

July 6, 1937.

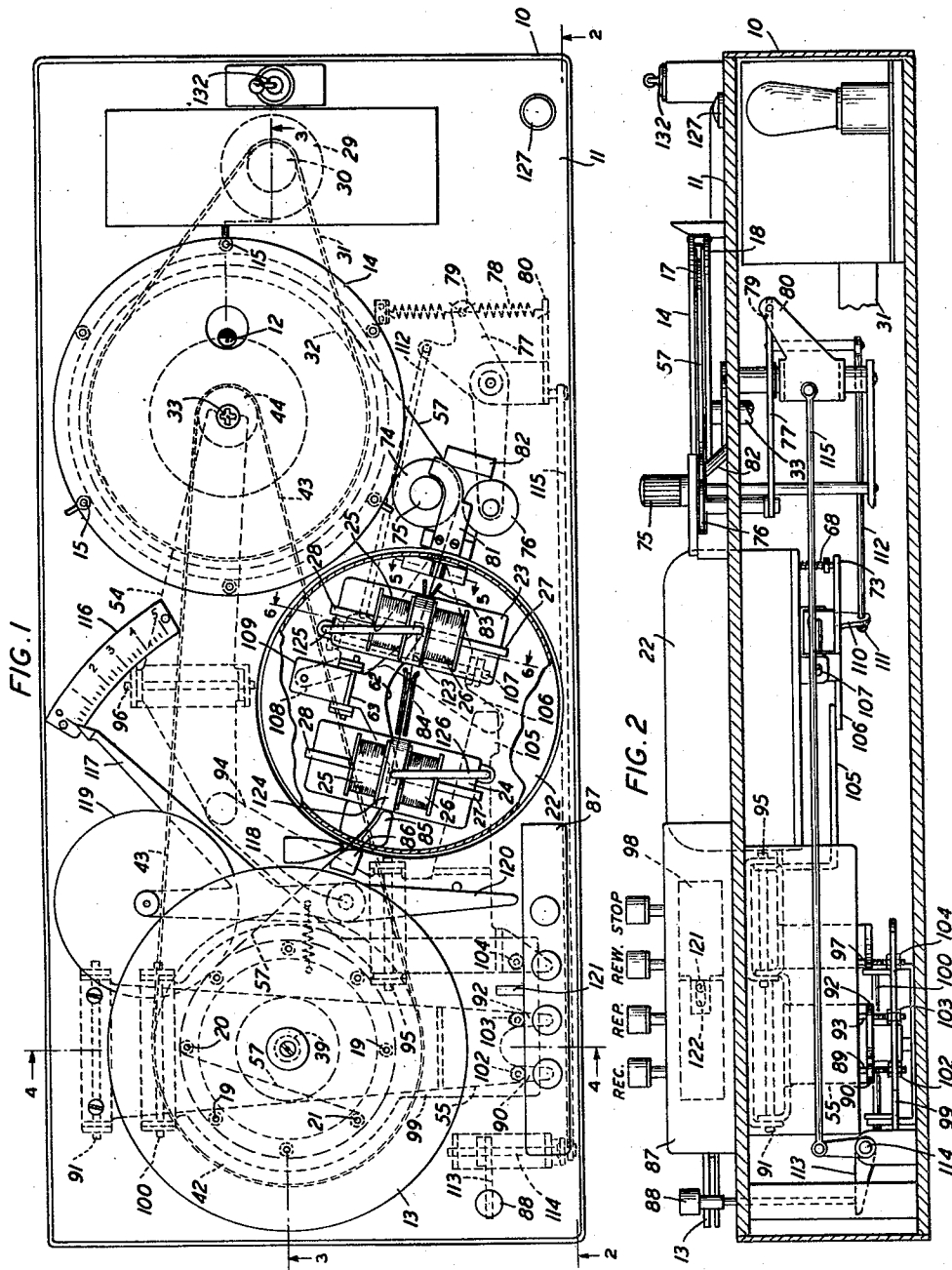
C. N. HICKMAN ET AL

2,086,130

TELEGRAPHONE

Filed Oct. 7, 1936

3 Sheets-Sheet 1



INVENTORS: C. N. HICKMAN
R. F. MALLINA
BY

E. M. Campbell
ATTORNEY

July 6, 1937.

C. N. HICKMAN ET AL

2,086,130

TELEGRAPHONE

Filed Oct. 7, 1936

3 Sheets-Sheet 2

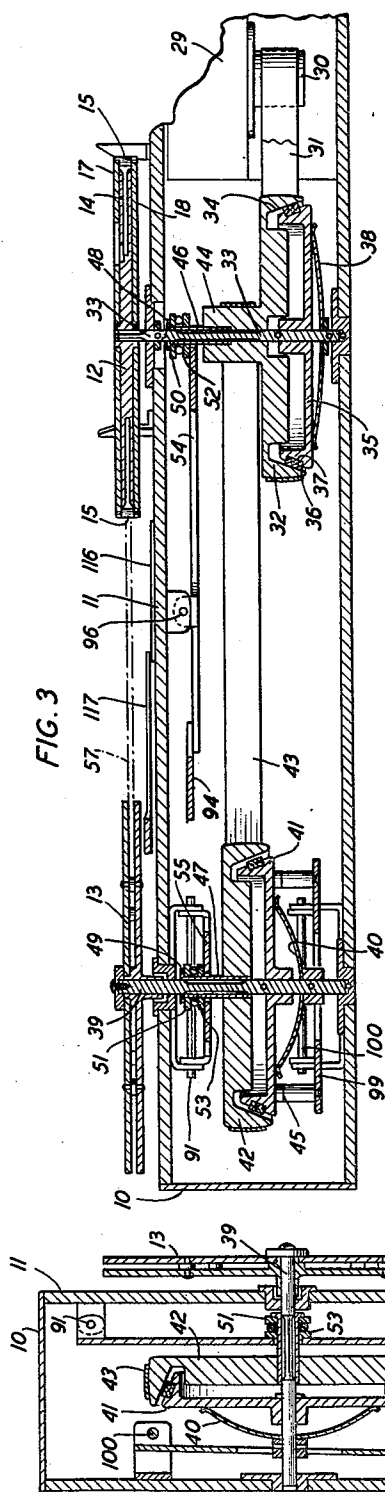


FIG. 3

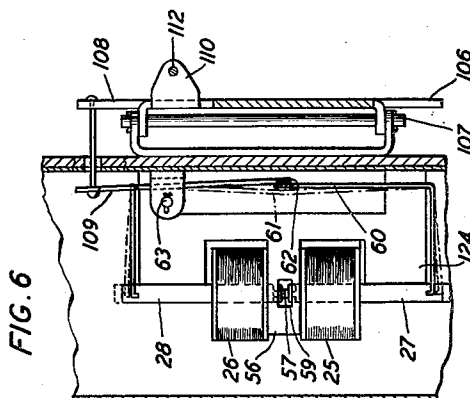


FIG. 6

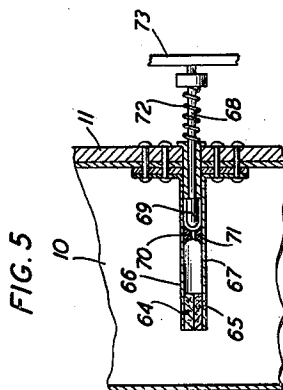


FIG. 5

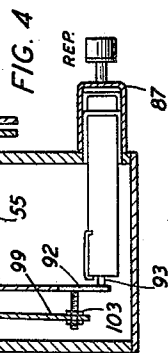


FIG. 4

INVENTORS: C.N. HICKMAN
R.F. MALLINA
BY *G.M. Campbell*
ATTORNEY

July 6, 1937.

C. N. HICKMAN ET AL

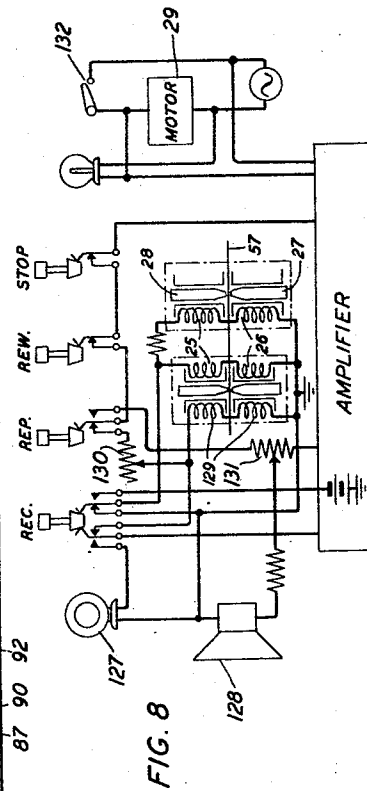
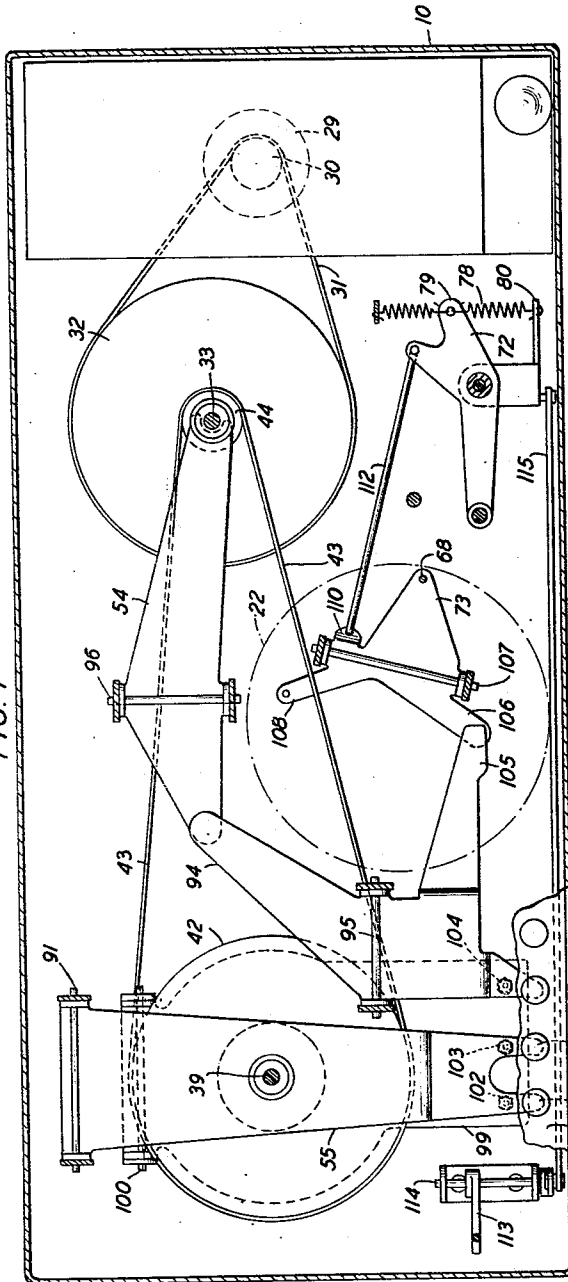
2,086,130

TELEGRAPHONE

Filed Oct. 7, 1936

3 Sheets-Sheet 3

FIG. 7



INVENTORS: C.N. HICKMAN
R.F. MALLINA

BY

G. M. Campbell
ATTORNEY

UNITED STATES PATENT OFFICE

2,086,130

TELEGRAPHONE

Clarence N. Hickman, Jackson Heights, and
Rudolph F. Mallina, New York, N. Y., assignors
to Bell Telephone Laboratories, Incorporated,
New York, N. Y., a corporation of New York

Application October 7, 1936, Serial No. 104,384

14 Claims. (Cl. 179—100.2)

This invention relates broadly to sound recording and reproducing apparatus and particularly to apparatus of the magnetic type commonly referred to as the telegraphone, that is, apparatus in which the record is impressed into a magnetic wire or tape as variations in the magnetization thereof.

It is the object of this invention to provide a compact, readily operable and rugged telegraphone which may be used for dictation, message recording and other purposes.

A feature of this invention is a means for rapidly threading a magnetic wire or tape through the machine.

Another feature is a push-button control system for a telegraphone by means of which the various operations normally required to be performed are initiated and terminated.

In its preferred form this invention comprises a small box or container, comparable in size to the average dictation machine, containing electromagnets for recording, reproducing and erasing sound controlled electrical currents in a magnetic tape. Supply and take-up reels are provided for the tape, and the reels are driven by means of clutches which in turn are driven from a continuously operating electric motor. A mechanical, tape-operated indicator is used to indicate the quantity of tape on a reel and means, operated by the indicator, are provided for stopping the machine when a reel is full. The recording system used is preferably that disclosed in Hickman Patent 1,944,238, dated January 23, 1934, and comprises in general transversely magnetizing a thin ribbon or tape of magnetic material which has previously been conditioned by an erasing and polarizing magnet. The magnets are preferably made with removable pole-pieces between which the tape is passed. The pole-pieces are separated during the threading and rewinding operation. Guides are provided for the tape which automatically direct the tape upon the take-up reel, and automatic means are provided on the take-up reel for gripping the tape and pulling it through the machine. The operations performed by the machine are record, reproduce, rewind, thread and stop, and each of these operations is controlled by a single button. By the term "button" is meant any mechanical device capable of rectilinear or curvilinear motion. Thus, pull rods and levers may be used as well as push-buttons.

These and other features of the invention will become more apparent from the detailed de-

scription which follows taken in connection with the accompanying drawings in which:

Fig. 1 is a plan view of the machine;

Fig. 2 is an elevation of the machine with the front panel removed;

Fig. 3 is an elevation in section taken through the center of the take-up reel;

Fig. 4 is a side elevation in section taken likewise through the center of the take-up reel;

Fig. 5 is a section taken through the wipers for the tape;

Fig. 6 shows the means for separating the pole-pieces.

Figure 7 is a section taken through some of the operating control members.

Figure 8 is a schematic diagram of the circuit connections.

Referring now to Figs. 1 and 2, 10 is a housing or container, preferably made of metal, across the top of which is a panel 11 upon which the apparatus is mounted. The supply reel is shown at 12 and the take-up reel at 13. The supply reel 12 may take the form of a double reel, that is, one reel mounted within another, the inner reel being free to rotate with respect to the outer. As shown in Figs. 1 and 2, the outer reel 14 is provided with a number of pins 15 around the periphery thereof and connecting side walls 17 and 18. The purpose of this construction is to provide a retaining means for the end of the tape when the reel is removed from the machine. Without a retaining means the end of the tape has a tendency to unwind from the reel and leave a loose end which may become snarled and occasion a loss of time when next the tape is used.

Take-up reel 13 is preferably formed without a solid core around which to wind the tape, but is supplied instead with a number of pins 19 forming in effect a squirrel cage. This construction is used to assist the end of the tape in binding upon the reel so that sufficient tractive force may be developed by the reel to pull the tape continuously through the magnets. When the tape is inserted into the reel it passes between two or more of the pins, and as the reel is rotated, the end is bent in two places as at 20 and 21 and carried around with the reel until the second layer pinches the first and firmly secures it to the reel. This type of reel eliminates hunting for a catch such as is generally used and also offers no resistance to the removal of the end of the tape from the reel in rewinding.

The sound translating units are located between supply reel 12 and take-up reel 13 and are

encased in a housing 22, the greater portion of which is shown removed in order to disclose the electromagnets. The polarizing or erasing unit is shown at 23 and the recording and reproducing unit at 24. These units are similar in appearance and each is comprised of coils 25 and 26 and retractile pole-pieces 27 and 28 the axes of which lie on the same straight line.

The driving mechanism for the reels is shown in Figs. 3 and 4. A motor 29, preferably electric, drives a pulley 30 which is connected by means of belt 31 to a second pulley 32. Supply reel 12 is secured to drive shaft 33 about which pulley 32 is free to revolve. The inner face 34 of pulley 32 is fashioned into a conical surface to form the driving member of a cone clutch. The driven member of the clutch is comprised of a wheel 35 likewise free to rotate about shaft 33 and containing a conical surface 36 into which a conical ring 37 of frictional material is set. The driving action is transmitted to shaft 33 through a spring 38 which contacts the side of clutch member 35 frictionally and is rigidly secured to shaft 33. The clutch is operated by lowering pulley 32.

Take-up reel 13 is likewise mounted on a shaft 39 which is driven through a spring 40 from driven member 41 of a cone clutch, the driving member of which 42 is a pulley driven by a belt 43 from a smaller pulley 44 secured to or forming an integral part of pulley 32. A brake 45 is provided for the driven member 41 of clutch 42 to prevent the momentum of driven member 41 and its associated parts from continuing to rotate the reel after a rewinding operation and thereby cause a pile-up of tape between the supply and take-up reels. The brake is operated by the release of push-buttons to be described later.

Each driving pulley is provided with a sleeve 46, 47 respectively carrying a flange 48, 49 respectively upon the upper end thereof. Against each flange is placed a collar 50, 51 which is separated from a second collar 52, 53 by means of ball bearings. An operating lever 54 is adapted to bear against collar 52 and thereby raise pulley 32 to disengage it from driven member 35 of the clutch. In a similar manner a lever 55 is adapted to bear against collar 53 to raise pulley 42 from driven member 41 of the clutch.

The driving mechanism for the reel, therefore, is comprised of a continuously rotating drive system, the power from which is derived by means of friction clutches. The springs 38 and 40 serve to absorb excess torque in the drive and thereby protect the tape from undue stress. Each clutch is operated by simply raising or lowering one member of the clutch.

The details of the magnets are shown in Fig. 6. Coils 25 and 26 are mounted on a bakelite or other non-magnetic support 56 and are apertured to receive close fitting cores 27 and 28, respectively. The tape, or the magnetic material upon which the magnetic record is to be made, passes between pole-pieces 27 and 28 through an aperture 59 in support 56. For ease in threading tape 57 through the machine pole-pieces 27 and 28 are made retractile, that is, they are separable to increase the spacing therebetween. Their outer ends, however, are connected by means of a U-shaped spring 60 which normally presses the two together, but which when flexed in the center as at 61 increases the distance between its outer ends and thereby withdraws pole-pieces 27 and 28. The flexing is accomplished by a lever 62 pivoted at 63 and operated through a system of levers 75 from control buttons to be described hereinafter.

Before the tape reaches the electromagnet, it is cleaned by a pair of wipers. These wipers are shown in Fig. 5 and are comprised of a pair of felt, or other soft material, pads 64 and 65 mounted on spring members 66 and 67, respectively. A pin 68 having a conical tip 69 may be made to bear against projections 70 and 71 on spring members 66 and 67, respectively and thereby separate pads 64 and 65. A spring 72 normally biases pin 68 away from projections 70 and 71 and a lever 73 may be used to push tip 69 against projections 70 and 71 to separate the pads.

The threading means for the tape comprises pressure rollers for urging the tape between the sound translating electromagnets, suitable guides throughout the distance between reels, and the starting means on reel 13 previously described. As shown on Figs. 1 and 2 a relatively large roller 74 having a knurled knob 75 cooperates with roller 76 which is secured to a pivoted member 77. Roller 76 is biased against roller 74 by spring 78 secured to extremity 79 of pivoted member 77 and to a vertical portion of the pivoted member 80. An upper guide 81 and a lower guide 82 are provided to insure the entrance of the tape into the recording unit at the proper level. Lateral guide 83 assists the tape in entering the polarizing unit, guide 84 assists the tape in entering the recording and reproducing unit, guide 85 directs the tape out of housing 22 and guide 86 directs the tape upon reel 13. An additional guide, such as a circular leaf spring, may be used to bend the tape around the reel.

The description thus far has been concerned chiefly with the components of the machine and the details of their operation. The operation of each component, however, must be coordinated with the operation of every other component and to this end a system of interconnecting levers is used. The operation of these levers, however, is quite simple and may be controlled by a relatively small number of push-buttons. In the machine shown, five such buttons are used. These buttons are conveniently mounted in one corner of the machine and perform not only mechanical operations, but electrical switching operations as well since they are likewise connected to prongs of electrical switches. The switches are encased in a housing 87 and are adapted to perform from left to right the operations of recording, reproducing, rewinding and stop. Button 88 is used to close rollers 76 and 74 and to separate wipers 64 and 65 and the pole-pieces of the polarizing and reproducing magnets. It does not perform any electrical functions.

To record, it is recalled that clutch 42 must be operated to rotate reel 13. The record button is, therefore, provided with an extension 89 which bears against extension 90 of lever 55 which is pivoted at 91, and since lever 55 is the one which raises and lowers pulley 42, the operation of the clutch is thus controlled by the record button. Since the same reel is operated for reproducing and recording, it is merely necessary to add an extension 92 to lever 55 so that extension 93 of the reproducing push-button may cooperate therewith. A separate button must be used, however, because of the difference in the electrical connections to be made when reproducing. To rewind, the power must be applied to the supply reel and removed from the take-up reel. It is also necessary to connect lever 54, which operates pulley 32 of the rewind clutch, to the rewind button. These operations are performed by means of two levers 94 and 75

54 pivoted at 95 and 96, respectively, and operated by extension 97 of the rewind button. Thus, depressing rewind button causes the opposite end of lever 94 to be raised, which in turn causes the opposite end, that is, the operating end, of lever 54 to be depressed and thereby engage clutch member 35 of the rewind pulley.

The record, reproduce and rewind buttons are all connected by means of a latch bar 98 which is operated by the stop button. Since the clutches are disengaged when the record, reproduce and rewind buttons are raised, and since these buttons are biased to the raised positions by means of suitable springs to stop the machine it is necessary merely to operate the latch to release whichever button is depressed. The brake 45 is secured to a brake operating lever 99 which is pivoted at 100 and biased upward by spring 101 (Fig. 4). Adjustable screws 102, 103 and 104 cause the lever to bear against levers 55 and 94, that is, the levers operated by the record, reproduce and rewind buttons. Thus when either the record, rewind or reproduce button is depressed, lever 99 is likewise depressed and the brake shoes 45 are removed from the clutch. When either of these buttons is released, however, lever 99 is raised and the friction brake is immediately applied.

In order to rewind, the pole-pieces, wipers and starting rollers must be separated so that the least possible friction is presented to the tape as it is being rewound. This is particularly desirable since the rewind speed is much greater than the record or reproduce speed. In order to thread the tape onto the take-up reel in starting, however, the pole-pieces and wipers must be separated and the starting rollers 74 and 76 must be pressed together. Accordingly, separate controls must be provided for threading and for rewinding. To this end, lever 94 operated by rewind button is provided with an extension 105 which cooperates with lever 106 pivoted at 107 and adapted at its opposite end 73 to operate pin 68 for separating wipers 64 and 65. Lever 106 is also provided with an arm 108 which cooperates with pivoted member 109, the opposite end of which is forked to provide a lever arm 62 for each pole-piece spring 60. A depending lug 110 (Fig. 2) is adapted to cooperate with head 111 of pull rod 112 so that when rod 112 is pulled to the right lug 110 will have the same effect upon pivoted member 106 as the depressing of rewind button, but that when rewind button is depressed, lug 110 will have no effect upon pull rod 112 due to the sliding connection therebetween. When it is desired to operate the rollers as well as the pole-piece and wiper separating mechanism, button 88 is depressed. This causes bell crank 113 to be rotated about its pivot 114 to pull rod 115 and thus rotate members 77 and 80 about their common pivot. Members 77 and 80 pull rod 112 and operate the pole-piece and wiper separating mechanism and also force pulley 76 against pulley 74.

The indicator for the take-up reel is comprised of a graduated arc 116, a pointer 117 cooperating therewith and pivoted at 118. The indicator 117 carries a roller 119 which cooperates with the tape on the reel and moves the indicator in accordance with the quantity of tape on the reel. When reel 13 is completely filled, extension 120 of the indicator strikes pin 121 and releases the record or reproduce button as the case may be. In order that the tape may

be rewound, however, when the reel is full, it is necessary to split release bar 98 so that the motion of pin 121 is confined to slot 122 without affecting the portion of the release bar cooperating with the rewind and stop buttons.

The electrical apparatus used with this machine comprises a microphone 127, a receiver 128, switches for effecting the various operations, a motor 29, an amplifier (shown as a block) and a suitable source of power supply, preferably 110 volt alternating current mains. The circuit is shown schematically in Fig. 8. For recording, microphone 127 is connected to the input of the amplifier and the output of the amplifier is connected to the recording-reproducing or sound translating magnet coils 129. For reproducing, the output of the sound translating coils is connected to the input of the amplifier, and the output of the amplifier is connected to the receiver 128. The rewind and stop buttons break the circuit to the sound translating magnets, and a separate switch 132 turns the motor on and off. A volume control 130 regulates the output from the microphone and a second volume control 131 controls the output from the amplifier.

It has been found that the tape sometimes has decided bends in it which cannot be removed by the pressure of the pole-pieces alone. As an added refinement, therefore, curved gates 123 and 124 are supplied for each electromagnet. These gates are curved oppositely to one another so that the impedance to the progress of the tape through the unit is increased by the reverse curvature and hence the added pull on the tape occasioned thereby is relied upon to remove the bends. The gates are removable and are held in place by spring clips 125 and 126.

The operation of the machine is as follows: A supply reel is placed upon shaft 33 and the end of tape 57 is inserted between rollers 74 and 76. Button 88 is then depressed and knurled knob 75 rotated clockwise to cause the tape to pass through the guides and electromagnets. The rotation of knurled knob 75 is continued until the end of the tape has passed through take-up reel 13 a few inches. The record button is now depressed and the matter to be recorded is spoken into the microphone. At the end of the recording, or to repeat a portion of what has been spoken into the microphone, the stop button is depressed to release the record button, the rewind button is next depressed in order to back up the tape. When the desired amount of tape has been rewound the stop button is again depressed, followed by the reproduce button. After all or part of the recorded matter has been reproduced, the record button may again be depressed to continue the recording. At the end of the recording the tape may be rewound by depressing the rewind button, or if desired, the take-up reel may be removed and the tape rewound on a separate machine. The stop button is used whenever there is a substantial pause between any of the other operations or after the record and reproduce operations. Motor switch 132 is operated at the beginning and the end of a complete set of operations, that is, at the time the operator begins to use the machine and at the time he has finished with the machine. The operation of the motor is indicated by the lighting of a lamp 127 located on panel 11. The quantity of tape on take-up reel 13 is continuously indicated by indicator 117 and scale 116 may be made removable so that markings may be made

thereon in accordance with the desires of operator. If for any reason take-up reel 13 becomes too full, extension 120 of the indicator will automatically stop the machine and the only operation possible thereafter is that of rewinding the tape.

The machine described may be used for dictation purposes, for recording telephone messages or for any purpose for which the ordinary phonograph may be used. Since magnetic material one and one-half mils thick is now available, a small reel may contain enough tape for eight or ten minutes of operation. The tape may be used over and over again and hence there is no waste. The recording and reproducing is done electrically and can, therefore, be controlled much more closely than in other types of phonographs. With the improved threading and button control systems the machine is very simple to operate.

It is understood that the foregoing description is merely illustrative of the invention, and that the scope of the invention is not to be limited thereto, but is to be determined by the appended claims.

What is claimed is:

1. In a telegraphic apparatus of the type described, a series of push buttons for controlling the operation of the apparatus and a latch bar cooperating with said buttons to hold one of said buttons in operative position, said latch bar being comprised of two parts, one part containing a slot and the other a pin cooperating in the slot, whereby all of the buttons are released when certain ones are depressed, and only a portion of the buttons are released when others are depressed.

2. In a telegraphic apparatus of the type described, a rewind button, a record button, a reproduce button, a latch bar cooperating with said rewind, record and reproduce buttons, said latch bar having means for holding the record and reproduce buttons in released position while permitting the latching of the rewind button.

3. In a telegraphic apparatus of the type described, a magnetic tape, a series of push buttons for controlling the operation of the apparatus including a rewind button, a latch bar cooperating with the buttons to hold one in operative position, said latch bar being comprised of two parts, one part cooperating with the rewind button and containing a slot and the second part cooperating with one or more of the remaining buttons and including a pin cooperating with the slot of the first part, and means operated by the tape for engaging the pin whereby the buttons controlled by the pin portion of the latch bar will be held in inoperative position, while the rewind button may be made effective.

4. In a telegraphic apparatus of the type described, a magnetic tape, push buttons for controlling the recording, reproducing and rewinding operations, a latch bar cooperating with the buttons to hold one in operative position, said latch bar being comprised of two parts, one part cooperating with the rewind button, the other part cooperating with the record and reproduce buttons, pin, and slot, connecting means between said bars such that movement of the pin operates to release the record and reproduce buttons but not the rewind buttons, and means operated by a predetermined condition of the tape for engaging the pin whereby the record and reproduce buttons are held in inoperative position while the rewind button may be made effective.

5. In a telegraphic apparatus of the type de-

scribed, a clutch, a brake for the clutch, electromagnets having retractile pole-pieces, and unitary means for controlling the operation of the clutch, brake and pole-pieces.

6. In a telegraphic apparatus of the type described, a clutch, a brake for the clutch, electromagnets having retractile pole-pieces, a switch for controlling the circuit through the electromagnets, and unitary means for controlling the operation of the clutch, brake, pole-pieces and switch.

7. In a telegraphic apparatus of the type described, a magnetic tape, separable wipers for the tape, a clutch, a brake for the clutch, electromagnets having retractile pole-pieces, a switch for controlling the circuit through the electromagnets, and a plunger for controlling the operation of the wipers, clutch, brake and pole-pieces.

8. In a telegraphic apparatus of the type described, a magnetic tape, individual push buttons for recording upon, reproducing from and rewinding the tape, a reel for the tape, a clutch-operated driving means for the reel, and a brake for the clutch, said brake being operable upon the release of all of said push buttons.

9. A magnetic tape, electromagnets cooperating with the tape and means for insuring the removal of undesirable bends in the tape, said means comprising curved guides, the curvature of one guide being in a direction opposite to that of the other guide to increase the tension on the tape and thereby remove undesirable bends therein.

10. In a telegraphic apparatus, a magnetizable tape, electromagnets cooperating with the tape, each of said electromagnets including a coil and a pole-piece, and means for guiding the tape past the pole-pieces, said guiding means comprising removable blocks, the guiding face of each block being curved in a direction opposite to that of the other to remove undesirable bends in the tape.

11. In a magnetic recording machine, a magnetizable tape, a supply reel for the tape, a take-up reel for the tape, electromagnets between the supply and take-up reels and means for threading the tape from the supply reel through the electromagnets and upon the take-up reel, said means comprising normally separated rollers, push button operated means for putting pressure upon the rollers to pinch the tape therebetween, means simultaneously operable with the rollers for removing obstructions from the path of the tape and guides for the tape to insure the entrance of the tape upon the reel.

12. In a magnetic recording machine, a magnetizable tape, a supply reel for the tape, a take-up reel for the tape, electromagnets cooperating with the tape, each electromagnet comprising opposed pole-pieces, separable wipers for the tape, and means for threading the tape from the supply reel to the take-up reel, said means comprising a pair of rollers for gripping the tape and feeding it toward the take-up reel, and a unitary control for separating the pole-pieces and wipers and for exerting operating pressure upon the feed rollers.

13. In a phonographic apparatus employing a ribbon as a record carrying medium, a supply reel for the ribbon, a take-up reel, means for feeding the ribbon toward the take-up reel and a core in the take-up reel comprised of spaced members which provide a plurality of openings through the core whereby the end of the ribbon is bent and carried around by the rotation of the reel and pinched under the succeeding layers of the ribbon.

14. Threading means for a magnetic tape of a telegraphonic apparatus, said means comprising feed rollers cooperating with the tape, guide members for directing the tape, a take-up reel, means for rotating said reel, and a core in said reel comprising a plurality of spaced members forming a plurality of passageways through the core for the end of the tape whereby the tape is

started upon the take-up reel by rotating the feed rollers until the end of the tape extends beyond the core of the take-up reel and then rotating the take-up reel until the end of the tape is pinched by the succeeding layers.

5

CLARENCE N. HICKMAN.
RUDOLPH F. MALLINA.