May 20, 1947. J. B. LITTLE 2,420,671

MAGNETIC RECORDER

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FIG. 1

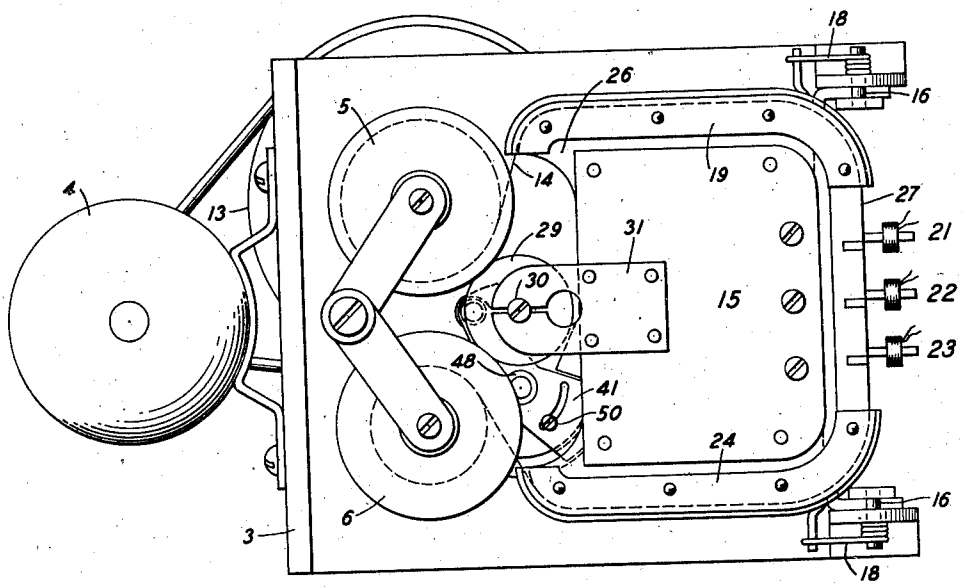
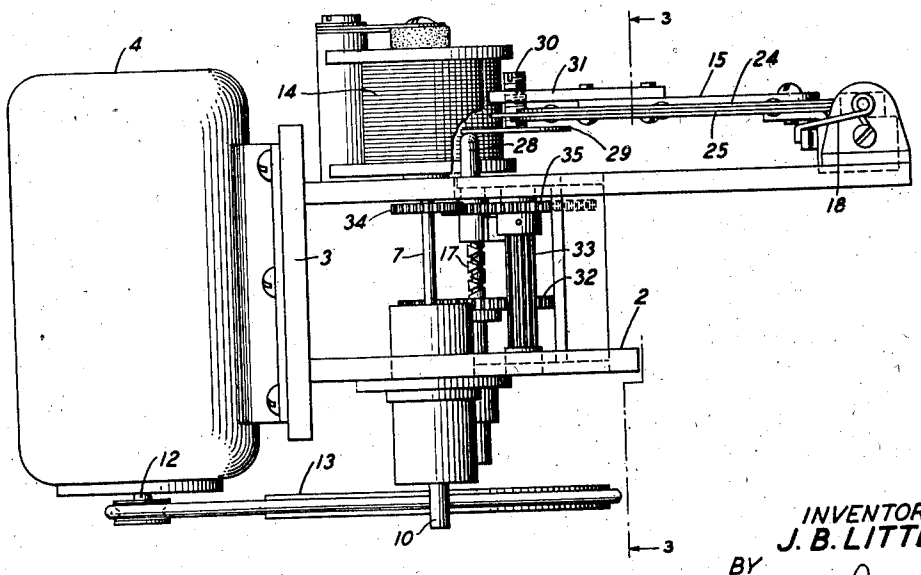


FIG. 2



INVENTOR
J. B. LITTLE
BY W. C. Parnell
ATTORNEY

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FIG. 3

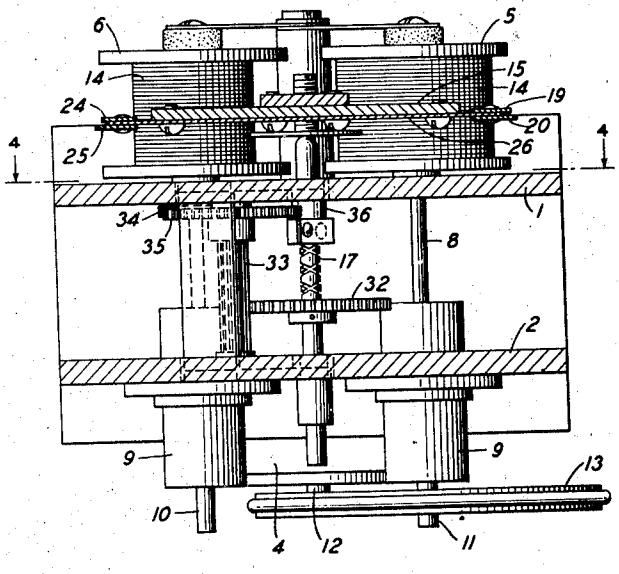


FIG. 4

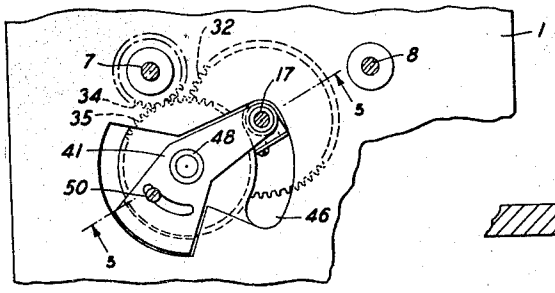


FIG. 5

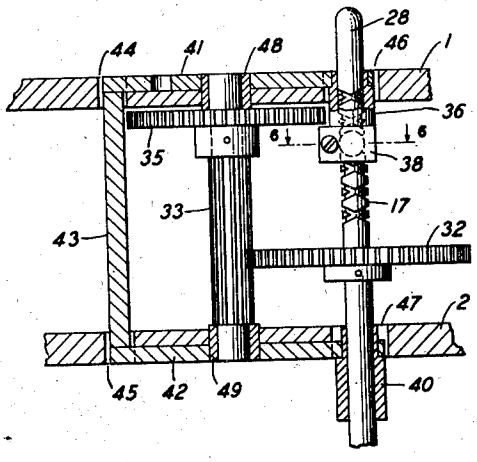
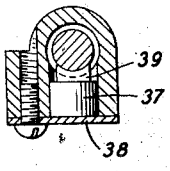


FIG. 6



INVENTOR
J. B. LITTLE
BY W. C. Parnell
ATTORNEY

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2,420,671

MAGNETIC RECORDER

John B. Little, Summit, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application October 27, 1944, Serial No. 560,699

10 Claims. (Cl. 179—100.2)

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This invention relates to magnetic recording and the object of the invention is a very compact recorder of this type which is capable of giving both long playing time and high quality of reproduction.

As is well known, both the playing time and the quality of reproduction obtained with a magnetic recorder are dependent on the speed of the wire or tape used as the record member and, other conditions being equal, the normal playing time can be increased only by accepting a corresponding reduction in quality and vice versa. It is also generally recognized that wire must be operated at several times the speed necessary with tape in order to give the same quality of reproduction.

On the other hand, wire may be readily spooled thereby permitting it to be stored in a very compact manner whereas the tapes commonly used heretofore have been reeled in flat coils which are necessarily of large diameter in the case of long play machines. Many attempts have been made to spool these tapes in order to avoid the necessity of using large reels but, insofar as applicant is aware, none of these efforts has been commercially successful since such tapes always buckled or warped and could not be spooled so as to lie in smooth regular layers.

According to this invention spooling of tape is effected satisfactorily by using a tape which is much narrower and hence exhibits less tendency to buckle than those commonly used heretofore and spooling this tape by means of a pivoted oscillating tape distributing mechanism in which the tape is free to twist or deflect in a torsional sense thereby relieving the edgewise stresses which would otherwise prevent the tape from lying flat on the spools. The tape is transferred from one spool to the other through a talking head carried by the distributing mechanism on the axis of oscillation where it is in offset relation to the reels. The section of tape extending from one spool to the other is pulled through between the spools to form an offset loop extending around the distributing mechanism between guides which have a substantially right-angle bend adjacent each spool. As the tape is transferred from one spool to the other by the oscillating action of the distributing mechanism it always approaches the take-up spool at the proper angle to lie in a flat spiral due to its freedom to twist in the guides on the other side of the bend.

These and other important features are explained in more detail in connection with the drawing in which:

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Figs. 1, 2 and 3 are plan, side and end views respectively of a recorder according to the invention; and

Figs. 4 to 6 are detail views of the tape spooling mechanism.

In the drawing the upper and lower mounting plates 1 and 2 are secured to a frame 3 carrying a centrally disposed driving motor 4. The tape reels or spools 5 and 6 are mounted on shafts 7 and 8 which are connected through suitable speed reduction mechanisms 9, 9 to drive shafts 10 and 11. In the structure shown these latter shafts are equidistant from the shaft 12 of the motor so that the drive pulley 13 may be readily placed on either of the shafts 10 or 11 and the motor reversed as required to drive the tape in opposite directions for recording and rewinding, respectively. It will be understood, of course, that this particular form of reversing drive is merely illustrative and may be replaced by any other known mechanism suitable for the purpose.

The record member 14 is preferably a tape about .020 inch wide and .002 inch thick which is somewhat less than half as wide as the tapes commonly used heretofore.

The tape spooling mechanism comprises essentially a rigid distributor plate 15 mounted on the plate 1 by means of the shafts 16, 16 and a reversing screw 17 against the upper end of which the plate 15 is held by stiff springs 18, 18 so that driving contact is maintained with the machine in any position. The tape extends from the spool 5 between the guides 19 and 20, the pole-pieces of the talking head magnets 21, 22, 23 and the guides 24 and 25 to the spool 6. The guides are mounted on a plate member 26 of a thickness only slightly in excess of the tape width and the lower guides 20 and 25 preferably extend beyond the upper guides as shown to facilitate threading of the tape between them. The plate member 26 is secured to the plate 15 with the edge 27 (Fig. 1) extending along the pivot axis defined by the shafts 16, 16 so that the portion of the tape passing through the talking head is always on the axis of the distributor plate. The width of the member 26 is somewhat greater than the spacing of the spool shafts 7 and 8 and the tape is fed from and reeled up on adjacent sides of the spools so that it makes a substantially 90-degree bend in passing from the distributor mechanism to either spool as shown.

The upper rounded end 28 of the reversing screw 17 engages the flat circular plate 29 which is adjustably mounted on the distributor plate 15 by means of a screw 30 in the plate 31. The re-

versing screw 17 carries a gear 32 meshing with a long pinion 33 which is driven from the shaft 7 by means of the gears 34 and 35.

The upper bearing 36 of the reversing screw 17 has a floating pawl 37 (Fig. 6) which is held in the lower part of the bearing housing by a cover plate 38 with the tongue 39 engaging the thread grooves of the screw. As the screw is rotated by the pinion 33, the pawl will therefore impart an axial motion to the screw and when at either end of the screw travel the pawl strikes the reverse pitch portion of the thread it is thereby rotated in its housing into the proper position for producing the return movement. By proper choice of the driving gear ratio and the length and pitch of the screw threads the distributor plate 15 is oscillated about the axis 16, 16 at the proper rate and amplitude to lay the tape evenly on the take-up spool. Some adjustment of the throw of the plate to adapt the machine to the use of spools of different lengths is provided by mounting the screw 17 so that its distance from the axis of the distributor plate may be varied as required. For this purpose the bearings 36 and 40 are mounted in the arms 41 and 42 which are secured together by the strap 43 extending through slots 44 and 45 in the upper and lower mounting plates 1 and 2 as shown in Figs. 4 and 5. Similar arcuate slots 46 and 47 are provided for the bearings 36 and 40 so that the arms 41 and 42 may be rotated about the outer surfaces of the bearings 48 and 49 of the pinion 33 and fixed in any desired position in their travel by the set screw 50. In Fig. 4 the screw is shown in its extreme backward position or furthest from the axis 16, 16 to give minimum throw of the plate 15 but as the screw supporting structure is rotated in a clockwise sense the screw moves toward the axis to increase the throw. The contact plate 29 is of sufficient diameter to engage the rounded portion 28 of the screw in any position throughout its range of adjustment and when the throw is correct for the length of the spools used, the upper and lower limits of motion may be adjusted with respect to the ends of the spools by means of the set screw 30.

As already pointed out the tape used with this machine is relatively narrow and this in itself is a large contributing factor in the successful spooling of the tape in regular even layers without buckling or forming deep crevices as in prior machines. It is also found however that by mounting the spools close together and passing the tape from one spool to the other around the distributor plate in an offset loop in the manner shown it is possible to obtain smooth spooling with a very compact structure. With this construction, the edgewise bending stresses in the tape produced by laying the tape on the spools in spiral form are relieved as the tape passes around the 90-degree bend to the straight portion of the guides since any such stresses in the portion of the tape being spooled merely causes the tape to twist slightly in the guides instead of buckling on the spool.

The location of the magnets 21 to 23 on the distributor plate in the line of the pivot axis where they are remote from the spools has several advantages. Since both the magnets and the section of tape involved in the recording and reproducing operations are on the pivot axis their displacement during the spooling operation is very small. For the limited rotary motion which does occur, the tape and magnets move as a unit and such motion does not adversely affect the

quality of reproduction. The fact that the magnets remain practically stationary also has the further advantage that the leads to the magnets are not subjected to excessive bending stresses. Due to the fact that a long curved tape guide is interposed between the magnets and each spool, tape vibration at the translating point is substantially eliminated and any longitudinal flutter in the tape tends to vibrate the distributor mechanism, including the magnets, as a unit and hence does not introduce appreciable distortion.

While no amplifier apparatus or circuits have been shown, since they form no part of this invention, it will be understood that in a commercial machine of the type contemplated such apparatus of any suitable known type would be mounted on the underside of the plate 1 and enclosed with the mechanical structure as a compact unit in a suitable casing.

In one machine according to this invention it was found that 3,000 feet of tape could be stored on spools only 2½ inches in diameter and 1 inch long. Operating at only 5 feet per second this machine was capable of recording and reproducing over a frequency range up to 30,000 cycles per second for a playing time of 10 minutes. For good quality voice reproduction up to about 5,000 cycles the tape speed may be correspondingly reduced to give a playing time of half an hour.

What is claimed is:

1. In a magnetic recorder, the combination with two reels, a record member on the reels and driving means therefor, a guiding distributor, a sound head mounted thereon, means for conducting the member from one reel to the other through said sound head, said distributor including loop-forming means, a pivot axis for the distributor extending through the sound head and means for oscillating the distributor about the axis to spool the member from one reel to the other.

2. A recorder, according to claim 1, in which the distributor is oscillated by a reversing screw rotated by the driving means and in which the screw is adjustably mounted with respect to the pivot axis of the distributor to control the amplitude of the distributor oscillations.

3. In a magnetic recorder, two reels mounted in closely spaced relation, a narrow magnetic tape wound on the reels, a tape distributor pivotally mounted for oscillation about an axis in offset relation to the reels, a source of power for rotating the reels and oscillating the distributor to spool the tape from one reel to the other, guides for conducting the portion of the tape between the reels around the distributor and bends in the guides adjacent the spools for relieving stresses produced in the tape by the spooling operation.

4. In a recorder, the combination with two reels mounted in closely spaced relation, pivotally mounted distributor mechanism for spooling a record member from one reel to the other and driving means for the reels, of an oscillating member driven by one of the reels for operating the distributor mechanism and means for adjusting the oscillating member with respect to the pivot mounting to vary the throw of the distributor mechanism.

5. In a magnetic recorder, two reels mounted in closely spaced relation, a narrow tape on the reels, a distributor plate having peripheral guides conducting the tape around a loop offset with respect to the reels, a pivot axis for the plate remote from the reels, magnets mounted on the

plate and cooperating with the tape along the pivot axis, driving means for the reels, a pinion driven by one of the reels, a reversing screw driven by the pinion for oscillating the plate and a support for the screw rotatably adjustable with respect to the pinion for varying the amplitude of the plate oscillations.

6. In a magnetic recorder, two reels in closely spaced relation, a tape on the reels, driving means therefor, an oscillating distributor for spooling the tape from one reel to the other, guides on the distributor for conducting the tape between the reels around an offset loop and bends in the guides adjacent the reels for permitting the tape to twist in the guides to relieve the edgewise bending stresses produced in the tape in the spooling operation.

7. In a magnetic recorder, the combination with two reels, a record member on the reels and driving means therefor, a guiding distributor for feeding said member to and from said reels, said distributor including loop-forming means, a sound head in operative relation to said member at a point in said loop, means for oscillating the distributor to spool the member from one reel to the other.

8. In a magnetic recorder, the combination with two reels, a record member on the reels and driving means therefor, a guiding distributor for feeding said member to and from said reels, said distributor including loop-forming means, a sound head in operative relation to said member at a point in said loop, means for oscillating the distributor about an axis to spool the member from one reel to the other.

9. A recorder, according to claim 8, in which the distributor is oscillated by a reversing screw rotated by the driving means and in which the screw is adjustably mounted with respect to the pivot axis of the distributor to control the amplitude of the distributor oscillations.

10. In a magnetic recorder, the combination with two reels, a record member on the reels and driving means therefor, a guiding distributor for feeding said member to and from said reels, said distributor including loop-forming means, a sound head in operative relation to said member at a point in said loop and mounted on and movable with the distributor, means for oscillating the distributor to spool the member from one reel to another.

JOHN B. LITTLE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,078,357	Woodmansee	Apr. 27, 1937

FOREIGN PATENTS

Number	Country	Date
4933(26)	Australia	Aug. 2, 1927
61,052	Sweden	Mar. 29, 1922