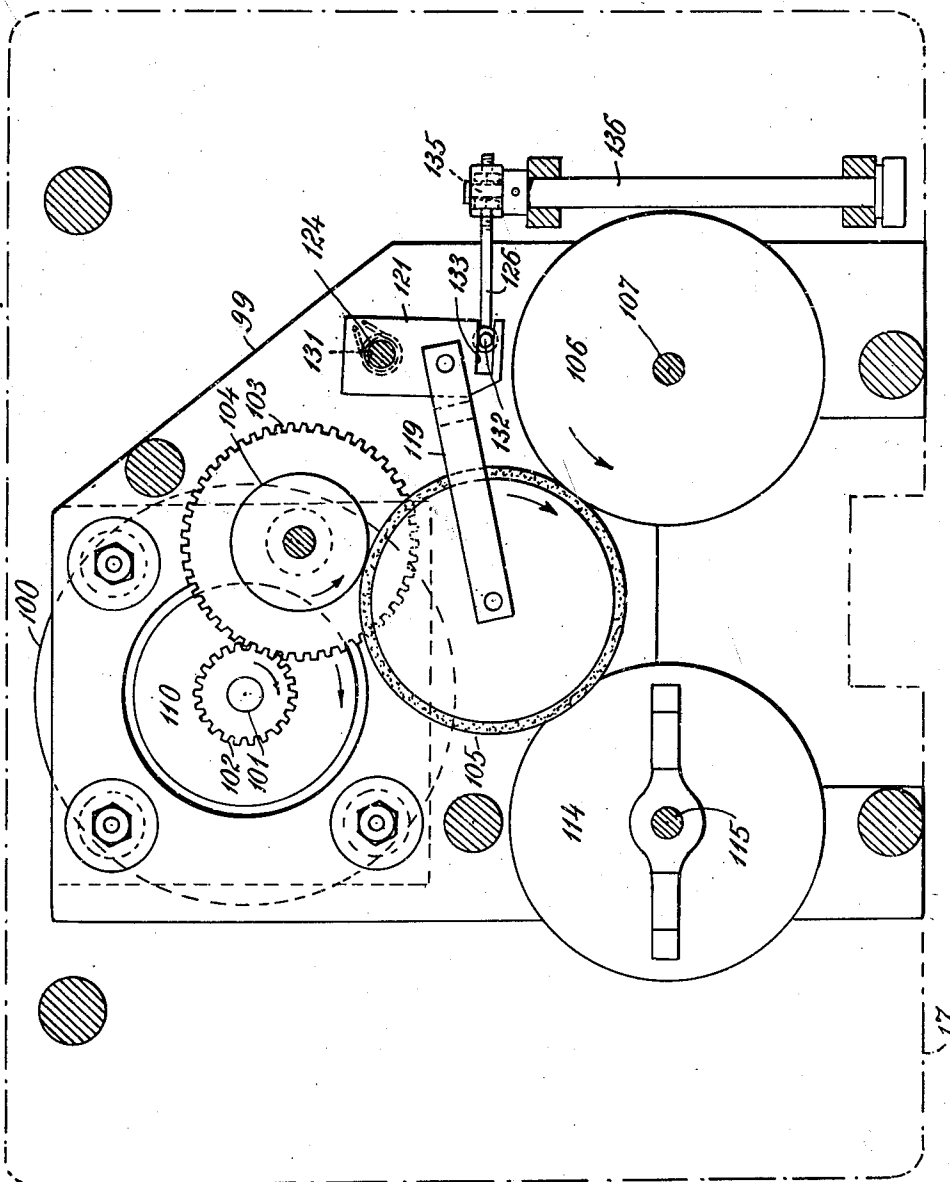
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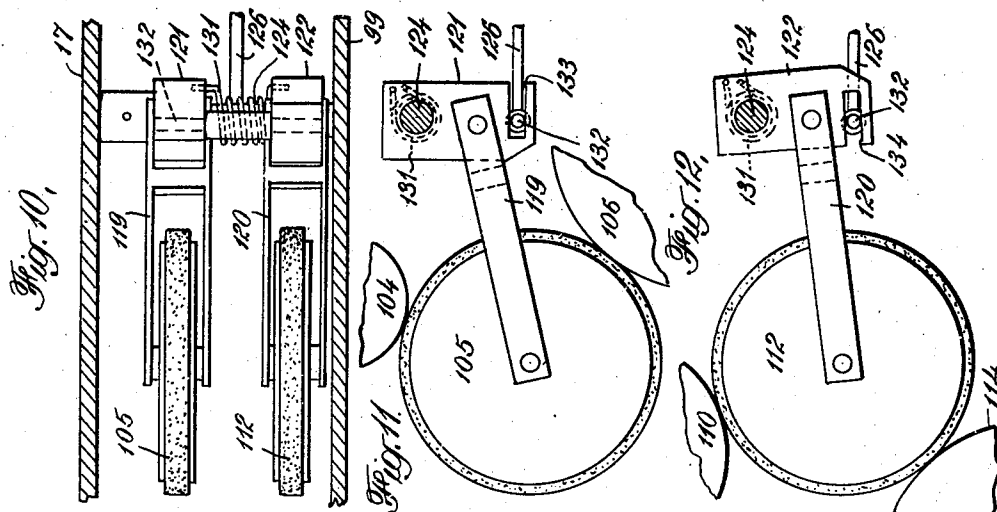
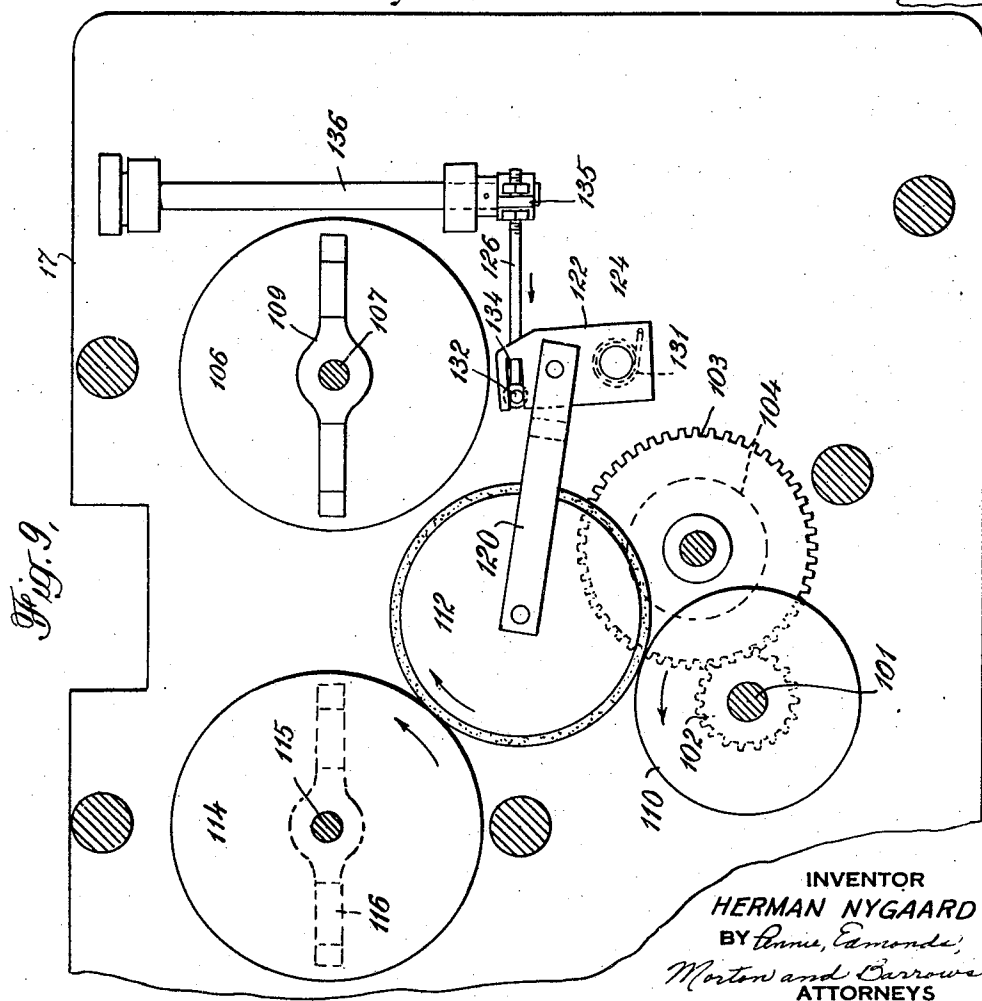
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MAGAZINE TYPE MAGNETIC RECORDER

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5 Sheets-Sheet 5



UNITED STATES PATENT OFFICE

2,487,170

MAGAZINE TYPE MAGNETIC RECORDER

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Application April 16, 1947, Serial No. 741,883

6 Claims. (Cl. 242—54)

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This invention relates to magnetic recorders, and particularly to a magazine type of recorder and reproducer, in which the recording medium is contained in a casing or magazine supported on a main housing in which are mounted the magnetic head, the recording and reproducing circuits, and the driving means.

The present invention offers an improved form of driving mechanism for the advancement of the recording medium past the magnetic recording and reproducing head, especially adapted to the needs of a recorder in which the recording means is carried on two spools loosely contained within a closed magazine of inexpensive manufacture, whose interior is inaccessible to the operator of the equipment and which is designed to be instantly interchangeable on the recorder with other magazines, all necessary connections electromagnetic and mechanical between the magazine and the recorder being automatically and correctly made in the process of positioning the magazine on the recorder. Magazines of this type are described in my copending application No. 741,885 filed April 16, 1947.

Rotation of the spools within the magazine by the driving mechanism draws the recording medium, preferably a paramagnetic wire, from one spool to the other, and the wire in passing from one spool to the other engages the magnetic head which extends into the magazine through an aperture provided therefor. During rotation the spools are carried by the driving mechanism, which belongs to the recorder proper but which extends into the magazine to journal and position the spools for rotation free of the magazine when the magazine is emplaced on the recorder. The wire is laid evenly on the spools by a resilient guide frame which oscillates within the magazine about a pair of pivots. At the same time the guide frame restricts the wire in its passage from one spool to the other to a path of which a portion is fixed relative to the magazine, and hence to the recorder itself, independently of the position of the guide frame. Hence the wire is always in position to engage the head, and the magazine can be instantly emplaced on the recorder, regardless of the relative proportions of the wire on the two spools.

The spool-driving mechanism in the recorder is designed to cooperate with the magazine in such a way as to align the spools accurately for, and support them during rotation, as well as to supply the driving force. Such construction makes it unnecessary to support the spools on shafts or bearings in the magazine, and makes

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possible the use of a magazine composed of simple castings or stampings, resulting in substantial savings in the manufacture of the magazines.

The cooperative driving and positioning mechanisms, together with the magnetic head arrangement, make possible for the first time a magnetic recorder in which true interchangeability of the magazines can be obtained in a way suitable for use by unskilled operators.

Within the recording unit, I have provided for a positive drive which cooperates with the magazine structure to keep a slight tension on the wire, eliminating slack or backlash. It thus effectively prevents breakage of the wire by sudden stresses even during frequent and rapid reversals of direction.

These and other important features of the invention may be better understood by reference to the accompanying drawings, in which a preferred embodiment is illustrated in detail. It will be understood that the invention is not limited to the exact structure shown, but may be incorporated in other equivalent forms within the terms of the appended claims.

In the drawings:

Fig. 1 is a perspective view showing the recording and play-back unit, hereafter referred to simply as the recorder, together with the magazine mounted thereon in operating position;

Fig. 2 is a perspective view similar to that of Fig. 1 but with the magazine removed from the recorder;

Fig. 3 is a perspective view of the magazine with its cover removed, and partially broken away to show the elements of the spools which cooperate with the recorder;

Fig. 4 is a fragmentary transverse sectional view of the top chassis plate of the recorder and of the magazine, taken as indicated by line 4—4 in Fig. 2 and line 4—4 of Fig. 3, with the magazine of Fig. 3 assumed to be in operating position on the recorder of Fig. 2;

Fig. 5 is a front elevational view of the spool driving elements;

Fig. 6 is a schematic elevational view showing the spool-driving sequence during recording and play-back;

Fig. 7 is a schematic elevational view showing the spool-driving sequence during rewind;

Fig. 8 is a top view of the driving arrangement, looking down on the plane indicated at line 8—8 in Fig. 5 during recording and play-back;

Fig. 9 is a bottom view of the driving mechanism in rewind position, looking up at the plane indicated at line 9—9 in Fig. 5;

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Fig. 10 is a side elevation of the suspension of the friction idler wheels which transmit power from the motor to the spool-driving shafts;

Fig. 11 is a plan view of the suspension of the upper friction idler wheel, showing it engaged with its driving and driven elements as it is when the record, play-back, and rewind control of the recorder is in neutral; and

Fig. 12 is a view similar to that of Fig. 11, but showing the lower friction idler wheel. Figs. 11 and 12 have been drawn with a line of centers joining a common element thereof to indicate the relative positions of certain parts of one figure to other parts of the other figure.

In Fig. 1 the recorder is illustrated as embodied in a single unit 1, on top of which is emplaced a magazine 2 containing the recording wire. Extending from the front panel 3 is a magazine release button 4, which is pushed in to unlock the magazine 2 for removal. The fraction of the total recording time or length of wire remaining on the supply spool in the magazine is shown on an indicator 5.

An off-on switch and volume control knob 7 is disposed in symmetrical arrangement on panel 3 with a four-position control knob 9, a screw-plug type microphone connection 10, and a neon glow lamp 11 which flashes when the level of sound supplied is adequate for recording. An ornamental grille 12 conceals a speaker for play-back purposes.

The four-position control knob 9 is arranged for recording in its first position, playing back in its second position, neutral in the third, and for rewinding in its fourth position. Control knob 9, in addition to making the desired electrical connections for recording, play-back and rewind, such as those relating the microphone input, the magnetic head and the loud-speaker to appropriate points in the amplifier, also controls the driving of the take-up spool in one direction during recording and play-back and the driving of the supply spool in the opposite direction during rewinding. This control of the drive mechanism is effected by mechanical linkages, to be described below.

In Fig. 2, the recorder is shown with the magazine removed to show the cooperating mechanism and the recessed seat 8 in which the magazine is emplaced. The magnetic head unit 15 is removably disposed in a head container 16 mounted on top chassis plate 17. Head unit 15 is shaped to assist in positioning the magazine 2 while it is being seated. Frusto-conical positioning members 19 and 20 mounted on spool-driving shafts within the recorder extend upwardly from plate 17 to position the spools for rotation within the magazine upon emplacement of the magazine on the recorder. The members 19 and 20 determine the height above the recorder at which the spools are borne during rotation, freeing them from friction with the magazine. Tapered studs 21 and 22 which extend upwardly from the members 19 and 20 engage bores within the spools and determine the axes of rotation of the spools. The driving force which rotates the spools is transmitted by drive pins 24 and 25 which engage suitable drive bores within the spools.

During the emplacement of the magazine, the recording wire within magazine 2 engages with the V-shaped upper engaging surfaces of the head 15, and is guided by the inclination of those surfaces through a slot into the interior of the head and into engagement with the magnetic

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recording, play-back, and erasing elements therein.

Three other cooperative engagements occur during the seating of the magazine 2. A castellated driving head 31 engages driven means in the magazine cooperating therewith to operate a level-winding mechanism within the magazine. A locking stud 32 secures the magazine firmly in place, until again released by pressing release button 4, and spool unlocking pin 35 releases the spools for rotation within the magazine.

The structure of the magazine interior is shown schematically in Fig. 3 with portions broken away to permit a better understanding of the functions. A cross-section of the magazine appears in Fig. 4. Magazine base plate 140 has recesses or races 141 formed therein in which the supply spool 144 and take-up spool 142 are loosely seated. The recesses are sufficiently greater in diameter than the spools so that they do not act as journals or control the axes of revolution of the spools, simply positioning them approximately. The spools float freely within the magazine, riding during rotation on the spool-positioning members 19 and 20 of the recorder. Resilient spring arms 145 having hardened bearing members 146 fixed therein bear upon central bearing surfaces 147 in the upper surface of the spools. These spring arms serve to hold the spools normally in their recesses without restricting their exact positioning when the magazine is emplaced on the recorder. Frusto-conical recesses 149 are formed on the underside of each spool, into which the corresponding frusto-conical positioning member 19 or 20 extending from the recorder may fit. Studs 21 and 22 engage central bores 150 within the spools to exactly fix the spools on the supporting members 19 and 20, the drive torque being transmitted by the association of the driving pins 24 or 25 with driving pin bores 151. When the magazine is not emplaced on the recorder, spool-locking spring arms 152 bend upwardly into contact with radial grooves 154 formed peripherally in the underside of the spools 142 and 144.

When the magazine is emplaced on the recorder, the spring arms 152 are withdrawn from engagement with the radial grooves 154 so that the spools may be freely rotated. This withdrawal is effected by the engagement of an unlocking pin 35 in the recorder top chassis plate 17 with the central portion 155 of the spool-locking spring arms 152. This engagement forces the central portion of the spring upwardly against base plate cross members 156, which act as fulcrum about which the arms 152 may be forced downwardly.

The paramagnetic recording medium 160 is laid on the spools by a resilient guide frame 161 pivoted at 162 about an axis coincident with the desired path of the wire across aperture 164 for presentation to the magnetic head. The resilient guide frame 161 is formed approximately in the shape of a W with the central leg carrying an engaging arm 165 (see Fig. 4). A pulley 163 is mounted at each of the outside corners of the guide frame and the pulleys carry the wire from one spool to the pivotal axis of the guide frame, across the aperture 164, and back to the other spool. The arm 165 carries a cam-engaging member 166 which is urged by a spring 167 into contact with a screw-type cam 169 having a right- and left-handed thread closed upon itself. Cam 169 is driven from the recording and play-back

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unit through a suitable driving pin 170 and is thus caused to oscillate or rock the guide frame 161 so that the wire may be laid evenly on the spools. The path of the wire is fixed during its passage across the base plate aperture 164 however, since the front pulleys 163 are so located in the frame 161 that the pivotal axis of the guide frame is tangent to these pulleys. By presenting the wire in a fixed path in which it is engaged by the magnetic head, which has guiding surfaces arranged to automatically direct the wire to engagement with the magnetic elements in the head, immediate interchangeability of magazines on the recording and play-back unit is achieved regardless of the proportion of the wire on the two spools and of the position of the guide frame.

The mechanism through which the cam 169 is rotated by driving pin 170 is seen to best advantage in Fig. 4. The driving pin 170 is fixed through the lower portion 171 of the shaft of cam 169 within a recess 172 in the magazine base plate 140. Castellated drive head 31 projects above the top chassis plate 17 and into the recess 172 in magazine base plate 140 when the magazine is emplaced. If the driving pin 170 happens to align itself immediately with one of the radial grooves 173 formed in the castellated drive head 31, it will seat therein at once. If, on the contrary, the pin 170 engages against the lands 174, drive head 31 will be depressed on its shaft 175 against the helical spring 176 until the head 31 has rotated sufficiently to align a set of grooves 173 with the pin 170. Movement of the head 31 axially of shaft 175 is permitted by a slot 177 formed diametrically therethrough and elongated axially thereof. A pin 179 fixed in head 31 and through the slot 177 transmits driving force from the shaft 175 to the head 31, while permitting this axial movement during seating of the magazine. Thus the magazine can be placed flat against top chassis plate 17 for locking to the recorder regardless of the relative rotational positions of drive pin 170 and the drive head 31. The actual locking is accomplished by the entry of locking stud 32 into a locking slot 33 in the magazine base plate.

Shaft 175 is journaled at its lower end through a lower support plate 180, and is expanded thereabove to form a hub 181. Within hub 181 is an annular recess 182 in which the helical spring 176 is seated, and into which it may be compressed when the head 31 is depressed.

The hub 181 is journaled in upper support plate 184, which, together with the lower support plate 180, contains the gear train to drive castellated head 31. Driving force is supplied initially by a pinion 185 (see Fig. 5) carried on the take-up spool drive shaft 107 immediately beneath chassis top plate 17. Pinion 185 drives a speed-reducing gear 186 (Fig. 4), journaled between lower and upper support plates 180 and 184; gear 186 in turn, through an intermediate pinion 187 fixed concentrically therewith, drives a gear 189 fixed about the enlarged hub 181, effecting a further reduction in the speed and driving cam 169 at the proper rate to lay the wire evenly on the spools within the magazine.

The mechanism in the recorder which drives the spools and the level-winding mechanism is shown schematically in Figs. 5-12. It includes a motor and two separate friction-operated power transmission systems leading therefrom, of which one communicates with the supply spool and the other with the take-up spool. During recording

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and playing back, the system leading to the take-up spool is engaged and during rewinding the system leading to the supply spool is engaged. The spool-driving mechanism also includes, however, provisions whereby both systems are engaged while the control knob 9 is in the neutral position (in which position the drive motor is deenergized), during the transition from recording or play-back to rewind. While the control knob is in the neutral position, the momentum of the motor armature tends to drive the two spools in opposite directions, so that they are brought to rest almost instantaneously, the wire between them being maintained taut. The frictional elements are calculated to prevent overstressing the wire so that it will not be broken.

These two power transmission systems will now be described. Referring to Fig. 5, power is supplied from a constant speed motor 100 mounted vertically in the recorder chassis below lower chassis plate 99. The motor is mounted on conventional supports designed to minimize the transmission of vibration to the chassis. The motor shaft 101 carries a pinion 102 and a fly wheel 110. Pinion 102 is the first element in the chain leading to the take-up spool and the fly wheel 110, which smooths out irregularities in motor speed, serves as the first element in the chain leading to the supply spool. The pinion 102 drives a spur gear 103 which has a friction driving wheel 104 fixed on the same shaft. The shaft of gear 103 is journaled in chassis plates 99 and 17.

In the setting of the mechanism for recording and play-back, governed by the control knob 9 and shown in Figs. 6 and 8, an upper rubber-tired friction idler wheel 105 is engaged between the driving wheel 104 and a take-up spool friction drive wheel 106. Take-up spool friction drive wheel 106 is freely journaled on the take-up spool drive shaft 107 which supports the take-up spool-positioning member 20. Shaft 107 is journaled in the upper and lower chassis plates 17 and 99. Shaft 107 and member 20 are caused to rotate in unison with take-up spool friction drive wheel 106 by means of a properly spring-loaded friction clutch 109. Proper speed reductions are introduced between drive pinion 102 and the take-up spool friction drive wheel 106 to translate the constant r. p. m. of the motor 100 into a linear winding velocity of about three feet per second on the take-up spool carried by positioning member 20. The actual linear velocity will of course increase during take-up, since the radius of the windings becomes greater as more layers of wire are laid on, while the motor speed remains constant. This does not affect sound reproduction, however, since each portion of the wire will be drawn over the magnetic head gap during play-back at a speed identical with that with which it was drawn thereover during recording.

It is necessary, after a spool of wire has had a recording made thereon, to rewind it from the take-up spool onto the supply spool before the record can be played back. The power transmission system leading to the supply spool, which begins with the fly wheel 110, is engaged by turning the control knob 9 on the front of the recorder to the rewind position. The driving sequence which results is illustrated in Figs. 7 and 9. Fly wheel 110 acts as a friction wheel to drive a lower rubber-tired friction idler wheel 112. Idler wheel 112 is engaged between fly wheel 110 and a supply spool friction drive wheel

114. Supply spool friction drive wheel 114 is journaled on the shaft 115 which supports the supply spool-positioning member 19 and engages therewith through the spring-loaded friction clutch 116. The clutches 109 and 116 are adjusted to slip at a torque substantially below that corresponding to the breaking strength of the wire applied to either one of the spools for any number of layers of the wire on the spools, so that there is no possibility of breakage of the wire, even upon rapid reversals of the direction of wire travel.

The means by which the recorder is shifted from recording or playing back to rewinding is shown in Figs. 5, 8, 9, 10, 11 and 12. This consists essentially of a linkage operated from the control knob 9 on the front of the recorder which alternately engages the idler wheels 105 and 112 and which operates to engage them both while knob 9 is in neutral, so as to effect a stopping and reversal in the rotation of the spools and direction of wire travel without either breaking the wire or allowing slack to develop therein. The upper and lower idler wheels 105 and 112, which serve respectively to transmit power from the driving wheel 104 to the take-up spool friction drive wheel 106 and from the motor fly wheel 110 to the supply spool friction drive wheel 114, are pivoted for free rotation in a horizontal plane in the mouths of a pair of yokes 119 and 120. This construction is best shown in Fig. 10. The yokes 119 and 120 are pivoted respectively on two levers 121 and 122, shown in plan in Figs. 11 and 12. The levers 121 and 122 are freely journaled for rotation about a vertical shaft 124 which is fixed in the chassis plates 17 and 99. A coil spring 131 wound about the shaft 124 and engaging the levers 121 and 122 urges them into opposite rotations, lever 121 counterclockwise and lever 122 clockwise when seen from above, as in Figs. 11 and 12. Rotation of the levers 121 and 122 shifts the idler wheels 105 and 112 to the right or left, in order to engage them with the spool friction drive wheel and driving wheel 104 or motor fly wheel, as the case may be, with which they are coplanar.

Rotation of the levers 121 and 122 is governed by a tie rod 126. This tie rod carries on its end a pin 132 which engages with a slot 133 in the upper lever 121 and with a slot 134 in the lower lever 122. The slots 133 and 134 are open in opposite directions, so that motion of the tie rod 126 to the right draws lever 122 into counterclockwise rotation and motion of the tie rod to the left pushes the lever 121 into clockwise rotation. Because of the tension exerted by the coil spring 131, however, rotation of either lever as compelled by tie rod 126 is followed by rotation of the other lever in the same direction, within the limits imposed by the spool drive friction wheels, against which the idler wheels bring up.

Tie rod 126 is connected to a crank 135 depending from a spring-loaded shaft 136 (Fig. 5). Shaft 136 is connected by conventional means to the control knob 9 on the front panel of the recorder and possesses by virtue of that mechanism two equilibrium positions of rotation, the first of these corresponding to the record and play-back positions of the knob 9 and the second corresponding to the rewind position of the knob 9. A third equilibrium position for the shaft 136 between these two is established by the spring loading of the shaft 136 and determines the rest

position of the tie rod 126 when the control knob 9 is in neutral.

In this third equilibrium position of the tie rod 126 the pin 132 engages neither of the levers 121 nor 122. They are urged into opposite rotations, however, by the spring 131, and so cause engagement of their respective idlers with the driving and driven elements thereof. The spacing of these elements, namely the two spool friction drive wheels, the motor fly wheel and the driving wheel 104, and the size of the idlers and dimensioning of their suspensions is such that with no stress exerted upon the levers 121 and 122 by the tie rod 126, the slots 133 and 134 overlap each other allowing slack within which the pin 132 may move either way before bringing up against the end of one of the slots 133 or 134. The relation of these elements in neutral is illustrated in Figs. 11 and 12, where both idlers are shown engaged although the pin 132 or tie rod 126 bears against neither of the levers 121 nor 122.

On record and play-back, the tie rod 126 is drawn to the right and held in the first of the above-mentioned equilibrium positions. In assuming this position, tie rod 126 brings the pin 132 to bear against the end of the slot 134 in lever 122 and rotates lever 122 counterclockwise, thus positively withdrawing the lower idler wheel 112 from engagement between the motor fly wheel and the supply spool friction drive wheel 114. Engagement of the upper idler wheel 105 between the driving wheel 104 and the take-up spool friction drive wheel 106 is provided solely by the tension of coil spring 131. The pin 132 of tie rod 126 is drawn away from the end of slot 133 in the upper lever 121, lever 121 being prevented from fully following the rotation of lower lever 122 by the engagement of the upper idler 105.

Conversely in rewind position, the tie rod 126 is drawn to the left and held in the second of the above-mentioned equilibrium positions. In assuming this position the tie rod 126 brings the pin 132 to bear against the end of slot 133 in lever 121 and rotates the latter clockwise, thus positively disengaging the upper idler wheel 105 from the take-up spool friction drive wheel 106. The lower idler wheel 112 is engaged between motor fly wheel 110 and supply spool friction drive wheel 114 by the tension of coil spring 131. Similarly, during rewinding the lower idler engages and prevents the lower lever 122 from fully following the rotation of the upper lever 121 which is compelled by the tie rod. It is to be noted thus that engagement of the idler wheels is not effected by pressure of the tie rod against the lever 121 or 122 of the idler in question, but that the tie rod effects primarily disengagement of the idler against whose lever it abuts.

On the changeover from record or play-back to rewind, the motion of the tie rod 126 towards neutral, with which the changeover begins is followed by the lever 122 against which the pin 132 is stressed until the disengaged idler 112 brings up against the fly wheel 110 and the supply spool friction drive wheel 114. The pin 132 then leaves contact with the end of the slot 134 in lever 122 and moves across the overlapping space of the two slots. Simultaneously the power to the motor is shut off by means of a switch associated with the control knob 9. Both idlers are now engaged and both spool friction drive wheels 106 and 114 are driven in opposite directions by the momentum of the motor armature. The clutches 109 and 116 slip and the spools come rapidly to rest with the wire between them remaining taut. As

the tie rod 126 continues its motion towards the rewind position, the pin 132 brings up against the end of slot 133 in lever 121 and disengages the idler 105. The motor is energized again; the drive to the take-up spool is disconnected, and the wire is wound up on the supply spool. Similarly on the changeover from rewind to record or play-back, the take-up spool friction drive wheel takes hold before the supply spool friction drive wheel is disengaged.

I claim:

1. In a magnetic recorder, a housing, a motor mounted therein having a vertically disposed motor drive shaft, spool-positioning and driving means extending from said housing, including a supply spool shaft, a first driven friction wheel rotatably disposed about said supply spool shaft, a first friction clutch arranged to fix said first driven friction wheel against rotation relative to said supply spool shaft; a take-up spool shaft, a second driven friction wheel rotatably disposed about said take-up spool shaft, a second friction clutch arranged to fix said second driven friction wheel against rotation relative to said take-up spool shaft; means for driving said first and second driven friction wheels from said motor, comprising a fly wheel arranged to act as a first friction driving wheel, a motor drive pinion mounted on the shaft of said motor, a spur gear arranged to mesh with said motor drive pinion and having a second friction driving wheel affixed thereto, a lower idler friction wheel mounted in said chassis on a first doubly-articulated mount and arranged to be shifted into engagement between said first friction driving wheel and said first driven friction wheel, an upper idler friction wheel mounted in said chassis on a second doubly-articulated mount and arranged to be shifted into engagement between said second friction driving wheel and said second driven friction wheel, spring means connecting said first and second mounts and urging them in mutually opposite directions for engagement of their idler friction wheels with their respective driving and driven friction wheels, whereby during such engagement said mounts assume a position of equilibrium under the influence of said spring means, linkage means loosely engaging said mounts for abutment thereagainst in directions respectively opposite to those in which said mounts are urged by said spring means, whereby displacement of one of said mounts by said linkage means increases the stress exerted on the other of said mounts by said spring means and tightens the engagement with its driving and driven friction wheels of the idler friction wheel in said other mount, said equilibrium position for said mounts providing slack in the engagement therebetween of said linkage means so that on the change-over from one displacement of said linkage means to the other both idler friction wheels are engaged during the passage of said linkage across said slack.

2. In a magnetic recorder employing a closed magazine for the storage of a paramagnetic recording medium, means to drive alternately and in opposite directions for the recording or play-back and rewinding respectively of the recording medium, either of two positioning and driving members extending from said recorder for engagement with the spools in said magazine, comprising a chassis adapted to accommodate the magazine for rotation of the spools therein, motor means arranged on said chassis, two friction driving wheels disposed in said chassis on spaced

apart parallel shafts and driven in opposite directions by said motor means, two spaced apart parallel spool-driving shafts arranged in said chassis, a driven friction wheel freely journaled on the first of said spool-driving shafts, a driven friction wheel freely journaled on the second of said spool-driving shafts, slipping clutches frictionally engaging said driven friction wheels with their respective spool-driving shafts, a first idler friction wheel adapted to engage the first of said friction driving wheels and the first of said driven friction wheels, a second idler friction wheel adapted to engage the second of said friction driving wheels and the second of said driven friction wheels, separate mountings for said idler friction wheels permitting their translation relative to said chassis, stressed spring means connecting said mountings and therethrough urging said idler wheels in opposite directions so as to engage them with their respective driving and driven friction wheels, said engagement establishing an equilibrium position for said mountings under the influence of said spring means, linkage means loosely engaging said mountings and adapted for alternate positive abutment against each of said mountings in directions opposite to those in which said mountings are respectively urged by said spring means, whereby motion of said linkage means disengages the mounting against which it abuts and by further stressing of said spring means tightens the engagement of the mounting against which it does not abut, and slack between said linkage means and the surfaces of said mountings against which said linkage means abuts while in the said equilibrium position, whereby on the change-over from abutment of said linkage means against one of said mountings to abutment against the other mounting both idler wheels are allowed to come into engagement with their respective driving and driven friction wheels under the influence of said spring means.

3. In a magnetic recording and reproducing device arranged for the interchangeable application thereto of magazines containing a paramagnetic medium wound on and extending between supply and take-up spools, a motor, means for transmitting power from said motor to supply and take-up spool-driving shafts, comprising a fly wheel driven by said motor, a first intermediate idler friction wheel arranged to engage said fly wheel, a supply spool shaft, a first driven friction wheel journaled rotatably about said supply spool shaft, and clutch means arranged to connect said supply spool shaft to said first driven friction wheel; a pinion driven by said motor, a gear meshing with said pinion, a friction drive wheel affixed to said gear, a take-up spool shaft, a second driven friction wheel journaled rotatably on said take-up spool shaft, clutch means for connecting said take-up spool shaft to said second driven friction wheel, and a second intermediate idler friction wheel arranged to engage said friction drive wheel and said second driven friction wheel; means for reversibly shifting said intermediate idler friction wheels from a position of engagement of one thereof between said fly wheel and said first driven friction wheel and disengagement of the other thereof, to a position of engagement of the other thereof between said friction drive wheel and said second driven friction wheel and disengagement of the first thereof, said shifting means being arranged to apply driving force simultaneously to both of said driven friction wheels during the shifting of

said intermediate idler wheels from one of said positions to the other.

4. In a magnetic recorder employing a closed magazine for the storage of a paramagnetic recording medium, means operative to drive alternately and in opposite directions either of two positioning and driving members extending from said recorder for engagement with the spools in said magazine, comprising a chassis adapted to accommodate the magazine for rotation of the spools therein, motor means mounted on said chassis, two friction driving wheels mounted in said chassis and adapted to be driven in opposite directions by said motor means, a pair of spaced apart spool-driving shafts, spool-positioning and driving means fixedly mounted on said spool-driving shafts, driven friction wheels journaled on said spool-driving shafts, slipping clutches frictionally engaging said driven friction wheels with their respective spool-driving shafts, two friction idler wheels journaled on separate axles and adapted to be separately frictionally engaged between said driving and driven friction wheels so as to transmit motion therebetween, mountings for said idler wheels pivotally mounted in said chassis and permitting translation of said idler wheels relative to said chassis, stressed spring means connecting said mountings and urging mutually opposite motions thereof so as to engage said idler wheels with their respective driving and driven friction wheels, linkage means loosely engaging said mountings so as to transmit motion thereto in directions respectively opposite to those in which said mountings are urged by said spring means, whereby said linkage means effects by motion in one direction disengagement of one of said idler wheels and resilient engagement of the second with its driving and driven friction wheels, and by motion in the opposite direction effects disengagement of the second of said idler wheels and resilient engagement of the first of said idler wheels with its driving and driven friction wheels.

5. In a magnetic recorder employing a recording medium wound upon two spools in a magazine, spool-driving means comprising a chassis, two spaced apart parallel spool-driving shafts mounted in said chassis, a first friction driving wheel mounted in said chassis for rotation in a first plane perpendicular to said spool-driving shafts, a second friction driving wheel mounted in said chassis for rotation in a direction opposite to that of said first friction driving wheel in a second plane parallel to said first plane, a driven friction wheel journaled on one of said spool-driving shafts for rotation substantially in said first plane, a driven friction wheel journaled on the other of said spool-driving shafts for rotation substantially in said second plane, slipping clutches frictionally engaging said driven friction wheels with their respective spool-driving shafts, an axle fixed in said chassis parallel

to said spool-driving shafts, two spaced apart levers journaled for rotation about said axle, spring means engaging said levers and urging them into mutually opposite rotations, a yoke pivoted on each of said levers for rotation in a plane perpendicular to said axle, idler wheels pivotally mounted in the mouths of said yokes for rotation in said first and second planes respectively, linkage means connecting said levers and restraining their mutually opposite rotations, the diameter and spacing of said friction driving wheels and driven friction wheels and the diameter of said idler wheels being so chosen that rotation of said levers by means of said linkage engages alternately one and the other of said idler wheels with its respective driving and driven friction wheels.

6. In a magnetic recorder employing a closed magazine containing a paramagnetic recording medium wound upon and extending between two spools, driving means adapted to transfer said medium from one to the other of said spools and back comprising a driving chassis adapted to accommodate the magazine for rotation of the spools therein, spaced apart spool positioning and driving shafts extending from the chassis for engagement with said spools within the magazine, driven friction wheels mounted on said shafts for rotation independently thereof, slipping clutches frictionally engaging said driven friction wheels with said shafts, a drive motor mounted on the chassis, a friction drive wheel on the axle of said motor, a second friction drive wheel axially displaced from said motor and driven in the opposite direction thereby through reduction gearing, two friction idler wheels journaled on separate parallel axles and susceptible of motion in the planes of their rotation along a path intermediate the line of centers of said shafts and the line of centers of said motor and said second friction drive wheel, and linkage means loosely connecting said idler wheels, whereby motion of said linkage means in one direction effects frictional engagement of one of said idler wheels with the friction drive wheel on the axle of said motor and with one of said driven friction wheels and motion of said linkage means in the opposite direction effects frictional engagement of the other of said idler wheels with said second friction drive wheel and the other of said driven friction wheels.

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REFERENCES CITED

55 The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,926,862	Wellman	Sept. 12, 1933
1,975,336	Stechbart	Oct. 2, 1934
2,215,468	Herzig	Sept. 24, 1940