May 5, 1942. W. P. PATRICK 2,281,793

MAGNETIC RECORDER

Filed Dec. 27, 1938

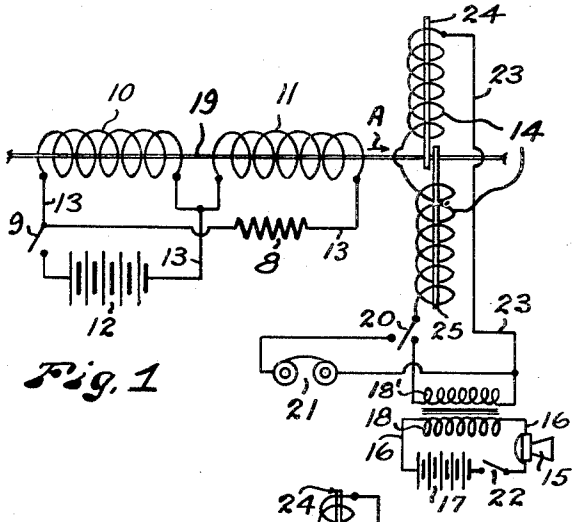


Fig. 1

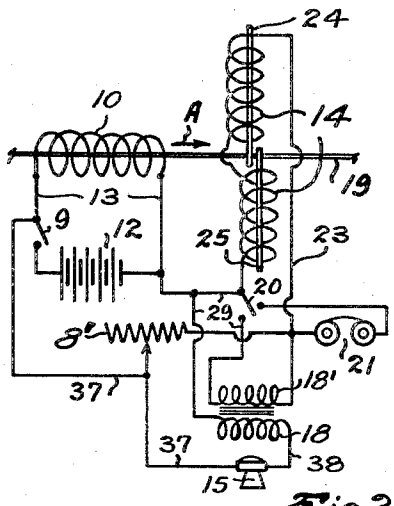


Fig. 2

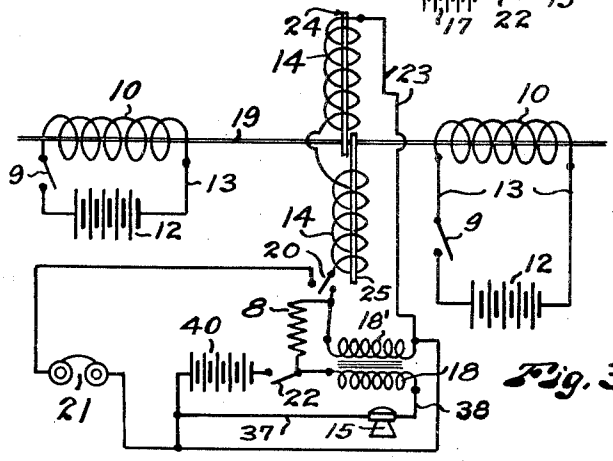


Fig. 3

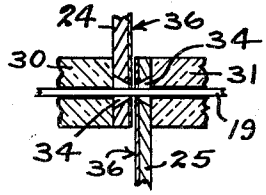


Fig. 5

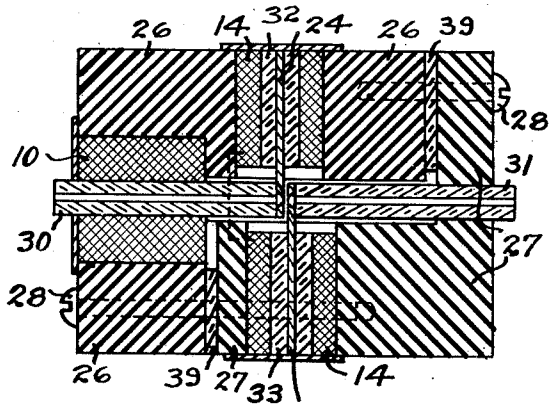


Fig. 4

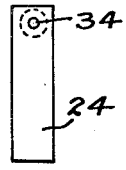


Fig. 6

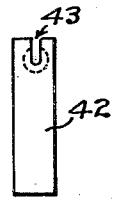


Fig. 7

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MAGNETIC RECORDER

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10 Claims. (Cl. 179—100.2)

This invention relates to magnetic recorders of the type in which electrical impulses usually modulated by sound vibration are recorded on and subsequently reproduced from a wire or like metallic strip of magnetizable material such as steel.

An object of this invention is to provide an improved magnetic recording and reproducing head which operates to magnetize the wire in such a manner that there will be no distortion of the reproduced electrical impulses and a true and even and correct reproduction of the recorded matter will be obtained.

Another object is to provide a magnetic recorder of this nature by which a wire or like member of magnetic material is magnetized in such a manner that the magnetism will always extend longitudinally along the wire, that is, the lines between north and south poles will always be disposed substantially longitudinally of the wire. This provides a magnetism in the wire in such a direction that, irrespective of the turning or twisting of the wire when the recorded matter is being reproduced the volume can always be kept substantially constant and a true and undistorted reproduction of the recorded matter obtained.

Another object is to provide magnetic recording means in which the wire whereon the impulses are to be recorded or from which they are to be reproduced or taken off is acted on by a coil which magnetizes the wire to saturation, then acted on by a coil which demagnetizes it and then acted on by the magnetic force or forces that produce the magnetic record in the wire.

A further object is to provide magnetic recording means by which the de-magnetizing of the wire and the recording of the record on the wire are accomplished simultaneously by the same coil.

Other and more specific objects of the invention will be apparent from the following description taken in connection with the accompanying drawings.

In the accompanying drawing Fig. 1 is a diagram illustrating one embodiment of my invention in which I provide one coil for magnetizing the wire, another coil for neutralizing the wire, and other coil means for producing the magnetic record on or in the wire or for reproducing the recorded matter from the wire.

Fig. 2 is a diagram of an embodiment of the invention in which one coil is provided for magnetizing the wire and other coil means is provided for both neutralizing the wire and causing the disturbing currents to pass through the wire to make the record or for reproducing the recorded matter from the wire.

Fig. 3 is a diagram of an embodiment of the invention in which two magnetizing coils are used one on each side of the coil means which neutralizes the wire and makes the record or which is used in reproducing a record, the two magnetizing coils making it possible to move the wire in either direction and make a record thereon by supplying current to the coil that the wire passes through first.

Fig. 4 is a somewhat diagrammatic sectional view showing in more detail a recording and reproducing head embodying the coils and cores shown in the preceding figures.

Fig. 5 is an enlarged fragmentary sectional view of the overlapped ends of two soft iron cores used in the invention.

Fig. 6 is a detached elevation of one of the soft iron cores.

Fig. 7 is a detached elevation of a modified form of soft iron core.

Like reference numerals designate like parts throughout the several views.

Referring to Fig. 1, the numeral 10 designates a magnetizing coil, 11 a neutralizing coil, 12 a battery connected by conductors 13, with the coils 10 and 11 for supplying electric current to the same, 8 a resistance, 9 a switch in the battery circuit, 14 a voice or disturbing coil, 15 a transmitter or microphone connected by conductors 16 with a battery 17 and primary coil 18 of a transformer. A switch 22 is provided in the circuit with the battery 17 and primary transformer coil 18. The secondary coil 18' of the transformer is connected by conductors 23 with the coil 14. A wire 19 or like member on which matter is to be recorded or from which recorded matter is to be reproduced is adapted to be moved in the direction indicated by the arrows A. Numeral 21 designates a receiving device, 20 a switch for selectively connecting either the transmitting device 15 or the receiving device 21 in the circuit and disconnecting the other. When the wire 19 is moved in the direction indicated by the arrow with switches 9 and 22 closed and switch 20 closed as respects the transmitting device 15 then the magnetizing coil 10, will be energized by the battery 12 and will magnetize the wire 19 to saturation longitudinally thereby erasing or eliminating the effects of all previous magnetic records in the wire 19 and leaving said wire in a uniformly magnetized condition.

If the coil 10 does not uniformly magnetize the

wire 19 longitudinally substantially to saturation then it will not be possible for the succeeding coil 11 to neutralize the wire substantially uniformly. As the uniformly magnetized wire 19 passes through the coil 11, the current from the battery 12 will energize coil 11 in the opposite direction and set up a magnetic field in the opposite direction just strong enough to demagnetize or neutralize the wire, leaving said wire in proper condition to receive a new record. The coil 14 has two soft iron cores 24 and 25 positioned substantially axially of the coil in the respective end portions thereof. The inner end portions of the soft iron cores 24 and 25 terminate in overlapped relation substantially mid way between the two ends of the coil. The two parallel overlapped end portions of the soft iron cores 24 and 25 are slightly spaced apart transversely, see Fig. 5, and the adjacent side faces of said soft iron cores preferably have thin non-magnetic layers or coatings 36 plated on the surfaces thereof. The plated coatings 36 insure that there will not be iron to iron contact between the two iron cores 24 and 25. A cone shaped hole 34 is provided in the end portion of each soft iron core 24 and 25. These holes converge toward the plated sides and when the soft iron cores are properly positioned the holes 34 in the two cores are in registration. The wire 19 passes through tubes 30 and 31 of glass or like insulating material, see Fig. 4, and through the holes 24 in the soft iron cores 24 and 25. Preferably the wire 19 is only slightly smaller than the passageways in the glass tubes so that it will run smoothly through the tubes but has little or no sidewise movement in the tubes. Also this wire 18 has a slight clearance as respects the iron cores 24 and 25 where it passes therethrough. Preferably the iron cores 24 and 25 are adhesively secured to the ends of the glass tubes 30 and 31.

If the transmitting device 15 is subjected to sound vibrations while the wire 19 is being moved through the holes 34 in the soft iron cores 24 and 25 of the coil 14 then variable electric impulses governed by the transmitting device 15 will magnetize the wire substantially longitudinally to provide a magnetic record in the wire and the coercive force of the wire will retain the magnetism.

To receive or reproduce the record from the wire 19 all batteries are disconnected, the sound recording device 15 is disconnected from the coil 14 and the sound reproducing device, such as an ear phone 21 is connected with the coil 14 by switch 20. The wire 19 is then moved through cores 24 and 25 of the coil 14 in the same direction in which it was moved in recording and the recorded magnetic impulses will produce electric currents which will be manifested as sound by the ear phones 21. Obviously this sound may be amplified if desired.

In Fig. 2, I show an embodiment of the invention in which the neutralizing coil 11, is omitted and the coil 14, with the soft iron cores 24 and 25 therein is caused to perform the wire neutralizing function that is performed by the coil 11, in Fig. 1. At the same time the coil 14 records electrical impulses or disturbances on the wire 19. This is accomplished by connecting the coil 14 with the battery 12 and interposing a resistance 8', preferably variable, in the battery circuit of said coil 14. In the apparatus shown in Fig. 2, a magnetizing coil 10, similar to the coil 10 in Fig. 1, is used. The neutralizing power of the coil 14 is sufficient to neutralize the wire 19 which has been magnetized to saturation by the coil 10, and the wire 19 would thus be reduced to a neutral condition if it were not for the influence of disturbing impulses to which the coil 14 is subjected due to its connection with a microphone or transmitter 15. This transmitter 15 is connected by wires 37 and 38 with the battery 12 and with the primary coil 18 of a transformer. The secondary coil 18' of the transformer is connected by wires 23 and 29 with the coil 14. A switch 20 is provided in wire 29 for selectively closing the circuit either to the transmitter 15 or to a receiving device 21.

Fig. 3, shows devices similar to Fig. 2, except that two magnetizing coils 10 are provided, one on each side of the coil 14. This makes it possible to move the wire 19 in either direction, and by closing the circuit to the magnetizing coil 10 through which the wire is passing first and opening the circuit to the other coil 10, to record on the wire 19 irrespective of the direction in which said wire is moved. Also an additional battery 40 is provided in Fig. 3, in the circuit with the coil 14 and transmitting devices. Otherwise the parts shown in Fig. 3, correspond to those shown in Fig. 2, and are correspondingly numbered.

Fig. 4 shows a preferred form of recording and reproducing head embodying the coils shown in Fig. 2. In said Fig. 4, 26 and 27 are two L shaped pieces of insulating material forming a frame. These pieces 26 and 27 are secured by screws 28. Shims 39 of material which has some resiliency are provided between the abutting portions of the frame pieces 26 and 27 to provide for a fine adjustment between the two soft iron cores 24 and 25 as hereinafter set forth. The two tubes 30 and 31 of insulating material, preferably glass, are provided in the respective frame pieces 26 and 27 in axial alignment with each other. The frame piece 26 is suitably recessed for reception of the magnetizing coil 10 which surrounds a portion of the insulating tube 30. The sides of the frame members 26 and 27 are respectively recessed for the reception of the end portions of the coil 14. Insulating members 32 and 33 respectively are provided within the coil 14 and the soft iron cores 24 and 25 are supported within the respective end portions of the coil 14. The cores 24 and 25 are transversely offset relative to each other and the inner ends of said cores overlap and are spaced apart a short distance transversely and extend across the end portions of the respective tubes 30 and 31. The two soft iron cores 24 and 25 are relatively offset longitudinally of the wire 19 and, in operation these cores become magnet poles of opposite polarity which set up magnetic fields longitudinally of the wire and magnetize the wire longitudinally. The wire passes through the holes in the core members 24 and 25 and thus the said core members completely surround the wire and magnetize the wire evenly around its entire circumference so that, in reproduction from the wire, any twisting or variation in the angular position of the wire will not distort or adversely affect the reproduction.

Fig. 7 shows a modified form of soft iron pole piece 42 in which a slot 43 is provided in the end portion thereof instead of a hole. This pole piece has been found to give good results in use but it does not entirely surround the wire and is not considered as desirable as the pole piece shown in Fig. 6.

The foregoing description and accompanying drawing clearly disclose certain preferred embodiments of my invention but it will be understood

that variations in the invention may be made within the scope and spirit of the following claims.

I claim:

1. A magnetic recorder for magnetizing a wire to provide a sound record, comprising magnetic core means provided with a north and a south pole piece positioned in magnetically spaced apart relatively overlapped relation, said two pole pieces having registering openings in their overlapped portions through which a wire to be magnetized is passed with the wire extending in a direction substantially transverse to the planes of the pole pieces; and coil means on said core means connected with a source of electrical energy and magnetically energizing said north and south pole pieces.

2. The method of recording electrical impulses by the use of a wire comprising magnetizing the wire to saturation in a substantially longitudinal direction, then demagnetizing said wire longitudinally, then producing in said wire a magnetic record capable of being reproduced by magnetizing said wire in a direction so that the magnetic poles in the wire are spaced from each other in a direction generally longitudinally of the wire.

3. A magnetic recorder for magnetizing a wire to provide a sound record, comprising two magnetic core members positioned with a pole piece of one and a pole piece of the other in relatively overlapped relation, said overlapped pole pieces being magnetically spaced apart and being provided with registering openings through which a wire to be magnetized is passed with the longitudinal dimension of the wire at substantially right angles to the planes of the pole pieces; and coil means wound on said core members and electrically connected to a source of electrical energy to provide opposite polarity in the said overlapped pole pieces.

4. A magnetic recorder for magnetizing a wire to provide a sound record, comprising a coil composed of two portions; two cores of magnetic material in said coil portions respectively having relatively overlapped magnetically spaced apart north and south pole pieces, portions positioned in face to face relation and provided with registering openings through which a wire to be magnetized is passed with the longitudinal dimension of the wire at substantially right angles to the cores; electric current supply means connected with the coil portions whereby said wire will be magnetized in a substantially longitudinal direction; and means for subjecting said coil portions to variable electrical disturbances.

5. In a magnetic recorder, a coil; two cores of magnetic material positioned within the respective end portions of said coil, said cores having relatively overlapped end portions providing north and south pole pieces positioned in close proximity to each other in magnetically spaced apart face to face relation and provided with registering openings; a magnetizing coil; a wire movable longitudinally through said magnetizing coil and the openings in said pole pieces; electric current supply means connected with said first named coil and said magnetizing coil whereby said wire will be magnetized in a substantially longitudinal direction; and recording circuit means connected with said first named coil.

6. In a magnetic reproducer, a coil; two cores of magnetic material positioned within the respective end portions of said coil, said cores having relatively overlapped end portions providing north and south pole pieces positioned in close proximity to each other in magnetically spaced apart face to face relation and provided with registering openings; a wire movable longitudinally through said openings in said pole pieces; and electrically actuated reproducer means connected with said coil to reproduce without distortion records of disturbances represented by substantially longitudinal magnetization of said wire.

7. In a magnetic recorder and reproducer, a coil; two cores of magnetic material positioned within the respective end portions of said coil, said cores having relatively overlapped end portions providing a north and a south pole piece positioned in close proximity to each other in magnetically spaced apart face to face relation and provided with registering openings; a magnetizing coil; a wire movable longitudinally through said magnetizing coil and through the openings in said pole pieces; electric current supply means connected with said first named coil and said magnetizing coil whereby said wire will be magnetized in a substantially longitudinal direction; electric recording means connected with said first named coil; electric reproducing means connected with said first named coil; and devices for selectively disconnecting either said recording means or said reproducing means relative to said first named coil.

8. In a magnetic recorder, a recording coil; two cores of magnetic material positioned within different portions of said recording coil and having overlapped end portions positioned in closely spaced apart relation and provided with registering openings; a magnetizing coil; a neutralizing coil between said magnetizing coil and said recording coil; a wire movable longitudinally through said magnetizing coil and said neutralizing coil and the openings in said cores; electric current supply means connected with each of said coils; and recording means connected with said recording coil.

9. A magnetic recorder and reproducer comprising supporting means; two aligned tubes of non-magnetic insulating material supported by said supporting means with their adjacent ends in spaced apart relation; two cores of magnetic material having relatively overlapped end portions providing a north and a south pole piece positioned between adjacent ends of said tubes and secured to said ends of said tubes with the said pole pieces in spaced apart face to face relation, said pole pieces having openings therein registering with the openings in said tubes through which a wire to be magnetized is passed; a magnetizing coil surrounding one of said tubes; and another magnetizing coil having one portion surrounding one of said cores and another portion surrounding the other core.

10. In a magnetic device for use in connection with a sound record wire, two cores of magnetic material having overlapping end portions provided with registering openings through which a wire may be passed; plating of non-magnetic material on adjacent overlapped portions of said cores preventing actual contact of said magnetic cores when said cores are positioned close together; electric coil means on said cores; and electrically energized sound devices connected with said coil means.

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