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METHOD OF AND MEANS FOR ENERGIZING MAGNETIC RECORDER HEADS

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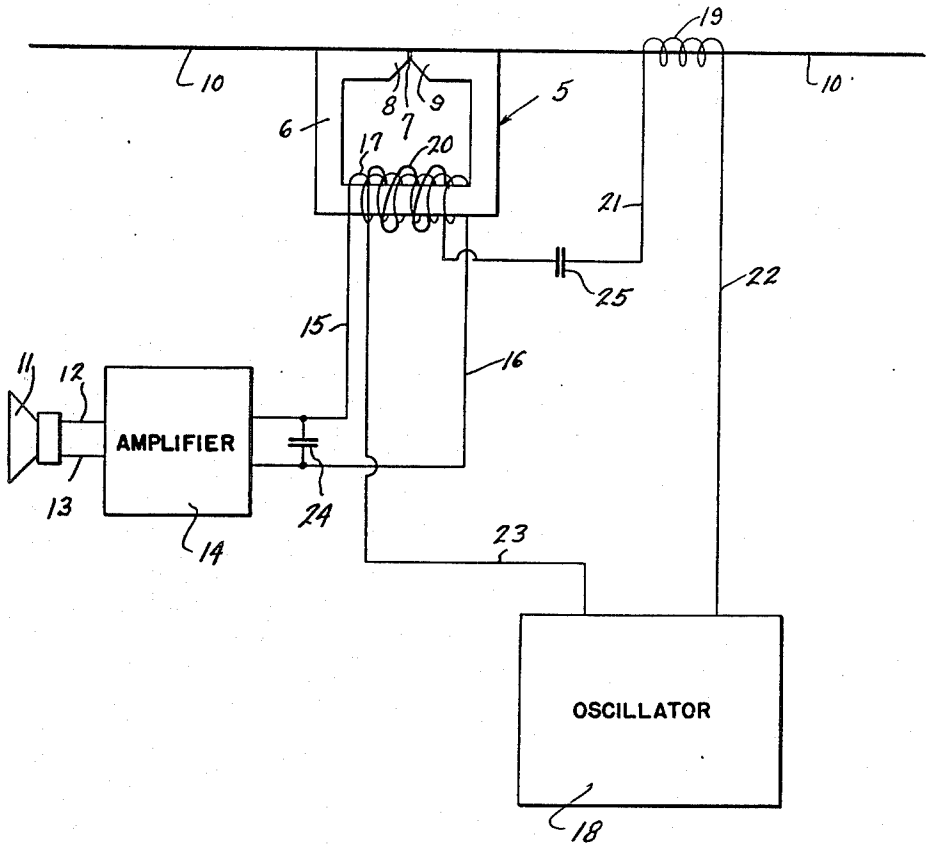

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METHOD OF AND MEANS FOR ENERGIZING MAGNETIC RECORDER HEADS

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This invention relates to improvements in a method of and means for energizing a magnetic recorder head, the invention being highly desirable for use in connection with the electrical circuit of a magnetic recording device, although the invention may have other uses and purposes as will be apparent to one skilled in the art.

This application is a continuation in part of my copending application entitled "Method of and means for controlling high frequency voltage in magnetic recorder heads," filed December 26, 1942, Serial No. 470,207.

In magnetic recording devices wherein a sound recording is made upon an elongated paramagnetic recording medium, such as a metallic tape or wire, a recording head may be used to apply successive magnetizations to the recording medium as it travels past the recording head, which magnetizations vary in keeping with variations of the sound being recorded. Such magnetic recording devices are preferably compact so as to be portable, and if the device is to remain semi-permanently in a single location, the electrical circuit and apparatus is preferably installed as compactly as possible in order to save space. Consequently, it is desirable to have simplified circuits or simplified circuit connections as much as is feasible consistent with adequate performance of the device.

Usually in magnetic recording devices, an audio circuit including a sound pick-up device and an oscillatory circuit as a source of high frequency voltage are utilized. Recorder heads have individual characteristics, as well as the recording medium itself. When one recording head is substituted for another in the same device, when a recording medium of a different paramagnetic alloy or metal is substituted for that previously used, or when a change in speed is made, etc., the characteristics of the recording head are affected, and therefore it is desirable to have a simple means for adjusting the high frequency voltage applied to the recording head so as to insure optimum efficiency and operation when such a change occurs. Likewise, it is desirable to use such adjusting means when a magnetic recording device is first manufactured so that it may be set to operate at optimum efficiency. If some change is later made, another adjustment may be made.

With the foregoing in mind, it is an important object of this invention to provide a simplified circuit arrangement for energizing the recording head of a magnetic recording device.

Also an object of this invention is the provision of a method of and means for adjusting the high frequency voltage applied to the recording head of a magnetic recording device in order to acquire optimum efficiency and operation, the adjustment being possible at any of a plurality of locations.

Still another object of the instant invention is to provide a method of and means for energizing the recording head of a magnetic recorder, wherein the output of an oscillatory circuit is directly associated with the recording head.

It is also a feature of this invention to provide a method of and means for inductively coupling an audio circuit and an oscillatory circuit at the recording head of a magnetic recording device.

Frequently in a magnetic recording device there is an erasing head which functions in a manner to uniformly magnetize or de-magnetize the recording medium in advance of the recording head, either operation being equivalent to an erasing operation so as to remove any previous recording which may be on that medium. It is not therefore necessary to utilize a clean medium, or a medium not carrying any recording, when a new recording is made, because the erasing head will condition that medium for the new recording prior to the medium reaching the point where the new recording is applied to it.

This invention also has for an object the provision of an electrical circuit for a magnetic recording device wherein the output of an oscillatory hook-up is split, one portion of this output functioning as an erasing head to recondition a previously magnetized recording medium, and the other portion of the output being inductively coupled with an audio frequency hook-up.

Also an object of the invention resides in the provision of an electrical circuit arrangement for a magnetic recording device in which the output of an oscillatory hook-up is divided into a plurality of parts connected in series, one of the parts functioning as an erasing head to recondition the previously magnetized recording medium, and another part being directly associated with the recording head of the device to set up a high frequency magnetic field in the recording head.

It is also an object of this invention to provide an electrical circuit arrangement for a magnetic recording device, wherein the recording head is subjected to the resultant of a magnetic field set up by an audio circuit, and a magnetic field set up by an oscillatory circuit, both such circuits being directly associated with the recording head.

A further object of the invention is the provision of a new and novel method of energizing and adjusting the recording head of a magnetic recording device.

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 disclosure, taken in conjunction with the accompanying drawing, in which:

The single figure is a diagrammatic view of a salient portion of a magnetic recording device, including a schematic wiring diagram of the electrical circuit arrangement embodied in the instant invention.

As shown on the drawing:

In the illustrated embodiment of this invention there is shown a very simplified and schematic circuit and apparatus arrangement for a magnetic recording device. Many parts of the recording device and various other circuit connections that may be embodied in the device as commercially manufactured are omitted, because the instant invention particularly centers itself in the recording circuit arrangement and immediately associated apparatus. It will also be appreciated that certain portions of the circuit arrangement and apparatus have been illustrated in exaggerated relative sizes and illustrated in a diagrammatic manner for clarity, these parts having different sizes and different appearances in actual manufacture.

The structure selected for illustration includes a magnetic recording head generally indicated by numeral 5 which includes a paramagnetic core 6, preferably laminated, and which may be of a substantially rectangular shape with the exception of a rather minute air gap 7 in the upper leg of the core. It will be appreciated that the core may have substantially any desirable general shape or configuration, the rectangular shape being easy to manufacture and convenient to use since it provides a level track along the top leg for the travel of the recording medium. The core is shaped to provide confronting pole faces 8 and 9 immediately adjacent the air gap 7, the shaping of these faces being such as to reduce the size of the pole faces at the medium magnetization point so as to concentrate the magnetic flux within a small area at this point where the actual recording is accomplished.

During operation of the recording device, a paramagnetic recording medium travels over the upper leg of the core 6, or preferably through a groove in the upper leg of the core, or it may travel directly through an aperture in this leg of the core. In this instance, we have illustrated the recording medium as a paramagnetic wire 10, which may be a fine round wire, approximately the size of a human hair, .004 to .005 inch in diameter being a satisfactory size. This recording medium is usually carried by a pair of spaced spools or reels, and is wound from one to the other, passing by the recording head during its travel from one of the reels to the other. During a recording operation, small increments of the traveling wire become successively magnetized in the region of the air gap 7, and these successive magnetizations which occur as the wire travels along past the recording head will vary in accordance with variations in the sound being recorded.

In order to so successively magnetize the recording medium, it is necessary, of course, that the magnetic field within the recording head, or more particularly within the core 6, must also vary in intensity in accordance with the sound being recorded. In the illustrated instance, the magnetic field set up within the recording head is a resultant field, being the resultant of a low frequency field established by an audio circuit, and a high frequency field established by an oscillatory circuit. These two circuit arrangements are inductively coupled at the recording head.

The audio circuit arrangement includes a microphone 11 or equivalent sound pick-up device which is connected by a pair of conductors 12 and 13 to an amplifier 14, diagrammatically illustrated, because this amplifier may be a standard known form of an amplifier, including whatever current supply means may be necessary for its proper operation. The amplifier is in turn connected by means of conductors 15 and 16 to opposite ends of a coil 17 which is preferably wound around a part of the core 6 of the recording head, in this instance the lower leg of the core. From this disclosure, it is obvious that the coil 17 will set up a magnetic field within the core 6, and this field will vary in intensity in accordance with variations in the sound picked up by the microphone or equivalent device 11.

The oscillatory circuit arrangement includes an oscillator 18, which is diagrammatically illustrated, because it may be a standard known form of oscillator, including whatever current supply means are necessary for its proper performance. In this instance, the output of this oscillator is divided into two coils 19 and 20 connected in series by a conductor 21, and the free end of coil 19 is connected to the oscillator by conductor 22, while the free end of coil 20 is connected to the oscillator by conductor 23. The coil 19 is preferably located in such position that the recording medium 10 must travel through or by this coil on its way to the recording head during a recording operation. The coil 19 therefore functions as an erasing head and de-magnetizes the recording medium in advance of the recording head. With this arrangement, it is not necessary to utilize a clean wire, a wire or other recording medium that is either free of magnetization or uniformly magnetized, in order to make a new recording. A wire carrying a previous recording may be passed through the recording device in the usual manner, and prior to the new recording being placed upon the wire, the previous recording will be erased or removed from the wire by the erasing head formed by the coil 19. This arrangement also reduces the necessary apparatus in a device of this character equipped with an erasing head, because a part of the oscillator output is utilized as the erasing head, and there is no necessity of providing separate apparatus and separate energization means for that purpose.

The other portion of the oscillator output, namely the coil 20, preferably consists of relatively few turns and may be wound around any part of the core 6 of the magnetic recorder head 5, being illustrated for convenience around the same portion of that core as the coil 17 is upon. In the illustrated instance, both the coils 17 and 20 are wound around the lower leg of the core 6 in concentric relationship, and an inductive coupling between the audio and oscillatory circuit arrangements will result.

It will be appreciated that the oscillator output coil 20 will set up a high frequency magnetic field within the core 6, and that the ultimate field within this core will be the resultant of the

two fields set up by the coils 17 and 20. This resultant field will, of course, be varied in accordance with the sound being recorded, by virtue of variations in the coil 17.

A condenser 24 which is of such capacity as to pass high frequency current but act as a high impedance for low frequency current is preferably connected across the conductors 15 and 16 leading from the amplifier in order to keep the high frequency current out of the audio circuit. Under certain conditions it may be desirable to use a suitable precaution to keep out low frequency current from the oscillating circuit, and to this end a blocking condenser 25 or equivalent means may be included in the conductor 21 or equivalent location. This condenser or equivalent means need not, however, be utilized in most operating conditions but may prove desirable in certain conditions where the relative voltages between the audio and oscillatory circuits are such that low frequency current might interfere with desired operation of the oscillatory circuit.

In operation, the present invention is extremely simple and effective. Let it be assumed that the magnetic recording device has just been manufactured, or that some change has been made in a device already under operation, such as a recording medium of different paramagnetic alloy or metal being substituted for the one previously used, a change in speed in the travel of the medium, the substitution of a new recording head for one previously used, or some similar change. It is desirable, therefore, to adjust the recorder head for optimum operation and efficiency. This may be accomplished by varying the high frequency voltage applied to the recording head by means of the coil 20 from the oscillatory circuit. This adjustment may be made by changing the impedance in the output circuit of the oscillator at substantially any desired location, the more feasible locations being either of the coils 19 or 20, and the impedance being varied by changing the number of turns in either of these coils. In the case of the coil 20, which is of relatively few turns, the addition or subtraction of a single turn is frequently sufficient to acquire optimum operation. In the case of the coil 19, it may be necessary to add or subtract several turns to acquire optimum operation. Once optimum operation has been acquired, the device is set for such operation until some other change affecting the characteristics of the recording head is made in the device. Then another adjustment should be made.

My novel method of energizing and adjusting the recorder head for a magnetic recording device is believed to be sufficently apparent from the foregoing as not to warrant further specific description herein.

From the foregoing, it is apparent that I have provided a highly simplified and effective electrical circuit arrangement for a magnetic recording device, which circuit arrangement provides a plurality of locations at any one of which a simple and easy adjustment may be made to compensate for variances in characteristics of component parts of the circuit connections and apparatus. It will be noted also that with this circuit arrangement the output of the oscillatory circuit is divided so that one portion of this output may function as an erasing head, and the other portion is directly associated with the recorder head. The circuit arrangement and method embodied in this invention results in efficient operation, a compact wiring arrangement, adding to the economy of production and use, eliminates the need of separate circuits for energizing the recorder head or providing an erasing head and the like, and the circuit arrangement and apparatus are extremely durable.

It will, of course, be understood that various details of construction and steps of the method 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.

I claim as my invention:

1. In a magnetic recording device, a recording head to magnetize a traveling paramagnetic medium, an audio circuit including a coil disposed to set up a magnetic field in said recording head, and an oscillatory circuit including a pair of coils in series of which one is disposed to set up a magnetic field in said recording head and the other is positioned to demagnetize said medium in advance of said recording head.

2. In a magnetic recording device, a recording head to magnetize a traveling paramagnetic medium, an audio circuit including a coil disposed to set up a magnetic field in said recording head, and an oscillatory circuit including a pair of coils in series of which one is disposed to set up a magnetic field in said recording head and the other is positioned to damagnetize said medium in advance of said recording head, the arrangement being such that the voltage applied to said recording head may be adjusted by varying the impedance in either of the coils in said oscillatory circuit.

3. In a magnetic recording device, a recording head to magnetize a traveling paramagnetic medium, an audio circuit including a coil associated with said recording head, and an oscillatory circuit of which the output includes a pair of coils in series with one associated with said recording head and one acting to demagnetize the medium in advance of said head, the arrangement being such that control of the recording head characteristics for optimum operation may be had by varying the number of turns in either oscillatory circuit coil.

4. The method of setting up a resultant magnetic field in a recording head of a magnetic recording device, which includes inductively coupling an audio circuit and an oscillatory circuit around a part of the core of the recording head.

5. The method of setting up a resultant magnetic field in a recording head of a magnetic recording device, which includes inductively coupling an audio circuit and an oscillatory circuit around a part of the core of the recording head and then adjusting the voltage applied to the recording head for optimum operation by varying the impedance in the oscillatory circuit.

6. The method of setting up a resultant magnetic field in a recording head of a magnetic recording device, which includes inductively coupling an audio circuit and an oscillatory circuit around a part of the core of the recording head and then adjusting for optimum operation of the recording head by changing the number of turns in the oscillatory coil at the inductive coupling point.

7. The method of applying a high frequency voltage to set up a magnetic field in the recording head of a magnetic recording device which magnetizes an elongated recording medium, including the steps of dividing the output of an oscillatory circuit into separate parts connected in

series, associating one part directly with the recording head, and positioning the other part to demagnetize the recording medium in advance of the recording head.

8. The method of applying a high frequency voltage to set up a magnetic field in the recording head of a magnetic recording device which magnetizes an elongated recording medium, including the steps of dividing the output of an oscillatory circuit into separate coils connected in series, positioning one of said coils around a part of the core of the recording head, and positioning the other coil in such location that the recording medium must pass through the field of the coil in advance of the recording head and be demagnetized.

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