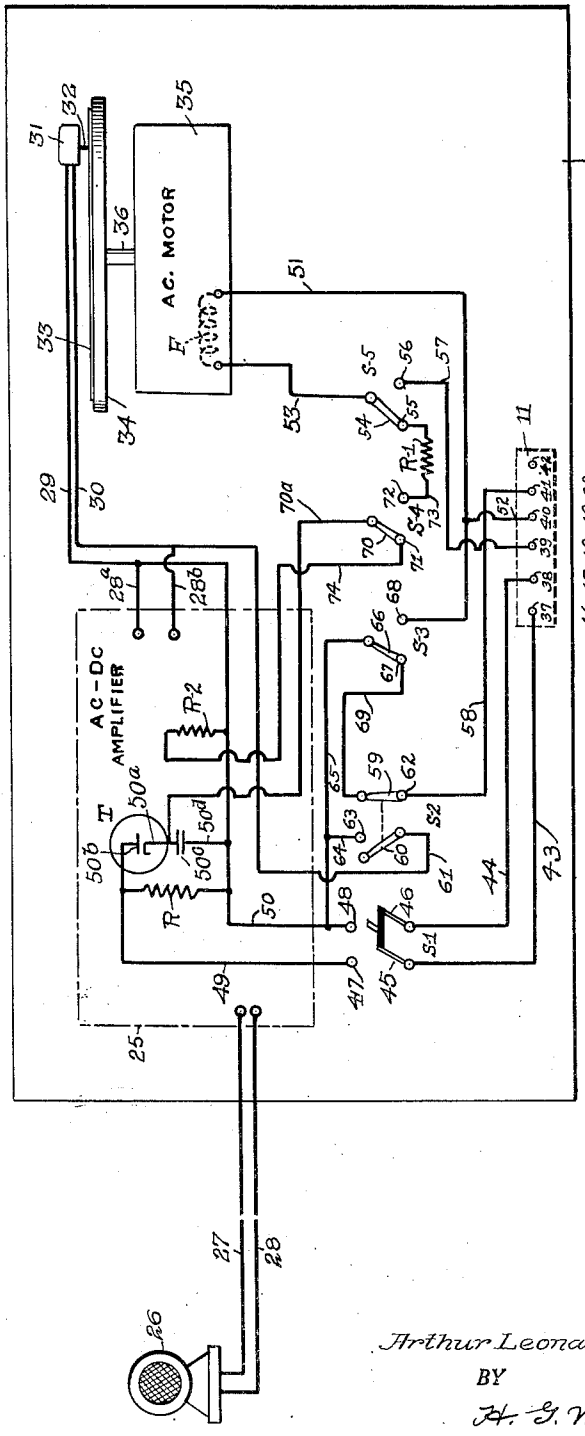
Dec. 13, 1949 A. L. ANDERSON 2,491,243

ELECTRIC BRAKING MEANS FOR PRODUCING A FAST STOP IN PHONOGRAPH MOTORS

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Fig. 1.



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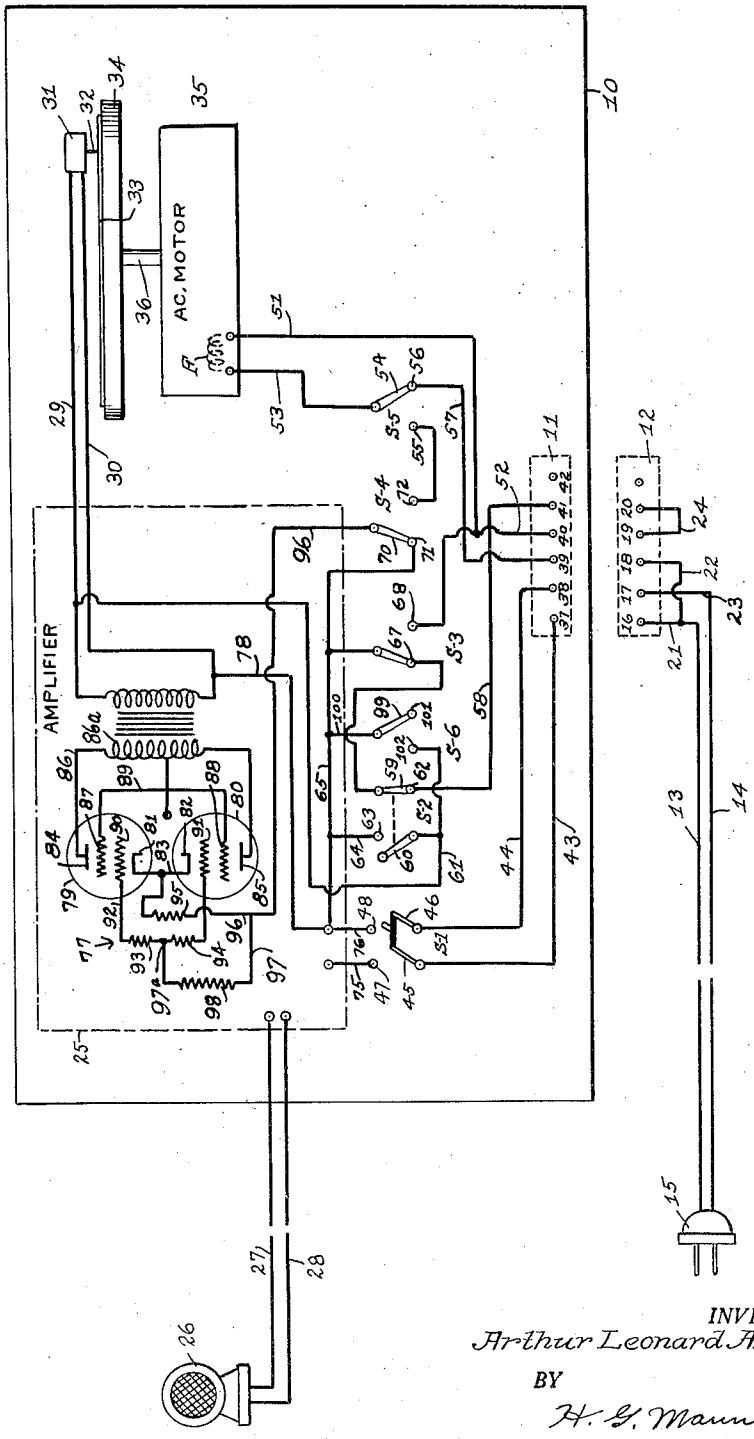
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ELECTRIC BRAKING MEANS FOR PRODUCING A FAST STOP IN PHONOGRAPH MOTORS

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Fig. 2.



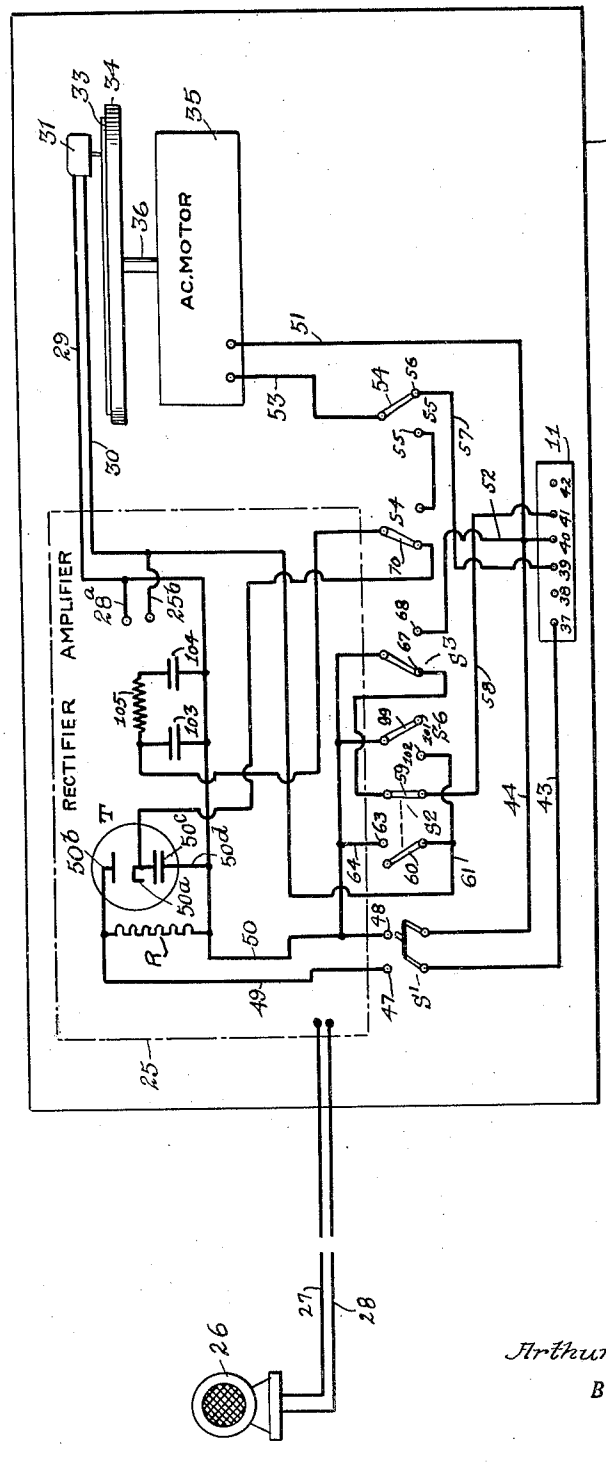
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Fig. 3.



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Patented Dec. 13, 1949 2,491,243

UNITED STATES PATENT OFFICE

2,491,243

ELECTRIC BRAKING MEANS FOR PRODUCING A FAST STOP IN PHONOGRAPH MOTORS

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Application April 2, 1945, Serial No. 586,108

4 Claims. (Cl. 179—100.4)

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This invention relates to sound recording, and more particularly to means for applying a quick braking action to a phonograph induction motor for the purpose of rapidly stopping the turntable and to avoid wasting of the transcriber's time in listening during the reproduction of the record.

One object of the present invention is to provide a mechanism of the above nature which will avoid the necessity of operating the motor except during the actual recording periods.

A further object of this invention is to provide an apparatus of the above nature employing an alterating current induction motor and having circuits of different natures whereby the field of said motor may be supplied with direct current to provide a sudden magnetic braking action for stopping the turntable of a dictating machine.

A further object is to provide an apparatus of the above nature in which the direct current for producing the fast stop of the turntable motor is obtained by the use of a condenser discharge.

A still further object is to provide an improved apparatus of the above nature which will be relatively inexpensive to manufacture, which will avoid blank coasting periods on the record, which will be simple in construction, compact, ornamental in appearance, and very efficient and durable in use.

The device as described in the present application is an improvement over the sound recording apparatus described in the prior Patent No. 2,342,503, issued to Lincoln Thompson on February 22, 1944, entitled Control circuit for sound recording apparatus, which was reissued on February 20, 1945, No. Re. 22,606.

The present invention is also an improvement over the apparatus disclosed in an application filed June 19, 1944, by Theodore H. Nakken, Serial No. 540,929, entitled "Rapid start and stop clutch mechanism for phonographs," patented May 18, 1948, No. 2,441,836.

In order to produce a rapid stopping of the record when the dictator is through talking, various forms of mechanical clutch brake mechanisms have been employed in the past, but these mechanisms were complicated and expensive, and it was difficult to avoid momentary oscillations in the speed which would distort the reproduction. Moreover, such mechanisms were liable to jerk the recording mechanism and result in shocks and jars which also would distort the reproduction.

By means of the present invention, the above and other disadvantages have been avoided by providing an apparatus which will produce a fast stop of the turntable motor electrically by switching direct current into the field of the turntable induction motor during the stopping period—this action producing a rapid magnetic braking effect without mechanical shocks. The rectifier system of the amplifier is a good source of such direct

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current, and such use is disclosed in the first form of the present invention. In this form a high-wattage resistor is employed to limit the current applied to the motor to prevent overloading the rectifier tubes.

In the second form of the invention, the use of a high resistor is eliminated by obtaining the direct current from a circuit in series with the output of the power tubes of the amplifier.

In the third form of the invention, use is made of a condenser which is charged while the motor is running and is discharged into the motor during the stopping period. This system has the advantage that the B-supply is not applied to the motor during the standby periods.

With these and other objects in view, which will appear as the description proceeds, there have been illustrated on the accompanying drawings three forms in which the invention may conveniently be embodied in practice.

In the drawings,

Fig. 1 is a diagrammatic view of the circuit connections of an apparatus for employing a D. C. magnetic braking action upon a phonograph induction motor and in which said D. C. is obtained from the rectifier of the amplifier.

Fig. 2 is a similar diagrammatic view of the circuit connections of a modified form of apparatus in which the D. C. for applying magnetic braking action is supplied to the motor from the rectified output stage of the amplifier.

Fig. 3 is a similar diagrammatic view of the circuit connections of another modified form of apparatus in which the D. C. braking current is obtained by discharging a condenser resistance network through the phonograph motor.

As in the apparatus disclosed in the above-mentioned Reissue Patent No. 22,606, the present invention includes an electronic amplifier which may operate on either A. C. or D. C. and a disk record turntable driven by a motor which may operate only on A. C.

First form

Referring now to the drawings in which like reference characters denote corresponding parts throughout the several views, the numeral 10 (Fig. 1) indicates a recorder cabinet of a dictating machine of the disk record type such as was disclosed in the Patent No. 2,200,866, issued to Lincoln Thompson May 14, 1940, and reissued September 22, 1942, No. Re. 22,133, entitled "Apparatus for recording sound on thin disks."

At the rear of the cabinet 10, provision is made of a 6-prong plug 11 which is adapted to be detachably connected to a corresponding 6-aperture socket 12, connected by a pair of conductors 13, 14 to a 2-prong plug 15 adapted to be inserted into an A. C. power line (not shown).

The socket 12 has six apertures, five of which

contain active contacts 16, 17, 18, 19, 20, and the sixth of which has no contact. The conductor 13 is joined by a wire 21 to the contact 16, and a wire 22 connects the wire 21 to the contact 18. The conductor 14 is connected by a wire 23 to the contact 17. The contacts 19, 20 are connected together by a wire 24.

Provision is made of an A. C.-D. C. amplifier 25 which is connected to a microphone 26 by a pair of conductors 27, 28. The output of the amplifier 25 is led by a pair of conductors 28*a*, 28*b*, to a pair of wires 29, 30, leading to a recording head 31 having a stylus 32 resting upon a thin disk record 33 mounted upon a flat turntable 34.

The turntable 34 is adapted to be driven by an A. C. motor 35 having a driving shaft 36 and a field coil F as indicated diagrammatically in Fig. 1.

The plug 11 has six prongs 37, 38, 39, 40, 41, 42, and it will be seen that current will be supplied from the power line through the contacts 16, 17 to the prongs 37, 38 which lead through wires 43, 44 to an amplifier switch S_1 located on the recorder cabinet 10. The prong 42 is electrically inactive, and merely serves as a guide member.

The amplifier switch S_1 has a pair of pivoted blades 45, 46 connected to the wires 43, 44, and said blades when in closed position, engage a pair of contacts 47, 48, from which a pair of wires 49, 50 supply current to the rectifier tube T of the A. C.-D. C. amplifier 25. The rectifier tube T has a cathode 50*a* and a plate 50*b*, the former being connected to a condenser 50*c* joined by a wire 50*d* to the conductor 29. A resistance R (which for simplicity represents the load of the filaments of the other tubes of the amplifier) is connected in shunt with the conductors 49, 50, as shown.

The A. C. motor field coil F is connected at one end by a conductor 51 to a wire 52 leading to the contact 40 of the 6-prong plug 11. The other end of the field coil F leads through a wire 53 to a pivoted blade 54 of a stop switch S_5 having a pair of fixed contacts 55, 56. When the blade 54 is in its right hand position engaging the contact 56, it will be electrically connected by a conductor 57 to the prong 39 of the 6-prong plug 11.

The contact 41 of the plug 11 is connected by a conductor 58 to a contact 62 of a motor switch S_2, which contact 62 is adapted to be engaged by a pivoted blade 59 mechanically connected with a similar blade 60 joined by a conductor 61 to the wire 30 leading to the recording head 31.

The switch S_2 also has a fixed contact 63 which is connected by a wire 64 to a conductor 65 leading from the conductor 50 to a single pivoted blade 66 of a switch S_3, which blade 66 is adapted to engage selectively with a pair of fixed contacts 67, 68. The contact 67 is connected by a conductor 69 to the blade 59 of the switch S_2, while the contact 68 is joined to the wire 51 leading to the field coil F of the motor 35.

Provision is also made of a switch S_4 having a single pivoted blade 70 adapted to engage the contacts 71, 72, selectively. The blade 70 is joined by a conductor 70*a* to the cathode 50*a* of the rectifier tube T. The contact 72 is joined by a conductor 73 to a high resistance R_1 electrically connected to the contact 55 of the switch S_5. The resistor R_1 is adapted to limit the current through the motor 35 and the rectifier tube T during the braking action.

The contact 71 is joined by a wire 74 to a resistor R_2, which in turn is connected to the conductor 29 leading to the recording head 31. The resistor R_2 for simplicity is intended to represent the D. C. load of the tubes of the amplifier 25.

It will thus be seen that the switch S_1 controls the flow of current to the A. C.-D. C. amplifier 25, and that the switch S_2 controls the current applied to the field F of the A. C. motor 35.

It will also be seen that when the blade 59 of the switch S_2 engages its contact 62, the blade 60 will be out of engagement with its contact 63, and vice versa.

Moreover, the conductors 29, 30 will be connected together by the wires 65 and 64, blade 60, and wire 61 when the motor is shut off so as to short-circuit the output of the A. C.-D. C. amplifier during pauses in the dictation when the motor is not running. The possibility of acoustical feed back between the microphone and the recording head will thereby be prevented in a manner similar to the disclosure in the Patent No. 2,342,503, previously mentioned.

Operation of first form

In operation, during dictation, when the turntable 34 is being rotated by the motor 35, current supplied to the rectifier tube T will flow in the following circuit: from supply plug 15 through conductors 14, 23, 44, blade 46 of switch S_1, conductors 50, 50*d*, condenser 50*c*, cathode 50*a*, plate 50*b*, conductors 49, 43, 21, 13, back to the plug 15.

The motor circuit will be as follows: from the conductor 23 through conductors 44, 50, 65, blade 66 of switch S_3, conductor 69, blade 59 of switch S_2, conductors 58, 24, 52, 51, motor field coil F, conductor 53, blade 54 of switch S_5, conductors 57, 22, to the conductor 21.

The cathode 50*a* will be connected through the conductor 70*a* and the blade 70 of the switch S_4 and contact 71 to the high resistor R_2.

In the motor stopping position, the B potential supplied by the cathode 50*a* of the rectifier tube will be applied to the motor field coil F from the cathode 50*a* through wire 70*a* to switch blade 70, contact 72, high resistor R_1, contact 55, switch blade 54 of switch S_5, lead 53, field coil F, lead 51 to contact 68 of switch S_3, blade 66, and lead 65 to wire 50.

Direct current from the A. C.-D. C. amplifier will thus be applied as a magnetic brake to the field F of the A. C. motor, the resistor R_1 serving, as stated above, to limit the D. C. passing through the rectifier tube and prevent overheating of the motor 35 and the recording cabinet 10.

It will be understood that the switch blades S_2, S_3, S_4, and S_5 may be interlocked by suitable mechanism so that they may be shifted from operating to stopping position and vice versa by a single actuation of a control means for the interlocking mechanism.

Second form

In the modified form of the invention shown in Fig. 2, the D. C. used to provide the braking action of the motor 35 is taken from the output stage of the amplifier instead of from the "B" supply terminals of the rectifier tube of said amplifier as in the first form, shown in Fig. 1.

Power is supplied to the amplifier 25 through a pair of conductors 75, 76, which are connected through the switch S_1, conductors 43, 44, plug 11, socket 12, wires 21, 23, and wires 13, 14 to the power plug 15, as clearly shown in Fig. 2.

During the dictation, current is supplied to the motor 35 for rotating the turntable 34 through

a circuit similar to that described in the diagram of Fig. 1 for the first form of the invention.

The motor stopping circuit for the second form, shown in Fig. 2 is also similar to that of the first form except that an additional switch S_6 is provided for short-circuiting the recording head 31 when the motor 35 is stopped. The switch S_6 has a blade 99 connected by a conductor 100 to the conductor 65. The blade 99 is adapted to engage an idle contact 101 when the motor is operating, and a contact 102 when the motor is stopped. The short circuit is completed through the conductor 30 which is also connected by a conductor 78 to the conductor 65.

This arrangement allows the direct current from the output stage 77 of the amplifier 25 to flow through the field F of the motor 35 when the switches S_2, S_3, S_4, S_5, and S_6 are actuated to produce a fast stopping action upon the motor 35.

The output stage 77 of the amplifier includes a pair of tetrode electron tubes 79, 80, containing cathodes 81, 82 connected by a conductor 83, and a pair of anodes 84, 85 connected by a conductor 86, a pair of grids 87, 88 connected by a conductor 89, and a pair of grids 90, 91 connected by a conductor 92. The conductor 86 includes a transformer inductance 86*a* in series therewith, while the conductor 92 includes in series therewith a pair of resistors 93, 94. The conductor 83 is connected to a resistor 95 which in turn is joined by a wire 96 to the blade 70 of the switch S_4. Provision is also made of a shunt circuit 97 connected at one end to a junction 97*a* of the resistors 93, 94 and at the other end to the conductor 96. The shunt circuit 97 also includes a resistor 98 in series therewith.

It will also be understood that the blade 54 of the switch S_5, blade 70 of switch S_4, blade 66 of switch S_3, and blade 99 of switch S_6 may be operated either manually or actuated by means of relays. In the latter case, the relays may be supplied with current from the B-supply of the amplifier 25 and controlled by a switch (not shown) in the microphone 26.

One advantage of the motor-stopping circuit illustrated in Fig. 2 is that the use of the heavy resistor R_1 of the first form shown in Fig. 1 is eliminated. The power consumption will thereby be reduced and the generation of excessive heat in the cabinet avoided.

Third form

In the modified form shown in Fig. 3, D. C. for providing the rapid magnetic braking action upon the motor 35 is obtained from a condenser-resistor network including a pair of condensers 103, 104, and a resistor 105 connected therebetween.

The switching from the operating circuit to the stopping circuit will be accomplished in a manner similar to the first two forms of the invention by interlocking control means for actuating all five of the switches S_2, S_3, S_4, S_5, and S_6 simultaneously. During this switching action, the swinging of the blade 70 of switch S_4 will cause the condensers 103, 104 (which have previously been charged with D. C. potential from the B-supply of the rectifier tube T of the amplifier) to discharge through the motor 35. The condenser 103 will be rapidly discharged so as to apply a sudden braking action to bring the motor to an initial quick stop. Immediately thereafter, the condenser 104 will more slowly discharge through the resistor 105 and will provide the remainder of the motor-braking action.

The condenser-resistor discharge circuit will be so designed as to give the proper discharge period to correlate with the time required for the brake to stop the motor and prevent coasting.

It is also within the scope of the present invention to control the operation of switches S_5, S_4, S_3, and S_6 by relays responsive to the manual actuation of switch S_2, placed in the relay coil circuits, instead of directly braking the motor circuit as shown in Figs. 1, 2, and 3.

While there have been disclosed in this specification several forms in which the invention may be embodied, it is to be understood that these forms are shown for the purpose of illustration only, and that the invention is not to be limited to the specific disclosures, but may be modified and embodied in various other forms without departing from its spirit. In short, the invention includes all the modifications and embodiments coming within scope of the following claims.

Having thus fully described the invention, what is claimed as new, and for which it is desired to secure Letters Patent, is:

1. In a phonograph recorder, a source of audio-frequency signals, sound record supporting means, an A. C. induction motor for driving said means, an electronic amplifier connected to said source, a recording head responsive to said amplifier for recording upon said record the amplified sound vibrations received by said source, means to supply A. C. to said motor to drive said record, means for applying the pulsating unidirectional current of the output of said amplifier to the field of said motor for exerting a sudden braking action to rapidly stop said record supporting means and reduce the length of the coasting period, and means to control the amount of the D. C. from said amplifier output supplied to said motor circuit.

2. The invention as defined in claim 1, in which resistance means are employed to control the amount of D. C. from the amplifier supplied to said motor circuit.

3. The invention as defined in claim 1 in which the output stage of said amplifier has a pair of tetrode electron tubes each containing a cathode, an anode and two grids, and resistance means in said output stage to control the amount of D. C. supplied therefrom to said motor circuit.

4. The invention as defined in claim 1 in which switch means are provided to simultaneously shut off the supply of A. C. to said motor, supply D. C. to the field of said motor, from the output of said amplifier and short-circuit the recording head to nullify any howling tendency due to the proximity of said microphone and said recording head.

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