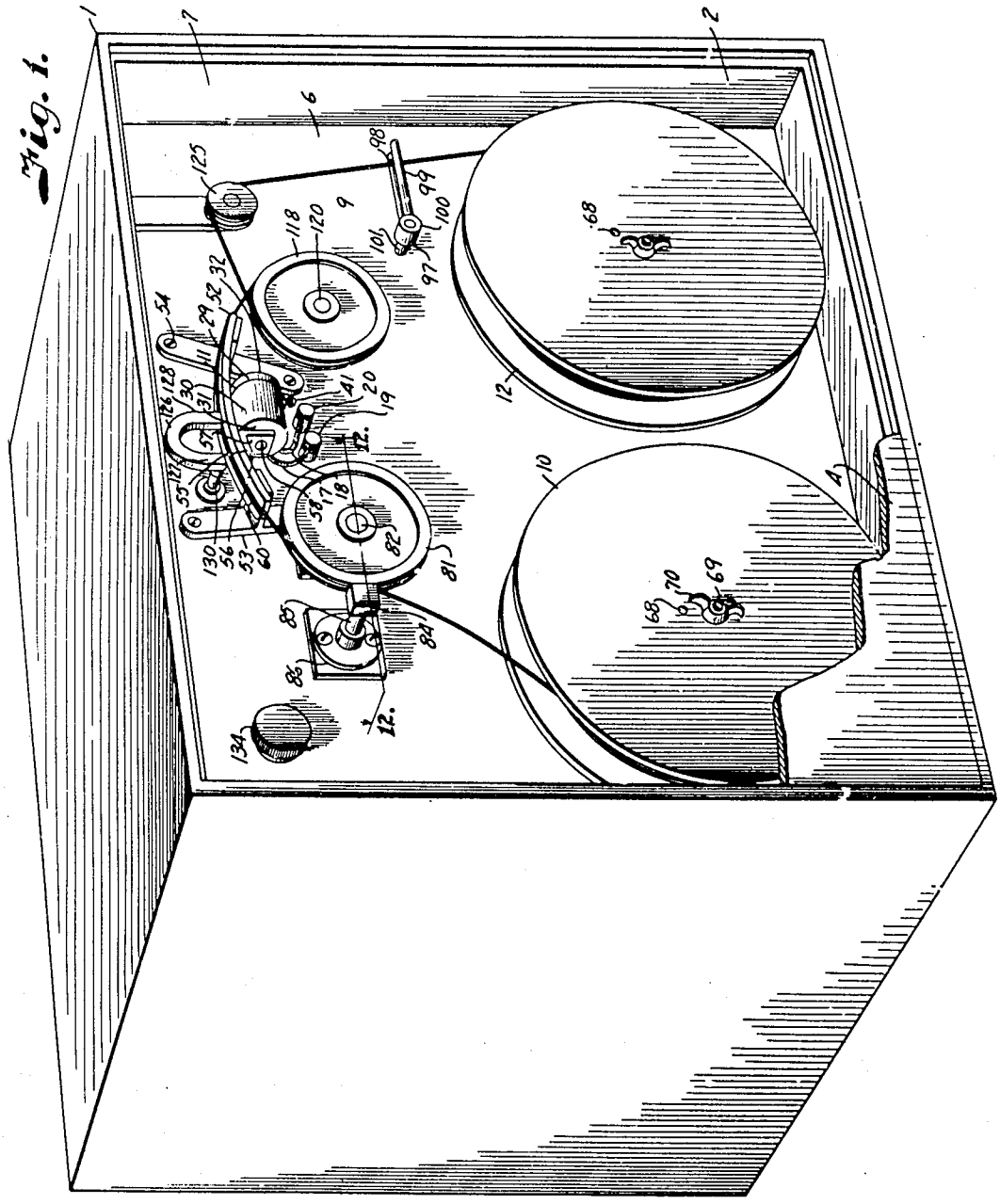
Aug. 10, 1937. T. J. MOLLOY 2,089,287

RECORDING AND REPRODUCING MECHANISM

Filed Nov. 23, 1936 4 Sheets-Sheet 1

Fig. 1.



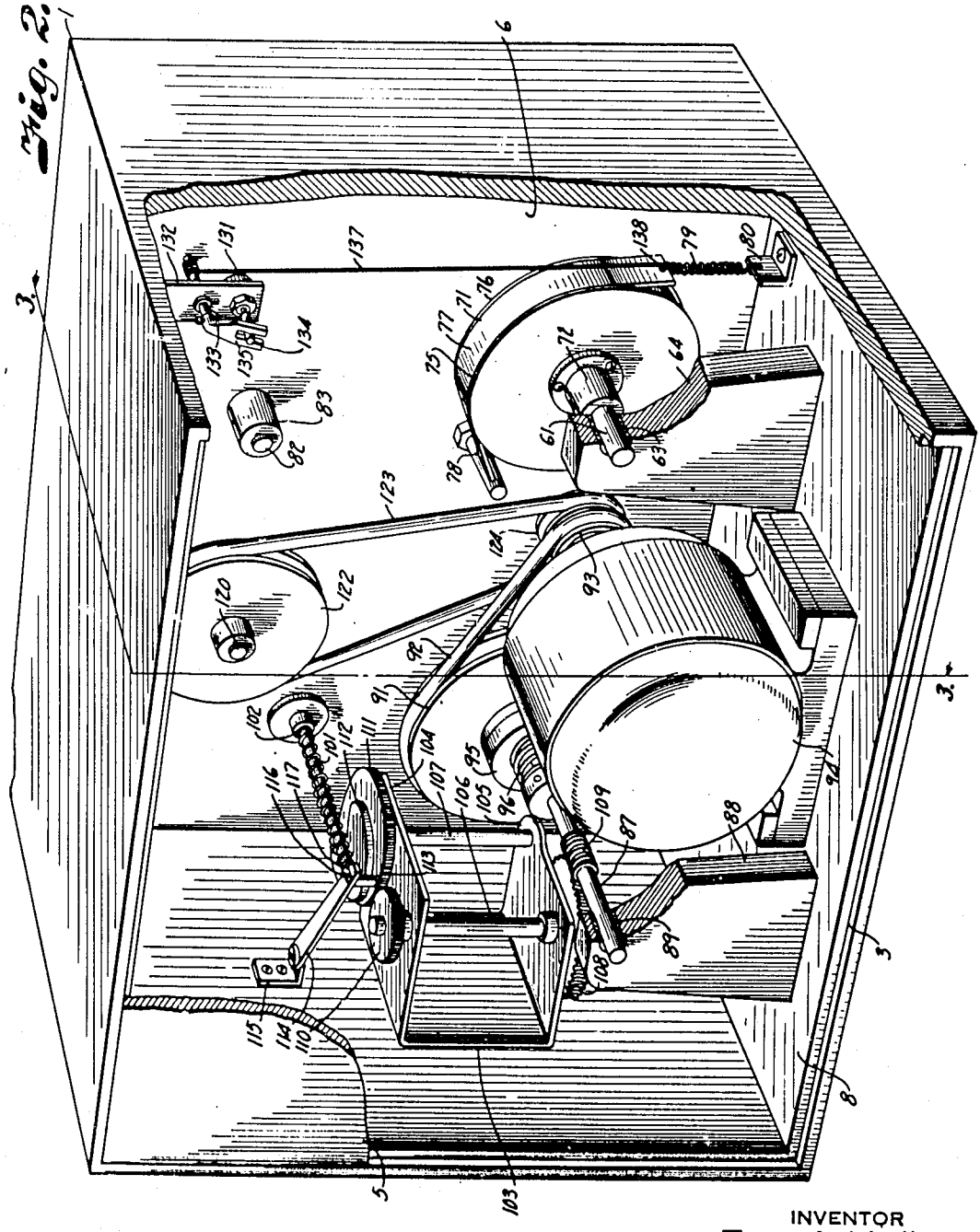
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Aug. 10, 1937. T. J. MOLLOY 2,089,287

RECORDING AND REPRODUCING MECHANISM

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Fig. 2.



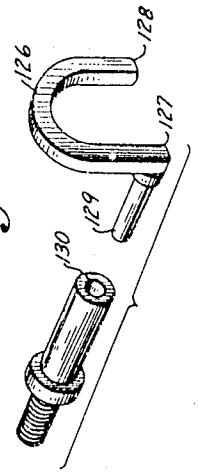
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RECORDING AND REPRODUCING MECHANISM

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Fig. 4.



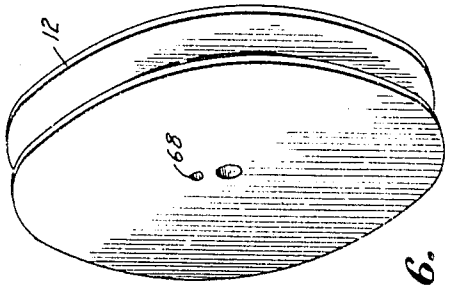


Fig. 7.

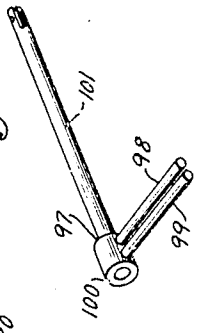


Fig. 5.

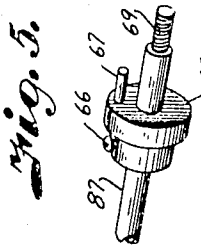


Fig. 6.

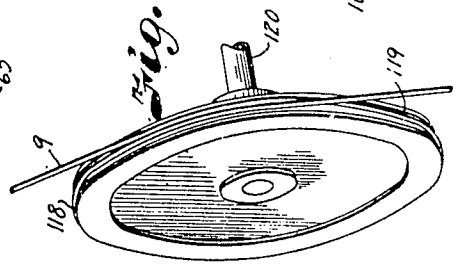
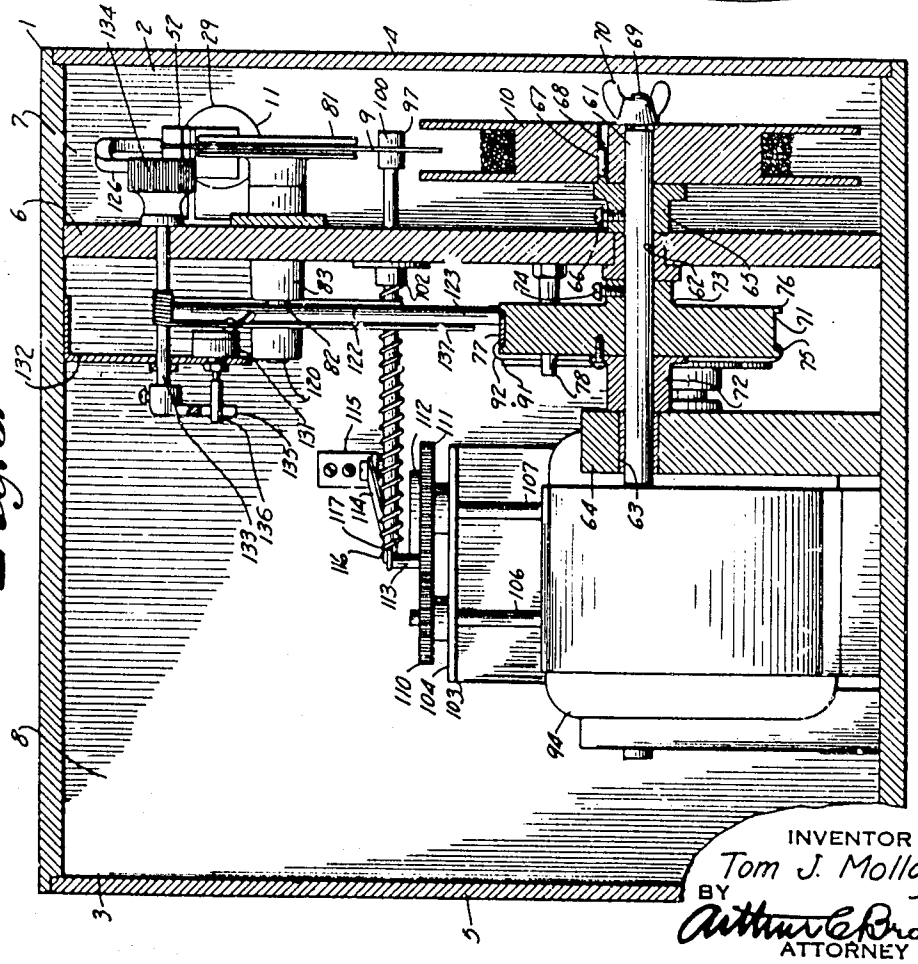


Fig. 3.



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RECORDING AND REPRODUCING MECHANISM

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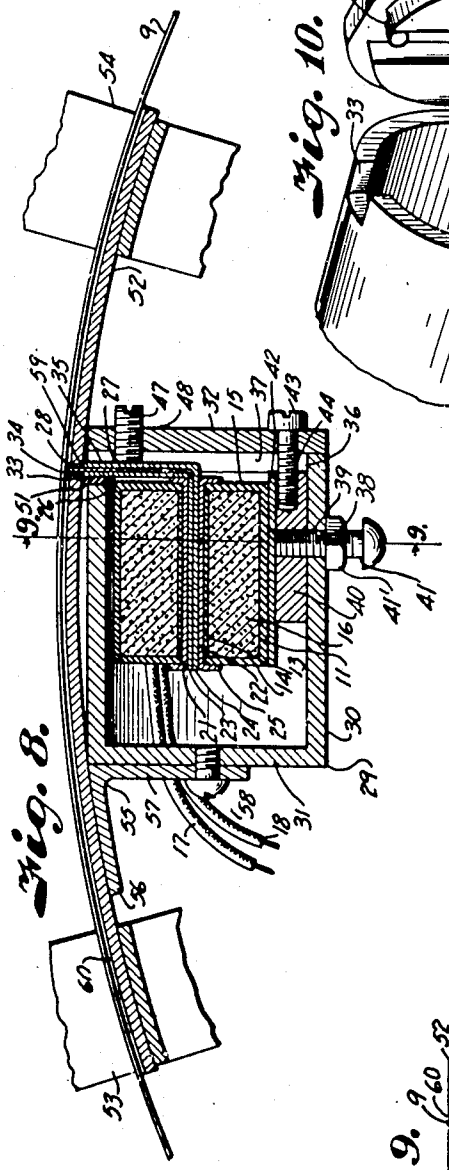


Fig. 8.

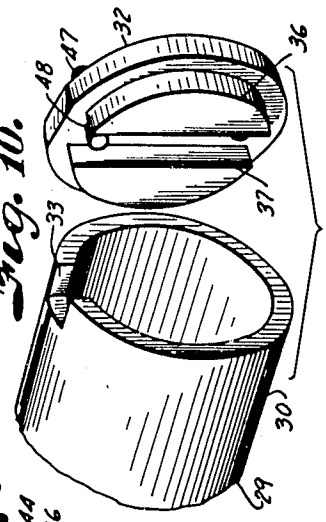


Fig. 10.

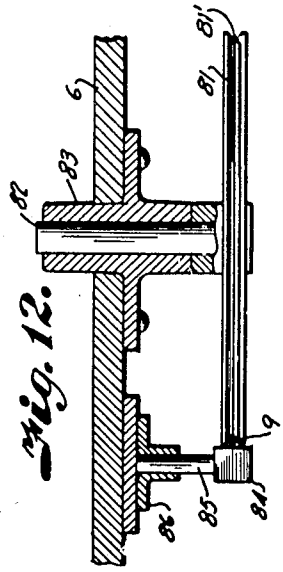


Fig. 12.

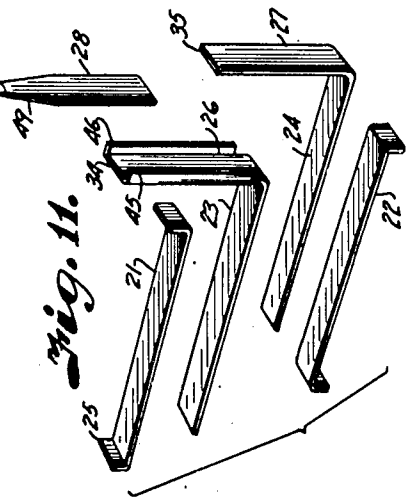


Fig. 11.

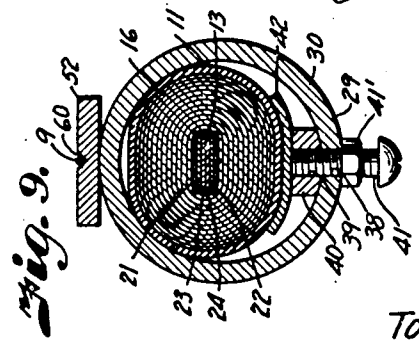


Fig. 9.

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UNITED STATES PATENT OFFICE

2,089,287

RECORDING AND REPRODUCING MECHANISM

Tom J. Molloy, Joplin, Mo.

Application November 23, 1936, Serial No. 112,267

21 Claims. (Cl. 179—100.2)

This invention relates to sound recording and reproducing apparatus and particularly to a telegraph-phone wherein translated sound vibrations, in the form of electrical current impulses, are passed through a magnetic circuit to effect magnetization of a continuously moving magnetizable element, such as a steel strand or ribbon, and wherein subsequent reproduction is effected by causing the magnetized record to induce fluctuating electrical impulses which may be translated to produce the original sound vibrations. Apparatus of this character has not come into commercial use because of failure to successfully respond to the wide range of frequencies required for satisfactorily reproducing both speech and musical renditions, particularly the latter which requires handling of most of the audible spectrum for good sound reproduction. Extremely long length of record and high speed operation necessary to produce a given recording, together with excessive disturbances caused by vibration of the record, have added to other inherent defects which make such systems of recording undesirable.

It is, therefore, the principal object of the present invention to overcome the above defects and to provide an apparatus of this character which will produce records from which sounds or signals are produced with greater degree of fidelity and naturalness.

Other important objects of the invention are to provide an electromagnet wherein the effective field thereof is confined to a limited extent; to provide for recording higher frequency ranges by registering each cycle within a limited area on the record; to provide a recording apparatus wherein the required length of the record is reduced to a minimum in proportion to the length of time required in making a recording; to provide an apparatus wherein the reproduction of background noises are minimized; and to provide support for the record whereby vibration is eliminated without subjecting the record to undue wear and which does not interfere with splices or repairs made in the record as in the case of breakage.

In accomplishing these and other objects of the invention, as hereinafter pointed out, I have provided improved details of structure, the preferred form of which is illustrated in the accompanying drawings, wherein:

Fig. 1 is a perspective view of an apparatus constructed in accordance with the present invention for recording and reproducing translated sound vibrations.

Fig. 2 is a perspective view of the apparatus as viewed from the rear, particularly illustrating the drive and control mechanisms for effecting movement of the record across the effective field of the magnet.

Fig. 3 is a cross-section through the apparatus on the line 3—3 of Fig. 2.

Fig. 4 is a detail perspective view of the magnet and its support that is used in subjecting the record to a polarizing flux and clearing it of previous magnetization, thereby permitting reuse of the record element in making a new recording.

Fig. 5 is a detail perspective view of one of the record-storing reels and its supporting shaft, particularly illustrating the driving connection therebetween.

Fig. 6 is a detail perspective view of the record driving pulley whereby constant uniform pull is imparted to the record while it is being drawn across the influencing point of the magnet.

Fig. 7 is a detail perspective view of the record guide arm for uniformly locating the lays of record across the width of the winding reel.

Fig. 8 is an enlarged detail section through the electromagnet and guide across which the record is drawn incidental to recording or reproducing sounds and signals.

Fig. 9 is a cross-section through the electromagnet on the line 9—9 of Fig. 8.

Fig. 10 is a detail perspective view of the magnet shield particularly illustrating the gap through which the point of the magnet projects into influencing relation with the record.

Fig. 11 is a detail perspective view of the parts of the electromagnet core and the magnetic point used in imparting magnetism to and from the record.

Fig. 12 is a detail section on the line 12—12 of Fig. 1.

Referring more in detail to the drawings:

1 designates a casing for enclosing a sound reproducing and recording apparatus constructed in accordance with the present invention, and which in the illustrated instance is of substantially rectangular shape, and has open sides 2 and 3 normally closed by removable panels 4 and 5. Supported in insert parallel relation with the open sides of the casing is a partition 6 to provide a reeling and recording compartment 7 and a compartment 8 for containing driving and control mechanism.

Contained in the compartment 7 is mechanism for recording translated sound waves in the form of magnetized points in a magnetic element, such as a steel strand 9, having circular cross-

section and which may have a diameter of .010 of an inch, the strand being stored upon a reel 10 and drawn over a selective portion of the field of a magnet 11 for rewinding upon a reel 12. The magnet 11 includes a laminated core 13 supporting spaced disks 14 and 15 to form a spool on which a wire 16 is wound and connected in circuit with the respective sound translating or electrical current translation apparatus (not shown) through connecting leads 17 and 18 connected with suitable binding posts 19 and 20 carried on the face side of the partition. The core of the magnet includes a plurality of laminations 21, 22, 23 and 24, the outer of which have their ends extending through openings in the disks and bent laterally as at 25 to engage the outer faces thereof in securing the assembly. The inner laminations 23 and 24 terminate at one of their ends in upwardly extending terminal portions to form jaws 26 and 27 between which a magnetizable point or pole piece 28 is anchored for influencing or scanning the wire as the case may be.

In devices of this character the field of the electromagnet has a tendency to spread out and magnetize a larger area of the record than the portion in immediate contact with the pole tip. Because of this characteristic a greater area of wire or tape is ordinarily required to register any individual cycle than would be necessary if the field were confined to an area approximating the thickness of the pole tip. A similar difficulty is encountered during the reproducing procedure from the stray fields caused by the record itself. This is due to the fact that the lines of force or magnetic fields of the magnetized portion of the record do not extend at right angles from any magnetized point but instead form curved paths which encompass a greater area than the magnetized point of the record. As a result of this condition the reproducing electromagnet is affected by a larger field area during the reproduction of any given cycle than the limited area of the magnetized record required to record the cycle and distortion caused. This condition is particularly disastrous to the higher frequencies inasmuch as each individual cycle must be registered within a very limited area thereby causing the stray fields to combine and flatten the peaks of the wave forms. The reproduction is, therefore, not sharp and natural but the sounds are somewhat muffled or flat. Such condition might be well likened to a sound film system when the knife edge ray of light which passes through the sound track is allowed to get out of focus and spread in such manner as to cause the light sensitive cell to receive the blurred images of several wave forms at one time instead of the sharp image of each separate wave as it should when the optical system is in proper adjustment.

The present invention, therefore, contemplates encasing the magnet within a shield of iron or other suitable magnetic material so constructed that only the pole tip of the magnet element remains unshielded for influencing or scanning the record as it is moved across the guide.

In the illustrated instance the magnet is enclosed in a casing 29 formed of iron and having a cylindrical wall 30 closed at one end by an integral end wall 31 and at the other by a removable cover 32 also formed of iron or similar magnetizable material. The wall 30 is provided adjacent the open end thereof with a notch or recess 33 through which the terminal upper ends 34 and 35 of the jaws 26 and 27 project in supporting the magnet tip or pole piece 28. In order to better close the joint between the cover 32 and the wall 30, the cover is provided with a substantially cylindrical boss 36 adapted to seat tightly within the inner open end of the wall 30 as clearly shown in Fig. 10, the boss 36 being provided with a transverse groove 37 to accommodate the jaws 26 and 27.

Threaded through an opening 38 in the lower portion of the wall 29 and extending through an opening 39 of a block 40 is a screw 41 adapted to engage a plate 42 which clamps the magnet against the opposite side portion of the wall. The screw, after being adjusted, is retained from rotation by a jam-nut 41'. The cover 32 is secured to the housing by a screw 43 insertable through an opening in the cover and threaded into a socket 44 formed in the block 40.

The jaw 26 is provided with side flanges 45 and 46 to engage the side edges of the magnet point 28 and prevent lateral shifting movement thereof. The jaw 27 is urged into gripping engagement with the magnetic point by means of a set screw 47 threaded in an opening 48 in the cover and having its inner end bearing against the jaw as clearly shown in Fig. 8.

The magnetic point or pole piece 28 includes a relatively thin flat piece of magnetizable metal having converging side edges 49 extending upwardly above the jaws and through the notch 33 to terminate in a knife-like edge 50 for engaging the record. The portions of the jaws extending through the notch 33 are spaced from the adjacent parts of the casing and cover 32 and the backing portion of the jaw 23 is preferably magnetically insulated from the casing by a suitable insert 51, as shown in Fig. 8, so as to prevent threading of the screw into the casing a sufficient distance to crowd the jaw 26 into magnetic contact with the casing as might be the case if the insulation were omitted.

In order to maintain the magnet in fixed relation with the record, the magnet is suspended from an arcuate shaped guide track 52 formed of non-magnetic material and having its ends supported by suitable brackets 53 and 54 from the partition 6 as illustrated in Fig. 1, the magnet being suspended from the under side of the guide by an angle-shaped bracket 55 having one leg 56 fixed to the under side of the guide and its other leg 57 secured to the end wall 31 by a screw 58 as shown in Figs. 1 and 8. The guide track is provided with an opening 59 in alignment with the notch 33 so that the magnetic point projects therethrough into engagement with the record that travels through a V-shaped groove 60 formed in the upper face of the guide track as best shown in Fig. 9. The V-shape of the groove is an important feature of the present invention, as it maintains the record in fixed definite relation with the magnetic point of the magnet. Any vibration tendency of the moving wire during passage across the magnetic point tends to introduce background noises which when reproduced cause annoying hissing or fluttering sounds which may reach such proportions to exceed the volume of the signals and cause sufficient distortion to render the apparatus impractical, but with the V-shaped groove and arcuate track the wire moves smoothly across the track, always centered within the base of the groove to eliminate vibration tendency. This form of groove is also important as it does not interfere with splices or repairs made in the wire in case of breakage since there is no chance for the splices to become

caught or jammed within the guide to cause further breakage and interrupt service of the machine.

The reel 10 storing the wire is mounted upon a shaft 61 rotatably carried in a bearing 62 in the partition and in a bushing 63 carried in a bearing bracket 64 supported within the compartment 8. An end of the shaft projects into the compartment 7 for mounting a collar 65 that is fixed to the shaft by a set screw 66. The shaft projects from the collar a sufficient distance to provide support for the reel 10 and is fixed in driving relation with the reel by means of a pin 67 projecting from the face of the collar and engaging in an opening 68 extending through the reel as best illustrated in Fig. 3. The shaft is provided with a reduced threaded portion 69 for mounting a thumb nut 70 to retain the reel. A braking action is applied to the shaft to prevent free rotation of the reel. This is accomplished by providing a brake drum 71 mounted on the shaft between the partition and the bearing bracket 64 as best illustrated in Fig. 3. The drum includes hub portions 72 and 73, one of which is provided with a set screw 74 adapted to engage against the shaft. The periphery of the brake drum has spaced flanges 75 and 76 for guidingly retaining a brake band 77 in braking relation with the drum. One end of the brake band is anchored to a stud 78 projecting inwardly from the partition 6 while the other end extends over the face of the brake drum and is secured to one end of a coil spring 79 having its opposite end engaged with an anchoring bracket 80 fixed to the floor of the casing. The wire, upon being withdrawn from the reel, is guided relative to the track by extending it over a pulley 81 having a peripheral V-shaped groove for the wire. The pulley 81 is rotatably mounted on a stub shaft 82 carried in a bearing 83 on the partition 6. The wire is retained on the pulley by a block 84 bridging the groove therein and which is supported on a rod 85 carried by an attaching flange 86 secured to the face of the partition 6, as best shown in Fig. 1.

The winding reel 12 is fixed to its shaft 87 by a collar similar to that described in connection with the reel 10 so that driving of the shaft effects rotation of the reel to wind the wire thereon. The shaft 87 is mounted in a bearing in the partition and in a bushing 89 provided in the bearing bracket 88 spaced from the partition and supported on the floor of the casing, as best shown in Fig. 2. Rotatable on the shaft within the compartment 8 is a pulley 91 having a peripheral groove for receiving a driving belt 92 operating over a drive pulley 93 on the armature shaft of a motor 94 also carried in the compartment 8, and having its base anchored to the floor of the casing. The pulley 91 is frictionally driven by a plate 95 slidingly keyed upon the shaft and pressed against the side face of the pulley by a spring 96.

In order to wind the wire uniformly upon the reel 12 I provide a guide device 97 consisting of spaced arms 98 and 99 engaging the respective sides of the strand at a point above the reel, the arms being attached to a head 100 that is carried on a shaft 101 adapted to reciprocate through a bushing 102 in the partition. The shaft is reciprocated to move the guide arm back and forth across the width of the reel by means of a reciprocating mechanism now to be described.

Fixed on a side wall of the casing within the compartment 3 is a bracket 103 having laterally extending plate portions 104 and 105 providing support for parallel vertical shafts 106 and 107, the shaft 106 having a worm wheel 108 fixed to its lower end and meshing with a worm 109 fixed to the shaft 87. The upper end of the shaft 106 carries a pinion gear 110 meshing with a gear 111 fixed to the shaft 107. Fixed to the gear 111 is a heart-shaped cam 112 engageable with a depending pin 115 on an arm 114 that is pivotally mounted on a bracket 113 fixed to the wall of the casing at a point above the shaft 101. The inner end of the shaft 101 is slotted to engage over the outer end of the arm 114 and is pivotally connected thereto by a pin 116. The cam is located on the gear 111 so that it reciprocates the shaft 101 to carry the guide arms back and forth across the width of the winding reel to effect winding of the strand in smooth even lays across the width of the reel. The pin 113 is retained against the periphery of the cam by a coil spring having one end anchored to the bushing 102 and its other end hooked to the shaft 101 as at 117, so that the tension of the spring draws the pin into constant engagement with the edge of the cam.

If the wire were drawn across the magnet point by the winding force of the reel 10 any ineffectiveness of the guiding mechanism would cause the wire to pile up in slightly uneven layers, and the unevenness would gradually build up as additional wire is wound until a point is reached where the guiding mechanism would become partially ineffective and the motion of the wire across the magnetic point would become jerky. This condition would be aggravated when the record is being drawn from a supply reel upon which it had been unevenly wound. The effect of this jerking movement of the wire is to cause not only a certain amount of vibration in the moving wire as its tension is momentarily varied, but also creates distortion during reproduction. I therefore provide a driving pulley 118 on the delivery side of the arcuate track having a V-shaped groove 119 about which the wire is completely looped before threading it between the guiding arms 98 and 99. A sufficient contact area of the wire is therefore provided with the pulley 118 so as to prevent slippage and the pulley 118 is driven at constant speed from the motor 94. This is accomplished by mounting the pulley on a driven shaft 120 that is rotatably mounted in a bearing in the partition and carries a driving pulley 122 fixed to the end of the shaft that projects into the compartment 8.

Operating over the pulley 122 is a drive belt 123 running over a second pulley 124 fixed to the armature shaft of the motor alongside of the pulley 93 previously described. It is thus obvious that the pulley 118 is positively driven to move the wire across the magnetic point or pole piece at constant speed so as to maintain uniform tension thereon and prevent any tendency for the wire to vibrate incidental to variable tractive forces acting thereon. It is also obvious that the wire is moved at constant speed across the magnetic point regardless of any variation in take-up of the wire incidental to build-up of wire on the winding reel. As the wire builds up on the winding reel the friction drive through the plate 95 permits sufficient slippage to compensate for the increasing diameter of the coil of the wire.

When a record is being produced it is desirable to prevent contact of the portion of the wire moving onto the pulley from contacting the portion moving therefrom for the reason that the magnetism has not become fixed, and any contact of

adjacent portions of the magnetized wire will affect the recordings thereon, resulting in cross talk or echo effects during reproduction. Therefore, at the time a record is to be made, the wire passing from the pulley 118 is threaded over an idler pulley 125 which is sufficiently out of line to prevent any contact that would produce this effect. This action does not take place within the turns on reel 12 for the reason that the flux has had sufficient time to drop to its minimum strength by the time a magnetized section of the wire reaches the reel, therefore no influence is imparted to the adjacent turns.

In making a record from a new wire, and particularly when it is desired to make a second record on a used wire, I provide means for subjecting the wire to a polarizing flux and to clear it of any previous magnetization while a new record is being made. This is accomplished by a small permanent magnet 126 having substantially U-shape and supported with its pole pieces 127 and 128 directed over the guide track in the path of the wire as it is moved across the magnetic point of the electromagnet. In the present instance the pole 127 of the magnet is provided with a laterally extending bar 129 that is pivotally mounted in a socket 130 carried by the partition 6, as best shown in Figs. 1 and 4. The pole faces of the magnet need not come into actual contact with the record as it is only necessary to provide sufficient flux to cause the correct amount of polarization for the desired registration and thereby eliminate wear and noises as would result if the pole pieces bore heavily on the wire.

The motor 94 is preferably energized by means of a toggle switch 131 that is mounted on a bracket 132 and operated by a shaft 133 which is rotatably carried in bearing openings in the bracket and partition respectively. The shaft is rotated by a knob 134 and has a slotted crank arm 135 connectingly engaging the operating shaft 136 of the toggle switch 131. Wound on the shaft 133 is one end of a cable 137 having its other end 138 connected with the spring 79. Thus when the switch is operated to energize the motor sufficient cable is wound on the shaft 133 to release tension of the spring acting on the brake band and thereby release sufficient braking pressure on the drum to allow rotation of the reel 10. However, sufficient tension is maintained by the spring 79 to apply the required amount of braking force to prevent free unwinding of the reel.

In using an apparatus constructed and assembled as described for making a record, the terminals 19 and 20 are connected with a suitable apparatus for translating sound vibrations to variable frequencies in an electric circuit which then includes the terminals 19 and 20 so that current is passed through the coil of the magnet to energize the core 13 and pole piece 28. The portion of the pole piece extending through the field and opening in the arcuate guide sets up a limited and controlled field in the path of a wire moving through the guide, the effective field being substantially only the width of the pole piece. The wire on which the record is to be made is wound on the reel 10 and the reel slipped on its shaft, after which the thumb nut is applied to secure the reel. The wire is then threaded between the block 84 and the groove of the pulley 81 across the arcuate guide, so that it seats in the bottom of the V-shaped groove thereof and then once around the groove of the pulley 118. The wire is then passed between the guide arms 98 and 99 and secured to the hub portion of the reel 12. The motor is then energized by operating the switch which simultaneously releases the brake band sufficiently to permit turning of the reel 10.

An important feature of the machine is the fact that it is not necessary to run the record entirely through to its end in order to thread it through the driving mechanism. A recording may begin at any point throughout the length of the wire and then may be rewound and reproduced without disturbing previously made records which may be carried upon other sections of the wire.

Driving of the motor actuates the pulley 118 to draw the wire through the track and across the tip of the pole piece so that the fluctuating current in the coil sets up a corresponding field about the pole piece to magnetize points in the wire. The magnet 126 is inserted in a socket 130 so that the poles 127 and 128 thereof are carried directly above the wire to polarize it and to neutralize any magnetic effects that occur in the wire previous to passage of the wire across the tip of the electromagnet. The reel 12 is also driven through the slip clutch connection with the pulley 91 to take up the portion of the record wire on which the recordings are made. The guide arms 98 and 99 are reciprocated back and forth across the width of the reel incidental to the cam and driving mechanism including the gears 108, 109, 110 and 111 to wind the wire in uniform layers on the reel 12. After the record has been made the wire is rewound by interchanging the position of the reels 10 and 12 on the shafts 61 and 87. The wire is then caused to travel directly from reel 12 to reel 10 without subjecting it to the control of the guiding mechanism which is not required during the rewinding procedure. The pull exerted by reel 10 keeps the wire taut and causes each of the turns to travel directly from its position on reel 12 to a relative point on reel 10 resulting in substantially smooth, even layers. The wire actually guides itself back and forth across the reels as the various turns are rewound. Rewinding is accomplished in a fraction of the time required for recording due to the fact that the wire is not subjected to the controlling action of driving pulley 118, consequently no slippage occurs in the friction drive plate 95 and the motor drives the winding reel at maximum speed. The magnet 126 is then removed and the wire bearing the magnetic record is threaded in the same manner as above described, so that when the motor is set in operation the wire will be drawn through the groove and across the tip of the pole piece. The terminals 19 and 20 are disconnected from the translating equipment and connected with a sound amplifier wherein electric frequencies are translated to audible sounds. The passage of the magnetized points of the record across the tip of the pole piece sets up varying electrical impulses in the electromagnet and these impulses in turn are amplified and converted into sound impulses by suitable translating equipment. Since the field of the magnetic tip is limited as above described, the reproduced sounds have the same quality as the sounds previously recorded.

From the foregoing it is obvious that I have provided a simple and relatively inexpensive apparatus wherein sounds and signals may be recorded and reproduced on a strand-like record with a greater degree of fidelity and naturalness, compared with the original sounds, and that the

limited field of the electromagnet tip influences only a limited area on the record so that it is not necessary to move the record at excessive speeds that result in extraneous noises usually resulting in the present type of recordings.

What I claim and desire to secure by Letters Patent is:

1. In an apparatus of the character described, in combination with a magnetic record element, an electromagnet including a pole piece having a face portion, means for supporting the electromagnet with the face portion of the pole piece in influencing relation with said record element, means for confining the effective field of the pole piece to said face portion, and means for moving said record element relatively to said face portion.

2. In an apparatus of the character described, means for guiding a magnetic element for movement through a fixed path, an electromagnet having a pole piece projecting into contacting relation with said element moved across said guide means, and shielding means for said electromagnet including said pole piece for limiting the effective magnetic field to the immediate locality of the contacting portion of said pole piece.

3. In an apparatus of the character described, a guide having a groove for guiding an elongated record member, an electromagnet having a pole piece projecting into contacting relation with said record member moved through said groove, and shielding means for said electromagnet including said pole piece for limiting the effective magnetic field to the immediate locality of the contacting portion of said pole piece.

4. In an apparatus of the character described, a guide having a groove for guiding an elongated record member of the type described, an electromagnet having a pole piece projecting into contacting relation with said record member moved through said groove, shielding means for said electromagnet including said pole piece for limiting the effective magnetic field to the immediate locality of the contacting portion of said pole piece, a traction member having a groove encircled by said record member, and means for driving the traction member to draw the record member through said guide groove.

5. In an apparatus of the character described, a guide having a V shaped groove for guiding a continuous magnetic element, an electromagnet having a pole piece projecting into contacting relation with said element moved through said groove, shielding means for said electromagnet including said pole piece for limiting the effective magnetic field to the immediate locality of the contacting portion of said pole piece, a traction member having a groove encircled by said element, and means for driving the traction member to draw the magnetic element through said guide groove.

6. In an apparatus of the character described, a guide having a groove for guiding a continuous magnetic metal record element, an electromagnet having a pole piece projecting into contacting relation with said element moved through said groove, shielding means for said electromagnet including said pole piece for limiting the effective magnetic field to the immediate locality of the contacting portion of said pole piece, a traction member having a groove encircled by said element, means for driving the traction member to draw said element through said guide groove, and means for maintaining substantially constant tension on said element.

7. In an apparatus of the character described, in combination with a magnetic record element, an electromagnet including a pole piece having a face portion, means for supporting the electromagnet with the face portion of the pole piece in influencing relation with said record element, means for confining the effective field of the pole piece to said face portion, means for moving said record element relatively to said face portion, and means for polarizing and neutralizing magnetism in said element.

8. In an apparatus of the character described, a guide having a groove for guiding a continuous magnetic metal record element, an electromagnet having a pole piece projecting into contacting relation with said element moved through the groove, shielding means for said electromagnet including said pole piece for limiting the effective magnetic field to the immediate locality of the contacting portion of said pole piece, and a magnet supported above said guide at a point spaced from said contact point of the pole piece to polarize and neutralize magnetization in said record element prior to contact thereof with said pole piece.

9. In an apparatus of the character described, a guide having a groove for guiding a continuous magnetic element, an electromagnet having a pole piece projecting into contacting relation with said element moved through the groove, shielding means for said electromagnet including said pole piece for limiting the effective magnetic field to the immediate locality of the tip of said pole piece, and a magnet supported in the field of said element at a point spaced from said contact point of the pole piece to polarize and neutralize magnetization in said element prior to contact thereof with said pole piece.

10. In an apparatus of the character described, a curved guide having a V shaped groove for guiding a magnetic metal record element, an electromagnet having a pole piece projecting into contacting relation with said element moved through the groove, and shielding means for said electromagnet including said pole piece for limiting the effective magnetic field to the immediate locality of the contacting portion of said pole piece.

11. In an apparatus of the character described, means for passing a magnetic metal strand through a fixed path, an electromagnet, means supporting the electromagnet with a selected portion of the field of said electromagnet in the path of said strand, and means for shielding the remainder of said field from the said strand.

12. In an apparatus of the character described, means for passing a magnetic metal record element through a fixed path, an electromagnet, means supporting the electromagnet with a selected portion of the field of said electromagnet in the path of said record element, means for shielding the remainder of said field from the said record element, and means for removing magnetism from said record element.

13. In an apparatus of the character described, an arcuate guide having a V-shaped groove to form a track for guiding a magnetic metal strand, a reel for storing the strand, a reel for winding the strand, means for applying a braking force to the storage reel, means for rotating the winding reel, a driving pulley having a groove for accommodating a loop in said strand to provide driving contact between the pulley and said strand, means supporting the pulley at the delivery end of the track, means for driving the pulley, means for adjusting lays of the strand

on the winding reel, and means for supporting the adjusting means intermediate the driving pulley and said winding reel.

14. In an apparatus of the character described, an electromagnet including a core, a winding on said core, means connected with the core forming spaced jaws, a shield for said electromagnet having an opening in registry with said jaws, and a removable pole piece engaged between said jaws and having a tip projecting through said opening to influence a magnetic metal record moved across said tip.

15. In an apparatus of the character described, an electromagnet including a laminated core, a winding on said core, means forming spaced jaws on a pair of said laminations, a shield for said electromagnet having an opening in registry with said jaws, and a removable pole piece engaged between said jaws and having a tip projecting through said opening to influence a magnetic metal record moved across said tip.

16. In an apparatus of the character described, an electromagnet including a laminated core, a winding on said core, means forming spaced jaws on a pair of said laminations, a shield for said electromagnet having an opening in registry with said jaws, a removable pole piece engaged between said jaws and having a tip projecting through said opening to influence a magnetic metal strand moved across said tip, and threaded means carried by the shield for effecting clamping engagement of said jaws to secure the pole piece.

17. In an apparatus of the character described, an electromagnet including a laminated core, a winding on said core, means forming spaced jaws on a pair of said laminations, a shield for said electromagnet having an opening in registry with said jaws, a removable pole piece engaged between said jaws and having a tip projecting through said opening to influence a magnetic metal strand moved across said tip, and means supporting the electromagnet in said shield.

18. In an apparatus of the character described, an arcuate guide having a V-shaped groove and provided with an opening, an electromagnet including a laminated core, a winding on said core, means forming spaced jaws on a pair of said laminations, a shield for said electromagnet suspended below said guide and having an opening in registry with the jaws and guide opening, and a removable pole piece engaged between said jaws and having a tip projecting through said registering openings to influence a metal strand moved across said tip and through the V-shaped groove of the guide.

19. In an apparatus of the character described, an electromagnet including a core, a winding on said core, means connected with the core forming spaced jaws, a shield for said electromagnet having an opening in registry with said jaws, a removable pole piece engaged between said jaws and having a tip projecting through said opening, and means for moving a magnetic record across the tip of the pole piece to induce a fluctuating magnetism in the pole piece for effecting a variable electrical potential in said winding.

20. In an apparatus of the character described, an electromagnet casing forming an electromagnetic shield and having an opening, an electromagnet enclosed in said casing and having a pole piece projecting through said opening whereby the effective field of the electromagnet is confined to the portion of the pole piece projecting through said opening, and means for moving a magnetic element across said opening in contacting relation with the pole piece.

21. In an apparatus of the character described, an electromagnet casing forming an electromagnetic shield and having an opening, an electromagnet enclosed in said casing and having a pole piece projecting through said opening whereby the effective field of the electromagnet is confined to the portion of the pole piece projecting through said opening, means for moving a magnetic element across said opening in contacting relation with the pole piece, and means for uniformly magnetizing said moving magnetic element.

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