

Oct. 28, 1947.

H. A. VAGTBORG ET AL
MAGNETIC RECORDING DEVICE

2,429,703

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2 Sheets-Sheet 1

Fig. 1.

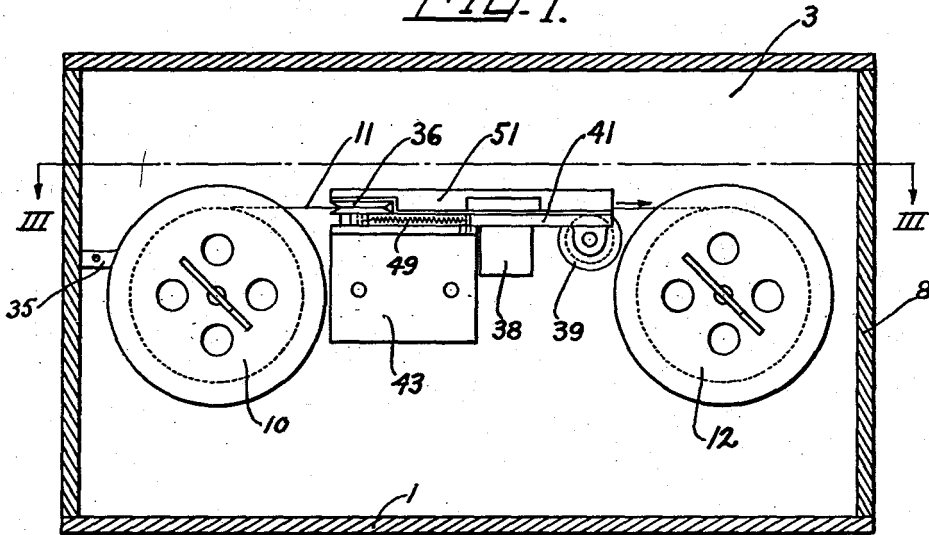
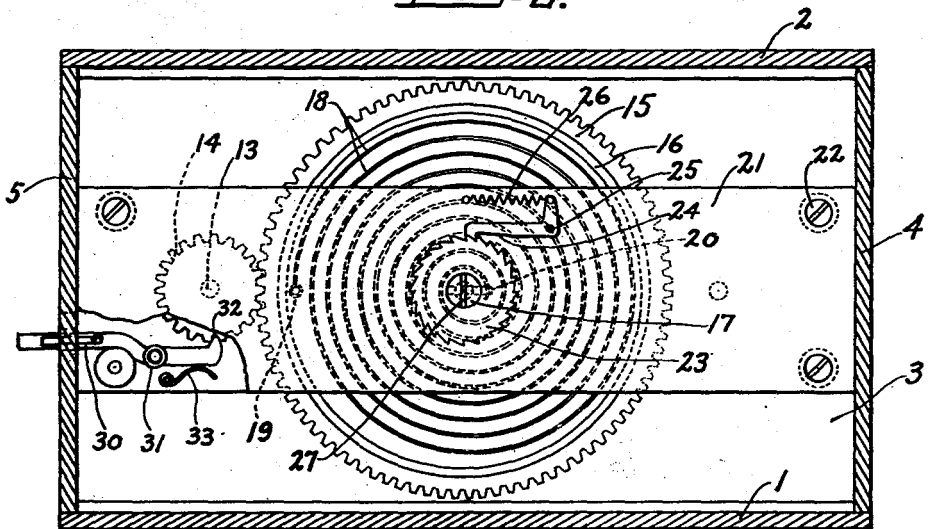


Fig. 2.



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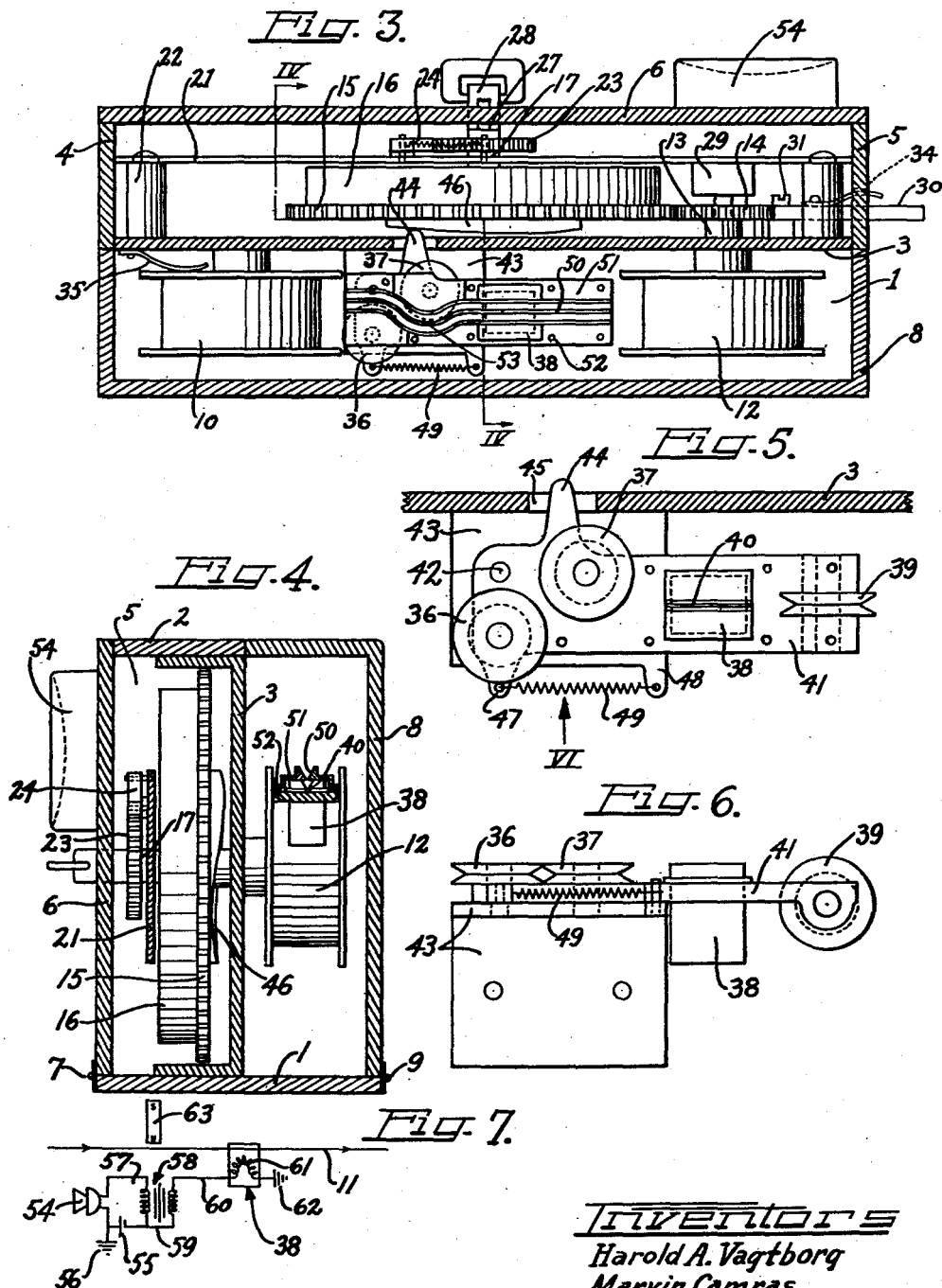
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UNITED STATES PATENT OFFICE

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MAGNETIC RECORDING DEVICE

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This invention relates to improvements in a magnetic recording device, wherein a sound recording, such for example as the human voice, may be made by magnetizing an elongated traveling recording medium in the form of a paramagnetic tape, paramagnetic wire, or the equivalent.

We are aware that in the past many and various types of magnetic recording devices have been developed, and in these devices a magnetic recording is made by successively magnetizing increments of the traveling recording medium. However, insofar as we are aware, not any of these previously known devices have been both portable to an ultimate degree and wholly self-energizing, that is, having embodied therein everything necessary for satisfactory and efficient operation.

Under certain circumstances and conditions it is highly desirable to have a magnetic recorder which requires no outside connections of any kind, and which is sufficiently portable to be carried in a pocket or knapsack on the person so as to be available for instant usage regardless of the locality of the bearer. A device of such character would be extremely convenient for use by a military officer or other person on inspection duty whereby comments, orders, suggestions, information, etc. would be immediately dictated by such officer or person for later reproduction and transcription. Such a device would also be extremely convenient for recognizance duty, enabling the recognizance man to directly dictate reports at the instant he makes observation, and for many other military and civilian duties, providing a record of events or observations which is substantially indestructible unless intentionally ruined, and which, if lost, is of little value to the finder unless the finder has adequate apparatus to reproduce the recording.

With the foregoing in mind, it is an important object of the instant invention to provide a self-sufficient magnetic recording device which is of such small size as to be carried within a pocket of the user, and which requires no outside connections or other apparatus in order to operate conveniently and efficiently.

Another object of the invention is the provision of a compact magnetic recording device which embodies its own power supply and which will perform efficiently without the aid of any connections to outside apparatus.

It is also an object of this invention to provide a magnetic recording device especially arranged to handle a scramble-wound recording medium,

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eliminating the necessity of rewinding such scramble-wound medium before it is used in connection with the present invention.

Also a feature of the invention resides in the provision of a magnetic recording device having guide means to provide for the very facile insertion of the recording medium in position to have a record placed thereon by way of magnetization.

Another feature of the invention resides in the provision of a light weight compact, highly portable magnetic recording device equipped with means not only for the purpose of magnetizing the traveling recording medium in accordance with sound being recorded, but also equipped with means to condition such medium prior to a new recording being placed thereon, thus eliminating the necessity of a separate operation to demagnetize and rewind a recording medium before it is used again on the instant recording device.

Still another object of the invention resides in the provision of a highly portable, light weight magnetic recording device arranged for one hand support and operation during its use.

A further object of the invention resides in the provision of a highly compact readily portable magnetic recording device including its own permanently attached sound pick-up element, eliminating the necessity of the operator carrying any additional or spare parts for the device, with the possible exception of an extra spool of recording medium in the event a longer than usual recording is contemplated.

Still a further object of the instant invention is the provision of a highly portable and compact magnetic recording device which is self-sufficient, even to the extent of having its own speed control, means to prevent over-run of the supply spool of the recording medium, and provided with simple stop mechanism to control the operation of the device.

It is also an object of this invention to provide a highly portable, compact and self-sufficient magnetic recording device wherein a recording is made by successively magnetizing a traveling recording medium, the device being equipped with a spring motor for operating the mechanism to move the recording medium.

While some of the more salient features, characteristics and advantages of the instant invention have been above pointed out, others will become apparent from the following disclosures, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a vertical sectional view taken

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through the front part of the casing of a magnetic recording device embodying principles of the instant invention, illustrating salient parts of the device in elevation.

Figure 2 is a vertical sectional view taken through the rear portion of the casing of the recording device seen in Figure 1, illustrating salient parts of the device in elevation.

Figure 3 is plan sectional view of the device of Figures 1 and 2, taken substantially as indicated by the section line III—III of Figure 1, looking in the direction of the arrows;

Figure 4 is a transverse vertical sectional view taken substantially as indicated by the staggered line IV—IV of Figure 3, with certain parts shown in elevation for clarity;

Figure 5 is a fragmentary enlargement of the structure seen in the lower central portion of Figure 3, with the guiding means for the insertion of the recording medium removed;

Figure 6 is a front elevational view of the structure seen in Figure 5; and

Figure 7 is a simplified schematic diagram showing a satisfactory electrical hook-up for the instant invention.

As shown on the drawings:

In Figures 1 to 6 of the drawings, the mechanical features of the illustrated embodiment of this invention are shown, the electrical connections being omitted, as well as certain parts of apparatus embodied in the electrical hook-up such as a battery, transformer, etc. It will be understood that the electrical connections as well as such apparatus as may be embodied exclusively in the electrical circuit are disposed within the casing containing the mechanical parts illustrated in Figures 1 to 6 inclusive in any suitable location not occupied by other apparatus. The salient elements of the electrical circuit are indicated in simplified schematic form in Figure 7 of the drawings.

In the illustrated embodiment of this invention there is shown a casing or a closure for the mechanism, which casing completely surrounds and protects all of the mechanism with the single exception of certain protruding parts necessary for access in order to control the operation of the device. The casing, as best seen in Figure 4, includes a bottom 1, a top 2 of substantially half the size of the bottom, and an inner channel shaped partition 3 fixedly attached to both the top and the bottom. End walls 4 and 5 of substantially the same width as the top 2 may be integral or attached to the bottom 1 and top 2 to form a box-like construction closed on one side by the partition 3 and on the other side by a back cover 6 pivoted to the bottom as indicated at 7. On the opposite side of the partition 3, the complete closure is made by a box-like front cover 8 pivoted as indicated at 9 on the bottom member 1. It is therefore apparent that when the cover 8 and back panel 6 are swung downwardly, all of the apparatus contained within the casing on both sides of the partition 3 is readily available for attention. Any suitable form of latching or locking means may be used to hold the back and front covers of the casing in closed position.

Mounted on the partition 3 near one end thereof and inside the front compartment of the casing is a reel or spool 10 which functions as a supply spool, carrying a supply of recording medium which in the illustrated instance is in the form of a fine round wire 11. This reel 10 is

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mounted on a suitable stub shaft, which engages the partition 3, for free rotation.

Near the opposite end of the panel 3 is a similar reel or spool 12 which functions as a pick-up or receiving reel upon which the recording medium is wound after it has been magnetized in accordance with the particular sounds to be recorded. During its travel from the spool 10 to the spool 12, the recording medium 11 may be both cleaned and magnetized again in accordance with a newly desired sound record. After the recording medium has been wound on the spool 12, it is a simple expedient to remove this spool, place the spool 10 in the position of spool 12, and insert a new supply spool in the position formerly occupied by spool 10.

The spool 12 is a driven spool and is mounted on the end of a driven shaft 13 extending through the partition 3. This shaft carries a gear 14 in the rear compartment of the casing which is enmeshed with a considerably larger gear 15 fixed to a rotatable spring housing 16 floating on a shaft 17. As best seen in Figure 2, a flat spring 18 is coiled within the housing 16, one end of the spring being anchored to the housing 16 as indicated at 19, and the other end of the spring being anchored to the shaft 17 as indicated at 20.

The shaft 17 extends rearwardly to a vertically disposed support 21 carried by the partition 3 with the aid of a plurality of bolt and spacer sleeve connections 22, as seen clearly in Figure 3. On the rear side of the support 21 the shaft 17 has a ratchet wheel 23 keyed thereto. This ratchet wheel is engaged by a bell crank pawl 24 pivoted as indicated at 25 to the support 21, and maintained in engagement with the ratchet wheel by a tension spring 26, as clearly seen in Figure 2. Thus, the shaft 17 is prevented from turning by action of the spring 18, and when the spring is wound, the opposite end of the spring namely, the point of attachment 19 with the spring housing, is the only one free to move, and so the spring housing, together with the gear 15, is rotated as the spring tends to unwind. With reference again to Figure 2, it will be seen that the exposed end of the shaft 17 is provided with a diametral rib 27 and, as seen best in Figure 3, a key 28 having a complementary end configuration may be inserted through an aperture in the back panel 6 into engagement with the shaft 17 for winding up the spring.

Of course, rotation of the spring housing 16 together with the gear 15 causes rotation in the opposite direction of the gear 14 and likewise the shaft 13 carrying the take-up spool 12. To maintain substantially constant speed of the spool 12 during operation, the rearwardly extending end of the shaft is provided with a suitable governing arrangement generally indicated by numeral 29 in Figure 3 which may be in the form of a friction brake or any equivalent structure, details of which are not necessary to illustrate herein.

The start and stop control for the magnetic recording device is best seen in Figures 2 and 3. With reference to these figures it will be noted that a lever 30 projects through a suitable opening in the end wall 5 of the casing, and this lever is pivoted to the aforesaid partition 3 as indicated at 31. The inner end of the lever is shaped for engagement between adjacent teeth of the gear 14 as indicated at 32 in Figure 2, so that when such engagement is established, the lever effectively prevents rotation of the gear 14 and likewise the gear 15 and spring housing 16. In order

to prevent accidental or unintentional operation of the device, a spring element 33 mounted on the partition 3 constantly urges the lever toward engagement with the gear 14. When it is desired to permit operation of the device, it is a simple expedient to move the lever 31 with the finger or thumb against the action of the spring 33 and lock the lever in a notch 34 (Figure 3) in the casing wall adjacent the slot through which the lever extends. A simple flick of the finger or thumb will then release the lever from the notch, and the spring 33 will return the inner end 32 of the lever into engagement with the gear 14 and not only stop but hold the device in stop position. If desired, a suitable switch for energizing the electrical circuit embodied in the invention may be incorporated with this lever, so that the switch will be closed when the lever is moved to running position, and the switch will automatically be opened when the lever is moved to stop position.

In view of the fact that a sudden stopping of operation may permit a slight over-run or coasting of the supply spool 10 so as to provide some slack in the wire immediately following the cessation of operation, a leaf spring 35 is mounted on the inner partition 3 in a manner to constantly bear against the inner side surface of the spool 10, as seen clearly in Figure 3, to thereby provide sufficient braking action to prevent over-run or coasting of the spool 10, but not sufficient braking action to interfere with normal operation of the device.

Now with reference to Figures 5 and 6, it will be seen that the wire 11 in traveling from the reel 10 to the reel 12 first passes between a horizontally disposed pulley 36 and a horizontally disposed pulley 37, then through the upper portion of a magnetic recording head 38, and over a vertically disposed pulley 39 to the reel 12. The pulleys 36 and 37 are staggered with respect to the desired path of travel of the wire 11, but it will be noted with reference to Figure 5 that the bottoms of the grooves in these two pulleys are in alignment with a groove 40 in the magnetic recording head 38 through which groove the wire must pass. This groove 40 is also in direct alignment with the upper point in the bottom of the groove of the vertically disposed pulley 39. Consequently, if the spool 10 contains a supply of scramble-wound wire, that is, wire that was wound haphazardly upon the spool with little or no level winding attempt, the pulleys 36 and 37 will line up such scramble-wound wire so that it will pass directly through the groove in the recording head, over the pulley 39, and evenly onto the reel 12.

To insure a level wind of the wire 11 on the reel 12, a mechanism is provided which includes a plate 41 pivoted at 42 to the horizontal face of an L-shape bracket 43 attached to the inner partition 3 of the casing. The plate 41 supports the pulleys 36 and 37, the magnetizing or recording head 38, and the pulley 39, so that all of these pulleys and the recording head must move backwardly and forwardly with the swing of the plate 41. With reference more particularly to Figures 3 and 5, it will be seen that a cam riding projection 44 extends laterally from the plate 41 through an opening 45 in the partition 3 into contact with the surface of a cam 46 carried by the aforesaid spring housing 16 and gear 15. The cam 46 is provided with such a surface that the plate 41 will be pivoted around the point 42 backwardly and forwardly during turning of the gear 15.

Thus, due to the pivotal movement of the plate 41, together with the various pulleys and recording head carried by this plate, the wire is accurately level wound upon the spool or reel 12. On the opposite side of the plate 41 from the cam rider 44, this plate is provided with another projection or lug 47, and a similar lug 48 extends from the fixed bracket 43. Between these lugs, a tension spring 49 is disposed so as to hold the plate 41 in operative connection with the cam 46. All of the pulleys 36, 37 and 39 are idler pulleys and rotate by the friction of the wire thereagainst.

Means are also provided to insure or facilitate a ready and easy threading of the recording medium into its proper position when a new supply roll 10 is placed upon the device. It would be an extremely difficult operation to thread the end of a wire between the pulleys 36 and 37, into the groove 40 of the recording head, and over the pulley 39, and then maintain that wire in proper position while the end of the wire was anchored to the receiving spool 12. To obviate any such difficulty, yet accomplish the same purpose in a very facile manner, the wire is first taken from the spool 10 and attached directly to the spool 12. Then the spool 10 is rotated slightly to provide some slack in the wire between the two spools. This slack portion of the wire is then pushed through an open bottomed groove 50 in a guiding member 51 which is secured to the movable plate 41 by bolts 52 or in any other equivalent manner. As seen best in Figure 4, the guide 51 is in the shape of an inverted channel, and the groove 50 is formed in the nature of a superstructure extending upwardly from the bottom of the channel. In that portion of the guide member that passes directly over the recording head 38, it will be seen that the groove 50 of the guide member is spaced directly over and parallels the groove 40 in the recording head. With reference to Figure 3, it will also be seen that the groove 50 in the guide member curves in keeping with the staggered pulleys 36 and 37 as indicated at 53, so that the groove of the guide member is disposed in such a manner that a wire pushed therethrough will pass by the flange on each of these pulleys.

When the wire 11 is threaded through the groove in the guide member 51, past the flanges on the pulleys 36 and 37, into the groove 40 of the recording head 38, and into the groove of the vertically disposed pulley 39, the reel 10 is then preferably turned backward sufficiently to take up the slack in the wire, and the wire will then seat within the grooves of the pulleys 36 and 37, properly seat within the groove 40 in the recording head, and ride the groove of the pulley 39. It is an extremely simple expedient to push the slack portion of the wire through the groove 50 in the guide member 51, and an expedient that may be accomplished with a minimum of time and effort.

In order to make this device quite self-sufficient, a microphone structure is preferably built on the back wall of the device as indicated at 54, so that all that is necessary for the operator to do is to talk directly into the part 54 when making a recording on the wire 11.

In Figure 7 we have illustrated a simplified form of wiring diagram showing an electrical circuit satisfactory for use with the instant invention. In this diagram, the aforesaid microphone or other pick-up device 54 is connected at one side to a battery 55 and to a ground 56. The other side of the microphone is connected through a conductor 57 to the primary coil of a transformer

58. The other side of the battery is connected by way of conductor 59 to both the primary and secondary coils of the transformer 58. The opposite end of the secondary coil is connected through conductor 60 to a magnetizing coil 61 in the recording head 38, and the other end of the magnetizing coil is grounded as indicated at 62. The recording head 38 in general comprises a core which is preferably laminated, and the coil 61 is disposed around one leg of this core. The upper leg of the core is provided with the groove 40 through which the recording medium travels, and this leg is divided transversely by a relatively narrow air gap so as to provide confronting pole faces of opposite polarity. It is over the region of this air gap that the recording medium receives its successive magnetizations during the making of a recording on the wire. From the foregoing description of the apparatus and the circuit of Figure 7, it will be seen that all the necessary electrical energy for the device may be supplied by a single battery, and this battery as well as the transformer and the necessary wiring may all be contained within the casing in locations not occupied by other apparatus, the partition 3 being apertured to provide passageway for the wiring wherever necessary. Preferably, the battery may be located in the space beneath the bracket 43 in the front compartment of the casing where it is readily accessible for removal and replacing. It will be apparent from the description and showing of the circuit that sound introduced through the microphone 54 will cause a variation in intensity of the current passing through the magnetizing coil 61, and thus the recording medium 11 will be variably magnetized in keeping with the variations of the sound being recorded. In order to render the device capable of cleaning a wire having a previous recording thereon, a permanent magnet 63 may be disposed adjacent the path of the wire 11 in front of the recording head 38. It is not necessary that the end of the permanent magnet actually contact the wire, but only that the magnet be in close proximity to the traveling wire. The action of such magnet upon the wire is sufficient to magnetically saturate the wire and thus wipe out any previous recording on the wire so that the wire will be "clean" or without a recording when it reaches the recording head 38. In some instances, especially with simplified circuits, it is desirable to employ the magnet 63 to condition a totally demagnetized wire for recording purposes by magnetically saturating the wire. This permanent magnet 63 may be disposed in any suitable location along the path of the wire in advance of the recording head 38, such for example as being mounted upon the swingable plate 41 in position adjacent the wire as the wire passes the pulley 37.

In operation, the present invention is extremely simple. Assuming that the spring 18 has been wound by the key 28, it is only necessary for the operator to hold the device easily in one hand, and with a finger or the thumb flick the starting lever 30 into running position and speak into the microphone 54. At the end of the speaking, it is a simple expedient to flick the lever into stop position, and replace the entire device in a pocket, knapsack, or the like. The only operation on the part of the operator necessary is periodically winding the spring, starting and stopping the device by the manipulation of the lever 30, and possibly replacing a supply spool of recording medium and now and then a battery, if such work

is not done for the operator at his base. It will be appreciated that the recording may be continuous because the spring may be wound during operation.

From the foregoing, it is apparent that we have provided a highly compact and self-sufficient recording device, which is not only pocket size, carries its own power, is enabled to handle scramble-wound wire, but is also capable of reconditioning a wire or other recording medium prior to its new magnetization in accordance with the new recording. It will also be apparent that the device is designed for one hand operation, is equipped with a speed control, an over-run preventing mechanism, adequate starting and stopping means, and the microphone may be built into a part of the casing. Consequently, there is no necessity for the operator to connect the device with any outside source of power, and it will be at once noted that the device is economical in construction and use.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

We claim as our invention:

1. A portable magnetic recording device, including a pair of spools from one to the other of which a recording medium is wound, means for magnetizing the traveling medium, a spring motor to drive the receiving spool, a casing containing all said structure, and sound pick-up means in said casing in circuit connection with said magnetizing means.

2. In a magnetic recording device, a pair of spools from one to the other of which a recording medium is wound, driving means to actuate the receiving spool, a pivotal member adjacent the path of the medium between said spools, straightening means for scramble-wound medium carried by said member, magnetizing means carried by said member, cam means associated with said driving means to swing said member back and forth to level-wind the medium on the receiving spool, and guide means also carried by said member to facilitate threading of recording medium into said straightening means and said recording means, said guide means being in the form of a cover member having a bottomless groove shaped in keeping with the path of the medium.

3. In a magnetic recording device, a pair of spools from one to the other of which a recording medium travels a predetermined path, and straightening means between said spools to direct scramble-wound medium on the supply spool along said predetermined path to the receiving spool, said straightening means being in the form of staggered pulleys.

4. A self-contained and portable magnetic recording device, including a pair of reels from one to the other of which a recording medium is wound, magnetizing means to act on said medium, spring drive means for one of said reels, an impulse pick-up element in circuit connection with said magnetizing means, a source of electrical energy for the circuit including the pick-up element and magnetizing means, and a pocket-size casing containing all the aforesaid structure.

5. A self-contained and portable magnetic recording device, including a casing, a pair of reels in said casing, a recording medium on said reels,

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spring drive means to cause motion of said reels and move the recording medium from one to the other of said reels, magnetizing means to act on the medium in said casing, a pick-up element in said casing, a source of electrical energy in said casing, and connections in said casing completing an electrical circuit including said magnetizing means, pick-up means, and source of energy.

6. In a magnetic recording device, a pair of spools from one to the other of which a recording medium is wound, driving means to actuate the receiving spool, a pivotal member adjacent the path of the medium between the spools, staggered pulleys mounted on said pivotal member to straighten scramble-wound medium, magnetizing means carried by said member, and means associated with said driving means to swing said

member back and forth to level-wind the medium on the supply spool.

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