July 22, 1947. H. NYGAARD 2,424,498

CONTINUOUS MAGNETIC RECORDING SYSTEM

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FIG. 1

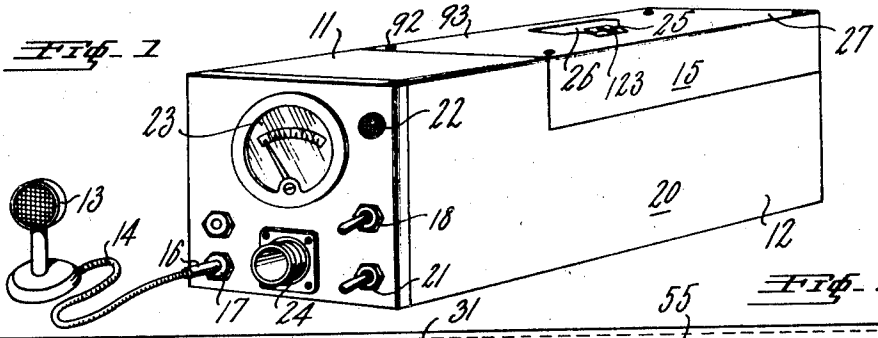
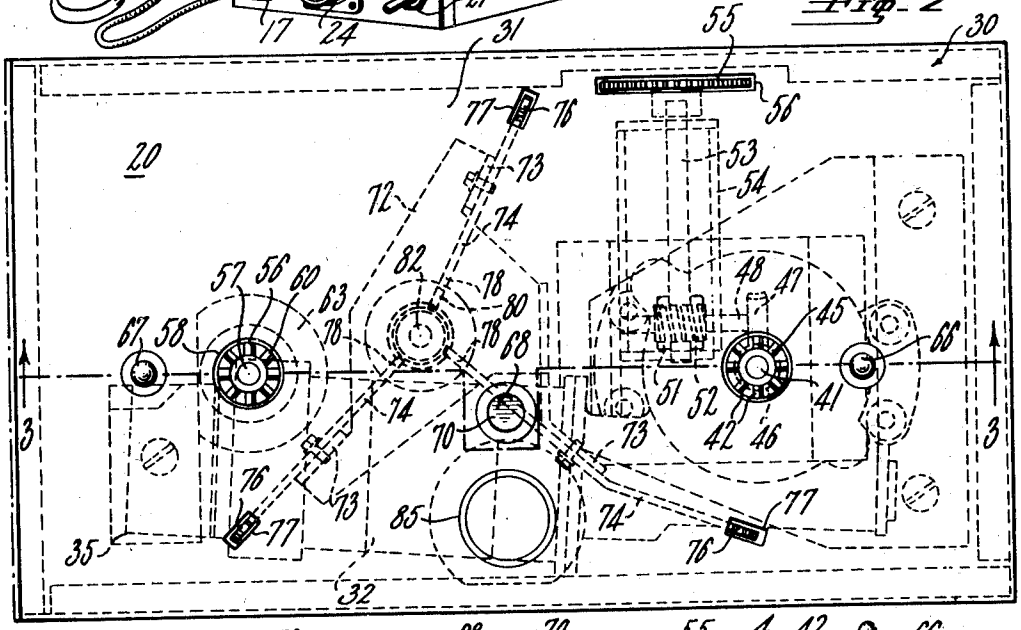


FIG. 2



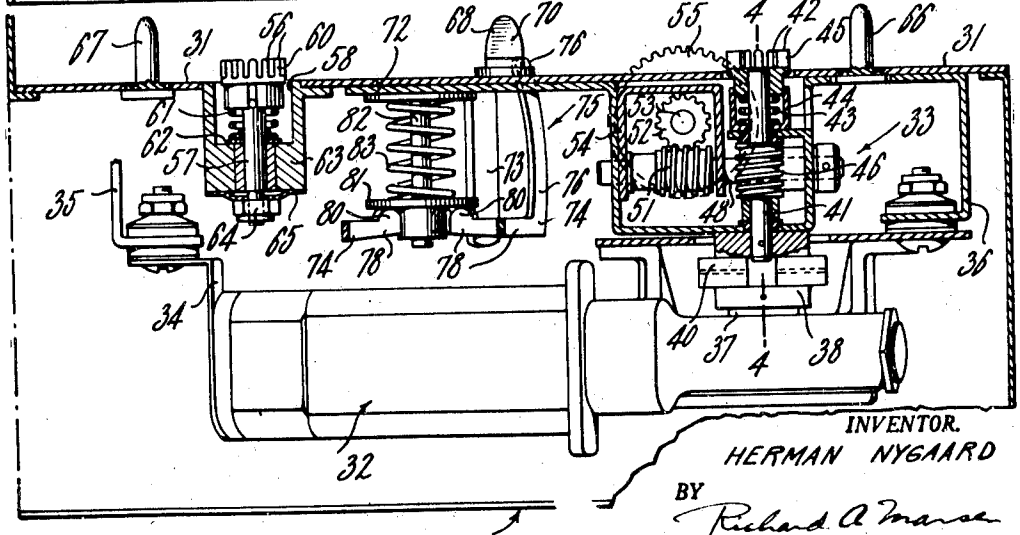


FIG. 3

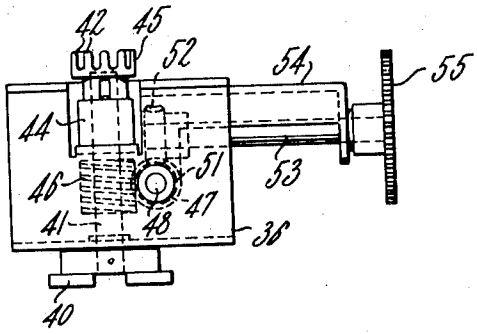
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Fig. 4



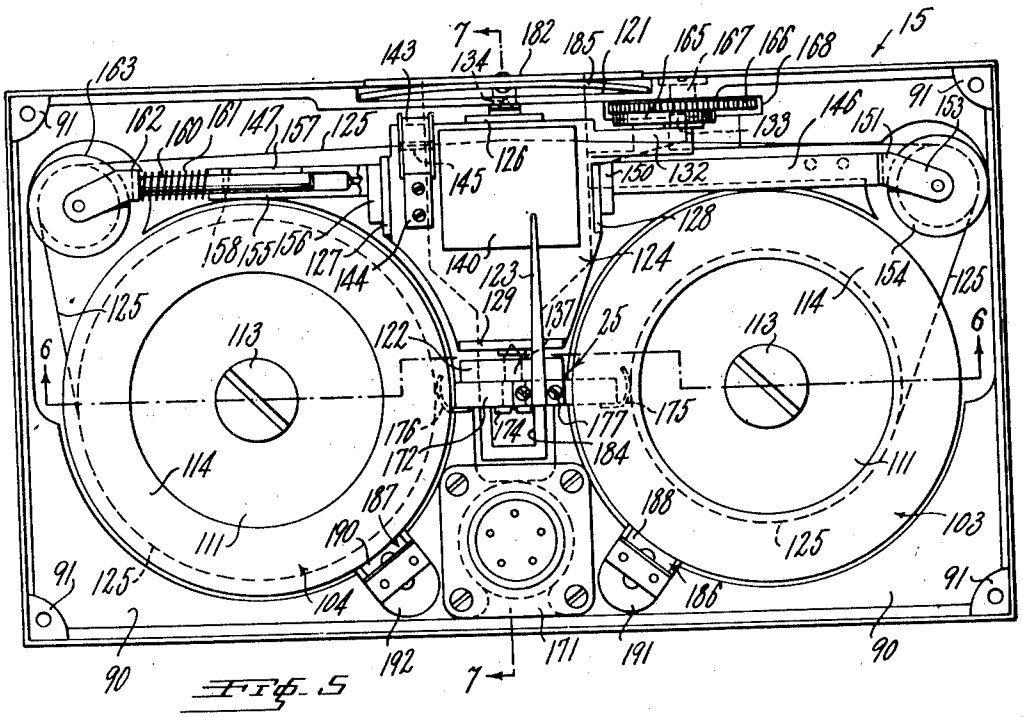


Fig. 5

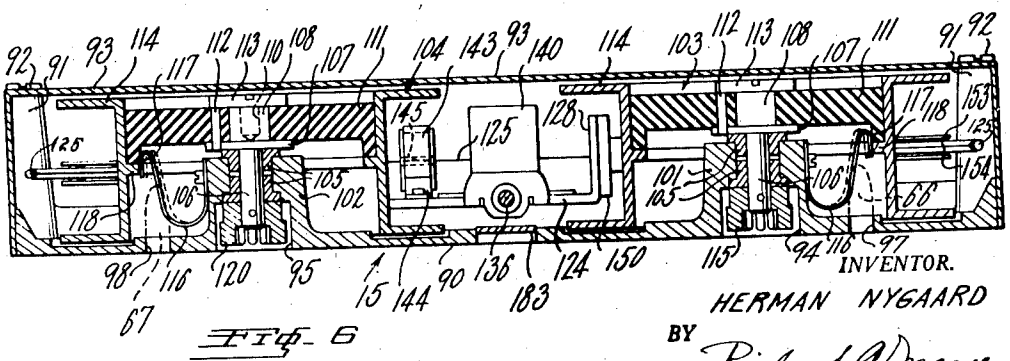


Fig. 6

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CONTINUOUS MAGNETIC RECORDING SYSTEM

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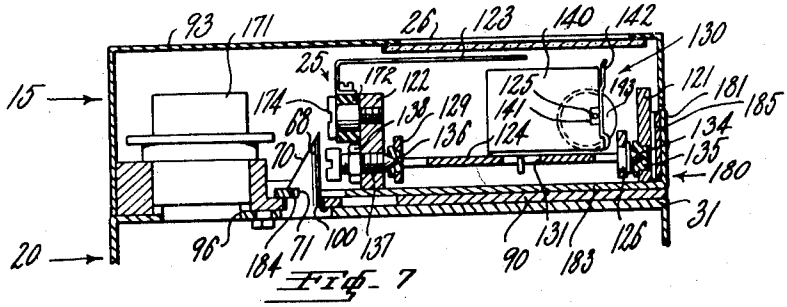


Fig. 7

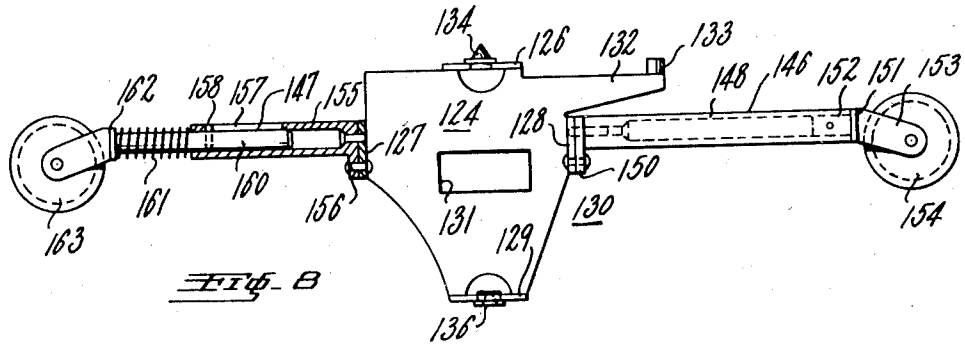


Fig. 8

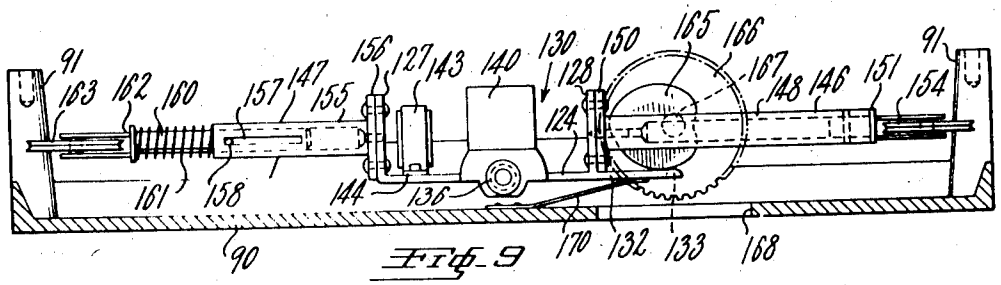


Fig. 9

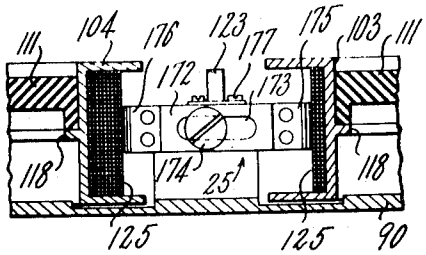


Fig. 10

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UNITED STATES PATENT OFFICE

2,424,498

CONTINUOUS MAGNETIC RECORDING SYSTEM

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Application March 2, 1945, Serial No. 580,625

18 Claims. (Cl. 179—100.2)

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This invention relates to continuous magnetic recording systems, and more particularly to a novel rugged interchangeable magazine containing the recording wire medium, particularly adapting such system for use aboard aircraft.

In accordance with the present invention, light weight, rugged, compact and easily stored magazines are provided each containing a recording head, recording wire and reeling means for the wire. A recording length of an hour may be readily contained in a relatively small magazine. These magazines are adapted for rapid and interchangeable use with a simple, light weight and rugged sound recording or "flight" unit carried aboard the aircraft. Each magazine is capable of recording for more than one hour before its recording capacity is exhausted. The magazine is then quickly detachable from the recording unit and quickly replaceable by a similar magazine. The recording unit may be connected to a microphone used by an observer or may be connected with the intercommunication system or radio of the aircraft. Thus a practically continuous record is available for any length of time desired. The magazines used are rugged, compact, light weight and easily stored.

At the conclusion of the mission, the magazines are placed, in proper sequence, in interchangeable cooperation with a sound recording and reproducing, or "ground" unit, where the recordings are directly "played back" to furnish a complete record of the oral observations and comments of the crew members during the mission. Subsequently, the magazines may be stored for future reference or the recordings therein may be magnetically "erased" and the magazine reused.

The magazine of the present invention includes a novel spooling arrangement for feeding the magnetic recording wire to and from a pair of reels. The spooling mechanism embodies a rocker arm assembly upon which the recording or translating head is rigidly mounted. The magazine is a compact yet rugged unit that faithfully records and reproduces sound even under severe vibration or operating conditions, such as encountered on an airplane or battleship. The magazine contains an elapsed time indicator that indicates the amount of "recording time" or wire remaining. Novel means are provided for inhibiting breakage of the magnetic recording wire during starting up or operation of the apparatus. A latching means is provided for securing the magazine to an associated sound translating unit, and the latter is provided with novel parallel ejecting means for displacing the magazine from

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the translating unit when such latch is released.

It is among the objects of this invention to provide a simple, rugged, light-weight compact magazine for interchangeable use with magnetic sound recording or reproducing units, to provide such a magazine containing a minimum number of essential components for operation in severe service conditions; to provide such a magazine adapted for easy economical and compact storage; to provide such a magazine containing a magnetic translating head, a linear magnetic recording medium, reeling means for traversing the medium through the head, and a novel spooling unit for properly disposing the wire on the reeling means; to provide such a unit including an elapsed time indicator for indicating the amount of recording medium still remaining on the storage reel; to provide such a magazine including novel shock absorbing means for preventing breakage of the magnetic recording medium or wire upon starting up or use; to provide such a magazine including a latch automatically operable to couple the magazine onto a sound translating unit; to provide a sound translating unit including novel parallel ejecting means for displacing a magazine therefrom upon release of the latch means contained in the magazine; to provide a sound translating unit containing driving mechanism for operating reeling means in a magazine cooperable therewith and a gear reduction unit for operating a spooling unit in the magazine at a reduced rate with respect to the reeling means; and to provide a continuous magnetic sound translating system, requiring no threading of the recording wire for using, presenting a minimum risk of wire breakage, and including rapidly interchangeable magazines adapted for easy and economical storage.

These and other objects, and novel features of the invention will be apparent from the following description and the accompanying drawings. In the drawings:

Fig. 1 is a perspective view of a sound translating unit and a magazine arranged in operative relation therewith.

Fig. 2 is a top plan view of the sound translating unit shown in Fig. 1.

Fig. 3 is a longitudinal sectional view on the line 3—3 of Fig. 2 looking in the direction of the arrows.

Fig. 4 is a view on the line 4—4 of Fig. 3 illustrating a gear reduction unit included in the sound translating unit.

Fig. 5 is a top plan view of the magazine with the cover removed.

Fig. 6 is a longitudinal sectional view on the

line 6—6 of Fig. 5 looking in the direction of the arrows.

Fig. 7 is a cross-sectional view on the line 7—7 of Fig. 5 looking in the direction of the arrows.

Fig. 8 is a plan view of a spooling mechanism incorporated in the magazine.

Fig. 9 is an elevational view of the spooling mechanism shown in Fig. 8, illustrating associated parts of the magazine in section.

Fig. 10 is an elevation view, partly in section, illustrating an elapsed time indicator forming part of the invention.

Generally speaking, the system of the invention includes a magazine unit adapted for ready interchangeable operation with any one of a plurality of sound translating units. The magazine unit includes an electromagnetic translating head, reeling means for transversing a sound recording medium with respect to such recording head, and novel spooling mechanism, common to both reeling means, for feeding the recording medium onto and off the reeling means without injuring the recording medium. An electrical coupling or connection member is electrically connected to the recording head, and mechanical coupling elements are operatively associated with each of the reeling means and with the spooling mechanism. By "translating head," as used hereinafter in the specification and claims, is meant a device operable either to impress magnetic impulses on the recording medium or wire or to convert impulses from the wire into electrical sound impulses. It is thus a recording and reproducing head.

The translating units include translating mechanisms for converting sound impulses into magnetic impulses imposable on the recording medium or wire in the magazine. An electrical connection or coupling member is associated with the translating mechanism for cooperation with the complementary element on the magazine. The translating units also include driving mechanism, having mechanical coupling elements associated therewith for detachable engagement with the mechanical coupling elements of the magazine. Gearing is provided in association with the driving mechanisms for operating the spooling mechanism of the magazine at a reduced speed with respect to the reeling means thereof.

Referring to Fig. 1, the system of the invention includes a magazine 15 electrically and mechanically cooperable with a sound translating unit 20. Magazine 15 is substantially rectangular in shape and unit 20 is provided with a forward section 11 extending upwardly above a rearward or base section 12 to a height substantially equal to the thickness of magazine 15. When magazine 15 is placed in cooperative relation with unit 20, the combined unit has a substantially rectangular outline. Magazine 15 is provided with flat perpendicularly related sides, thereby adapting it for convenient and economical storage.

Translating unit 20 illustrated in Fig. 1 is adapted for airborne use, and contains means for translating sound impulses from a microphone 13 into magnetic impulses imposable upon a linear magnetic recording medium or wire contained in magazine 15. A cable 14 connects microphone 13 to a jack 16 cooperable with a plug 17 on unit 20. Unit 20 is provided with suitable control switches 18 and 21, an indicating light 22, an indicating level meter 23, and an electrical coupling member 24 for coupling the unit to a suitable source of electrical energy.

Magazine 15, as will be described more fully hereinafter, contains a pair of reels for moving a magnetic recording wire with respect to a magnetic translating head, and spooling mechanism for feeding the wire in uniform layers to and from the reels. The magazine also contains an elapsed time indicator comprising a needle cooperable with a scale 25 on a window 26 in cover 27 of the magazine. An erasing coil is also mounted in the magazine. This coil and the translating head are electrically connected to an electrical socket in the base of magazine 15, and are electrically connected to the circuits in unit 20 through an engaging plug on unit 20. Similarly, the reels are each provided with mechanical coupling means on the base of magazine 15 cooperable with mechanical coupling elements on unit 20, as is also the spooling mechanism unit. The electrical and mechanical coupling means of the magazine are recessed within the magazine adjacent apertures in the base and the outer surfaces of such means are substantially coplanar with the outer surfaces of the base, as will be described in more detail hereinafter.

Translating unit 20 contains driving mechanism for operating the reeling means and reduction gearing operable by the driving mechanism for operating the spooling mechanism at a reduced rate with respect to the reeling means. By disposing the reduction gearing for the spooling mechanism in unit 20, a reduction in weight is achieved in magazine 15, as well as a decrease in the components carried therein, contributing to the simplicity and compactness of the magazine. Unit 20 also includes a suitable recording circuit operable to convert sound impulses into electrical impulses which are electrically transmitted to the translating head in magazine 15. The electrical and mechanical coupling elements of unit 20 project above the surface of section 12 thereof for entry into the base apertures of magazine 50 for cooperation with electrical and mechanical coupling means of the magazine, as will be described in detail. Furthermore, unit 20 is provided with locating pins and a latching pin, the latter being cooperable with an automatically operable latch on the magazine for retaining the magazine in position on the unit when it is placed in operative relation therewith. An automatically operable parallel ejecting mechanism is provided in unit 20 for displacing magazine 15 with respect thereto upon release of the magazine latching means so that the magazine may be quickly detached from the translating unit.

Translating unit 20 and its components, are more clearly illustrated in Figs. 2, 3 and 4 of the drawings. As shown, base section 12 of the translating unit includes a casing 30 having an upper plate 31. Plate 31 supports the driving mechanism, the electrical and mechanical coupling elements, the locating and latching pins, and the parallel ejection mechanism.

The driving mechanism includes a motor 32 which preferably is a constant speed or governor controlled type coupled to a reduction gearing unit generally indicated at 33.. One end of motor 32 is supported by a bracket 34 detachably secured to a bracket 35 in turn secured to plate 31. Reduction gearing unit 33 is mounted in a composite bracket 36 secured to plate 31 and supports the other end of motor 32. The armature shaft of motor 32 is provided with a worm (not shown) which drives a worm gear 37 secured to a detachable coupling member 38 cooperable with a coupling member 40, shown more particularly in Fig. 4. One of the coupling members may be

of resilient material such as rubber to absorb shock incident to starting and stopping of motor 32. Coupling member 40 is secured to a vertical extending shaft 41 on the upper end of which is slidably mounted a coupling element 45, comprising a gear having axially extending teeth 42 with rounded outer edges. A spring 43 surrounding shaft 40 and engaging gear 45 and the bottom of a socket 44 normally urges gear 45 outwardly.

Intermediate its ends, shaft 41 is provided with a spiral gear 46 meshing with a spiral gear 47 on a shaft 48 extending horizontally. Shaft 48 has secured thereto a worm 51 engaging a worm gear 52 on a shaft 53. Shaft 53 extends transversely of casing 30 and is supported in a bracket 54, forming part of bracket 36. A coupling element, such as a spur gear 55 is secured to the outer end of shaft 53 and extends through an aperture 56 in the plate 31. Through the described gearing arrangement, shaft 53 is rotated at a greatly reduced rate with respect to shaft 41. Gear 45 is arranged for cooperative relation with a mechanical coupling means for one of the reels in magazine 15, and gear 55 is arranged for cooperation with mechanical coupling means for spooling mechanism contained in magazine 15.

A mechanical coupling element cooperable with mechanical coupling means for the other reel in magazine 15 is also provided, and comprises a gear 60 similar to the gear 45 and having axially extending teeth 58 rounded at their outer edges. Gear 60 is keyed to a shaft 57 and is normally urged outwardly through aperture 58 in plate 31 by a spring 61 surrounding shaft 57 and engaging the bottom of gear 60 and a spring seat 62 mounted in a socket 63 secured to plate 31. A nut 64 secures a friction spring 65 to the lower reduced end of shaft 57. Spring 65 thus exerts a drag resisting rotation of shaft 57 for a purpose described more fully hereinafter.

A pair of locating pins 66 and 67 are secured to plate 31 and extend upwardly therefrom for cooperation with suitable locating apertures in magazine 15. Plate 31 also has mounted thereon a latching pin 68, shown more clearly in Fig. 7. Pin 68 is provided with an upper tapered surface 70 and a notch 71 cooperable with latching means in magazine 15.

A parallel ejecting mechanism generally indicated at 75 (Fig. 3) forms part of unit 15 and is adapted, upon release of the latch in magazine 15, to eject the magazine from unit 20 while maintaining parallel relation therebetween to prevent binding of the magazine on the unit. The parallel ejecting mechanism comprises a bracket 72 secured to plate 31 and having three downwardly extending arms 73. Each arm 73 pivotally supports an ejecting member 74. Each member 74 comprises a substantially vertically extending curved arm 76 extending through an aperture 77 in plate 31, and a horizontally extending arm 78 provided with a projection 80. All the projections 80 engage a washer 81 slidably mounted on a pin 82 secured to bracket 72. A coil spring 83 surrounds pin 82 and engages washer 81 and bracket 72. Coil spring 83 exerts a uniform pressure against arms 78 of members 74 forcing these arms downwardly and the projecting arms 76 through apertures 77 in plate 31. The operation of the parallel ejecting mechanism will be described more fully hereinafter.

The forward section 11 of unit 20 contains suitable electrical and electronic circuit components for the sound translating system. These electrical and electronic control elements are associated with control switches 18, 21, "on" light 22, level meter 23, electrical coupling member 24, and microphone jack 17. Electrical impulses from the sound translating circuit contained in section 11 are conducted to the electrical coupling element 85 projecting above the surface of plate 31 and cooperable with electrical plug means in magazine 15. Through coupling element 85 and its associated plug means, the electrical impulses are conducted to the magnetic translating head in magazine 15 where they are transformed into magnetic impulses that are imposed upon the moving magnetic recording wire in the magazine.

Magazine 15, and its component elements, are shown in more detail in Figs. 5 through 10. The magazine comprises a base 90 which may be cast of a suitable light metal such as aluminum or an alloy thereof. Base 90 is provided with corner posts 91 having threaded apertures for receiving screws 92 which secure a rectangular cover 93 to the base. By suitable disengagement of screws 92, cover 93 is quickly and easily detachable from base 90 for ready access to the components of magazine 15. Base 90 is provided with apertures 94, 95 and 96 through which mechanical coupling elements 45 and 60 and electrical coupling element 85 of translating units 20 are adapted to extend into engagement with the mechanical and electrical coupling means, respectively of magazine 15. The magazine is also provided with apertures 97 and 98 cooperable with locating pins 66 and 67, and with an aperture 100, shown in Fig. 7, receiving latching pin 68 of unit 20.

Referring more particularly to Figs. 5 and 6, base 90 is provided with a pair of upstanding apertured bosses 101 and 102 which acts as bearing supports for the reeling means 103 and 104. Two part bearings 105 are disposed in the aperture of each boss 101, 102, for receiving a pivot comprising a shaft 106 having a flange 107 and a head 108 provided with a threaded aperture 110. Secured to the lower ends of each shaft 106 are mechanical coupling means 115 and 120, each of which comprises an axially toothed gear cooperable respectively with the similar gears 45 and 60 of translating unit 20. To facilitate such cooperation, the outer edges of the teeth of gears 115, 120 are rounded.

The reels, per se, each comprise a circular disk 111 of insulating material having central apertures receiving the heads 108 of pivots 106 and offset apertures each receiving a pin 112 extending through the fiber disk and an aperture in flanges 107 of pivots 106. Screw 113 threaded into apertures 110 of pivots 106 secures each disk 111 to its associated pivot 106. Annular metal members 114 having channel shaped peripheries are secured to each of the disks 111 in any suitable manner, and receive the magnetic wire 125 for storage and winding purposes. Bow springs 116 are secured to the external surface of each boss 101, 102 and have outer inturned ends 117 bearing against an inwardly directed flange 118 on each of the reel members 114.

When magazine 15 is placed in operative relation with translating unit 20, locating pins 66, 67 enter through apertures 97, 98 of the cartridge as indicated in dotted lines in Fig. 6. Pins 66, 67 engage bow springs 116, releasing the reels for rotation. As soon as the cartridge is disengaged from the translating unit, the bow springs snap into engagement with the reels to retain the same

against relative rotation. This prevents unwinding and possible tangling of magnetic recording wire 125 during periods when the cartridge is disengaged from the associated translating unit, in transit, or stored, and, in effect, is an automatically releasable braking means for each of the magazine reels.

Base 90 is provided with a pair of vertical walls 121 and 122 which act as supports for the pivotally mounted combined spooling mechanism, translating head and erasing head unit, constituting rocker-arm assembly 130. Wall 121 is recessed inwardly from the outer edge of base 90, as shown in Figs. 5 and 7, for a purpose to be described hereinafter. Wall 122 extends parallel to wall 121 and is located adjacent the transverse center of the base. This latter wall also acts as a support for the elapsed time indicating mechanism 25 which includes a needle 123 disposed adjacent the aperture 26 in cover plate 93 of cartridge 15, as shown more clearly in Figs. 1, 7 and 10.

Referring to Figs. 7, 8 and 9, unit 130 includes a flat plate 124 having vertical ears 126, 127, 128 and 129. The plate is further formed with an aperture 131 for electrical connections of magnetic translating head 140, and with a longitudinally extending arm 132 having a semi-rounded projection 133. A bearing pivot 134 is mounted in aperture 126 and engages a recessed bearing 135 mounted in an aperture in wall 121. Similarly, a recessed bearing 136 is mounted in an aperture in ear 129 and receives a threaded pivot 137 extending through an aperture in wall 122 and provided with a lock nut 138. Plate 124 is thus supported for oscillating movement in a vertical plane with respect to base 90, or in a plane parallel to the axes of reels 103, 104, and thus for oscillating movement with respect to the reels.

Magnetic translating head 140 for recording and reproducing is secured near the outer edge of plate 124, and has a groove 141 through which magnetic recording wire 125 extends. The wire is retained in place in the groove by a spring pressed plate 142 extending across the groove. Referring to Figs. 6 and 9, erasing head or coil 143 is mounted, by means of a bracket 144, on plate 124, and is provided with an aperture 145 through which magnetic wire 125 extends. Under the control of suitable switches on translating unit 20, high frequency potential such as 25 kilocycles is impressed on erasing head 143 for the purpose of wiping out any magnetic impulses on wire 125 as it passes through the erasing head, in a manner well known to those skilled in the art, to prepare the wire for a recording.

It is important for good quality of reproduction, that recording wire 125 be fed uniformly through translating head 140. Provision is made to take up shock incident to starting or operation of the reels, to prevent breaking or damage of the recording wire. The pair of wire feeding rocker-arms 146 and 147 are mounted on bracket plate 124, as shown more particularly in Figs. 8 and 9. Rocker-arm 146 comprises a tube 148 having a flange 150 riveted or otherwise secured to ear 128 of plate 124. A forked member 151 extends into the hollow outer end 152 of sleeve 148 and rotatably supports a grooved pulley 154.

Rocker-arm 147 comprises a sleeve member 155 having a flange 156 suitably secured to ear 127 of plate 124. Sleeve 155 is provided with a longitudinally extending slot 157 slidably receiving a pin 158 secured to a plunger 160 disposed in the sleeve. A spring 161 extends between the outer end of sleeve 155 and a forked member 162 rotatably supporting a grooved pulley 163. Wire 125 passes over pulleys 154, 163 which, as may be seen more clearly in Figs. 5, 6 and 9, are disposed adjacent reels 103 and 104, respectively, and as near as possible to the outer ends of the magazine unit. By having the pulleys disposed at the extreme distance from recording head 140, the greatest length of wire 125 between bends is provided, thereby substantially decreasing the possibility of weakening or breakage of the wire due to being bent at too sharp an angle of curvature. The shock absorbing mechanism 147, including spring 161, prevents damage or breaking of the wire due to the shock of starting or stopping rotation of reels 103, 104.

Spooling mechanism 130 is oscillated by means of a reentrant cam 165 secured to a spur gear 166 mounted on a pivot screw 167 extending through wall 121 of base 90. Gear 166 is disposed adjacent an aperture 168 in base 90, which aperture, when magazine 15 is placed in operative relation with translating unit 20, is aligned with aperture 56 of unit 20. Accordingly, gear 55 secured to the gear reduction unit 33 will extend through aperture 168 and mesh with gear 166 to operate cam 165 at a reduced rate with respect to the rate of rotation of reels 103, 104. Cam 165 is designed to oscillate spooling mechanism 130 at such a rate that wire 125 of a given diameter, is fed onto and off of reels 103, 104 in uniform layers. Cam 165 is engaged by a cam follower constituting rounded projection 133 of extension 132 of plate 124. Follower 133 is maintained in engagement with the cam surface by leaf spring 170 secured to base 90 and engaging the underside of arm 132. As gear 166 is rotated by gear 55, cam 165 oscillates rocker-arm 132, and thus spooling mechanism 130, providing uniform spooling of wire 125 by pulleys 154, 163 onto reels 103 or 104.

Electrical coupling means such as an electrical socket 171 is mounted on base 90 adjacent aperture 96 therein. Accordingly, when magazine 15 is placed in operative relation with unit 20, electrical coupling element 85 of unit 20 will project through aperture 96 into electrical cooperation with socket member 171. For the sake of simplicity, the electrical circuit connections have not been illustrated in the drawings. Suitable electrical connections extend between socket 171, translating head 140 and erasing head 143, through aperture 131 in plate 124, as will be understood by those skilled in the art.

The elapsed time indicating means 25 comprises an insulating block 172 having an elongated slot 173 through which extends a shouldered stud 174 threaded into wall 122. A pair of bowed springs 175, 176 are secured to either end of block 172 and engage the wire on reels 103, 104 respectively. As the wire is fed from one reel to the other through recording head 140 and erasing head 143, indicator 25 is reciprocated back and forth with respect to the aperture 26 and cover plate 93. Thus, reference to a suitable scale adjacent aperture 26, indicates the amount of "time" or remaining wire 125. Needle 123 comprises an L-shaped member secured to block 172 by screws 177.

A releasable latching means 180 is provided in magazine 15 for ready disengagement thereof from unit 20, in cooperation with parallel ejecting means of unit 20. This latching means shown in Figs. 5 and 7 comprises an L-shaped bar 181 hav-

ing a vertical arm 182 disposed adjacent the recess in wall 121 of base 90, and a horizontal arm 183 extending through slots in walls 121 and 122. The inner end of arm 183 is provided with an aperture 184 substantially aligned with aperture 100 in base 90. A spring 185 normally maintains latching bar 180 in its outer position. When magazine 15 is placed on unit 20, the sloping surface 70 of latching pin 68 moves bar 180 inwardly against the force of spring 185 until such time as the inner end of the bars snaps into notch 71 of the latching pin as shown in Fig. 7. Magazine 15 is thereupon locked upon unit 20, with the ejecting arms 76 forced inwardly against the force of associated spring 83. To release magazine 15 from unit 20, bar 180 on the side of magazine 15 is gripped and pressed inwardly, releasing its inner end from notch 77 of latching pin 68. Spring 83 thereupon motivates ejecting arms 76 to force magazine 15 a short distance away from unit 20, meanwhile maintaining the magazine base disposed parallel to the upper surface of unit 20. Magazine 15 may thereupon be quickly removed from unit 20 and a new one readily placed thereon.

As seen in Fig. 5, brush means 186 and 187 are provided adjacent each reeling means 103, 104 and comprise spring contact members 188 and 190 secured to base 90 of magazine 15 through the medium of insulating blocks 191 and 192. Contact members 188, 190 engage metal reel elements 114. Reel elements 114 are in electrical contact with the wire 125. Brushes 186, 187 are included in an electric supervisory circuit including the motor drive, controlling operation of the components of unit 20. Should the wire 125 break, such supervisory circuit is opened to operate a warning signal and/or stop operation of the system.

The operation of the apparatus of the present invention is as follows. Wire 125 is first wound up on "pay out" reel 104, by a suitable rewinding mechanism which may be provided in unit 20 or in a separate drive device with which the magazine is adapted to cooperate. To place the system in operation, "rewound" magazine 15 is placed on translating unit 20, being automatically latched thereon by engagement between locking bar 180 of the magazine and locking pin 68 of unit 20, as previously described. Mechanical coupling elements 45, 55 and 60 will enter into meshing engagement with the associated mechanical coupling means 115, 166 and 120 of magazine 15. Similarly, electrical coupling element 85 will enter into electrical cooperation with electrical coupling means 171 of magazine 15. In the event that either meshing pair of the radially toothed gears is not properly aligned, the rounded edges of the teeth of these gears, in cooperation with springs 43 and 61, will permit the small relative rotation and axial movement of gears 45 and 60 to obtain meshing engagement with associated gears 115 and 120. Through actuation of switches 18 and 21, the sound translating elements of unit 20 are conditioned to translate sound impulses from microphone 13 into electrical impulses which are transmitted to recording head 140 and converted therein to magnetic impulses imposable on wire 125. Motor 32, through the described gearing arrangement, operates gear 45 to rotate reel 103 and wind wire 125 thereon from reel 104. At the same time, spring washer 65 associated with coupling gear 60 exerts a drag on reel 104 to maintain wire 125 taut between the reels. Wire 125 is fed onto and off of the reels

over pulleys 154 and 163. The spring 161 associated with pulley 163 takes up any shock to the wire inhibiting its breakage, and maintains the moving wire substantially in uniform tautness. At the start of unreeling of wire 125 from spool 104 indicating needle 123 of elapsed time indicator 25 will be in its right-hand position, referring to Fig. 5 as a reference.

Spooling mechanism unit 130 will be oscillated at a uniform rate, slower than the rate of rotation of reel 103, by gear reduction unit 33 to feed the wire in uniform layers onto reel 103. The spooling mechanism oscillates at such a rate that the oscillation is reversed each time one layer is completely wound on reel 103. A uniform spooling is thus effected upon the "take on" reel 103. During rewind operation, the reverse occurs, with the uniform spooling effective on the other reel, namely 104.

The magnetic translation with respect to the reeled wire 125 may be recording as described, or reproducing if desired. As the reeling proceeds, indicating needle 123 will move from the far right position shown in Fig. 5 to the far left position, due to the wire being wound off reel 104 and wound onto reel 103, thereby moving the indicator to the left by engagement of springs 175, 176 with the wire on each of the reels, to properly indicate the condition of the wire on the spools. When it is desired to remove the magazine, the operator places his hand on it, pressing latching bar 180 inwardly with his fingers. This releases the latching bar from latching stud 68 of unit 20. The parallel ejecting members 76 thereupon push cartridge 15 upwardly from unit 20 and the magazine may be quickly moved therefrom and another magazine readily replacing it.

The magazine removed from unit 20 and containing a recording may be quickly and compactly stored, due to its flat sided construction, for filing purposes and later used on a sound reproducing unit where the wire 125 is first rewound, and then played. Access to the interior of cartridge 15 for repair or replacement of parts is conveniently afforded by ready removal of cover 93 from base 90 through disengagement of screws 92. However, should a magazine become defective in service, its ready replacement with a spare renders any repair thereof in the field unnecessary except at a depot or back at the base. The rugged construction of the system and magazine components permits excellent recording and reproduction operation under severe service conditions.

While a specific embodiment of the invention has been described to illustrate the application of the principles thereof, it will be apparent to those skilled in the art that the invention may be otherwise embodied without departing from such principles.

What is claimed is:

1. A magazine adapted for interchangeable sound translating cooperation with a magnetic sound translating unit and comprising a pair of reels rotatably mounted for traversing a magnetic recording wire; spooling mechanism for feeding the wire uniformly onto and from said reels, said spooling mechanism comprising a member pivotally supported between said reels for oscillation about an axis perpendicular to a plane including the axes of said reels and elements connected to said member and projecting toward each of said reels for guiding the magnetic wire between said reels; means for oscillating said member and elements to feed the wire in uniform layers onto and

from said reels; and externally accessible mechanical coupling means associated with each of said reels for rotating them in synchronism with the oscillating means.

2. A magazine adapted for interchangeable sound translating cooperation with a magnetic sound translating unit and comprising a pair of reels rotatably mounted for traversing a magnetic recording wire; spooling mechanism for feeding the wire uniformly onto and from said reels, said spooling mechanism comprising a member pivotally supported between said reels for oscillation about an axis perpendicular to a plane including the axes of said reels and a pair of elongated arms connected to said member and projecting toward each of said reels for guiding the magnetic wire between said reels, a pulley mounted in the outer end of each arm adjacent the associated reel for guiding the magnetic wire between said reels and a cam follower projecting from said member; a reentrant cam rotatably mounted in said magazine and operatively engaging said cam follower for oscillating said member and arms whereby said pulleys will feed the wire in uniform layers onto and from said reels; and externally accessible mechanical coupling means operatively associated with each of said reels and with said cam.

3. A magazine adapted for interchangeable sound translating cooperation with a magnetic sound translating unit and comprising a magnetic translating head; a pair of reels rotatably mounted for traversing a magnetic wire with respect to said translating head; spooling mechanism for feeding the wire uniformly onto and from said reels, said spooling mechanism comprising a member pivotally supported between said reels for oscillation about an axis perpendicular to a plane including the axes of said reels, said translating head being mounted on said member for oscillation as a unit therewith, and elements connected to said member and projecting toward each of said reels for guiding the magnetic wire between said translating head and said reels; means for oscillating said member and elements to feed the wire in uniform layers onto and from said reels; and externally accessible mechanical coupling means associated with each of said reels for rotating them in synchronism with the oscillating means.

4. A magazine adapted for interchangeable sound translating cooperation with magnetic sound translating unit and containing a magnetic translating head; a pair of rotatably mounted reels for traversing a magnetic wire with respect to said translating head; spooling mechanism for feeding the wire uniformly onto and from said reels, said spooling mechanism comprising a plate pivotally supported between said reels for oscillation about an axis perpendicular to a plane including the axes of said reels, said translating head being mounted on said plate for oscillation as a unit therewith, arms connected to said plate projecting toward each of said reels, and a pulley mounted in the outer end of each arm adjacent the associated reel for guiding the magnetic wire between said translating head and said reels; means for oscillating said plate and arms whereby said pulleys will feed the wire in uniform layers onto and from said reels; and externally accessible mechanical coupling means associated with each of said reels for rotating them in synchronism with the oscillating means.

5. A magazine adapted for interchangeable sound translating cooperation with a magnetic sound translating unit and containing a pair of rotatably mounted reels for traversing a magnetic wire; spooling mechanism for feeding the wire uniformly onto and from said reels, said spooling mechanism comprising a plate pivotally supported between said reels for oscillation about an axis perpendicular to a plane including the axes of said reels, arms connected to said plate projecting toward each of said reels, and a pulley mounted in the outer end of each arm adjacent the associated reel for guiding the magnetic wire between said reels; means for oscillating said plate and arms whereby said pulleys will feed the wire in uniform layers onto and from said reels; and externally accessible mechanical coupling means associated with each of said reels for rotating them in synchronism with the oscillating means; one of said arms comprising a pair of telescoping members and a spring urging said members to their extended position, said spring absorbing uneven tensions on the wire.

6. A magazine adapted for interchangeable sound translating cooperation with magnetic sound translating unit and containing a magnetic translating head; a pair of rotatably mounted reels for traversing a magnetic wire with respect to said translating head; spooling mechanism for feeding the wire uniformly onto and from said reels, said spooling mechanism comprising a plate pivotally supported between said reels for oscillation about an axis perpendicular to a plane including the axes of said reels, said translating head being mounted on said plate for oscillation as a unit therewith, arms connected to said plate projecting toward each of said reels, and a pulley mounted in the outer end of each arm adjacent the associated reel for guiding the magnetic wire between said translating head and said reels; means for oscillating said plate and arms whereby said pulleys will feed the wire in uniform layers onto and from said reels; and externally accessible mechanical coupling means associated with each of said reels for rotating them in synchronism with the oscillating means; one of said arms comprising a pair of telescoping members and a spring urging said members to their extended position, said spring absorbing uneven tensions on the wire.

7. A magazine adapted for interchangeable sound translating cooperation with a magnetic sound translating unit and comprising a casing containing a magnetic translating head; a pair of reels rotatably mounted in said casing for traversing a magnetic wire with respect to said translating head; spooling mechanism for feeding the wire uniformly onto and from said reels, said spooling mechanism comprising a plate pivotally supported between said reels for oscillation about an axis perpendicular to a plane including the axes of said reels, said translating head being mounted on said plate for oscillation as a unit therewith, a pair of elongated arms connected to said plate and projecting toward each of said reels, a pulley mounted in the outer end of each arm adjacent the associated reel for guiding the magnetic wire between said translating head and said reels, and a cam follower projecting from said plate; a reentrant cam rotatably mounted in said casing and operatively engaging said cam follower for oscillating said plate and arms whereby said pulleys will feed the wire in uniform layers onto and from said reels; externally accessible mechanical coupling means operatively associated with each of said reels and

with said cam; and externally accessible electrical coupling means in electric circuit connection with said translating head.

8. A magazine adapted for interchangeable sound translating cooperation with a magnetic sound translating unit and comprising a casing containing a magnetic translating head; a pair of reels rotatably mounted in said casing for traversing a magnetic wire with respect to said translating head; spooling mechanism for layer winding the wire uniformly onto and from said reels, said spooling mechanism comprising a member pivotally supported between said reels for oscillation about an axis perpendicular to a plane including the axes of said reels, said translating head being mounted on said member for oscillation as a unit therewith, a pair of elongated arms connected to said member and projecting toward each of said reels, a guide mounted in the outer end of each arm adjacent the associated reel for guiding the magnetic wire between said translating head and said reels, and a cam follower projecting from said mechanism; a reentrant cam rotatably mounted in said casing and operatively engaging said follower for oscillating said member; resilient means maintaining said cam follower in engagement with said cam whereby said guides will feed the wire in uniform layers onto and from said reels; externally accessible mechanical coupling means operatively associated with each of said reels and with said cam; and externally accessible electrical coupling means in electric circuit connection with said translating head; at least one of said arms comprising a pair of telescoping elements and a spring urging said elements to their extended position, said spring absorbing uneven tensions on the wire; and all of said coupling means being disposed substantially within said casing whereby said magazine is adapted for compact flat storage.

9. A magazine adapted for interchangeable sound translating cooperation with a magnetic sound translating unit comprising a casing; a pair of reels rotatably mounted in said casing for traversing a magnetic wire; a bowed spring aligned with an aperture in the base of said casing normally engaging one of said reels and normally restraining rotation thereof when the magazine is disengaged from the translating unit to prevent displacement of the wire, said spring being automatically disengageable from said reel when the magazine is placed in operative relation with the translating unit by entry of a pin on the unit through said aperture into abutment with said spring; and externally accessible mechanical coupling means operatively associated with each of said reels; said coupling means being disposed substantially within said casing whereby said magazine is adapted for compact flat storage.

10. A magazine adapted for interchangeable sound translating cooperation with a magnetic sound translating unit comprising a casing containing a magnetic translating head; a pair of reels rotatably mounted in said casing for traversing a magnetic wire with respect to said translating head; a bowed spring aligned with an aperture in the base of said casing normally engaging one of said reels and normally restraining rotation thereof when the magazine is disengaged from the translating unit to prevent displacement of the wire, said spring being automatically disengageable from said reel when the magazine is placed in operative relation with the translating unit by entry of a pin on the unit through said aperture into abutment with said spring; externally accessible mechanical coupling means operatively associated with each of said reels; and externally accessible electrical coupling means in electric circuit connection with said translating head; all of said coupling means being disposed substantially within said casing whereby said magazine is adapted for compact flat storage.

11. A magazine adapted for interchangeable sound translating cooperation with magnetic sound translating unit and containing a magnetic translating head; a pair of rotatably mounted reels for traversing a magnetic wire with respect to said translating head; spooling mechanism for feeding the wire uniformly onto and from said reels, said spooling mechanism comprising a plate pivotally supported between said reels for oscillation about an axis perpendicular to a plane including the axes of said reels, said translating head being mounted on said plate for oscillation as a unit therewith, arms connected to said plate projecting toward each of said reels, and a pulley mounted in the outer end of each arm adjacent the associated reel for guiding the magnetic wire between said translating head and said reels; means for oscillating said plate and arms whereby said pulleys will feed the wire in uniform layers onto and from said reels; brake means normally restraining rotation of said reels when the magazine is disengaged from the translating unit to prevent displacement of the wire, said brake means being disengageable from said reels by placement of the magazine in operative relation with the translating unit; externally accessible mechanical coupling means operatively associated with each of said reels and with the oscillating means; and externally accessible electrical coupling means in electric circuit connection with said translating head.

12. A magnetic sound translating system comprising a magazine, a pair of reels rotatably mounted in said magazine for traversing a magnetic wire, spooling mechanism for feeding the wire uniformly onto and from said reels, first externally accessible mechanical coupling means operatively associated with each of said reels, and second externally accessible mechanical coupling means operatively associated with said spooling mechanism; a sound translating unit containing driving mechanism, including reduction gearing, sound translating means, a first mechanical coupling element operatively associated with said driving mechanism, and a second mechanical coupling element operatively associated with said reduction gearing; said magazine being detachably cooperative with said unit by engagement of said first and second coupling means with said first and second coupling elements to establish driving relation between said driving means and reels and between said gearing and spooling mechanism to operate the latter at a reduced rate relative to said reels; latching means mounted in said magazine; a latching element mounted in said unit and adapted to engage said latching means, when said magazine is placed on said unit, to lock said magazine to said unit; and ejecting means mounted in said unit and automatically operable, upon manual release of said latching means from said latching element, to displace said magazine from said unit.

13. A magnetic sound translating system comprising a magazine containing a magnetic translating head, a pair of reels rotatably mounted

in said magazine for traversing a magnetic wire with respect to said translating head, spooling mechanism for feeding the wire uniformly onto and from said reels, first externally accessible mechanical coupling means operatively associated with each of said reels, second externally accessible mechanical coupling means operatively associated with said spooling mechanism, and externally accessible electrical coupling means in electric circuit connection with said translating head; a magnetic sound translating unit containing driving mechanism, including reduction gearing, and sound translating means, a first mechanical coupling element operatively associated with said driving mechanism, a second mechanical coupling element operatively associated with said reduction gearing and an electrical coupling element for circuit connection with said translating means; said magazine being detachably cooperative with said unit by engagement of said first and second coupling means with said first and second coupling elements to establish driving relation between said driving means and reels and between said gearing and spooling mechanism to operate the latter at a reduced rate relative to said reels, and engagement of said electrical coupling means with said electrical coupling element to electrically connect said translating head with said translating means; latching means mounted in said magazine; a latching element mounted in said unit and adapted to engage said latching means, when said magazine is placed on said unit, to lock said magazine to said unit; and ejecting means mounted in said unit and automatically operable, upon manual release of said latching means from said latching element, to displace said magazine from said unit.

14. A magnetic sound translating system comprising a magazine containing a magnetic translating head, a pair of reels rotatably mounted at each end of said magazine for traversing a magnetic wire with respect to said translating head, spooling mechanism for feeding the wire uniformly onto and from said reels, an axially toothed coupling gear secured for rotation with each of said reels and aligned with an aperture in the base of said magazine, a spur gear operatively associated with said spooling mechanism and having a plane of rotation aligned with a slot in the base of said magazine, and externally accessible electrical coupling means in electric circuit connection with said translating head and aligned with an aperture in the base of said magazine; and a magnetic sound translating unit containing driving mechanism, including reduction gearing, and sound translating means, a first shaft rotatable by said driving mechanism, a second shaft rotatably mounted in said unit, friction means restraining rotation of said second shaft, an axially toothed coupling gear slidably mounted on each of said shafts and rotatable therewith, resilient means urging each of said last named gears to project above the upper surface of said unit, a spur gear operable by said reduction gearing and projecting above the upper surface of said unit, and an electrical coupling element in circuit relation with said translating means and projecting above the upper surface of said unit; said magazine being detachably cooperative with said unit by engagement of the coupling gears and spur gear of said magazine with the coupling gears and spur gear of said unit, respectively, to establish driving relation between said driving means and reels and between said gearing and spooling mechanism, to operate the latter at a reduced rate relative to said reels, and engagement of said electrical coupling means with said electrical coupling element to electrically connect said translating head with said translating means; the coupling elements of said unit entering said apertures and said slot to engage the coupling means of said magazine.

15. A magnetic sound translating system comprising a magazine containing a magnetic translating head, a pair of reels rotatably mounted in said magazine for traversing a magnetic wire with respect to said translating head, spooling mechanism for feeding the wire uniformly onto and from said reels, an axially toothed coupling gear secured for rotation with each of said reels and aligned with an aperture in the base of said magazine, a spur gear operatively associated with said spooling mechanism and having a plane of rotation aligned with a slot in the base of said magazine, externally accessible electrical coupling means in electric circuit connection with said translating head and aligned with an aperture in the base of said magazine, and a pair of bowed springs each aligned with a locating aperture in the base of said magazine and each normally engaging one of said reels and restraining rotation thereof when said magazine is disengaged from a translating unit, to prevent displacement of the wire; and a sound translating unit containing driving mechanism, including reduction gearing, and sound translating means, a first shaft rotatable by said driving mechanism, a second shaft rotatably mounted in said unit, friction means restraining rotation of said second shaft, an axially toothed coupling gear slidably mounted on each of said shafts and rotatable therewith, resilient means urging each of said last named gears to project above the upper surface of said unit, a spur gear operable by said reduction gearing and projecting above the upper surface of said unit, an electrical coupling element in circuit relation with said translating means and projecting above the upper surface of said unit and locating pins projecting from the upper surface of said unit; said magazine being detachably cooperative with said unit by engagement of the coupling gears and spur gear of said magazine with the coupling gears and spur gear of said unit, respectively, to establish driving relation between said driving means and reels and between said gearings and spooling mechanism, to operate the latter at a reduced rate relative to said reels, and engagement of said electrical coupling means with said electrical coupling element to electrically connect said translating head with said translating means; said locating pins entering said locating apertures and engaging said bow springs to disengage the same from said reels.

16. A magnetic sound translating system comprising a magazine containing a magnetic translating head, a pair of reels rotatably mounted at each end of said magazine for traversing a magnetic wire with respect to said translating head, spooling mechanism for feeding the wire uniformly onto and from said reels, first externally accessible mechanical coupling means operatively associated with each of said reels, second externally accessible mechanical coupling means operatively associated with said spooling mechanism, externally accessible electrical coupling means in electric circuit connection with said translating head, a latching bar slidable transversely of said magazine and having an aperture

in its inner end substantially aligned with an aperture in the base of said magazine and resilient means normally urging said bar outwardly from said magazine; and a sound translating unit containing driving mechanism, including reduction gearing, and sound translating means, a first mechanical coupling element operatively associated with said driving mechanism, a second mechanical coupling element operatively associated with said reduction gearing, an electrical coupling element in circuit relation with said translating means, a pin projecting above the upper surface of said unit and having a sloping surface and a notch formed below said surface and ejecting means operable to displace said magazine from said unit; said magazine being detachably cooperative with said unit by engagement of said first and second coupling means with said first and second coupling elements to establish driving relation between said driving means and reels and between said gearing and spooling mechanism to operate the latter at a reduced rate relative to said reels, and engagement of said electrical coupling means with said electrical coupling element to electrically connect said translating head with said translating means; said pin entering the apertures in the magazine base and in said bar, the sloping surface of said pin moving said bar against said spring until said bar enters said notch to latch the magazine on the unit; said ejecting means automatically displacing said magazine from said unit upon manual release of said bar from said notch.

17. A magnetic sound translating system comprising a magazine containing a magnetic translating head, a pair of reels rotatably mounted at each end of said magazine for traversing a magnetic wire with respect to said translating head, spooling mechanism for feeding the wire uniformly onto and from said reels, first externally accessible mechanical coupling means operatively associated with each of said reels, second externally accessible mechanical coupling means operatively associated with said spooling mechanism, externally accessible electrical coupling means in electric circuit connection with said translating head and latching means; a sound translating unit containing driving mechanism, including reduction gearing, and sound translating means, a first mechanical coupling element operatively associated with said driving mechanism, a second mechanical coupling element operatively associated with said reduction gearing, an electrical coupling element in circuit relation with said translating means, a latching element adapted to engage said latching means, when said magazine is placed on said unit, to lock said magazine to said unit, a plurality of bars pivotally mounted in said unit and extending radially at equal angular intervals from the center thereof, the outer ends of said bars projecting upwardly through apertures in the upper surface of said unit and spring means engaging the inner ends of all of said bars; said magazine being detachably cooperative with said unit by engagement of said first and second coupling means with said first and second coupling elements to establish driving relation between said driving means and reels and between said gearing and spooling mechanism to operate the latter at a reduced rate relative to said reels, and engagement of said electrical coupling means with said electrical coupling element to electrically connect said translating head with said translating means; said spring means being compressed by inward movement of the outer ends of said bars when said magazine is latched to said unit, and urging such outer ends outwardly to uniformly displace said magazine from said unit upon manual release of said latching means from said latching element.

18. A magnetic sound translating system comprising a magazine containing a magnetic translating head, a pair of reels rotatably mounted at each end of said magazine for traversing a magnetic wire with respect to said translating head, spooling mechanism for feeding the wire uniformly onto and from said reels, first externally accessible mechanical coupling means operatively associated with each of said reels, second externally accessible mechanical coupling means operatively associated with said spooling mechanism, externally accessible electrical coupling means in electric circuit connection with said translating head, a latching bar slidable transversely of said magazine and having an aperture in its inner end substantially aligned with an aperture in the base of said magazine and resilient means normally urging said bar outwardly from said magazine; and a sound translating unit containing driving mechanism, including reduction gearing, and sound translating means, a first mechanical coupling element operatively associated with said driving mechanism, a second mechanical coupling element operatively associated with said reduction gearing, an electrical coupling element in circuit relation with said translating means, a pin projecting above the upper surface of said unit and having a sloping surface and a notch formed below said surface, a plurality of bars pivotally mounted in said unit and extending radially at equal angular intervals from the center thereof, the outer ends of said bars projecting upwardly through apertures in the upper surface of said unit and spring means engaging the inner ends of all of said bars; said magazine being detachably cooperative with said unit by engagement of said first and second coupling means with said first and second coupling elements to establish driving relation between said driving means and reels and between said gearing and spooling mechanism to operate the latter at a reduced rate relative to said reels, and engagement of said electrical coupling means with said electrical coupling element to electrically connect said translating head with said translating means; said pin entering the aperture in the magazine base and in said bar, and the sloping surface thereof moving said bar against said spring until said bar enters said notch to latch the magazine on the unit and said spring means being compressed by inward movement of the outer ends of said bars when said magazine is latched to said unit, and urging such outer ends outwardly to uniformly displace said magazine from said unit upon manual release of said latching bar from said notch.

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