Nov. 11, 1947. R. M. SOMERS 2,430,538

TELEGRAPHONE

Filed June 14, 1944 4 Sheets-Sheet 1

Fig. 1

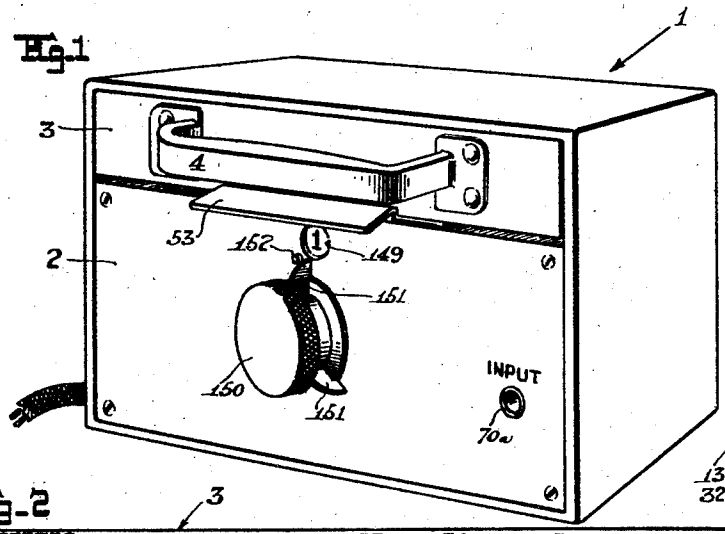


Fig. 4

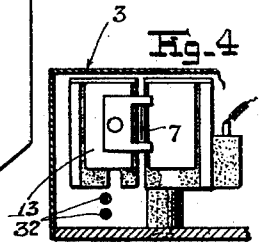
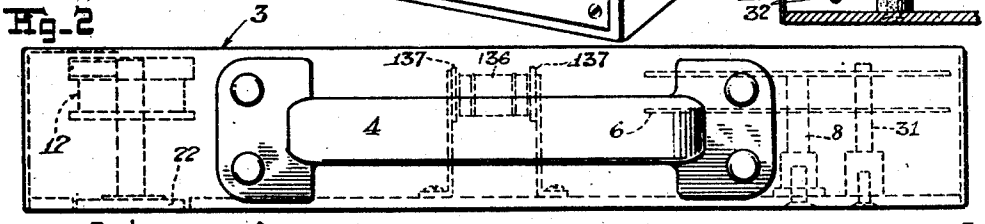
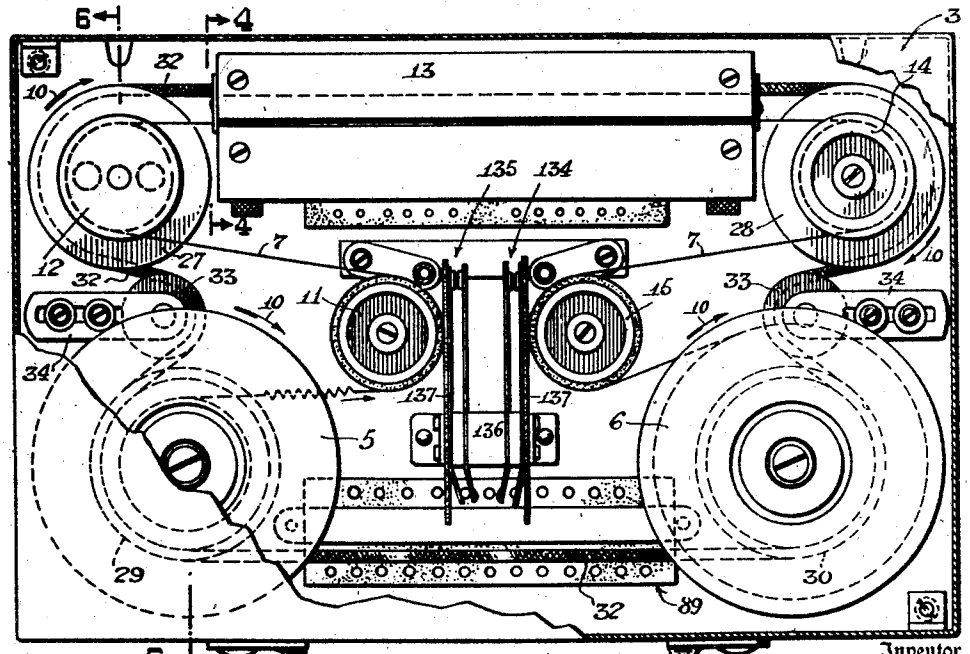


Fig. 2





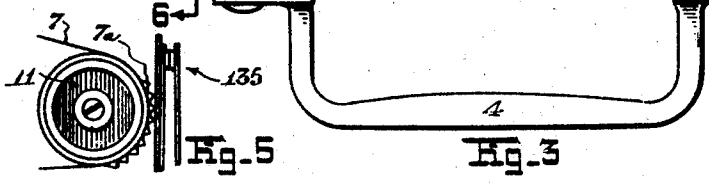


Fig. 5

Fig. 3

Inventor

Richard M. Somers

Henry Lanahan

Attorney

Nov. 11, 1947. R. M. SOMERS 2,430,538

TELEGRAPHONE

Filed June 14, 1944 4 Sheets-Sheet 2

Fig. 6

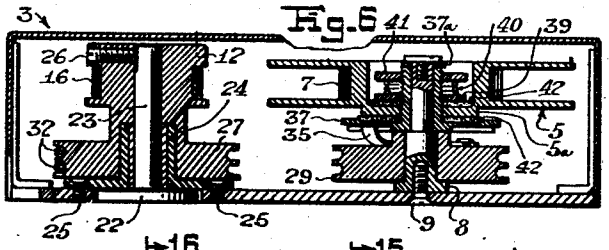


Fig. 7

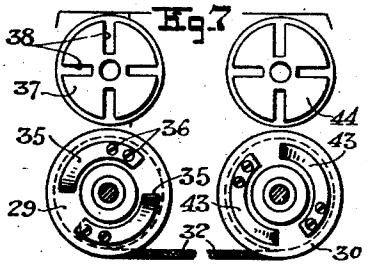


Fig. 8

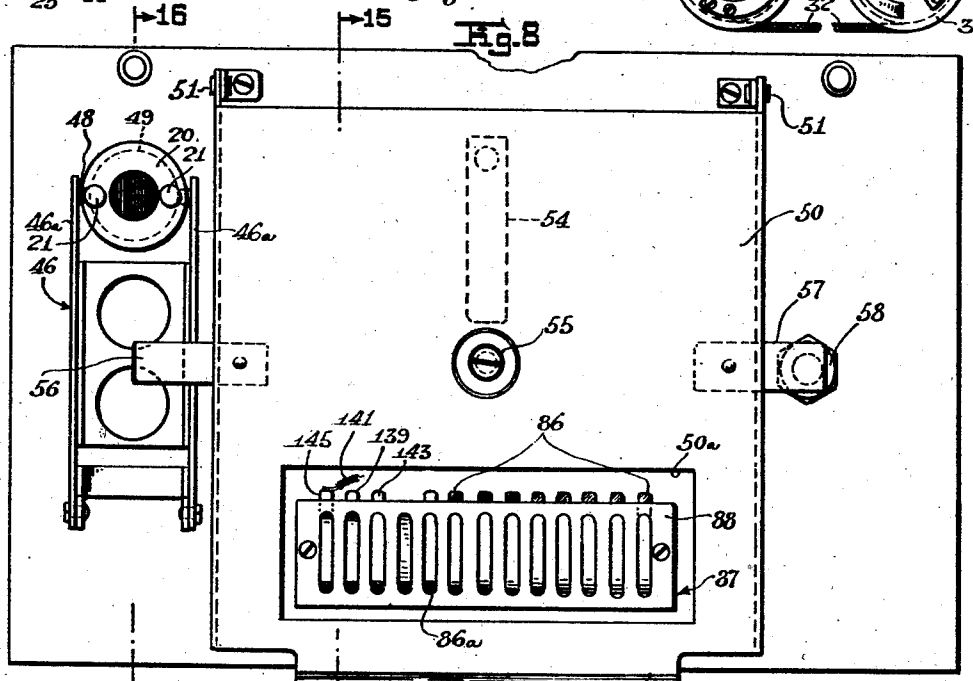


Fig. 9

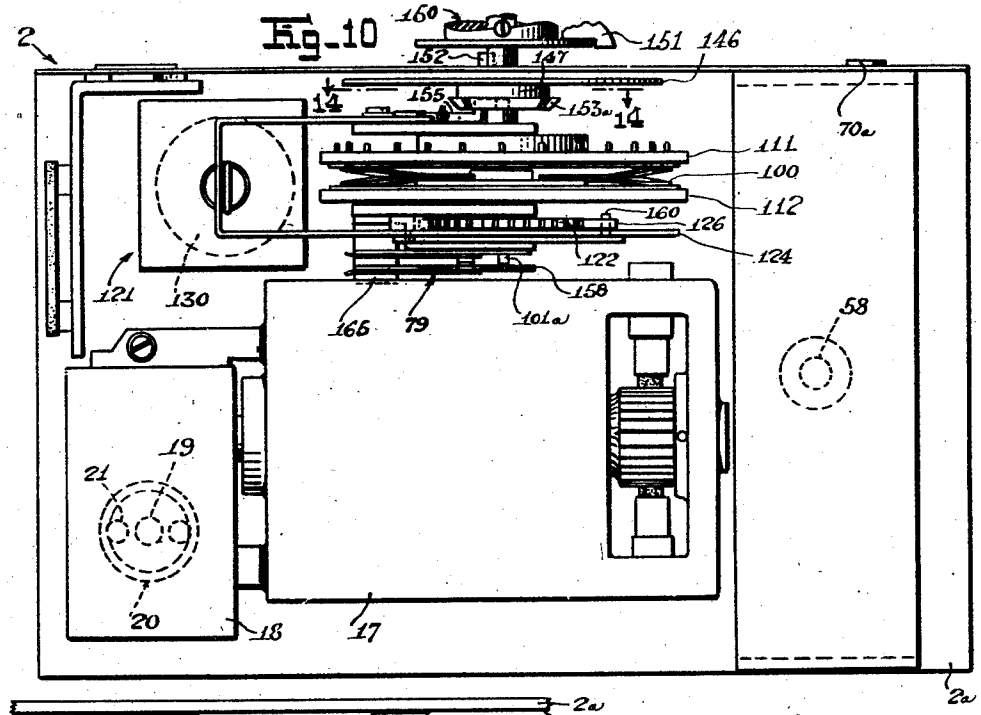
Inventor
Richard M. Somers
Henry Lanahan
Attorney

Nov. 11, 1947. R. M. SOMERS 2,430,538

TELEGRAPHONE

Filed June 14, 1944 4 Sheets-Sheet 3

Fig. 10



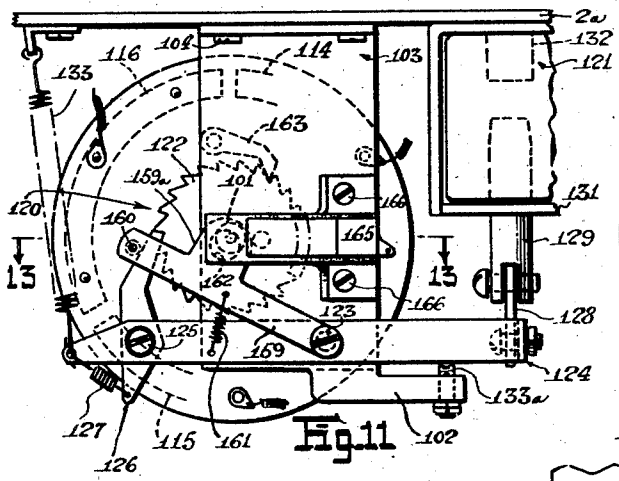


Fig. 11

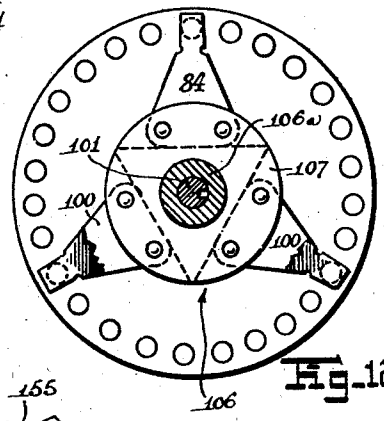
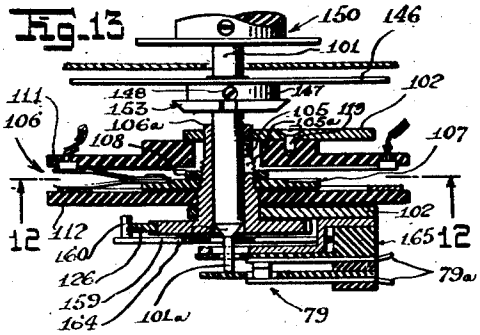


Fig. 12

Fig. 13



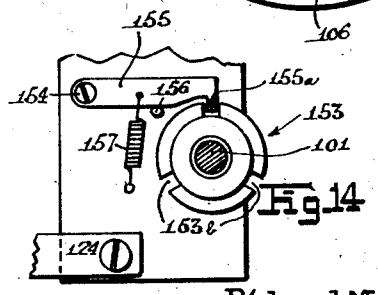


Fig. 14

Inventor

Richard M. Somers

By Mary Lanahan

Attorney

Nov. 11, 1947. R. M. SOMERS 2,430,538

TELEGRAPHONE

Filed June 14, 1944 4 Sheets-Sheet 4

Fig. 15

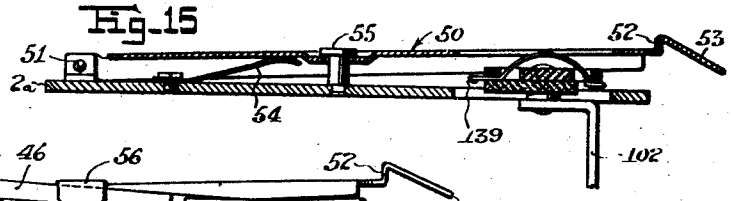
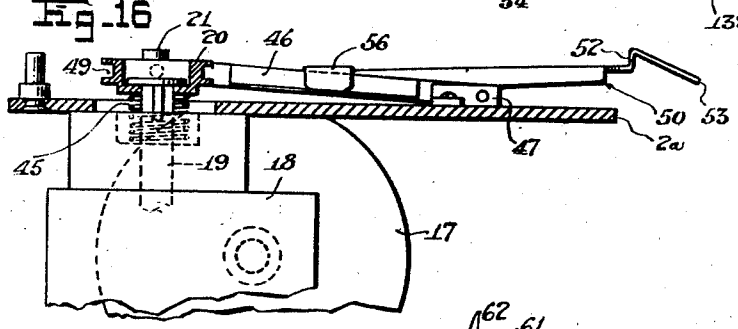


Fig. 16



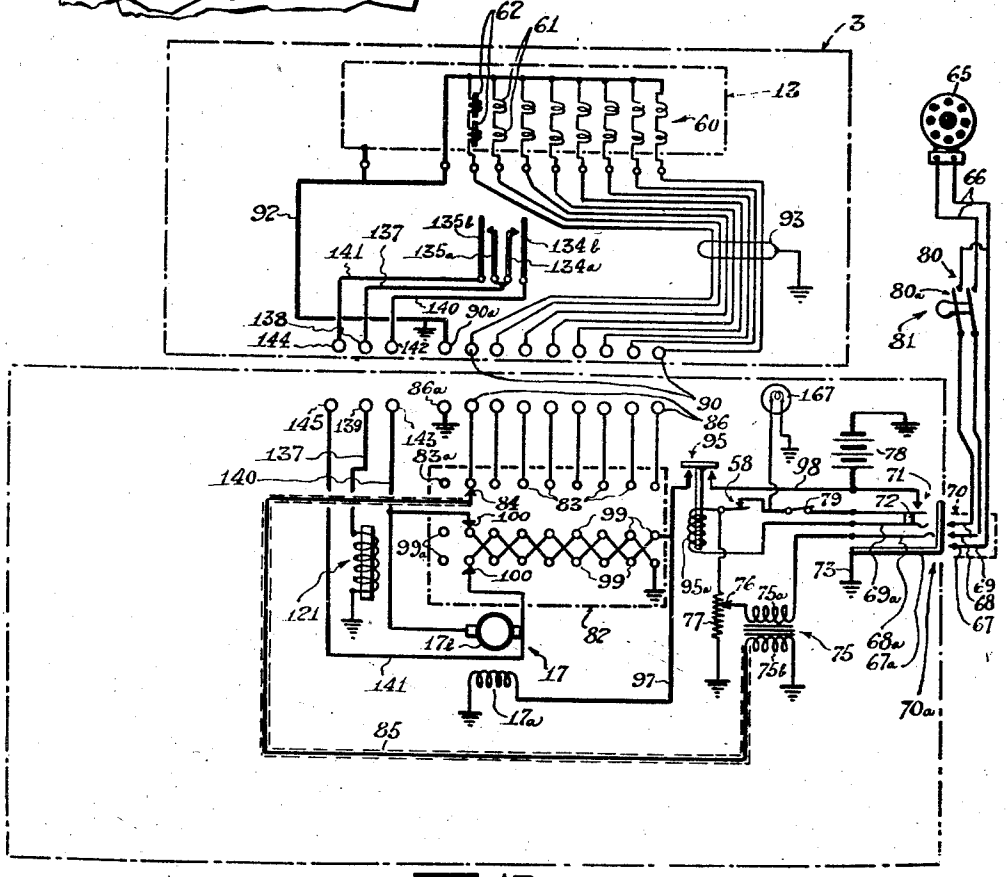


Fig. 17

Inventor

Richard M. Somers

Henry Linnehan

Attorney

Patented Nov. 11, 1947 2,430,538

UNITED STATES PATENT OFFICE

2,430,538

TELEGRAPHONE

Richard M. Somers, West Orange, N. J., assignor to Thomas A. Edison, Incorporated, West Orange, N. J., a corporation of New Jersey

Application June 14, 1944, Serial No. 540,259

11 Claims. (Cl. 271—2.1)

1

This invention relates to telegraphones and more particularly to improvements in the construction, operation and control of telegraphones.

The subject matter of this application is disclosed in the joint application of the applicant and Roscoe C. Van Camp, Serial No. 520,508, filed January 31, 1944, and entitled Telegraphone, and issued June 10, 1947, as Patent No. 2,422,143, and many features of the disclosure not claimed herein are claimed in the prior joint application.

While not limited thereto, the invention has particular application to recording and reproducing telegraphones which operate a multiple times along a magnetic medium in transversely-spaced lanes of that medium, such telegraphones being known as the multiple-lane type. By way of preferred illustration, the invention is shown in connection with a telegraphone having a removable magazine carrying a recording medium in the form of a magnetic tape.

It is an object of my invention to provide improved drive and control mechanisms for telegraphones and, more especially, to provide a positively-acting means for reversing automatically the magnetic recording medium, or tape, at the end of travel thereof in each direction.

Other objects of my invention are to provide a control system for reversing a tape-driving mechanism which will effect a reversal only in response to a complete reciprocation of a control device thereof, to provide means for positively reciprocating such device at the end of travel of the tape in each direction, to provide a control system having two such control devices for starting the drive mechanism in its respective directions, to provide a control system wherein the respective control devices are rendered ineffective in the system upon initial operation thereof following the operation of the other, and to provide such control system wherein the respective control devices are rendered ineffective alternately, each by the operation of the other.

Further objects are to provide a reversing mechanism which is first conditioned for operation and thereafter operated in response to unidirectional movement of a predetermined portion of the tape, and to provide a thickened or corrugated portion of the tape for so operating the mechanism which has a length adapted to assure positive operation of the mechanism at the end of travel of the tape in each direction.

It is a further object to provide a reversing switch for the tape-driving mechanism and separate control switches for starting the drive

2

mechanism in its respective directions, which control switches are rendered effective alternately in the system by the reversing switch.

It is another object to provide improved means for reversing the tape and selectively conditioning the machine for operation on the respective lanes of the tape.

Still other and allied objects and features of my invention will appear from the following description and the appended claims.

In the description of my invention reference is had to the accompanying drawings, of which:

Figure 1 is a perspective view of a telegraphone embodying my invention;

Figure 2 is a front elevational view of the removable magazine of that telegraphone;

Figure 3 is a top plan view, with a cover portion removed, of the abovementioned magazine;

Figure 4 is a fractional sectional view taken substantially on the line 4—4 of Figure 3;

Figure 5 is a detailed fractional view illustrating the operation of the selector control switches of the magazine by the magnetic tape;

Figure 6 is a fractional sectional view taken substantially on the line 6—6 of Figure 3;

Figure 7 shows top and bottom views to reduced scale of cooperating parts of ratchet drive transmissions for the supply and take-up reels of the magnetic tape;

Figure 8 is a top plan view of the cabinet section below the magazine;

Figure 9 is a front elevational view, with the front panel of the cabinet removed, showing the mechanism in the lower cabinet section;

Figure 10 is a bottom plan view of the mechanism in the lower cabinet section;

Figure 11 is a rear elevational view of a stepping-relay selector mechanism provided in the lower cabinet section;

Figure 12 is a view, partly broken away, taken substantially on the line 12—12 of Figure 13;

Figure 13 is an axially sectional view of the stepping-relay mechanism, taken substantially on the line 13—13 of Figure 11;

Figure 14 is a detailed sectional view taken substantially on the line 14—14 of Figure 10;

Figure 15 is a fractional sectional view taken substantially on the line 15—15 of Figure 8;

Figure 16 is a fractional sectional view taken substantially on the line 16—16 of Figure 8; and

Figure 17 is a diagrammatic view of circuits and mechanism according to my invention.

As is shown in Figure 1, the present telegraphone comprises a substantially rectangular cabinet 1 having a lower or main section 2 and

an upper or magazine section 3, the magazine section being hereinafter termed the "magazine." The magazine contains the magnetic tape of the machine, and may be removed and replaced by another, as for example when the tape has been recorded upon, so as to permit transcription of the recordation. The magazine is mounted in the cabinet in drawer fashion and provided with a handle 4 so that it may be readily withdrawn from the cabinet by a single manipulation of the hand. In order, however, to safeguard the machine and prevent misoperation thereof, certain automatic controls have been associated with the magazine as is hereinafter explained.

All components of the drive mechanism are provided in the magazine except for the drive motor, the advantage in this arrangement being that only one drive coupling is required between the main cabinet section and the magazine. Reference being had to the top plan view of the magazine shown in Figure 3, the drive mechanism will be seen to comprise two reels 5 and 6 for a magnetic tape 7. These reels are positioned in the front portion of the magazine respectively at the left and right corners thereof, in which positions they are journalled on studs 8 held by screws 9 to the bottom wall of the magazine as indicated in Figure 6. It will be understood that these reels serve alternately as supply and take-up reels, depending upon the direction of travel of the tape. For instance, in the direction of travel of the tape indicated by the arrows 10 in Figure 3, the left-hand reel 5 serves as a supply reel and the right-hand reel 6 as a take-up reel. Between these reels, as from reel 5 to reel 6, the tape passes approximately 180° around an idler pulley 11, then leftwardly and approximately 180° around a drive pulley 12, then rightwardly through a tone head box 13 to a second drive pulley 14, next approximately 180° around this drive pulley and leftwardly to a second idler pulley 15, and thereafter approximately 180° around this idler pulley to the take-up reel 6. The drive pulleys 12 and 14 serve alternately, depending upon the direction of travel of the tape, to pull the tape at constant speed through the tone head box, and in order that they may drive the tape without slippage the peripheries thereof are covered with a layer 16 of a frictional material, such as of rubber, as shown in Figure 6.

In the direction of travel of the tape indicated by the arrows 10, the operation of the drive mechanism is as follows: the take-up reel 6 is overdriven with frictional slip so that the tape 7 ahead of the drive pulley 14 will be held taut against the drive pulley 14. This pressure of the tape against the drive pulley 14 serves to produce a frictional driving connection of the pulley to the tape so that the pulley pulls the tape rightwardly through the tone head box 13. Concurrently the supply reel 5 exerts a frictional drag on the tape and holds the tape under tension as it is pulled through the box.

For operating the drive mechanism in the magazine there is an electric motor 17 provided in the lower cabinet section 2. This motor is coupled through a gear reduction transmission 18 to an upstanding shaft 19 as shown in Figures 10 and 16. Splined to the upper end of the shaft is a clutch member 20. This member has a set of diametrically disposed vertical pins 21 adapted to engage a corresponding coupling member 22 on the magazine to effect a drive connection of the motor to the drive pulley 12 when the magazine is in mounted position, the manner in which this coupling is made being hereinafter described in detail.

The coupling member 22 has an upstanding shaft 23 integral therewith which is journalled in a bearing 24 held by screws 25 to the bottom wall of the magazine. The drive pulley 12 is secured to the shaft 23 by a set screw 26 and seats onto, and surrounds, the bearing 24 as shown in Figure 6.

The means for taking power from the pulley 12 to operate the drive mechanism in the magazine comprises a doubly-grooved pulley 27 formed integrally with the drive pulley 12, a similar doubly-grooved pulley 28 formed integrally with the drive pulley 14 (the pulley 14 being journalled on a stud bolt 31 held to the bottom plate of the magazine as shown in Figures 2 and 3), and two similar doubly-grooved pulleys 29 and 30 journalled on the stud bolts 8 below the reels 5 and 6 as indicated in Figures 3 and 6. These four pulleys are drivingly interconnected by a pair of cords or belts 32 which run over tensioning idler pulleys 33 provided respectively between the pulleys 27 and 29 at the left side of the magazine and between the pulleys 28 and 30 at the right side of the magazine, these idler pulleys being journalled on brackets 34 which are adjustably secured to the bottom wall of the magazine.

The pulleys 29 and 30 are coupled to the respective reels 5 and 6 by means of frictional and ratchet drive transmissions such as are shown in Figures 6 and 7, these transmissions being identical except for the ratchet drives being oppositely directed as indicated in Figure 7. The transmission between the pulley 29 and reel 5, for example, comprises a pair of upwardly-bowed leaf springs 35 held to the top face of the pulley 29 by screws 36. These springs engage the lower face of a ratchet wheel 37. This ratchet wheel is journalled on the upper portion of the stud bolt 8 against the hub of the pulley 29, and has four radially-extending slots 38 with which the tips of the springs 35 may engage to effect a one-way coupling between the pulley 29 and ratchet wheel. The hub 5*a* of the reel 5 is journalled to the hub 37*a* of the ratchet wheel and is pressed yieldably against the top face of the ratchet wheel by downward pressure of a compression spring 40 acting against a washer 39 loosely surrounding the hub 37*a*, the compression spring being held in position by a nut 41 that is threaded onto the top portion of the hub 37*a*. However, interposed between the hub 5*a* of the reel and the top and bottom faces of the ratchet wheel 37 and washer 39 respectively are friction pads 42 made for example of felt. The yieldable clamping of these pads against the hub of the reel 5 permits frictional slip between the ratchet wheel and the reel.

The coupling between the pulley 30 and reel 6 is identical with the coupling between the pulley 29 and reel 5 as just described except that there is here provided a pair of springs 43, corresponding to the springs 35, which are oppositely directed from the springs 35 for coaction with a ratchet wheel 44 similar to the wheel 37 as shown in Figure 7. As is illustrated, the one-way ratchet coupling between the pulley 29 and the reel 5 is effective when the pulley moves in a counterclockwise direction and that between the pulley 30 and reel 6 is effective when this pulley moves in a clockwise direction. Thus, when the tape is driven in the directions of the arrows 10 appearing in Figure 3, the coupling to the take-up reel is engaged but that to the supply reel is disengaged.

All of the pulleys 27, 28, 29 and 30 have equal diameters so that they will be driven at the same rotational speed by the motor 17. The diameters of the coils of tape on the reels 5 and 6 are however always greater than the diameter of the drive pulleys 12 and 14. Accordingly, when the tape is driven in the direction of the arrows 10, the reel 6 tends to be driven at the same rotational speed as the drive pulley 14, but the greater diameter of the coil of tape on the reel 6 causes this reel to tend to take up the tape at a faster rate than it is supplied by the drive pulley. The reel 6 thus holds the tape taut against the drive pulley 14 and the drive pulley becomes controlling because the frictional coupling of it to the tape overpowers the frictional coupling between the reel 6 and its corresponding drive pulley 30, with the result that the take-up reel is constantly overdriven with frictional slip as above-mentioned. At the same time the ratchet coupling to the supply reel 5 is moved in ineffective direction and no force is exerted on the reel to unwind the tape; rather, the friction in the mounting of the reel causes it to exert a drag on the tape to hold the tape taut as it is pulled through the tone head box.

The above explained drive coupling between the motor 17 and the drive pulley 12 of the magazine is disengageable to permit withdrawal of the magazine from the cabinet and is controlled to reengage automatically when the magazine is remounted. For these purposes, as is shown in Figures 8 and 16, the clutch member 20 is biased upwardly by a spring 45 into position to engage the coupling member 22 of the magazine, and a control lever 46 is connected to the clutch member for disengaging the clutch member as required. The control lever is pivoted to a bracket 47 on the top side 2a of the lower cabinet section 2, near the front left corner thereof, and has two rearwardly-extending arms 46a lying at diametrically opposite sides of the clutch member. These arms have pins 48 which engage a peripheral groove 49 in the clutch member so as to couple the control member to the clutch. Under pressure of the spring 45 the control lever is normally held in a slightly upwardly inclined position as shown in Figure 16.

Overlying the central and major portion of the top side 2a of the lower cabinet section 2 is a latch member 50 for the magazine. This latch member comprises a flat plate portion pivoted at 51 to the rearward portion of the cabinet, and a front portion projecting ahead of the front panel of the cabinet which is bent upwardly to form a catch 52 and then forwardly and gradually downwardly to form a cam 53. The latch member is biased upwardly by a leaf spring 54 mounted on the top side of the lower cabinet section 2, and the upper position of the latch member is defined by a stop pin 55 as shown in Figures 8 and 15. At the left side of the latch member there is a tab 56 overlying the clutch control member 46 and at the right side of the latch member there is another tab 57 overlying a push-button switch 58 which is biased upwardly into closed position and which controls the drive motor as is hereinafter explained. The action of this latch member is as follows:

In the upwardly biased position of the latch member the cam 53 thereof extends up into the path defined by the magazine as it is moved into and out of the cabinet. Thus, when the magazine is inserted into the cabinet the bottom of the magazine will first slidably engage this cam and

move the latch member downwardly. As the latch member is so moved the tab 56 depresses the clutch lever 46 to move the clutch member 20 downwardly out of the path of the magazine, and the tab 57 operates the switch 58 to "off" position so as to assure that the drive motor will be stopped. When the magazine reaches fully-mounted position, it slides off the catch 52 and the latch member then is snapped upwardly by its biasing spring to latch the magazine in the cabinet. The upward movement of the latch member frees the clutch lever 46 to permit reengagement of the clutch member 20 with the corresponding coupling member 22 of the magazine and, simultaneously, the switch 58 is restored to "on" position so that the drive motor may again be put in operation. (It will be understood that a primary start-stop control for the drive motor is provided, as is hereinafter explained, and that the switch 58 is provided as a precautionary means to assure, among other things hereinafter explained, that the drive motor will be idle during mounting and removal of the magazine into and out of the cabinet.) While the pins 21 of the clutch member 20 will not ordinarily be aligned with the holes in the coupling member 22 to permit the clutch member to engage immediately upon the magazine reaching mounted position, this alignment will occur in the first fraction of a revolution of the clutch member and the clutch member will then move to engaged position under the influence of the spring 45.

When a magazine is to be removed from the cabinet the latch member 50 is first released from the magazine by applying a downward pressure with the hand onto the forwardly-projecting cam 53. This is accomplished automatically as the handle 4 is gripped by the hand for the cam 53 lies directly below the handle where it will be pressed downwardly by the fingers as one takes hold of the handle to withdraw the magazine as shown in Figure 1. This downward movement of the latch member causes the clutch to be disengaged and the motor circuit again to be opened, permitting the magazine to be withdrawn from the cabinet without danger of any misoperation of the machine. It will be understood that the latch member need be depressed only during the initial withdrawal of the magazine from the cabinet, for as soon as the magazine has been moved out of mounted position the bottom thereof will engage the catch 52 and hold the latch member depressed during the further withdrawal of the magazine. Thus, the magazine is unlatched and removed simply by gripping the handle 4 and pulling outwardly from the cabinet.

The telegraphone here shown is of the multiple-lane type. These telegraphones require a translating means which is conditionable selectively for coaction with successive lanes of the tape. Such selective conditioning may be effected by moving a single tone head, by steps, across the tape so that it will operate along successive lanes of the tape. Preferably however there is provided a plurality of offset tone heads, one for each lane of the tape, and the selective conditioning is performed by connecting these tone heads selectively to the audio circuit of the machine. The aforementioned tone head box 13 therefore comprises a plurality of consecutively offset tone heads 60 of which there are typically eight as shown in Figure 17. Each of these tone heads comprises a pair of field coils 61 and respective core pieces 62 placed axially in line with each other at opposite sides of the tape. The

construction of these tone heads is conventional and need not be herein further described.

In operation, the tape is driven in one direction while the audio circuit is connected to one of the tone heads, and when the tape has reached the end of its travel in that direction it is reversed and the audio circuit is connected to the next one of the tone heads. This procedure is continued ordinarily until each tone head has scanned the tape, whereupon the magazine may be removed for transcription of the recordation and another magazine may be mounted in the cabinet in its place.

The audio circuit may be adapted for recording or reproducing—i. e., to feed electrical oscillations to the tone heads or to receive electrical oscillations from the tone heads—but by way of illustration there is shown an audio circuit primarily adapted for recording purposes only. This audio circuit comprises simply a carbon button microphone **65** together with a suitable operating circuit for the microphone and switch for connecting the microphone selectively to the tone heads. The microphone has a pair of leads **66** connected respectively to the sleeve and ring contacts **67** and **68** of a suitable telephone plug shown diagrammatically in Figure 17 as **70**, this plug having also a tip **69** the function of which is hereinafter explained. The plug is adapted for insertion into a telephone jack **70***a* provided in the front panel of the lower cabinet section **2** and marked "Input" as shown in Figure 1. The jack has sleeve, ring and tip contacts **67***a*, **68***a* and **69***a* respectively, and additionally includes a normally open switch **71** comprising a pair of contact springs of which one is coupled through an insulating block **72** to the tip **69***a* so that the switch will be closed whenever the plug **70** is inserted into the jack. The sleeve contact **67***a* of the jack is grounded at **73**—i. e., connected to the frame of the machine—while the ring contact **68***a* of the sleeve is connected through the primary winding **75***a* of an audio transformer **75** to an adjustable tap **76** of a volume control or rheostat **77**. One end of this rheostat is connected to ground but the other end is connected to one side of a battery **78** by way of the aforementioned switch **58**, a second switch **79** hereinafter particularly described, and the switch **71** just mentioned above. The other side of the battery **78** is connected to ground as shown. Thus, whenever the switches **58** and **79** are closed—which the switch **58** is when a magazine is mounted in the cabinet and the switch **79** is when the selector mechanism of the machine is in correct operating condition as will hereinafter appear—battery potential is available to the microphone upon the plug being inserted into the jack. However, in the microphone circuit **66** there is a pair of make-and-break contacts **80** of a normally open hand switch **81** which is provided for starting and stopping the machine as during dictation. Accordingly, potential is supplied to the microphone to render it operative only when this hand switch is closed to start the machine.

In the lower cabinet section **2** there is a selector switch **82** for selectively connecting the microphone to the respective tone heads **60**. This switch comprises a set of terminals **83** of which there is one for each tone head and a first idle terminal **83***a*. Associated with this set of terminals **83** is a movable contact means **84** connected by a shielded lead **85** to one side of the secondary **75***b* of the audio transformer **75**, the other side of this secondary being connected to ground. The terminals **83** of the selector switch, except for the idle terminal **83***a*, are connected respectively to a set **86** of contact springs included in a bank **87**, the springs of this bank being mounted in an insulating block **88** that is supported at the top of the lower cabinet section **2** as shown in Figure 8. Additionally, corresponding to the idle terminal **83***a*, there is another one of such contact springs **86***a* which is however permanently connected to ground. These contact springs bow upwardly above the block **88** and are exposed to the magazine chamber by way of an opening **50***a* provided in the latch member **50**. At the bottom of the magazine there is mounted a terminal bank **89** including a set of terminals **90** and **90***a* corresponding to the contact springs **86** and **86***a* of the bank **87**, these terminals being mounted in an insulating block **91** as indicated in Figure 3. These terminals of the magazine slidably engage the respective contact springs **86** as the magazine is slid into the cabinet. The first of the terminal set **90** on the magazine, designated as **90***a* in Figure 17 and corresponding to the grounded contact spring **86***a* of the bank **87**, is itself grounded to the frame of the magazine and connected by a lead **92** to one side of each of the tone heads; the other eight terminals of the set **90** are however connected by a shielded cable **93** to the other sides of the respective tone heads. From the foregoing description it will be apparent that voice currents from the microphone **65** will be fed to one or another of the tone heads **60**, depending upon the setting of the selector switch **82**, by way of the transformer **75**, shielded lead **85**, the movable contact means **84** and associated terminal **83** of the selector switch, the respective contact spring **86** and terminal **90** of the banks **87** and **89** between the lower cabinet section and the magazine, and the cable **93**.

The reversing of the tape-driving mechanism is preferably carried out by reversing the direction of rotation of the motor **17**, and to this end there is provided a motor of the shunt type depending for its direction of rotation upon the relative polarity of its shunt field **17***a* and armature **17***b*. This motor is adapted for operation by the battery **78**, which may typically have a potential of the order of 24 volts. Current supply to the motor is controlled by a start-and-stop relay **95** for the machine having a field coil **95***a* one side of which is connected by way of the aforementioned switches **58**, **79** and **71** (see Figure 17) to the battery **78**, and the other side of which is connected to ground by way of the tip contacts of the jack and plug **70***a* and **70**, a pair of make-and-break contacts **80***a* included in the start-stop hand switch **81** and the sleeve contacts of the plug and jack to the ground **73**. The shunt field **17***a* has a direct connection to the battery by way of a lead **97**, the contacts of the relay **95** and a lead **98**, but the current supply to the armature is taken from the lead **97** through a reversing switch comprising a section of the selector switch **82**. The reversing switch comprises a series of pairs of terminals **99** and a pair of respectively cooperating movable contact means **100**. The first pair **99***a* of the terminals **99** is idle and represents stop terminals for the motor, but the remaining pairs, of which there is one for each tone head **60**, are interconnected in crisscross relationship. The last of these interconnected pairs is connected respectively to the lead **97** and to ground, and the movable contact means **100** are connected across the armature **17***b*. These movable contact means **100** are me-

chanically connected to the aforementioned contact 84 to move in unison therewith as is hereinafter described. Thus, when the movable contacts of the selector switch are advanced from one position to the next, not only is the microphone 65 connected to a next succeeding one of the tone heads 60 but the polarity of the armature 17b is reversed relative to that of the shunt field 17a to reverse the direction of drive of the magnetic tape.

I alone have found a very effective and positive means for operating the selector switch 82 at the end of travel of the tape in each direction. In practicing my invention, the selector switch is preferably constructed as a rotary-step type of switch. This type of switch—which itself is known for this purpose—may be constructed as shown in Figures 10, 11, 12 and 13. The switch comprises a shaft 101 extending forwardly through the front panel of the lower cabinet section 2 and passing through a pair of downwardly-extending legs 102 of a U-bracket 103 held by screws 104 to the top plate 2a of the lower cabinet section. Secured to the shaft 101 by a screw 105 (see Figure 13) is an armature 106 for the switch having a shouldered hub 106a that is journalled in the legs 102 of the bracket 103. Onto this hub there is clamped a small insulating disk 107, the clamping being done by a nut 108 which threads onto the hub and presses the disk against a shoulder portion of the hub. Riveted to this disk are three pairs of contact arms, spaced 120° apart, of which one pair represents the aforementioned movable contact means 84 and the other pairs represent the aforementioned movable pair of contact means 100 of the selector switch as is hereinafter more fully explained. At the front and back of the armature 106 there are centrally apertured insulating disks 111 and 112 which are secured to the depending lugs of the bracket 103 and held concentric to the shaft 101, the front disk 111 being held for example to the bracket by screws 113 as indicated in Figure 13. This front disk 111 carries twenty-seven equally-spaced contact terminals of which one continuous set of nine represent the abovementioned terminals 83 of the selector switch, and the remaining continuous set of eighteen represent the terminals 99 of the reversing switch section of the selector switch. Riveted to the other stationary disk 112 are three arcuate contact members 114, 115 and 116 which are equally spaced and each approximately 120° long. The contact member 114 is angularly aligned with the terminal set 83 and the two contact members 115 and 116 are angularly aligned with the terminal set 99. Each pair of the movable contact means 84 and 100 comprises two electrically interconnected blades that are spaced apart axially along the shaft 101 as shown in Figures 10 and 13. One of these blades slidably engages continuously one of the arcuate contact members 114, 115 or 116 and the other blade slidably engages one of the terminals 84 or 99. It will be understood that the shielded lead 85 will have direct permanent connection to the arcuate contact member 114 and that the leads from the motor armature 17b will be connected respectively to the arcuate contact members 115 and 116. It will moreover be understood that the last eight of the set of terminals 83 are connected to the respective contact springs 86 as hereinbefore explained, and that one group of alternate ones of the last sixteen of the terminal set 99 will be interconnected to each other and be connected to ground and that the other group of alternate ones of the last sixteen of this set 99 will be likewise interconnected to each other and further connected to the current supply lead 87. Accordingly, it will be observed that with continuous step-by-step advance of the armature 106 in one direction the selector switch is moved recurrently through its successive positions with the movable contact means 84 and 100 always advancing from left to right at they appear in Figure 17 and with each succeeding one of the respective movable contact means 84 and 100 taking on the function of the one just ahead of it after each nine intervals of advance of the armature.

For successively advancing the armature 106 of the selector switch at the end of travel of the tape in each direction, I provide a stepping mechanism which together with the selector switch 82 may be termed a stepping relay. This stepping mechanism comprises a ratchet 120 operated by a solenoid 121 as shown in Figures 11 and 13. The ratchet comprises a ratchet wheel 122 positioned behind the bracket 103 and made integral with the aforementioned hub 106a. Pivoted at 123 to the bracket 103 is a rock lever 124 and pivoted at 125 to one end portion of this rock lever is a feed pawl 126 which is urged by a tension spring 127 into engagement with the ratchet wheel. Coupled by a link 128 to the other end of the rock lever is the armature 129 of the solenoid 121. This solenoid is preferably of the ironclad type and comprises a coil 130 surrounded by a rectangular iron frame 131 and provided with a core piece 132, all as is indicated in Figure 11.

When the solenoid is not energized, the rock lever 124 is held in an advanced or operated position by a tension spring 133 connected between the lever and the plate 2a, which position is defined by the abutment of the lever against an adjustable screw 133a in a turned-over lug of the bracket 103. When the solenoid 121 is energized, the rock lever is turned from its advanced position against the force of the spring 133 but in so turning it does not impart any movement to the armature 106 of the selector switch, the effect of this turning being only to cock the ratchet 120 by withdrawing the feed pawl 126 from one tooth to the next of the ratchet wheel 122. Upon interrupting the current supplied to the solenoid, however, the rock lever 124 is propelled forwardly by the spring 133 to advance the selector switch from one position to the next.

In accordance with my invention, the solenoid 121 is controlled so that it will be momentarily energized once at the end of travel of the tape in each direction. The means for so controlling the solenoid comprises a pair of selector control switches 134 and 135 respectively comprising semistationary contact arms 134a and 135a and movable contact arms 134b and 135b, the arms of each switch being biased to open positions. These switches are positioned in the magazine between the idler pulleys 11 and 15 of the magnetic tape drive mechanism, the switches being held insulatedly in cantilever fashion in a stack 136 which is bracketed to the bottom plate of the magazine. The outer sides of the movable contact arms 134b and 135b are faced by insulating strips 137. These strips lie adjacent to the idler pulleys 11 and 15, with the magnetic tape passing between the strips and the pulleys. On the magnetic tape 7, near each end thereof, there is a thickened strip portion 7a. As this strip portion rides over one or the other of the idler pulleys 11 or 15, it presses the adjacent strip 137 inwardly

to close the corresponding switch 134 or 135 as shown in Figure 5. Preferably, this strip portion 7a of the tape is formed simply by crinkling or corrugating the tape as for example by running the tape between two intermeshing gears.

Reference being had to Figure 17, it will be seen that the two semistationary contact arms 134a and 135a of the switches 134 and 135 are each connected by a common lead 137 to one side of the solenoid 121, the other side of the solenoid being grounded as shown. This lead connection is made from the magazine to the lower cabinet section 2 through contact terminals and contact springs 138 and 139 comprised in the aforementioned switch contact banks 89 and 87. The movable contact arms of the switches 134 and 135 are connected by leads 140 and 141, respectively by way of terminals and contact springs 142—143 and 144—145 of the banks 89 and 87, to the respective movable contact means 100 of the reversing section of the selector switch.

In the positions occupied in Figure 17 by the movable contact means 100 of the selector switch, potential from the battery 78 is supplied to the lead 141 running to the switch 135 provided of course the start-stop relay 95 is closed. For the direction of travel of the tape indicated by the arrows 10 in Figure 3, the switch 135 will be closed by the corrugated tape portion 7a running over the idler pulley 11 as the tape nears the end of its travel. When the switch 135 is closed by the corrugated tape portion 7a, the solenoid 121 withdraws the pawl 126 from one tooth to the next succeeding one of the ratchet wheel 122; and then when the corrugated tape portion 7a has moved past the switch and the switch reopens to deenergize the solenoid, the relay is advanced one interval by the spring 133 acting through the pawl and ratchet wheel. In the initial reverse travel of the tape following the advance of the selector switch, the tape section 7a will again ride over the idler pulley 11 to close and open the switch 135, but the tape will continue to be driven in its reverse direction since it is a feature of my invention that upon operation of either switch 135 or 134 the same is disabled from further controlling the machine until the other of the two switches is operated. This is accomplished by alternately connecting the contact arms 134b and 135b of switches 134 and 135 to ground and to the battery 78 as the selector switch is advanced from one position to the next. For example, in the operation of the selector switch at the end of travel of the tape in the direction of the arrows of Figure 3, the lower contact 100 is advanced one step from the position it occupies in Figure 17 to connect switch 135 to ground and the upper contact 100 is advanced one such step to connect switch 134 to the battery 78. When the tape nears the end of its travel in its reversed direction, the switch 134 will be next momentarily closed to cause the selector switch to be advanced another position. This reverses the direction of travel of the tape and causes switch 134 to be now grounded and switch 135 to be connected to the battery 78 so that the tape will continue to be driven throughout the length of its travel again in the direction of the arrows 10 of Figure 3. Upon continued operation of the machine this process will continue with the selector switch advancing successively at the end of travel of the tape in each direction. At the completion of recordation of the last line of the tape, however, the selector switch is advanced to place the movable contact means 84 and 100 in contact with the idle terminals 83a and 99a, whereupon the operation of the machine is stopped.

Due to the inertia of the plunger 129 and of the mechanism coupled thereto, there is unavoidably some delay in the response of the plunger to current energization of the solenoid coil 130. As a result, because of the high speed of travel of the tape 7, a single corrugation of the tape does not hold the switches 134 or 135 closed sufficiently long to assure positively that the pawl 126 will be retracted and the stepping mechanism be then operated when the switches are next opened. However, according to my invention the portions 7a are made of such length that, taking into account the speed of the tape, the switch 134 or 135 will be held closed for a sufficient period to assure full retraction of the pawl and consequent operation of the stepping mechanism when the switch is reopened.

It will be observed that the switches 134 and 135 are rendered effective alternately in the machine by the reversing section of the selector switch 82; moreover, it will be noted that by not advancing the selector switch until the switch 134 or 135 last closed is restored to open position, and by then transferring the control function from that one of the switches 134 or 135 to the other simultaneously with the operation of the selector switch, I obtain a very positive and dependable operation of the selector mechanism at the end of travel of the tape in each direction.

Upon sliding the magazine out of and into the cabinet the bottom wall thereof may slidably engage the contact springs of the bank 87 and short them with one another. This produces no effect however because in positions of the magazine wherein this shorting occurs, the switch 58 is in "off" position and the whole telegraphone system is out of operation.

Just behind the front panel of the lower cabinet section 2 there is a dial 146 having a hub 147 secured by a set screw 148 to the shaft 101. This dial has numbers thereon one of which is rendered visible through a window 149 of the front panel in each position of the selector switch. The number exposed indicates the position occupied by the selector switch or, in other words, the lane of the tape on which the machine is operating. For example, the dial has the number "0" at the window 149 when the movable contact means 84 and 100 of the selector switch are in open positions—i. e., in contact with the idle terminals 83a and 99a. In clockwise direction from the number "0" are numbers running consecutively from "1" to "8." When the selector switch is in the first of its closed positions, the position which it occupies in Figure 17, the number "1" on the dial appears at the window 149, and for the next higher positions of the selector switch a corresponding number on the dial will appear at the window. Since the selector switch is advanced through the range of its positions for each 120° advance of the armature 106 of the switch, this succession of numbers from "0" to "8" is repeated within each 120° angular interval on the dial, there being accordingly three such sets of numbers as shown in Figure 9.

In the usual and customary operation of the machine the operator will begin recordation on the first lane of the tape, i. e., with the selector switch in position "1." Should an operator have recorded on only some of the lanes of the tape when he removes the magazine for transcription of the recordation, the selector switch will be

left in some intermediate position. Accordingly, before beginning recordation on the tape of a newly-mounted magazine, he will want to restore the selector switch to "1" position. This restoration of the selector switch is performed manually by a knob 150 at the front of the panel on the shaft 101. It is however a feature of my joint invention with Roscoe C. Van Camp above-mentioned to have this knob normally locked, and to require that it be depressed before it is operable to advance the selector switch. An advantage in this mode of enforced operation of the knob arises by the provision of three equally-spaced and radially-projecting fins 151 on the knob, and of a stop pin 152 on the front panel for cooperation with these fins as indicated in Figures 1 and 10. In the outward position of the knob the fins 151 clear the stop pin 152 to permit the selector switch to be advanced automatically at the end of travel of the tape in each direction. When the knob is depressed, however, the pin will lie in the path of these fins and will serve, by its abutment against one or another of the fins, to stop the knob in "1" position of the selector switch.

In order to facilitate this manual return of the selector switch to "1" position, there is provided means operable automatically to latch the knob in depressed position upon the knob being depressed while in any position of the selector switch other than its "1" position; the latch is however released when the selector switch is restored to "1" position. This latch means comprises a disk member 153 secured to and projecting from the hub 147 of the knob. This disk member has an inclined peripheral surface 153*a* provided with three equally-spaced peripheral slots 153*b* extending through the member. Pivoted to the front leg of the bracket 103 at 154 is a latch arm 155 as shown in Figures 10 and 14. This latch arm has a nose 155*a* sufficiently narrow to pass through the respective slots 153*b*. Normally, the latch is held against a stop pin 156 by a spring 157 in which position thereof the nose 155*a* lies just behind the inclined peripheral surface 153*a* of the disk member 153. Upon depressing the knob while in an intermediate position the latch arm is cammed over the member 153 and the knob is thus latched in its depressed position. However, upon the knob being turned to restore the selector switch to "1" position, the nose will come into alignment with one of the slots 153*b* and the knob will then be snapped outwardly by spring means acting on the shaft 101 as hereinafter described. Thus, to manually return the selector switch to "1" position it is only necessary to first press inwardly on the knob and then only to turn the knob in a counterclockwise direction until it is stopped by the abutment of one of the fins 151 against the pin 152.

To permit the knob 150 to be depressed as above explained, the shaft 101 has a splined connection with the hub 106*a*, which connection is afforded by providing an axial slot 105*a* in the hub 106*a* and having the aforementioned pin 105 disposed within this slot as shown in Figure 13. Bearing against the rearward end of the shaft 101 is a cantilever-mounted spring arm 158 which yieldably holds the shaft 101, and accordingly the knob 150, in outward positions.

The means for locking the knob 150 against being turned manually when the same is in outward position comprises an arm 159 pivoted at 123 to the back side of the bracket 103 as shown in

Figure 11. This arm carries a cross pin 160 at its outer end, and is biased inwardly relative to the feed pawl 126 by a tension spring 161 into a position wherein the pin 160 lies directly behind the feed pawl. This position of the arm is defined by contact of a reduced diameter end portion 101*a* of the shaft 101 with the edge of a circular hole 162 provided in an offset portion 159*a* of the arm 159. When the pin 160 lies behind the feed pawl, the pawl is locked in engagement with the ratchet wheel 122 and the ratchet wheel is therefore prevented from being advanced by means of the shaft 101—i. e., from being turned clockwise as it appears in Figure 11; on the contrary, the ratchet wheel may be advanced by the feed pawl as above explained. Backward movement of the ratchet wheel is prevented by means of a detent 163 as indicated in Figure 11. Accordingly when the pin 160 lies behind the feed pawl the selector switch is locked against being moved manually by the knob 150 in either direction. On the shaft 101 just in front of the hole 162 in the arm 159 there is however a conical cam 164 formed incidental to reducing the diameter of the end portion of the shaft as shown in Figure 13. When the shaft 101 is depressed, this cam 164 engages the edge of the hole 162 and turns the arm 159 so as to move the pin 160 beyond the end of the feed pawl. The feed pawl is then no longer held in locked engagement with the ratchet wheel and, accordingly, the selector switch may now be advanced by the knob 150.

In order to insure that the drive mechanism will be at standstill during the manual return of the selector switch to "1" position, there is provided means to cause the aforementioned switch 79 to be held open while the knob 150 is depressed. This switch comprises a pair of cantilever-mounted contact arms 79*a* held, with the aforementioned arm 158, in a stack 165, the stack being held by screws 166 to the back side of the bracket 103 as shown in Figures 11 and 13. The arm 158 is clamped between the contact arms 79*a* against the back one of these arms but is made of an insulating material so that it will not form any electrical connection to the arms. The contact arms are biased closed and assume this position when the shaft 101 is moved to outward position by the arm 158. Upon depressing the shaft by the knob 150, however, the arm 158 is moved rearwardly and the switch 79 is thereby opened. Reference being had to Figure 17, it will be observed that when this switch is open the circuit of the start-stop relay 95 for the machine is held open to prevent operation of the machine.

As a panel light and signal for indicating when the machine is in operative condition, there is provided a lamp 167 which is bracketed to the underside of the plate 2*a* as shown in Figure 9. This lamp may be connected from the control circuit to ground as indicated in Figure 17.

I have herein particularly shown and described a preferred embodiment of my invention, but it will be understood that this embodiment is subject to changes and modifications within the range of engineering skill without departure from the scope of my invention, which I endeavor to express according to the following claims.

I claim:

1. In a telegraphone including a magnetizable element and reversible drive mechanism for said element: the combination of means for reversing said drive mechanism; a pair of independently-reciprocable control devices for said reversing means; means associated with said element for

operating said respective control devices in response to driven movement of the element; and means rendered effective upon completion of a reciprocation of either one of said control devices following the operation of the other, for restrictively influencing the controlling action of said devices on said reversing means whereby to prevent operation of the reversing means twice in succession by either one of said devices.

2. In a telegraphone including a magnetizable element and reversible drive mechanism for said element: the combination of reversing means for said drive mechanism; a control device for said reversing means associated with said element and reciprocated through one cycle at the end of travel of the element in one direction; and means controlled by said control device and operated in response only to a complete reciprocation thereof, for actuating said reversing means.

3. In a telegraphone including a magnetizable element and a reversible drive mechanism for said element: the combination of means successively operable for reversing said drive mechanism; electrically energizable means associated with said reversing means and adapted upon the termination of each energization thereof to reverse said drive mechanism; a pair of current supply circuits for said electrically energizable means; a pair of normally open switches in said supply circuits respectively, said switches being closed momentarily by said magnetic element in response to driven movement of the element in different directions and causing momentary energization of said energizable means to reverse said drive mechanism at the termination of said energization; and means controlled by said reversing means for alternately disabling said supply circuits upon the opening of each of said switches.

4. A control system for a reversible drive mechanism for the magnetic recording element of a telegraphone, comprising a pair of independently-reciprocable control devices each associated with said magnetic element, one of said devices being reciprocated in response to driven movement of said element in one direction and the other to driven movement of said element in the other direction; means for alternately connecting said devices into said system to render the respective devices effective to reverse said drive mechanism; and means to operate said last-mentioned means at the completion of one reciprocation of either of said devices following a reciprocation of the other of said devices.

5. In a telegraphone including a magnetizable element, a reversible drive mechanism for said element and means advanceable to successive positions for reversing said drive mechanism: a stepping mechanism for successively advancing said reversing means at the end of travel of the magnetic element in each direction, comprising electrical means momentarily energized at the end of travel of the element in each direction, a ratchet wheel coupled to said reversing means, a feed pawl cooperating with said ratchet wheel and retracted relative thereto by said electrical means upon each energization of the latter, and means for operating said feed pawl to advance said reversing means upon a termination of energization of said electrical means.

6. In a telegraphone including a magnetizable element, a reversible drive mechanism for said element and means advanceable to successive positions for reversing said drive mechanism: the combination of a stepping mechanism for successively advancing said reversing means, said stepping mechanism being electrically energizable and responsive within a predetermined time interval following the initiation of each energization thereof to advance said reversing means by one step; switch means associated with said magnetic element for controlling said stepping mechanism; and a plurality of successive corrugations of said magnetizable element for holding said switch means operated for a period at least as great as said time interval in response to driven movement of said element.

7. In a telegraphone including a magnetizable element, a reversible drive mechanism for said element and means advanceable to successive positions for reversing said drive mechanism; a stepping mechanism for successively advancing said reversing means at the end of travel of the magnetic element in each direction, comprising electrical means energizable to condition said stepping mechanism for operation, means for producing an actuation of said stepping mechanism at the termination of an energization of said electrical means for a predetermined time interval, switch means associated with said magnetic element for controlling said electrical means, and thickened portions on said element for holding the switch means operated for at least said time interval at the end of travel of the tape in each direction.

8. In a telegraphone having a drivable magnetic element and reversible drive means for said element: the combination of reversing means for said drive means; reciprocable means effective upon each complete reciprocation thereof for operating said reversing means, said reciprocable means comprising control means operatively associated with said magnetic element, and said magnetic element having predetermined portions movable past said control means on driven movement of the element and each effective upon being so moved to produce a complete reciprocation of said reciprocable means.

9. In a telegraphone having a drivable magnetic element and reversible drive means for said element: the combination of reversing means for said drive means; a pair of control devices for said reversing means each effective on movement from an unoperated position to an operated position and back again to cause operation of said reversing means, said control devices being associated operatively with different portions of said magnetic element and biased to normally occupy unoperated positions, said magnetic element having predetermined portions movable past said control devices respectively, on driven movement of the magnetic element, for momentarily holding the respective control devices in operated positions to cause reversal of said drive means; and means responsive to operation of each control device for disabling the same and concurrently rendering the other effective.

10. In a telegraphone having a movable magnetic element, means for driving said element in different directions, and means advanceable by steps for successively reversing said drive means: the combination of means for intermittently advancing said reversing means, including electromagnetic means energizable to put said advancing means in condition for operation and spring means for advancing said reversing means one step upon said electromagnetic means being deenergized; a current supply circuit for said electromagnetic means; and switch means in said circuit operatively associated with said magnetic element and closed momentarily upon movement of

said element through a predetermined portion of travel thereof.

11. In a telegraphone including a movable magnetic element, means for driving said element in different directions, means advanceable by steps for successively reversing said drive means, and a pair of switches operatively associated with said magnetic element one of which is closed momentarily at the end of travel of said element in one direction and the other of which is closed momentarily at the end of travel of said element in the other direction: the combination of a ratchet wheel coupled to said reversing means, a feed pawl for said ratchet wheel, an electromagnetic means for retracting said pawl for subsequent operation, a spring for advancing said pawl when said electromagnetic means is deenergized, a pair of current supply circuits for said electromagnetic means serially including said switches respectively, and means responsive to each advance of said reversing means for disabling one of said supply circuits and conditioning the other for operation.

RICHARD M. SOMERS.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,950,692	Owens	Mar. 13, 1934
1,789,607	Steurer	Jan. 20, 1931
1,882,554	Galbraith	Oct. 11, 1932
2,066,041	Kiel	Dec. 29, 1936
2,224,854	Begun	Dec. 17, 1940