

July 11, 1939.

P. C. RICCHIARDI

2,166,079

METHOD AND APPARATUS FOR THE MECHANICAL RECORDING OF SOUND OSCILLATIONS

Filed Nov. 6, 1936

6 Sheets-Sheet 1

Fig. 1

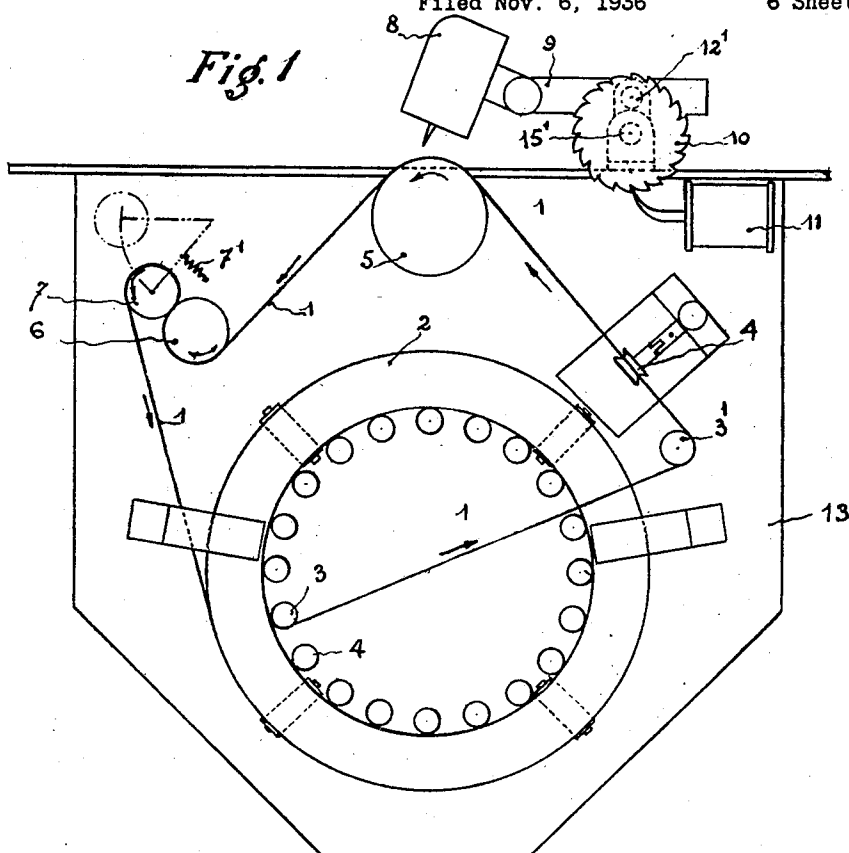
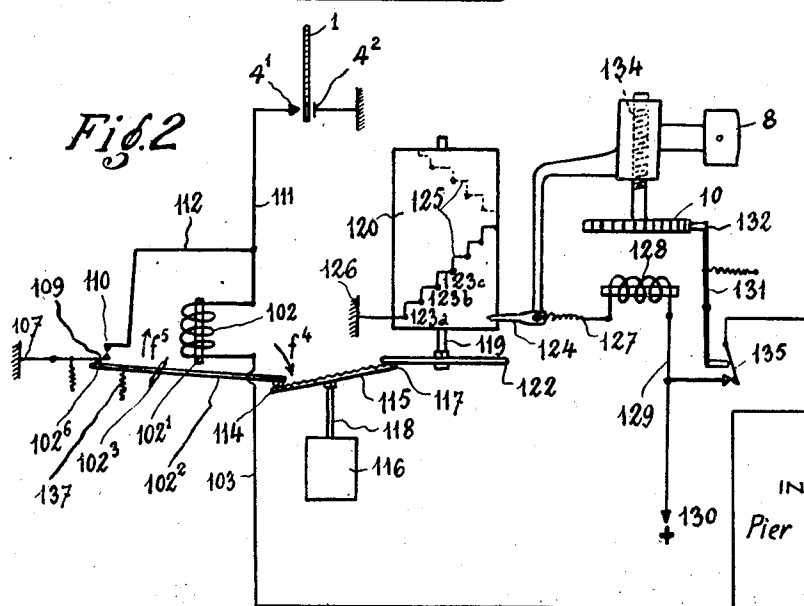


Fig. 2



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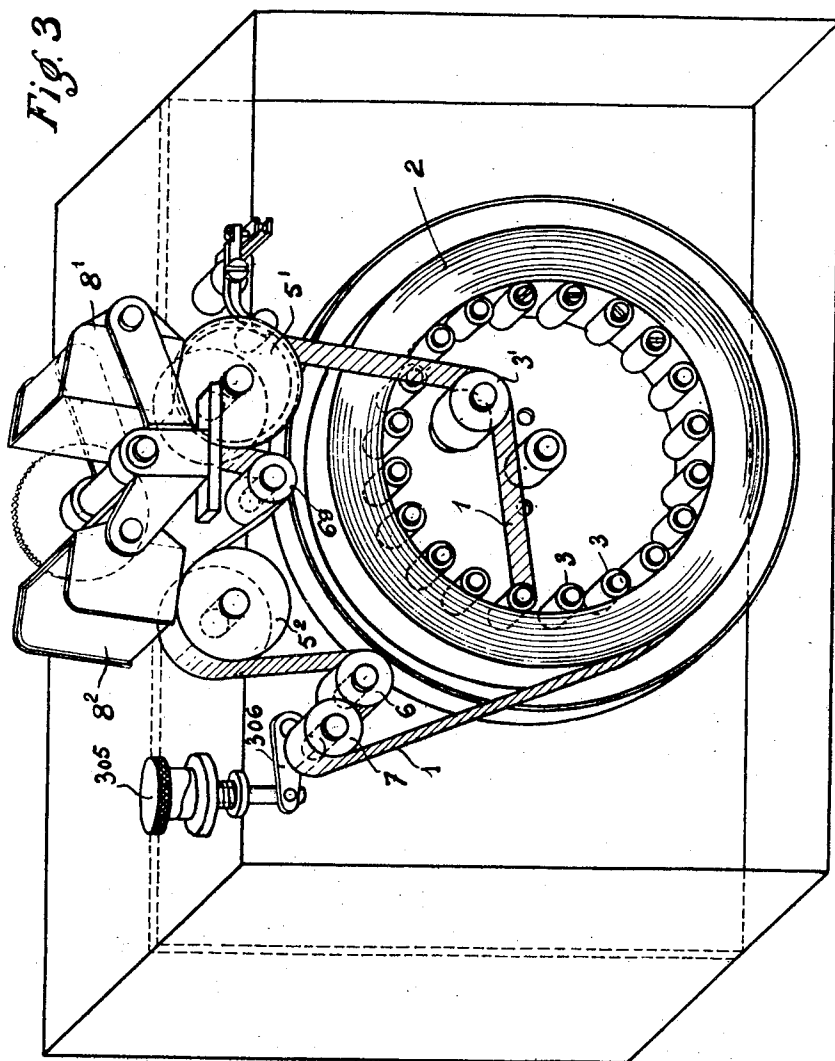
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6 Sheets-Sheet 2



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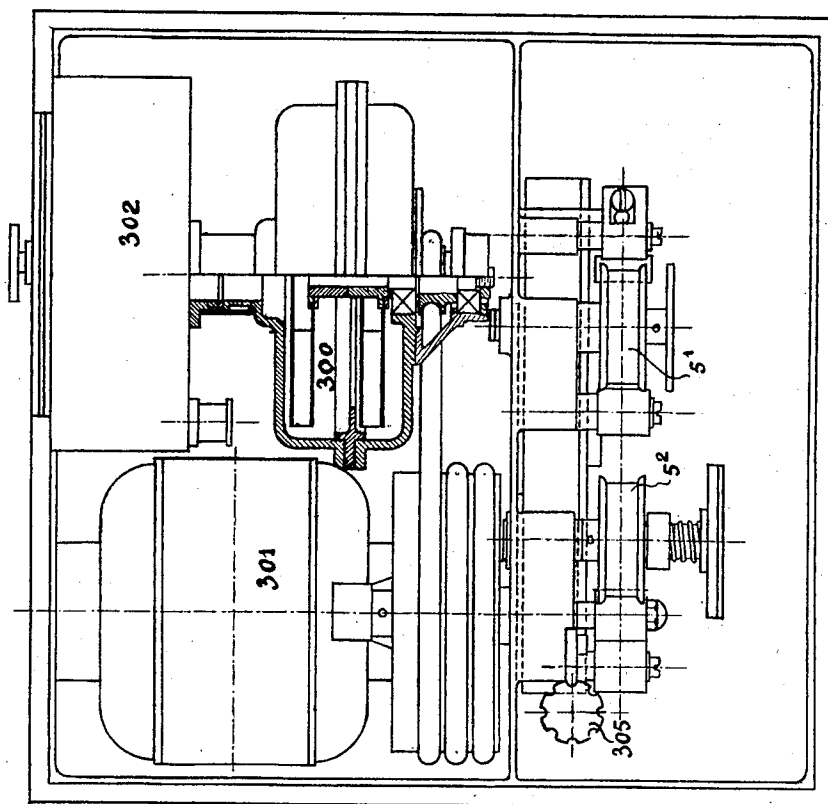
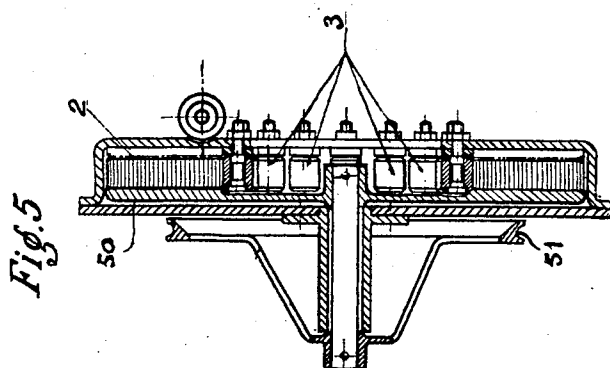


Fig. 4

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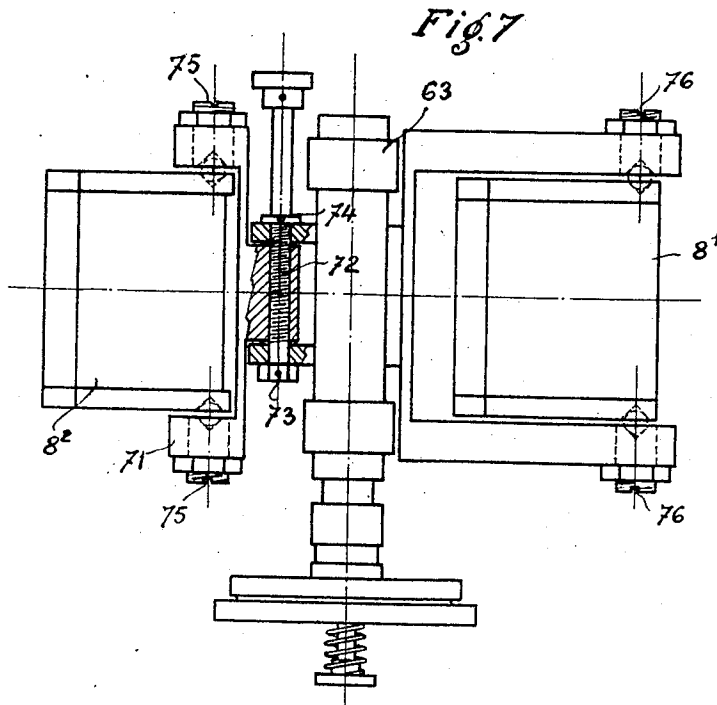
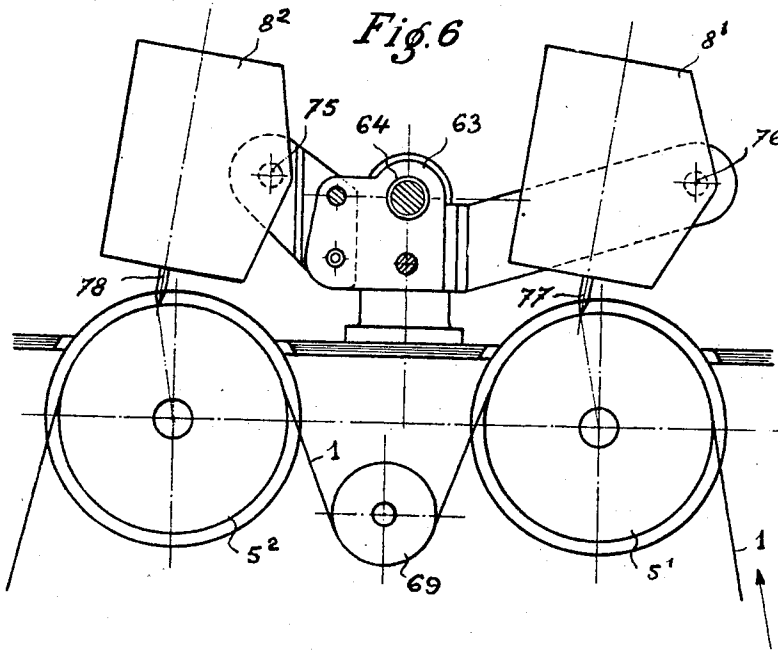
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6 Sheets-Sheet 4



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METHOD AND APPARATUS FOR THE MECHANICAL RECORDING OF SOUND OSCILLATIONS

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Fig. 8

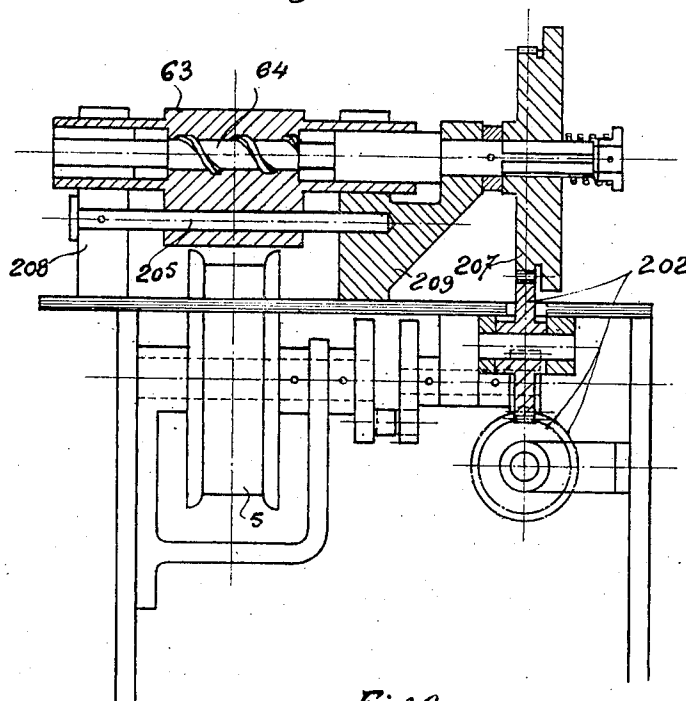
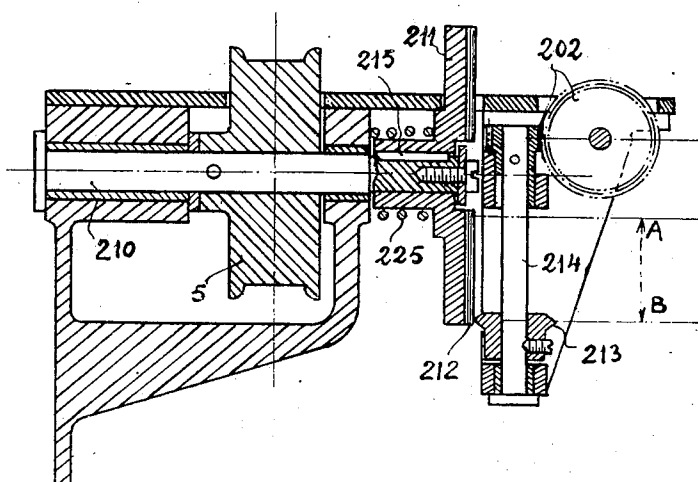


Fig. 9



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METHOD AND APPARATUS FOR THE MECHANICAL RECORDING OF SOUND OSCILLATIONS

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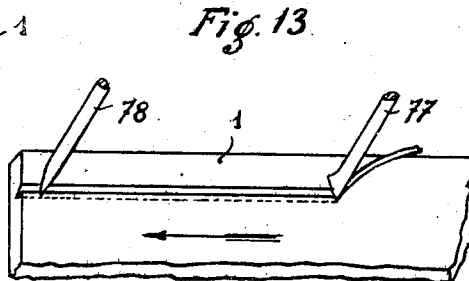
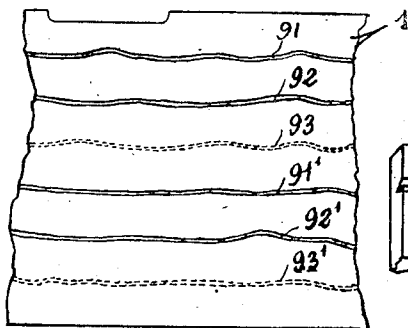
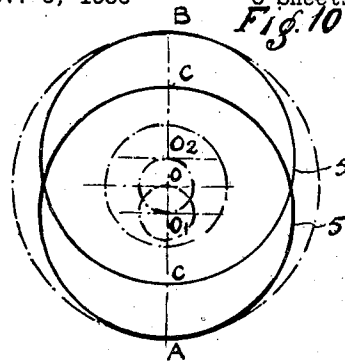
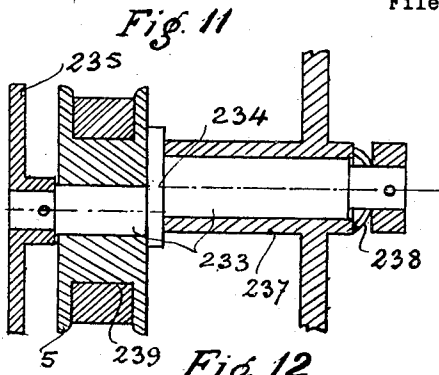


Fig. 14

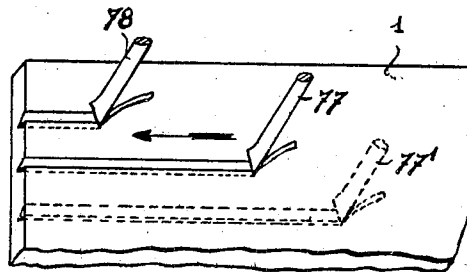
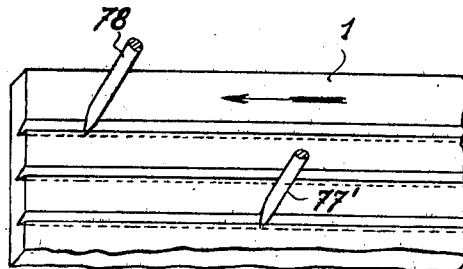


Fig. 15



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UNITED STATES PATENT OFFICE

2,166,079

METHOD AND APPARATUS FOR THE MECHANICAL RECORDING OF SOUND OSCILLATIONS

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Application November 6, 1936, Serial No. 109,473

7 Claims. (Cl. 274-11)

It has already been proposed to record, in a continuous manner, sounds on a film, the latter unwinding from a spool and winding up on another reel, the continuity of the recording being ensured by reversing the working of the motor.

The object of the present invention, on the contrary, is to provide an apparatus permitting to record sounds on a film by means of an engraving member, the film winding and unwinding in a continuous manner upon itself by passing several times in front of the engraving member always in the same direction, which permits of recording, while occupying a space as reduced as possible, sound records of long duration. The continuity of the recording is ensured by the gradual or step-by-step displacement of the recording member.

On the other hand, under actual conditions of the practice, recording apparatus of the engraving type include a recording member and, eventually, a reproducing organ. One of these members serves to trace the phonographic oscillations upon the support and the other serves to the reading of these oscillations. If several sound sources are simultaneously recorded, a mixing and a dosing of these various sources in certain proportions of sound intensities is effected then recording is effected on a single track which gives, during recording, a resultant of the different sound sources.

However, it happens frequently enough that, on account of a defective dosing or even of mistakes made during the recording, it is necessary to make a correction. No known method permits of performing such corrections, so that it is necessary to effect a new recording.

This new recording is possible in cinematographic works, where the same record can be repeated over and over, but, on the other hand, it is wholly impossible when recording an interview or a ceremony for broadcasting purposes, although such recordings are often defective because unforeseen events often occur.

The object of the present invention is to obviate these drawbacks. It is more especially intended to permit, after recording of the phonograms, of performing the necessary corrections without interfering with the other records already taken.

The present invention is essentially characterized in that the recording is effected along a plurality of tracks, corresponding to the respective sound sources, on a common support.

Therefore, when the sounds are reproduced, it is easy to observe the quality of the mixture of

the respective elementary records. It is then possible to wholly eliminate one of these records and to correct it or to replace it by a new record which will also be traced upon the same support.

The invention therefore consists in a new arrangement of the sound tracks on a support, especially on a film, in such manner that it becomes possible, after recording of the sounds from various sound sources, to correct, modify, and even replace one of the sound tracks, which is found to be defective, by one or several new sound tracks, without interfering with the other sound tracks.

This result is obtained by providing a number of recording and reproducing members equal to the number of sound tracks to be recorded upon the common record support, which may be a film or a disc.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a diagrammatical elevational view of a simplified apparatus for recording on an endless film;

Fig. 2 is a diagram of the electrical connections of the device for the lateral displacement of the engraving member;

Fig. 3 is a perspective view of the chief elements of an apparatus according to the invention;

Fig. 4 is a plan view of this apparatus;

Fig. 5 is an axial section of the film supporting drum;

Figs. 6 and 7 show in elevation and in plan view respectively the support of the engraving or reproducing members;

Fig. 8 is a section through the axis of lateral displacement of the engraving member of a control device according to a first embodiment;

Fig. 9 relates to another embodiment;

Figs. 10 and 11 show, in front view and in axial sectional view respectively, the roller on which the sounds are recorded;

Fig. 12 is a plan view of a piece of a film recorded according to the invention;

Figs. 13 and 15 are three diagrammatical views explaining the principle of recording and reproduction according to the invention.

The simplified apparatus shown in Figs. 1 and 2 essentially comprises an endless ribbon or film which is unwound from reel 2, in the direction indicated by the arrow, between two rollers 4

and 3. These rollers are a part of the whole constituting the central core of the reel fixed on magazine 13. These rollers are free to turn on their axis and the rotary movement with which they are moving is imparted thereto by ribbon 1 which acts by friction whereas the last spire of this ribbon unwinds under the action of a traction. Ribbon 1 leaves the magazine in an oblique direction. It is straightened up by a roller 3¹, in such manner as to be brought in the axis of drum 5 upon which it bears and along which the recording is effected by means of an engraving style 8.

When passing between the straightening roller 3¹ and drum 5, film or ribbon 1 rubs through its edge against the roller of a detector 4 which is intended to laterally displace the engraving member 8 after a full cycle of the endless ribbon. For this purpose, this ribbon is provided along its edge with a notch which, upon its passage, permits the detector 4 to oscillate and to release a relay, as it will be hereinafter explained.

From drum 5, ribbon 1 engages between a pulling roller 6 and a pressing roller 7 mounted loose upon its axis. The pressure of this roller 7 upon pulling roller 6 is easily obtained by means of a spring 7¹.

The pulling roller 6 is covered with rubber so as to exert without slipping its pulling action upon ribbon 1.

Upon leaving compressing roller 7, the ribbon goes back to reel 2 and automatically winds along the outer periphery of the latter.

The recording tool 8 is carried by an arm 9, pivoting at 12. This arm 9 is connected to a trailer 15 moving with a lateral movement. This trailer 15 is controlled by a sector 10 which includes as many teeth as there are sound traces to be recorded upon the surface of the ribbon.

An electrical device 11, which will be hereinafter described, serves to actuate sector 10 which, in turn, controls the displacement of the recording tool 8 at each passage of the notch provided for this purpose in ribbon 1.

An embodiment of the electric control device for the lateral displacement in a step-by-step manner of the engraving member is shown on the diagram of Fig. 2.

In this system, the displacement from one sound track to the other must take place before the end of the full cycle of the ribbon that constitutes the support, because otherwise, there would be a risk of two sound tracks being superposed, which would therefore destroy a part of the first recording.

In order to avoid the overlapping of two sound tracks, the electro-magnet controlling the displacement of the engraving member should work with a great rapidity and a great regularity, which is practically difficult to obtain.

In order to eliminate this drawback, according to the present invention, the displacement of the engraving tool for each full cycle of the ribbon is effected with a slight delay before this cycle is completed which provides for the continuity of the recording without stopping or overlapping.

In other words, it is supposed that the notch intended to bring into play the device for displacing the engraving style comes opposite detector 4 (Fig. 2) and that the surface of the ribbon permits of tracing thereon twenty sound tracks. The displacement of the engraving tool takes place in this case with a difference corresponding to twenty units of time for the first track. At the second passage, there is a differ-

ence of 19 units of time before the transverse displacement; for the third passage, the difference will be 18 units of time and so on until the surface of the ribbon is fully covered.

With this device it is found that a useful margin is obtained in the transverse displacement of the engraving tool, this margin corresponding to one unit of time for each full cycle of the ribbon and therefore a sufficient period of time for obtaining a deviation of the sound track before its meeting with the preceding track.

Ribbon 1 operates two contacts 4¹, 4² of detector 4 which are applied against each other when the notch of ribbon 1 is passing. When contacts 4¹, 4² are closed, the negative source of the electric feed which arrives to contact 4² passes to contact 4¹ through conductor 111, to the negative terminal of the electro-magnet, flows through the coil 102 of the latter and passes to the positive source 103.

The electro-magnet 102 is operated, its armature 102¹ is attracted and acts upon lever 102² which pivots about an axis 102³ in the direction of arrows f⁴ and f⁵. In the course of its oscillation, the end 102⁶ of lever 102 closes the negative circuit 107 through the making of contacts 109 and 110.

In the meantime, the notch of ribbon 1 has passed and contacts 4¹, 4² are again open and thus cut off the negative feed of electro-magnet 102.

But a maintaining circuit has been established by lever 102² and conductor 107, contacts 109 and 110, and conductor 112, itself connected to the negative terminal of the electro-magnet 102.

As lever 102² remains in its position of attraction, the end 114 of the latter acts against toothed wheel 115, which is kept in constant rotation by a motor 116 of any type.

Due to the effect of the pressure of part 114 against the external edges of wheel 115, the latter, which is elastic bears through its opposite side 117 against the surface of a friction wheel 122. The two axes 118 and 119 being thus interconnected, cylinder 120, carried by spindle 119, is set in rotation.

On cylinder 120 are helically mounted electric contacts 123a, 123b, 123c, . . . 123x. The number of contacts 123 on cylinder 120 is equal to the number of sound tracks to be traced upon the surface of the ribbon.

All these contacts 123 are connected to the negative mass 126. Cylinder 120 being set in movement, contact 123a comes into contact with brush 24 only after a certain time.

It will then be noted that, in order to obtain the desired time difference between each displacement of the engraving style, contacts 123 fixed on cylinder 120 are disposed along helix 125, determining for each of them a different and diminishing unit of time. This time is regulated by the speed of the spindle 119 of drum 120.

Contact 123a and brush 124 constitute a negative circuit which, starting from mass 126, contacts 123a, brush 124, conductor 127, the coil of electro-magnet 128, and conductor 129, is closed on the positive terminal 130.

Consequently, electro-magnet 128 is energized and attracts its lever 131. The end of this lever 131 carries a pawl 132 which causes sector 10 (Fig. 1) and therefore screw 134, to move a distance corresponding to a tooth. Under this action, engraving element 8 moves a distance equal to the space between two grooves. At the same time, brush 124, which is fixed to the trailer, moves the

same distance. On the other hand, the displacement of lever 131 releases contact 135 and cuts off the positive source 130 which feeds electro-magnet 102. Finally, a sudden breaking of the feed circuit of electro-magnet 128 is obtained, since contacts 123a and brush 124 are no longer in electrical connection.

However, it will be noted that the cutting off of the feed of electro-magnet 128 permits lever 102² to come back into its position of rest under the action of a return spring 137. This lever 102² releases toothed wheel 115 which in turn, by ceasing to rub against the disc 122, causes drum 120 to stop.

Therefore, the engraving style 8 has been moved along the ribbon a distance which is accurately determined and corresponds to the rotation of a tooth of sector 10 and therefore to the distance between two sound tracks.

This displacement is ensured with a delay with respect to the closing of contacts 41, 42 of the detector, this delay being equal to the number of units determined by the number of contacts mounted on cylinder 120. This delay will always go diminishing since the rotation of cylinder 120 is uniform.

Through this arrangement, I obtain the displacement of the style in a discontinuous manner for each cycle of the ribbon, with a sufficient lag for controlling all tolerances in the electric or mechanical precision of relay 102 controlled by the closing of contacts 41, 42, this lag being amply sufficient for ensuring the continuity of the sound grooves, without any risk of overlapping.

The simplified apparatus described with reference to Fig. 1 may undergo many modifications and variations without departing from the principle of the invention.

For instance, I will hereinafter describe a more complete apparatus, which includes other characteristic features which are of interest.

Fig. 3, which shows the whole of this apparatus shows the endless ribbon 1, which unwinds from reel 2 in the manner above described with reference to Fig. 1.

The magazine supporting reel 2, which more particularly shown in Fig. 5, is characterized by the following feature: The reel of endless ribbon 1 bears upon rollers 3, which are free to rotate upon their axis. The reel engages, with a lateral friction, a disc 50 which is given a rotary movement imparted by grooved pulley 51 driven by the engine.

Rollers 3, which constitute the magazine, have the same direction of rotation as the film, and move together with it in its movement, which permits the latter to easily disengage from its magazine without any jamming, as would otherwise occur if this central core were constituted by a single ring turning freely about the axis of the magazine.

The number and the diameter of rollers 3 are determined by the inner diameter that is chosen for reel 2, which diameter is also directly proportional to the number of spires which determines the length of the film. As a rule, the ratio of the inner diameter and the outer diameter of the reel will be $\frac{1}{2}$.

This ratio gives a resistance to traction sufficient for the correct recording of the oscillations, without producing any appreciable deformation of the support that is employed. This ratio is given merely by way of example and it may be substantially varied.

In order to reduce the tension of the ribbon

as it leaves the magazine, the rotary disc 50 (Fig. 5) upon which reel 2 bears helps the latter to turn in its magazine.

The tension of the ribbon, upon its leaving the magazine, is due chiefly to the reaction of the gradual tightening of the spires of the ribbon and to the ratio of the inner and outer diameters of the reel. Thus, the greater the ratio of the smaller and larger diameter, the more important the tension of the ribbon will be.

As a consequence, in order to reduce this tension, it is necessary to mechanically reduce the reaction of the spires and for this purpose, disc 50 gives the reel a rotary movement independent of that due to the traction exerted upon the ribbon.

This movement will be the more important as the required pressure is smaller and, consequently, the pressure exerted in the reel is inversely proportional to the speed of revolution of disc 50.

The endless unwinding thus obtained is not based upon the natural reaction due to the elasticity of the ribbon but merely to the reaction due to the gradual tightening of the spires of the ribbon while the latter in unwinding under the effect of a traction.

This device has the advantage of eliminating, during the recording, the two reels and all the devices for reversing the working, the purpose of which is to obtain an uninterrupted recording and reproduction of oscillograms including multiple tracks upon a common ribbon, as it will be hereinafter explained. It permits also the use of a ribbon of indefinite length for a space occupied reduced to a minimum.

The apparatus of Figs. 3 and 4 also includes a group of two engraving tools the detail of which is more especially shown by Figs. 6 and 7.

This system permits of carrying out the process of recording on simultaneous multiple tracks. It may also be employed as recorder and reproducing system. In the latter case, one of the organs will be used for recording and the other for reproducing which then permits immediate reproduction of the oscillograms that are recorded.

This system includes two recording or reproducing members 8¹ and 8², fixed upon a common frame 63, which is itself displaced laterally by a trailer 64. These two recording and reproducing members 8¹ and 8² are pivoted to frame 63 through pivots 75 and 76.

On the other hand, the apparatus includes two drums for inscription 51, 52, instead of a single one as in the apparatus of Fig. 1. These drums 51, 52 act as supports for styles 77 and 78 and as bases for the ribbons which unwind upon their surface by passing along an intermediate roller 69.

One of the two engraving elements 8² can move transversely to the ribbon independently of the other engraving element 8¹. For this purpose, the connection between frame 63 and the intermediate support 71 is obtained through a screw 72 fixed by pins 73 and 74 to the frame.

In order to obtain a transverse displacement of engraving element 8² with respect to engraving element 8¹, it suffices to act upon handle 75¹ (Fig. 7) keyed upon screw 72, which, due to its rotation, displaces the desired distance the support 11 and also engraving element 8².

This system works in the following manner:

(a) For the recording and the immediate reproduction of sound oscillograms, ribbon 1, the direction of movement of which is given by the direction of the arrow, passes between drum 51

and the style 77 of the recording element 8¹. Ribbon 1 receives the sound record from this recording element. When leaving drum 5¹, ribbon 1 engages between drum 5² and style 78 of the reproduction organ 8², by passing first along the intermediate roller 69. The latter has for its object to destroy the mechanical vibrations which might occur when the ribbon leaves drum 5¹.

Both of the styles 77 and 78 being disposed on the same axis and in the same channel, it is possible to perform, with a very small lag, the reading of the sound oscillograms traced in the support by the recording element 8¹.

Fig. 13 shows the arrangement of the recording and reproducing styles 77 and 78 on the support 1.

(b) For the simultaneous recording and reproduction of two tracks from two different sound sources, the engraving element 8² is displaced with respect to the engraving style 77 a distance equal to the space between two tracks. In this way, I obtain with both styles, during the recording, two tracks parallel to each other.

Fig. 14 shows the position of the two engraving styles 77 and 78 and the tracks formed on support 1. I have shown at 77¹ the tracing of an auxiliary track which is reserved, after recording, and in case of need to replace one of two preceding ones, according to the method above set forth.

Fig. 15 shows how reproduction is effected with an auxiliary track 77¹ replacing track 77, which has for instance given a defective record. In this case the two reproducing members 77 and 78 are disposed independently of each other upon traces 77¹ and 78, by transverse displacement of style 78, as above explained.

The invention also includes this method of recording, whatever be the method of obtaining the sound tracks and whatever be the nature and the form of the support (film or disc).

Fig. 12 shows, for instance, a portion of a ribbon the tracks 91, 92 and 91¹, 92¹ of which, running parallelly and in the form of spirals, have been traced by a device consisting of two recording members, each of these tracks representing the recording of an independent sound source. Tracks 93 and 93¹ represent the available auxiliary tracks intended for the replacement of one of the two preceding tracks.

Of course, the number of these auxiliary tracks may be higher than one without, for this reason, departing from the principle of the invention.

In order to better explain the usefulness and the technical value of the invention, I will hereinafter describe a practical example of a recording on a band, with parallel tracks.

It will be assumed for instance that two different sources are recorded at 91 and 92. Track 91 corresponds to the sonorous background record, and track 92 corresponds to a speech explaining these sounds and made by a speaker. Assuming that track 92 must not be used and a new track must be substituted in place thereof, it suffices to displace one of the recording elements along the axis of track 93 and to repeat the speech. When reproducing, the reproducing elements will be placed on tracks 91 and 93, track 92 being left alone.

The invention therefore permits of eliminating the chief defect of the actual technic of phonographic recording, by permitting:

- (a) A true making up of the recorded sounds;
- (b) The mixing of these various sources after recording;

(c) The replacing of the correcting of the recording of one or several sound sources.

It has been above explained, when describing the apparatus of Figs. 1 and 2, that the engraving element could be displaced periodically, in a discontinuous manner after a complete cycle of the ribbon.

In this case, the sound tracks are parallel to one another and at the edge of the ribbon. The displacement of the engraving element may be ensured either through mechanical means or through electrical means, as explained with reference to Fig. 2.

It is also possible to displace the engraving style in a gradual manner and proportionally to the speed of unwinding of the ribbon.

In the latter case, the tracks are of spiral shape and parallel to one another. For this purpose, the engraving style is given a continuous movement proportional to the movement of the ribbon.

A first embodiment of this mechanism is shown in Fig. 8. The control of this mechanism is obtained from drum 5, which is itself driven by the moving film.

The transverse displacement of the engraving style is continuous and proportional to the length of ribbon contained in the magazine. This displacement is extremely small with comparison to the speed of drum 5, which constitutes the driving part, and accordingly there is provided a speed reducing gear 202.

This reduction of the speed of the drum is calculated in such manner as to displace, for each complete cycle of the ribbon, the engraving style a distance equal to the interval between two sound tracks in the axial direction.

The trailer includes;

A frame 63 on which is fixed the engraving element 8;

A helical pitch screw 64 in line with which are fixed the last reduction stage 207 and sector 206 which acts as a marking element for the recorded tracks;

A guide 205, fixed to two supports 208 and 209 permitting the transverse displacement of the trailer, while ensuring the absolute rigidity thereof.

The movement transmitted by ribbon 1 to drum 5 is reduced by system 202—207 and is transmitted to screw 64, which ensures a slow displacement of the engraving style corresponding to the distance between two sound tracks for one cycle of the ribbon, which determines a spiral shaped tracing upon the surface of the ribbon, these tracks being parallel to one another.

As this reduction is calculated with reference to the length of ribbon contained in the magazine, it becomes impossible to increase or reduce this length without varying, in a corresponding manner, the ratio of the reduction because, the pitch of the helix engraved in the support being proportional to the length of ribbon, if the length in question were considerably reduced, this would involve causing adjacent tracks to overlap one another and to destroy the phonograms that are recorded.

The modification of Fig. 9 avoids this drawback by permitting of changing the gear ratio of screw 64. This modification thus permits of keeping the same distance between two tracks for any length of ribbon in the magazine.

This device includes, as chief element, a fly-wheel 211 one of the faces of which is covered 75

with an adhering material 212, which may consist of rubber.

5 Fly-wheel 211 slides on the axis 210 of drum 5 and through the medium of a key 215 fixed to spindle 210 it is given a rotary movement by this drum. A spring 225 is intended to increase the adhesion of fly-wheel with a roller 213 which transmits the movement to speed reducing group 202, which is itself connected to screw 204 (Fig. 8) 10 of the trailer.

In order to vary the pitch of the helix, it suffices to displace, on axis 214, roller 213 in the direction of the radius of fly-wheel 211.

15 The variable ratio of the speed reduction is therefore obtained by the displacement, along the axis 214, of wheel 213, its movement being limited by A B. Point B corresponds to the smallest gear ratio and point A to the highest ratio.

20 The apparatus of Fig. 3 also includes a device permitting of adjusting the pressure of the engraving element on the film and of modifying the cutting angle of this engraving element.

For this purpose (Fig. 11) the record drum which constitutes a support for ribbon 1 when sounds are recorded or reproduced, is carried by a spindle 233 slightly eccentric at 234. This eccentric spindle 233 turns in a bearing 237 which is a part of the frame of the apparatus supporting the other elements.

30 Spindle 233 is braked by a spring 238 which is calculated in such manner as to oppose the reaction due to the rotation of drum 5 and to the traction exerted thereon by ribbon 1. Drum 5 turns loose about its eccentric spindle 233. A groove 239 has been provided for being filled up with hard rubber giving said drum the elasticity necessary for a good recording of the sound oscillograms.

40 A control handle 235 produces, when turned, the rotation of spindle 233, which displaces drum 5 along a circle (Fig. 10) the center O of which will be at an equal distance from O¹ and O² and the diameter of which is equal to (AB). OC is the minimum displacement and OB the maximum displacement of this eccentric.

45 The starting of the apparatus is ensured in a particularly simple manner, by means of a control knob 305 actuating a lever 306 (Fig. 3) on which is mounted the compressing roller 7 the pressure of which upon ribbon 1 causes the adhesion of this ribbon to driving roller 6, actuated by motor 301.

50 Finally the whole of the apparatus, a plan view of which is given by Fig. 4, can advantageously be completed, eventually, by a vacuum device for removing cuttings.

55 Fan 300 is driven by the motor 301 of the apparatus. This fan includes a suction nozzle disposed close to the engraving styles and blows the cuttings into a box 302 disposed at the rear of the apparatus.

60 While I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within 70 the scope of the appended claims.

What I claim is:

75 1. An apparatus for mechanical recording of sound oscillations with linear tracks, which comprises a stationary frame, two electromechanical organs carried by said frame and having en-

graving members for recording and reproducing sound oscillograms, an endless film serving for supporting the record, means for winding and unwinding in a continuous manner said endless film on a reel and passing it against said engraving members, in such a manner that one of said electromechanical organs working as reproducer permits to control the record made by the other, and a device for moving transversely with respect to said endless film one of said two electromechanical organs in order that it describes a new track.

2. An apparatus for mechanical recording of sound oscillations and for reproducing of sound records, which comprises a stationary frame, 15 electromechanical organs carried by said frame and having engraving members for recording and reproducing, an endless film which serves for supporting the record, means for winding and unwinding in a continuous manner said endless film on a single reel and passing it against said engraving members, a rotary disc applied against the edges of the spirals of said reel and means for driving said disc in order to give it a peripheral speed at least equal to the unwinding speed of the film, in the same direction as that of the movement which said film, when unwound, tends to communicate to said reel.

3. An apparatus for mechanical recording of sound oscillations, which comprises a stationary frame, electromechanical organs carried by said frame and having engraving members for recording, an endless film which serves for supporting the record, a device for winding and unwinding said endless film on a single reel and passing it against said engraving members said device comprising a traction friction organ acting on said endless film, a rotary disc applied against the spirals of said reel and means for driving the rotation of said disc in order to give it a peripheral speed at least equal to the unwinding speed of said film, in the same direction as that of the movement which said film, when unwound, tends to communicate to said reel, and means for transmitting rotation from said traction organ to said rotary disc.

4. An apparatus for mechanical recording of sounds, which comprises a stationary frame, an endless film, electromechanical organs with engraving members carried by said frame for recording on said film and means for giving to said engraving members a transverse displacement by jerks at the end of each complete revolution of said film, said means comprising a delaying organ introducing in the drive of said displacement a decreasing delay from one revolution to the following.

5. An apparatus as claimed in claim 4, in which the means for giving to the engraving members a transverse displacement at each revolution comprise a friction roller driven in rotation by said endless film and a reducing gear driven by said wheel.

6. An apparatus as claimed in claim 4, in which the means for giving to said engraving members a transverse displacement at the end of each revolution comprises a friction roller driven in rotation by said endless film and a reducing gear driven by said friction roller and provided by an adjustable organ for controlling and regulating with precision the proportion between the transverse displacement and the unwinding time, in order to maintain in suitable limits the distance separating two successive sound tracks on said endless film.

7. An apparatus for mechanical recording of sounds, which comprises a stationary frame, an endless film, means for winding and unwinding said film in a continuous manner, electromechanical organs with engraving members carried by said frame for recording on said film, a drum on which passes said film against said engraving members, an axle carrying said drum and means for rotating said axle, in order to adjust the applying force of said engraving members against said film.
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