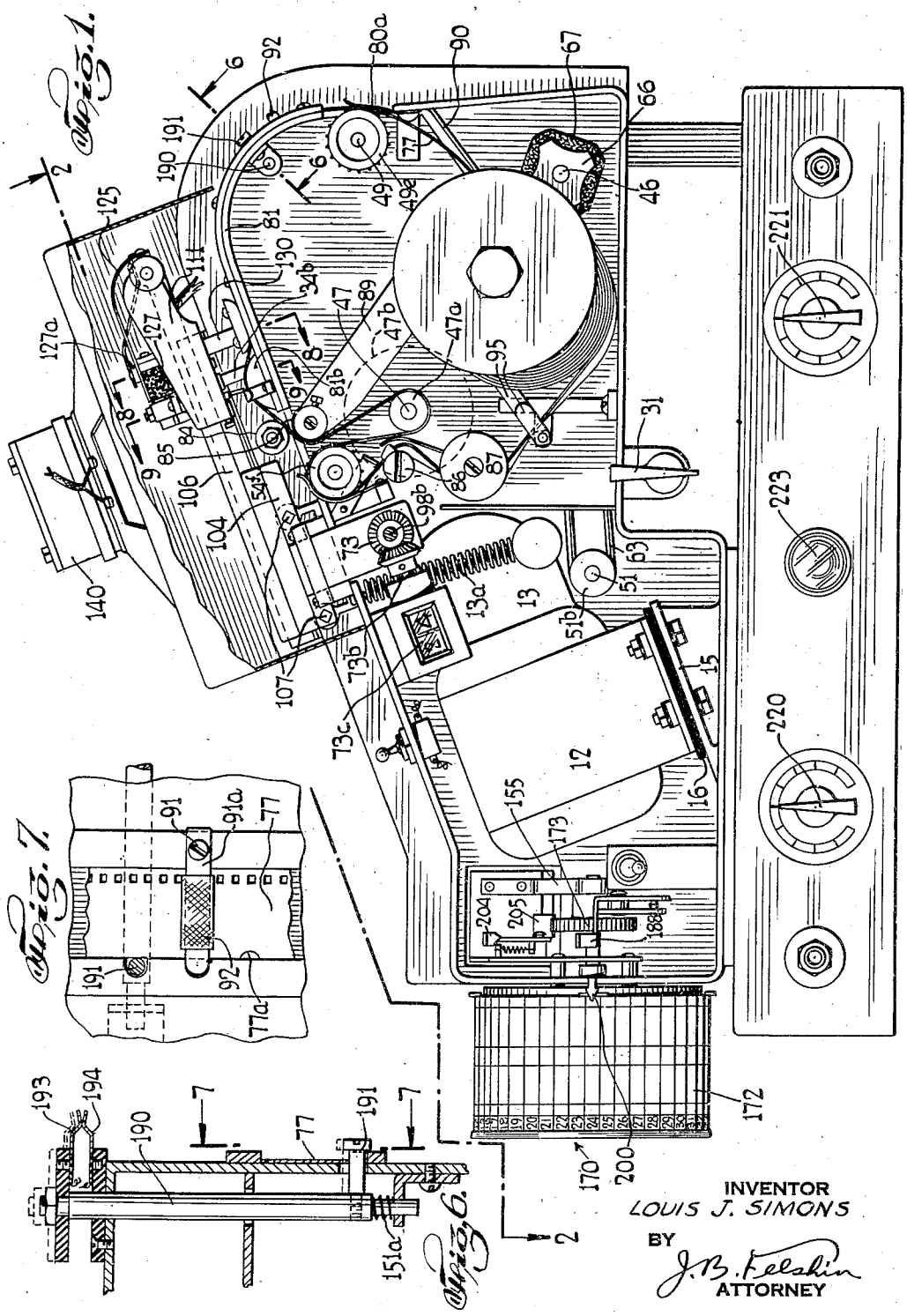
July 14, 1942. L. J. SIMONS 2,289,555

SOUND RECORDING AND REPRODUCING MACHINE

Filed April 5, 1940 6 Sheets-Sheet 1



July 14, 1942. L. J. SIMONS 2,289,555

SOUND RECORDING AND REPRODUCING MACHINE

Filed April 5, 1940 6 Sheets-Sheet 2

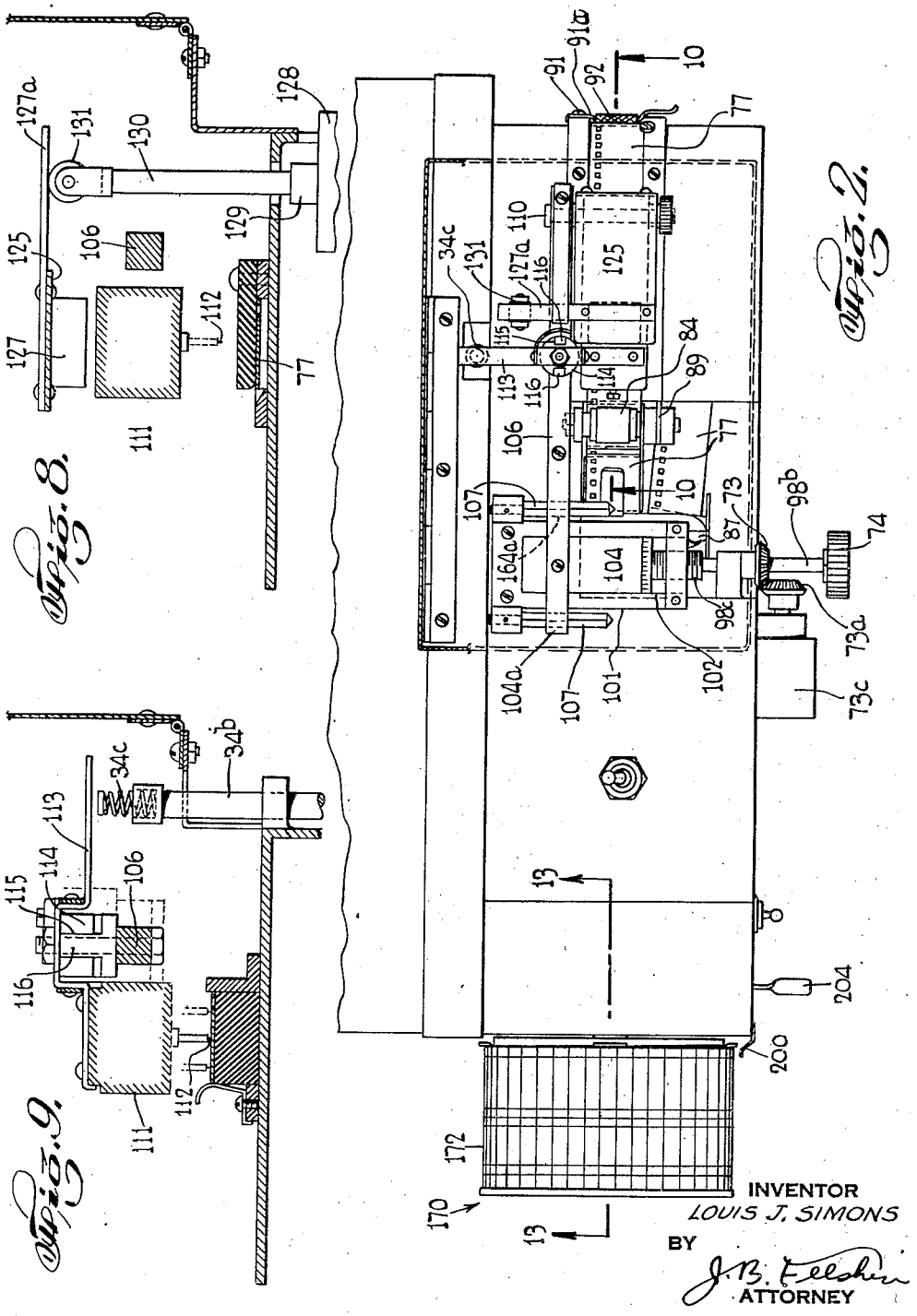


Fig. 8.

Fig. 9.

Fig. 2.

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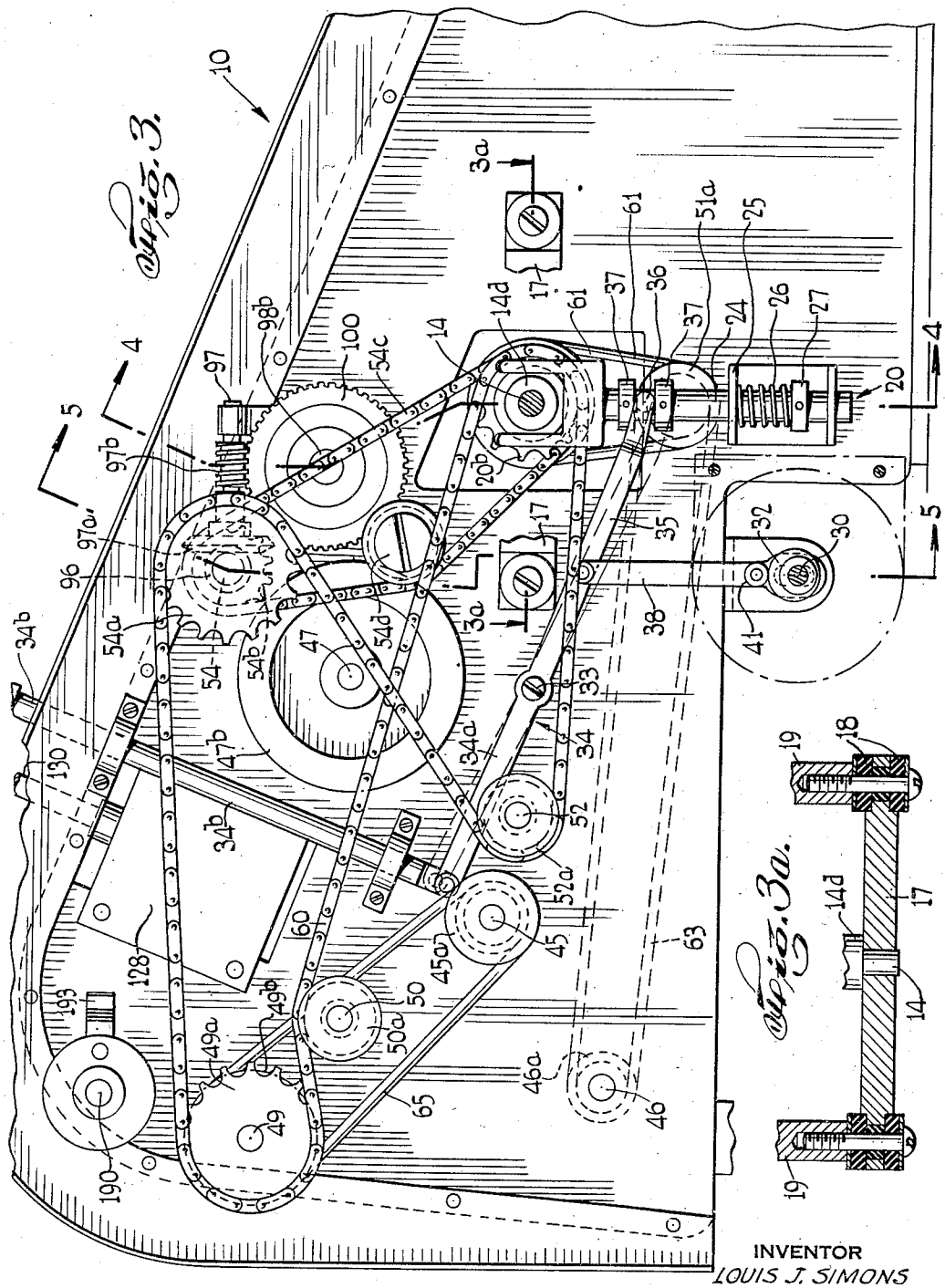
SOUND RECORDING AND REPRODUCING MACHINE

Filed April 5, 1940 6 Sheets-Sheet 3



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SOUND RECORDING AND REPRODUCING MACHINE

Filed April 5, 1940 6 Sheets-Sheet 4

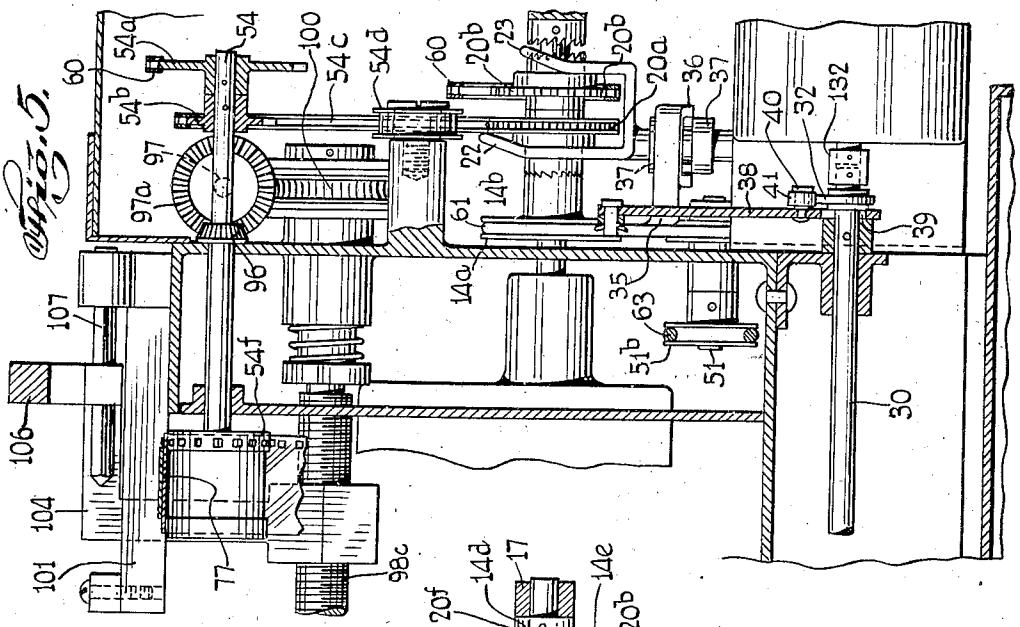

Fig. 3.

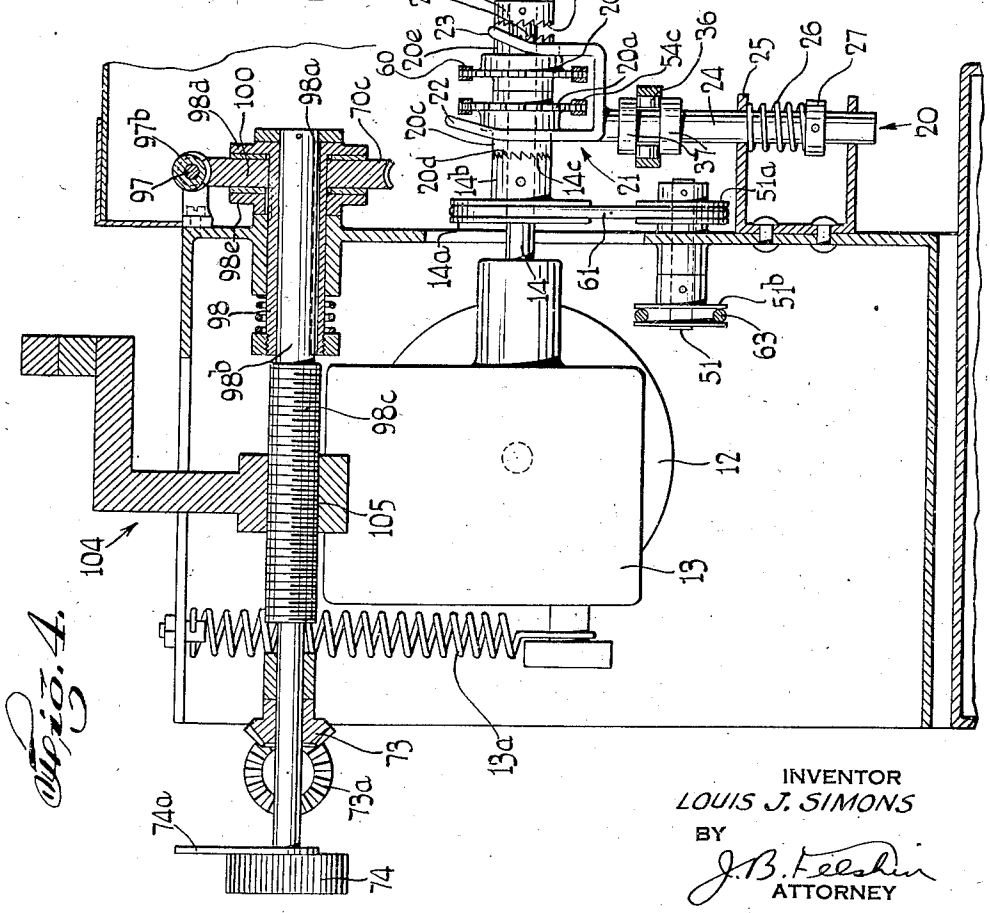

Fig. 4.

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SOUND RECORDING AND REPRODUCING MACHINE

Filed April 5, 1940 6 Sheets-Sheet 5

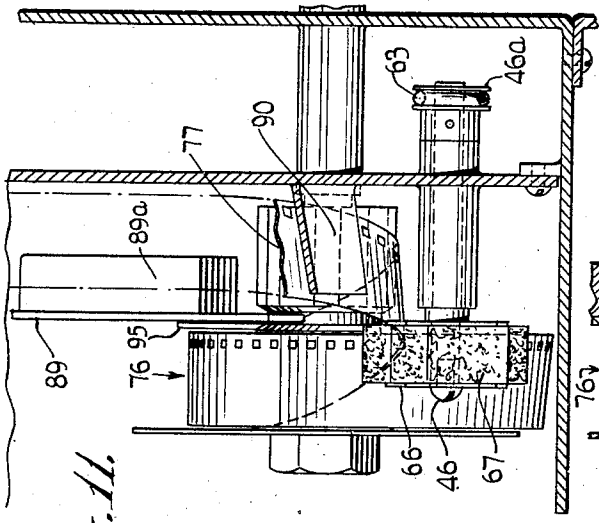

Fig. 11.

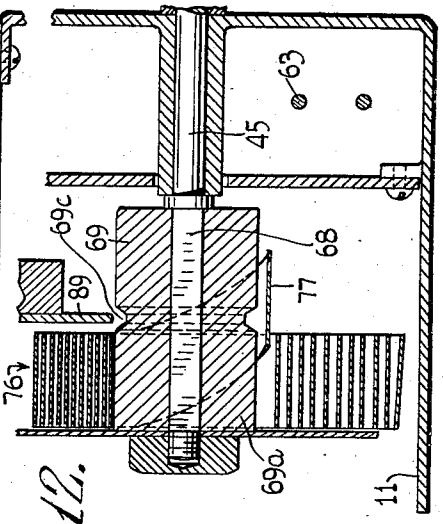

Fig. 12.

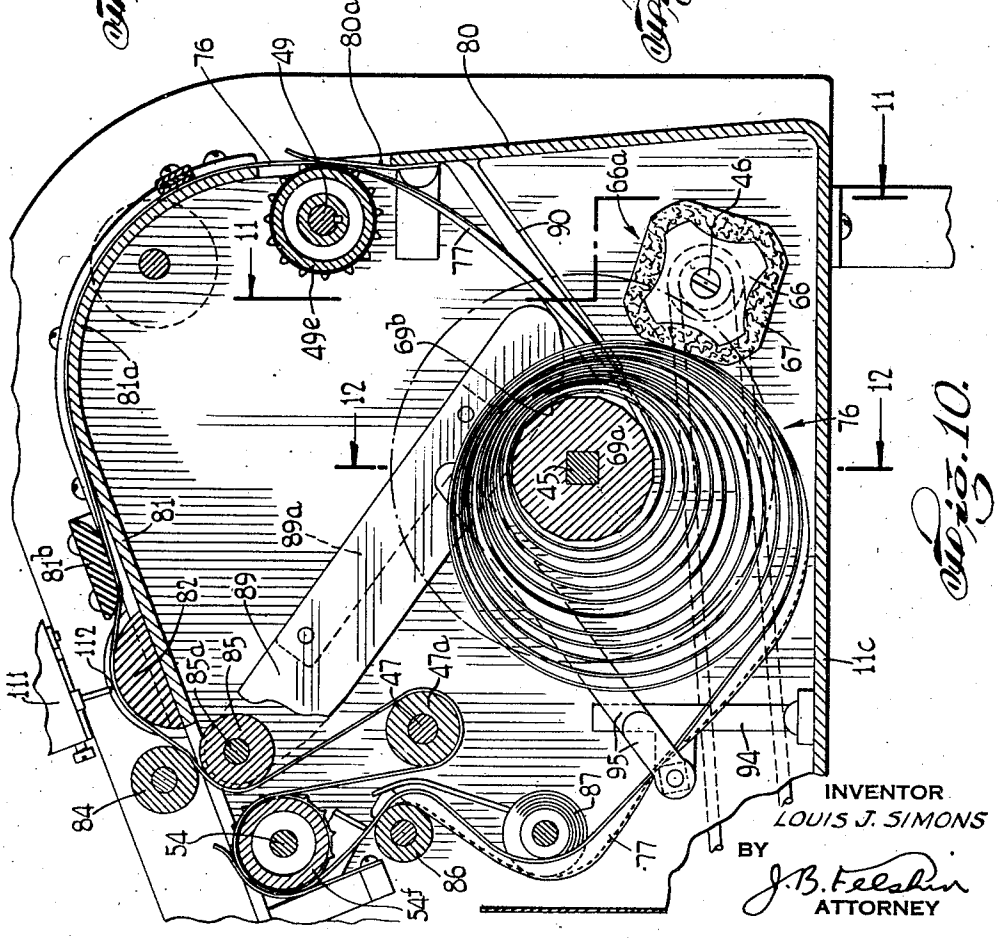

Fig. 10.

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SOUND RECORDING AND REPRODUCING MACHINE

Filed April 5, 1940 6 Sheets-Sheet 6

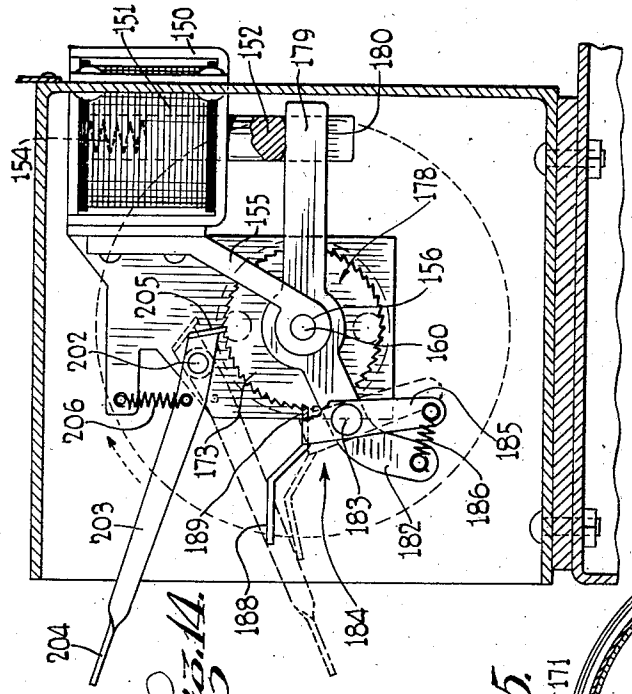

Fig. 14.

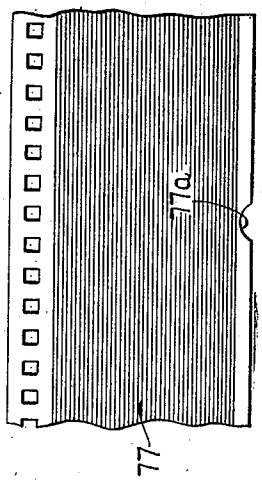

Fig. 17.

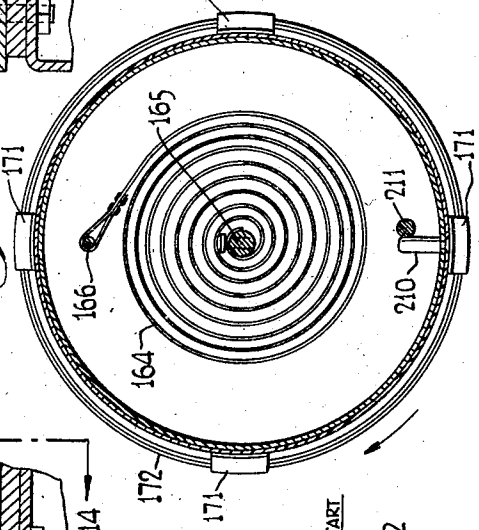

Fig. 15.

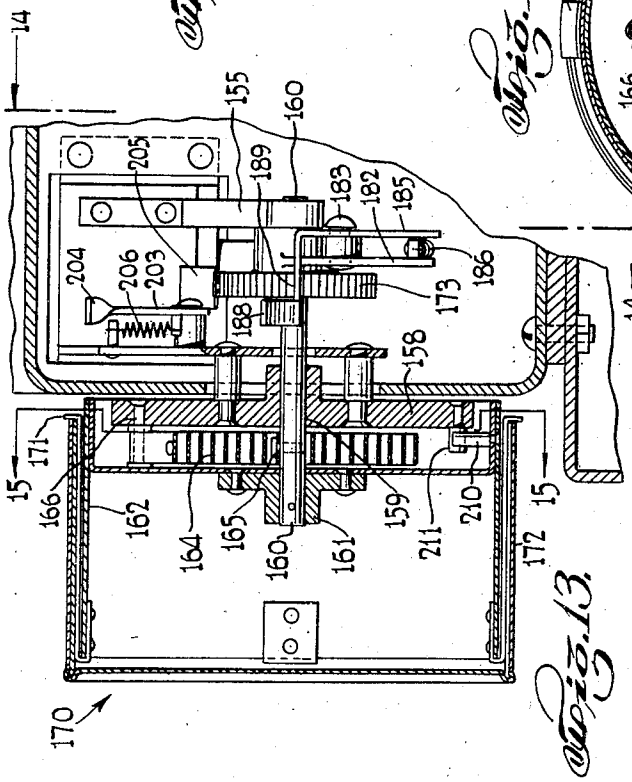

Fig. 13.

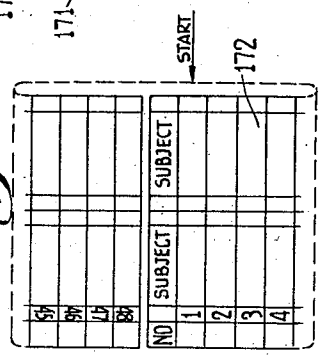

Fig. 16.

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Patented July 14, 1942

2,289,555

UNITED STATES PATENT OFFICE

2,289,555

SOUND RECORDING AND REPRODUCING MACHINE

Louis J. Simons, Long Beach, N. Y., assignor of one-third to Bernard Arbuse, and one-third to Sol P. Schechter, both of New York, N. Y.

Application April 5, 1940, Serial No. 328,108

19 Claims. (Cl. 179—100.4)

This invention relates to sound recording and reproducing machine. It is particularly directed to a machine for recording sound on an elongated, flexible endless strip or film.

An object of this invention is to provide in a machine of the character described in which the major part of the strip on which the sound is recorded is wound in a roll or spool spirally on a shaft and passes from the outer and inner ends of the roll or spool around rollers, pulleys, guides and the like, and past the recording portion or pickup of the machine, highly improved means to keep the strip moving during the recording, reproducing or reversing movement of the strip without binding or tearing thereof, whereby a considerable length of recording strip may be efficiently used in a compact machine, the construction being such that the reproduction may be repeated without reversing the direction of drive to rewind the strip.

Another object of this invention is to provide in a machine of the character described, highly improved means for manually moving the pickup transversely of the strip to any desired position, means being further provided to automatically move the pickup transversely in one direction or the other, in synchronization with the movement of the strip, either when said strip is moving forwardly during recording or reproducing, or when said strip moves in a reverse direction.

Another object of this invention is to provide in a machine of the character described, highly improved means to indicate what linear portion of the film is at the pickup, and also to indicate in which line of recording the pickup is located.

Yet another object of the invention is to provide a machine of the character described which can be reversed, that is run backwards, to any portion or the complete length of the recording strip. With the improved machine, a person can record, and if interrupted, can reverse the machine to any desired point, as indicated on the indicating mechanism, and then reproduce the reversed portion, and again record after the reproduction has ended.

A further object of this invention is to provide a machine of the character described having an automatic register which is tripped at the end of each line of recording (full length of strip) to present a space on the register on which a memorandum may be made of the subject matter recorded in the corresponding record line.

Still another object of this invention is to provide a machine of the character described which is so constructed that one record strip will take recording during a relatively long period of time in uninterrupted sequence, so that conferences, court proceedings and the like, may be conveniently recorded on a single record strip.

Yet a further object of this invention is to provide in a machine of the character described a rewind mechanism which can be used in home or commercial motion picture projectors, as well as in sound recording machines. Today on a motion picture projector there are two spools, and in projecting the picture the film runs from one spool onto the other. Then to reproduce again the film has to be first reversed so that it can be run again. With the present improved rewinder mechanism, only one spool is necessary. To repeat the run of the film it is not necessary to reverse the film, so that for motion pictures the record spool and the reversing apparatus will be eliminated, thus increasing the life of the film.

Still another object of this invention is to provide in a machine of the character described, an electric pick-up adapted to engage the strip for recording or reproducing, and a weight on the pick-up to press the pick-up down against the strip, when recording, means being provided to automatically lift both the pick-up and the weight when reversing the motor, and also for automatically lifting only the weight off the pick-up, when cutting in the reproducing circuit.

Yet a further object of this invention is to provide a strong, rugged, durable and compact machine of the character described, provided with radio amplification for reproducing, which shall be relatively inexpensive to manufacture, sure and positive in action, easy to manipulate, and yet practical and efficient to a high degree in use.

Other objects of this invention will in part be obvious and in part hereinafter pointed out.

The invention accordingly consists in the features of construction, combinations of elements, and arrangement of parts which will be exemplified in the construction hereinafter described, and of which the scope of application will be indicated in the following claims.

In the accompanying drawings, in which is shown one of the various possible illustrative embodiments of this invention,

Fig. 1 is a front elevational view of a machine embodying the invention, with the front cover removed.

Fig. 2 is a cross-sectional view taken on line 2—2 of Fig. 1;

Fig. 3 is a rear elevational view thereof, with the rear cover removed:

Fig. 3a is a cross-sectional view taken on line 3a—3a of Fig. 3;

Fig. 4 is a cross-sectional view taken on line 4—4 of Fig. 3;

Fig. 5 is a cross-sectional view taken on line 5—5 of Fig. 3;

Fig. 6 is a cross-sectional view taken on line 6—6 of Fig. 1;

Fig. 7 is a cross-sectional view taken on line 7—7 of Fig. 6;

Fig. 8 is a cross-sectional view taken on line 8—8 of Fig. 1;

Fig. 9 is a cross-sectional view taken on line 9—9 of Fig. 1;

Fig. 10 is an elevational, cross-sectional view taken through the spool shaft;

Fig. 11 is a cross-sectional view taken on line 11—11 of Fig. 10;

Fig. 12 is a cross-sectional view taken on line 12—12 of Fig. 10;

Fig. 13 is a cross-sectional view taken on line 13—13 of Fig. 2;

Fig. 14 is a cross-sectional view taken on line 14—14 of Fig. 2;

Fig. 15 is a cross-sectional view taken on line 15—15 of Fig. 2;

Fig. 16 is a front, enlarged, elevational view of a portion of the paper on the recording drum; and

Fig. 17 is a top plan view of a piece of the recording film or strip.

Referring now in detail to the drawings, 10 designates a machine embodying the invention. The same comprises a supporting casing or frame 11, in which is mounted a motor 12 provided with reduction transmission box 13, having a driven or output shaft 14. Transmission box 13 may be connected to the top wall of frame 11 by spring 13a. The motor 12 may be supported on an inclined base 15, within frame 11, a soft rubber pad 16 being interposed between the base and the motor. One end of the driven shaft 14 may be journalled in a plate 17; the ends whereof are supported on rubber bushings 18 fixed to bosses 19 on the frame 11.

Fixed on shaft 14 is a pulley 14a formed with a hub 14b having clutch teeth 14c. Fixed to the outer end of the shaft 14, a collar 14d having clutch teeth 14e. Keyed to the shaft 14, and disposed between the hub 14b and collar 14d, are a pair of sprocket wheels 20a and 20b rotatably mounted on shaft 14. Sprocket wheel 20a is formed with a hub 20c having clutch teeth 20d adapted to engage the teeth 14c on hub 14b. Sprocket wheel 20b is formed with a hub 20e having clutch teeth 20f adapted to engage the teeth 14e of the collar 14d.

Clutch means is provided to shift wheels 20a, 20b on shaft 14 to selectively engage either wheel 20a with hub 14b or wheel 20b with collar 14d. To this end, there is fixed to the frame 11 a bracket 25, on which is slidably mounted a vertical pin 24 forming part of clutch mechanism 20. At the upper end of pin 24 is a member 21 having a pair of upwardly extending, inclined, bifurcated arms 22 and 23 straddling the hubs 20c and 20e, and disposed on opposite sides of the sprocket wheels 20a and 20b. Arm 22 extends above arm 23 and both arms have fingers inclined in the same direction, so that when pin 24 is raised, the sprocket wheels 20a and 20b are mounted to the left to engage the teeth 20d with the teeth 14c for rotating the sprocket wheel 20a, and disengaging the sprocket wheel 20b. When the pin 24 moves downwardly, sprocket wheels 20a and 20b are moved to the right to disengage the teeth 20d from the teeth 14c, and to engage the teeth 20f with the teeth 14e. Thus, when the pin 24 is up, sprocket wheel 20a is rotated, and when said pin is down, sprocket wheel 20b is rotated.

The pin 24 is biased downwardly by a coil compression spring 26 thereon, engaging at its upper end the bracket 25, and at its lower end, a collar 27 fixed to said pin.

Means is provided to raise and lower the clutch pin 24. To this end, there is mounted on the frame 11 a horizontal shaft 30, to the front end of which is attached a pointed handle 31 located at the front of the machine. Fixed to the shaft 30 is a cam or eccentric 32, for the purpose hereinafter appearing. Pivoted to the frame, as at 33, is a lever 34, having one arm 35 provided with a fork 36 engaging between a pair of spaced collars 37 on pin 24. Pivoted to said arm 35 is a link 38 formed with a slot 39 at its lower end, through which the shaft 30 passes. Fixed to the link 38 is a pin 40 carrying a roller 41 contacting the cam or eccentric 32.

It will now be understood that the spring 26 lowers the pin 24, tending to rotate lever 34 in a clockwise direction, looking at Fig. 3 of the drawings, to keep the roller 41 in engagement with the cam 32. Upon turning the handle 31, shaft 30 will be rotated to turn the cam 32 for lifting link 38 and rotating lever 34 in a counterclockwise direction, to lift pin 24 to change the drive from wheel 20a to wheel 20b.

Rotatably mounted on the frame 11 is a shaft 49, parallel to shaft 14, carrying a sprocket wheel 49a, and also a shaft 54, parallel thereto, carrying a sprocket wheel 54a. Also rotatably mounted on the frame 11 is another parallel shaft 52 carrying a sprocket wheel 52a. Received on the sprocket wheels 20b, 49a, 54a and 52a is a sprocket chain 60.

The mid portion of the chain 60 is crossed so that shafts 14 and 52 rotate in one direction and shafts 49 and 54 rotate in an opposite direction. Mounted on the frame is a shaft 50 carrying an idler take up sprocket wheel 50a engaging the sprocket chain 60. The output shaft 14 rotates in a clockwise direction looking at Fig. 3 of the drawings. When the clutch mechanism 20 is down, and clutch member 20e is in engagement with the collar 14d, rotation of shaft 14 and wheel 20b in a clockwise direction will cause rotation of the sprocket wheel 54a in a counterclockwise direction.

On shaft 54 is a second sprocket wheel 54b connected by sprocket chain 54c to the sprocket wheel 20a. Rotatably mounted on the frame is an idler pulley 54d to take up the slack in the chain 54c.

When the clutch mechanism is raised to move the clutch hub 20c in engagement with the collar 14b, then clutch wheel 20a is rotated in a clockwise direction to rotate the shaft 54 also in a clockwise direction.

On shaft 49 is a sprocketed film feeding roller 49c. On shaft 54 is a sprocketed film feeding roller 54f, aligned with the roller 49c. Rotatably mounted on the frame is a shaft 45 carrying a pulley 45a; and on shaft 49 is a pulley 49b aligned therewith, and connected therewith by a belt 65. On shaft 45 is a portion 68 of square, transverse, cross-section. Mounted thereon is a hub 69 having a portion 69a of transverse, outer, regular polygonal cross-section. Said outer surface is thus formed with a plurality of flat faces 69b. Hub 69 is also formed, for the purpose here-

inafter appearing, with a central annular groove 69c.

On the portion 69a of the hub 69 is a spirally wound spool 76 of strip film 77, of plastic or any other suitable material, on which a sound track may be made by a needle on an electric pick-up, to be described hereinafter. The strip 77 is endless and passes from the inside of the spool, sideways at an inclination out of the plane of the spool, upwardly into engagement with the sprocketed feed roller 49c and through an opening 80a in the rear wall 80 of the casing 11. The strip then passes over an upwardly and forwardly curved wall or film guide 81a onto a downwardly inclined wall 81. The walls 81 and 81a are fixed with respect to the casing 11 and constitute a film track.

The film then passes beneath a guide 81b fixed to the frame 81, then over a platen 82 and between a pair of spaced rollers 84 and 85 rotatably mounted on the frame, and then downwardly and around the roller 47a rotatably mounted on shaft 47, then upwardly and around the sprocketed film feed roller 54b, then around an idler roller 86 and in engagement with a cone pulley 87, back to the outside of the spool 76. The cone pulley 87 guides the film 77 back to the plane of the spool 76. On shaft 47 is a fly wheel 47b to help feed the film when the motor is operated.

Fixed to the shaft 14, and rotatable therewith, is a pulley 14a. Rotatably mounted on the frame 11 is a stud shaft 51, to which is fixed a pulley 51a aligned with pulley 14a and connected thereto by a belt 61. On shaft 51 is a second pulley 51b. Rotatably mounted on the frame is a shaft 46, on which is mounted a pulley 46a aligned with pulley 51b and connected thereto by a belt 63. Thus, whenever the motor is running shaft 46 will be rotated in the same direction no matter whether wheel 20a or 20b is being rotated. On shaft 46 is a kicker or brush 66a comprising a metal hub 66 carrying a substantially square rubber tread 67 having rounded corners, to kick up spool 76 and keep the film from binding.

It will be noted that the direction of rotation of shaft 45 may be reversed by the reversing mechanism 20, whereas, the direction of rotation of the kicking or brushing device 66a remains constant. When the film is being fed forwardly, the kicker 66a and the shaft 45 rotate in the same direction, that is clockwise, looking at Fig. 3 of the drawings. When the film is being moved in reverse direction, the shaft 45 rotates in a counter-clockwise direction while the kicker moves in a clockwise direction, and the rounded corners of the tread 67 and the kicker punch the spool as the kicker rotates to prevent the film from binding or tearing. Furthermore, the polygonal faces of portion 69a of the hub 69 which engage the inner convolution of the spool prevents binding of the strip.

Pivoted on shaft 85a, on which the roller 85 is mounted, is an elongated bar 89, to one side of which is fixed a weight 89a. The outer end of bar 89 engages within groove 69c to keep the convolutions of the speed 76 in one plane. Fixed to the back wall 80 of the frame is a downwardly inclined guide 90 onto which passes the portion of the film which emerges out from the inside of the spool. Thus, the guide 90 guides the strip 77 from the inside of the spool 76 to the sprocketed roller 49c.

It will be noted that the roller 49c, the film track 81, 81a, rollers 84, 85, 54f, 47a and 86 are not in the plane of the spool 76, the film passing to one side of the plane of said spool as it emerges from the inside of the spool, and said strip being guided back to the plane of said spool by the cone roller 87 as the strip passes onto the outer side of said spool.

Attached to the casing wall 81a, as at 91, is a spring strip 91a carrying a sleeve 92 of any suitable soft material to contact the strip 77 and retain the same on the track.

Fixed to the bottom wall 11c of the frame is a bracket 94 which carries a pair of parallel bars 95, on opposite sides of the spool 76 and contacting a portion of the strip 77 which is in advance of the spool.

Means is provided to record a sound track on the strip 77 as it is moved forwardly by the operation of the motor 12. To this end, shaft 54 carries a bevel gear 96. Rotatably mounted on the frame is a shaft 97 disposed at right angles to the shaft 54. On shaft 97 is a bevel gear 97a meshing with bevel gear 96. On shaft 97 is a worm 97b.

Journalled in the frame 11 is a sleeve 98 disposed parallel to the shaft 54. Extending through the sleeve 98, and keyed thereto, as at 98a, is a shaft 98b provided with a threaded portion 98c. Sleeve 98 has a friction disc 98d at one end, and keyed to said sleeve is a second friction disc 98e. Rotatably mounted on the sleeve and between friction discs 98d and 98e, and contacting the same, is a worm wheel 100 meshing with the worm 97b. Thus, when shaft 97 is rotated, the worm wheel 100 will be rotated, and through a friction drive will rotate shaft 98b.

Fixed to the top of the frame is a guide 101 formed with a transverse slot 102. Extending through said slot is a bracket 104 having an internally screw threaded opening 105 receiving the threads of the screw threaded portion 98c of shaft 98b. As shaft 98b rotates, bracket 104 will be moved transversely in the slot 102. Fixed to the upwardly extending portion of bracket 104, is a longitudinal bar 106. Bracket 104 is formed with a pair of square shaped openings 104a, and fixed to the guide 101, are a pair of transversely extending, parallel, square shaped pins 107 slidably extending through the openings 104a. The pins 107 thus guide the bracket.

Bar 106 extends rearwardly, and pivoted to said bar 106 on pivot 110, is an electric pick-up 111 carrying a downwardly extending needle 112 adapted to contact the upper surface of the film or strip 77. Fixed to the top of the pick-up is a transverse bar 113, to the underside of which there is attached a pair of spaced guide members 114 forming therebetween a groove 115 to receive a guide member 116 fixed to the bar 106.

When the handle 31 is turned to reverse position to actuate the clutch mechanism 20, the lever 34 is rotated in a clockwise direction, looking at Fig. 3. Lever 34 has an arm 34a extending in a direction opposite to the arm 35. Attached to the outer end of arm 34a is a pin 34b projecting upwardly through the frame to a position beneath bar 113. At the upper end of pin 34b is a spring 34c. When the handle 31 is moved to "reverse," pin 34b moves upwardly to lift bar 113 and hence the electric pick-up off the film, while the film is being reversed.

Pivoted to the rear end of bar 106 is a weighted plate 125, to the underside of which is attached a rubber block 127 contacting the upper side of the electric pick-up 111 to press the needle

against the film to produce a sharp and clear sound groove. Attached to the plate 125 and extending sideways therefrom, is a bar 127a. Mounted on the frame is a solenoid 128 provided with an armature 129, to which is attached an upwardly extending pin 130 provided with a roller 131 at its upper end disposed beneath the bar 127a.

Coupled to the shaft 30, as by coupling 132, is a switch, not shown, but adapted to cut in a sound reproducing and amplification radio circuit of any well known suitable construction. Upon turning the handle 31 to a position where the reproducing switch is turned on, the solenoid circuit for solenoid 128, will also be energized by closing of a switch (not shown). Thus, when the handle 31 is turned to "reproduce" position, the reproducing circuit is cut in and the solenoid circuit is also closed to move the pin 130 upwardly to raise the weighted plate 125, so that although the electric pick-up is down with the needle 112 in engagement with the sound track or groove in the strip to permit reproduction, there is nevertheless a relief of weight from the pick-up.

It will now be understood that when the pin 34b is lifted upon reversing the drive, both the electric pick-up and the weighted plate are lifted simultaneously, and when the machine is reproducing, only the weighted plate is lifted and the pick-up remains in contact with the strip.

It will now be understood, furthermore, that as the motor operates to record or reproduce, the pick-up will move transversely of the film. It will now be understood that a continuous sound track will be made in the film as the film is fed for recording. The threads of portion 98c of shaft 98b may be proportioned in accordance with the number of circuitous lines of recording it is desired to obtain on the film. Thus, if it is desired to obtain a predetermined number of continuous convolutions of sound track on the film, the threads 98c are so proportioned that the pick-up will move the width of the portion of the strip which receives the sound track when the film has been fed said predetermined number of complete times past the electric pick-up.

Means is provided for manually shifting the pick-up. To this end, a handle 74 is fixed to the forward end of said shaft 98b. It will now be understood that the handle 74 may be rotated to manually move the pick-up without affecting the worm wheel 100 by reason of the friction clutch means between said worm wheel and said shaft. Preferably the gearing for turning the shaft 98b will be given one revolution when one complete length of film is fed past the pick-up.

Means is provided to indicate the location of the pick-up needle, that is, in which line or convolution of sound track the needle is located at any particular time. To this end, there is fixed to the shaft 98b, a bevel gear 73 meshing with a bevel gear 73a on a shaft 73b which is connected to any suitable revolution counter 73c mounted on the machine. The bevel gears 73 and 73a are of similar dimension, and hence the numbers indicated on the revolution counter 73c indicate the number of revolutions through which the shaft 98b has been rotated, and hence the number of times the film has been fed past the pick-up, and hence the convolution of sound track in which the pick-up needle is located.

The machine may be provided with a loud speaker 140 of any suitable construction in connection with the sound reproducing circuit.

Means is provided to permit a memorandum of the subject matter recorded on each convolution of sound track on the film. To this end, there is fixed to the frame, a bracket 150 in which is mounted a solenoid coil 151 provided with an armature 152 normally biased downwardly by a spring 154 and adapted to be raised when the solenoid is energized. Fixed to the bracket 150 is a bracket 155 formed with a bearing opening 156. Fixed to the casing in any suitable manner, is a plate 158 provided with a bearing opening 159 aligned with the bearing opening 156.

Journalled in the bearing openings 156, 159 is a shaft 160. Fixed to said shaft is a hub 161, and fixed to said hub is a drum 162 rotatable with said shaft. Spirally wound on the shaft 160 is a spring 164, the inner end of which is fixed to the shaft 160, as at 165. The outer end of the spring is fixed, as at 166, to the backing plate 158. Thus, as the shaft 160 is rotated in a clockwise direction, looking at Fig. 15 of the drawings, drum 162 will likewise be rotated in the same direction, and the spring 164 will be tensioned.

Mounted on the drum 162 is an outer drum 170, held thereon by a plurality of springs 171 of any suitable construction. On the outside of the drum 170 is a sheet of paper 172 divided into numbered spaces on which may be written any suitable notes or memorandum referring to the subject matter recorded on the film, there preferably being as many spaces as there are convolutions of sound track on the film.

Means is provided to advance the drum 170 through an angle equivalent to one space each time the film moves a full length past the pick-up. To this end, there is fixed on the shaft 160 a ratchet 173 having as many teeth as there are spaces on the paper sheet 172 (and hence as many convolutions of sound track on the strip of film 77).

Fixed to said shaft 160 is also a bell crank 178 having one arm 179 passing through an opening 180 in the armature 152. Bell crank 178 also has an arm 182 on which is pivoted, as at 183, a lever 184. One arm 185 of lever 184 is connected to the outer end of arm 182 by a coil tension spring 186. Lever 184 is also formed with a handle 188, and a tooth engaging portion 189 adapted to engage a tooth of the ratchet 173, and normally held in engagement with said ratchet by the spring 186.

The strip of film 77 is formed with a notch 77a in one edge thereof. Slidably mounted on the frame is a shaft 190, to which is attached a pin 191 contacting one edge of the strip 77. On shaft 190 is a contact member 193 normally engaging the contact member 194 mounted on the frame and insulated therefrom. Contacts 193 and 194 are interposed in the circuit for the solenoid 151.

Any suitable spring means 151a may be provided to press the pin 191 towards the edge of the strip 77. When the notch 77a passes the pin 191, said pin moves into the notch under the action of the spring 151a, thus shifting the shaft 190 and separating the contacts 193, 194 to open the solenoid circuit and permit the spring 154 to push the armature 152 downwardly for rotating the bell crank 178 in a clockwise direction, looking at Fig. 14 of the drawings, to rotate the ratchet 173 an angular distance equivalent to

one tooth, and hence also rotating the drum one space. Thus, each time a full length of strip 77 is run past the pick-up, the solenoid is released once to turn the drum one space. A suitable starting pointer 200 may be fixed with respect to the frame to indicate the space on the drum which corresponds to a convolution of sound track being recorded.

Means is provided to prevent the drum from being rotated in a backward direction. To this end, there is pivoted to the frame, as on pivot 202, a lever 203 formed with a handle 204 at its forward end. On lever 203 is a portion 205 engaging a tooth of the ratchet 173. Lever 203 is interconnected by a spring 206, attached to the frame, for retaining the portion 205 in engagement with the ratchet.

It will be noted that as the drum rotates forwardly, the spring 164 is tensioned. Upon depressing the handles 204 and 188 to release the levers 203 and 184 from the ratchet, the spring 164 will rotate the drum backwards to starting position. On the drum is a stop pin 210 adapted to engage a fixed pin 211 on the frame at the place where space No. 1 is abreast of the indicating pointer 200.

The machine may be provided with any suitable radio control knobs 220 and 221, and also with any kind of a light indicator 223 to indicate when the machine is recording. Such a light may be closed by a switch controlled by shaft 30.

It will thus be seen that there is provided a device in which the several objects of this invention are achieved, and which is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiment above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. In a sound recording machine for recording sound on an endless strip, part of which is wound spirally into a spool, advancing means engaging a portion of the strip outside of the spool, to move the strip past a pick-up, and means to vibrate the spool as the strip is being advanced, to prevent binding of the convolutions of said spool.

2. In a sound recording machine for recording sound on an endless strip, part of which is wound spirally into a spool, advancing means engaging a portion of the strip outside of the spool, to move the strip past a pick-up, means to vibrate the spool as the strip is being advanced, to prevent binding of the convolutions of said spool, means to guide the innermost convolution of the spool to one side of the plane of said spool, and means to guide a portion of the strip adjacent the outermost convolution of said spool, back to the plane of said spool.

3. In a sound recording machine for recording sound on an endless strip, part of which is wound spirally into a spool, rotary advancing means engaging a portion of the strip outside of the spool, rotary means to vibrate the spool as the strip is being advanced to prevent binding of the convolutions of said spool, and means for reversing the direction of rotation of the advancing means relative to the direction of rotation of the vibrating means.

4. In a sound recording machine for recording sound on an endless strip, part of which is wound spirally into a spool, advancing means engaging a portion of the strip outside of the spool, and means below the spool to repeatedly kick the spool upwardly as the strip is being advanced, to prevent binding of the convolutions of said spool.

5. In a sound recording machine for recording sound on an endless strip, part of which is wound spirally into a spool, advancing means engaging a portion of the strip outside of the spool, means below the spool to repeatedly kick the spool upwardly as the strip is being advanced, to prevent binding of the convolutions of said spool, a shaft on which the spool is wound, having a non-circular exterior surface, and means to rotate said shaft.

6. In a sound recording and reproducing machine for recording sound on an endless strip having a portion wound in a spool, means to guide the innermost convolution of said spool out of the plane of said spool, means to guide a portion of the strip adjacent the outermost convolution of said spool, back to the plane of said spool, an advancing means engaging a portion of the strip which is not in the spool and which is between the innermost convolution and the outermost convolution, to move said strip, a member rotatably mounted on the machine and having a non-circular portion adapted to contact the outermost convolution of the spool, and means for rotating said member, whereby said member will repeatedly kick the spool to keep the convolutions thereof loose with respect to one another, to prevent binding of the strip.

7. In a sound recording and reproducing machine for recording sound on an endless strip having a portion wound in a spool, advancing means engaging a portion of the strip which is not in the spool and which is between the innermost convolution and the outermost convolution, to move said strip, a shaft on which the spool is mounted and contacting the inner convolution of said spool, said shaft being of polygonal outer cross-section, and means to rotate the shaft.

8. In a sound recording and reproducing machine for recording sound on an endless strip having a portion wound in a spool, advancing means engaging a portion of the strip which is not in the spool and which is between the innermost convolution and the outermost convolution, rotary means for vibrating said spool, whereby to keep the convolutions of the spool loose with respect to one another, to prevent binding of the strip, means to rotate said vibrating means, a shaft on which the spool is mounted, means for rotating said shaft, and means for reversing the direction of rotation of said shaft without reversing the direction of rotation of said vibrating means.

9. In a sound recording and reproducing machine for recording sound on an endless strip having a portion wound in a spool, a shaft on which the spool is mounted, means to rotate said shaft, an electric pick-up engaging said strip, advancing means engaging a portion of the strip which is not in the spool and which is between the innermost convolution and the outermost convolution, to move said strip past said pick-up, rotary means to vibrate said spool, whereby to keep the convolutions of said spool loose with respect to one another, to prevent binding of the strip on said shaft, means to rotate said vibrating means, means for reversing the direction of rotation of said shaft without reversing the direction of rotation of said vibrating means, and means for automatically lifting said pick-up out

of engagement with respect to said strip upon reversing the direction of rotation of said shaft.

10. In a sound recording and reproducing machine for recording sound on an endless strip having a portion wound in a spool on a shaft, means for rotating said shaft, advancing means engaging a portion of the strip which is not in the spool and which is between the innermost convolution and the outermost convolution, rotary means to vibrate said spool, whereby to keep the convolutions thereof loose with respect to one another, to prevent binding of the strip on said shaft, means for reversing the direction of rotation of said shaft without reversing the direction of rotation of said vibrating means, an electric pick-up having a needle contacting said strip to make a sound track record thereon, means for automatically lifting said pick-up out of engagement with respect to said strip upon reversing the direction of rotation of said shaft, a weighted member on said pick-up to increase the pressure of the needle on said strip, a reproducing and amplification circuit, switch means for said circuit, and means for lifting said weight off the pick-up upon actuating said switch to cut in said circuit.

11. In a sound recording and reproducing machine for recording sound on an endless strip having a portion wound in a spool on a shaft, means for rotating said shaft, advancing means engaging a portion of the strip which is not in the spool and which is between the innermost convolution and the outermost convolution, means for reversing the direction of rotation of said shaft without reversing the direction of rotation of said advancing means, an electric pick-up having a needle contacting said strip to make a sound track record thereon, means for automatically lifting said pick-up out of engagement with respect to said strip upon reversing the direction of rotation of said shaft, a weighted member on said pick-up to increase the pressure of the needle on said strip, a reproducing and amplification circuit, switch means for said circuit, and means for lifting said weight off the pick-up upon actuating said switch to cut in said circuit.

12. In a sound recording and reproducing machine for recording sound on an endless strip having a portion wound in a spool on a shaft, means for rotating said shaft, advancing means engaging a portion of the strip which is not in the spool and which is between the innermost convolution and the outermost convolution, means for reversing the direction of rotation of said shaft without reversing the direction of rotation of said advancing means, an electric pick-up having a needle contacting said strip to make a sound track record thereon, means for automatically lifting said pick-up out of engagement with respect to said strip upon reversing the direction of rotation of said shaft, a weighted member on said pick-up to increase the pressure of the needle on said strip, a reproducing and amplification circuit, switch means for said circuit, and means for lifting said weight off the pick-up upon actuating said switch to cut in said circuit, said weighted member being adapted to be lifted together with said pick-up when said pick up is lifted upon reversing the direction of rotation of said shaft.

13. In a sound recording and reproducing machine for recording sound on an endless strip having a portion wound in a spool, an electric pick-up having a needle contacting said strip to make a sound track thereon, advancing means engaging a portion of the strip which is not in the spool and which is between the innermost convolution and the outermost convolution, to move said strip past said pick-up, means to automatically move the pick-up transversely of the strip in synchronization with movement of the strip, whereby to produce a continuous circuitous sound track on the strip, and means to manually move said pick-up transversely of the strip, without moving said strip.

14. In a sound recording and reproducing machine for recording sound on an endless strip having a portion wound in a spool, an electric pick-up having a needle contacting said strip to make a sound track thereon, advancing means engaging a portion of the strip which is not in the spool and which is between the innermost convolution and the outermost convolution, means to automatically move the pick-up transversely of the strip in synchronization with movement of the strip, whereby to produce a continuous circuitous sound track on the strip, and means to indicate the position of the pick-up needle with respect to said strip.

15. In a sound recording and reproducing machine for recording sound on an endless strip, advancing means engaging a portion of the strip, a drum, a record sheet on the drum, and means for rotating said drum through a predetermined angle each time a predetermined length of strip is advanced by said advancing means.

16. In a sound recording and reproducing machine for recording sound on an endless strip, advancing means engaging a portion of the strip, a drum, a record sheet on the drum, means for rotating said drum through a predetermined angle each time a predetermined length of strip is advanced by said advancing means, and means to return said drum to a predetermined angular position from any position to which it is advanced by said advancing means.

17. In a sound recording machine for recording sound on an endless strip, part of which is wound spirally into a spool, advancing means engaging a portion of the strip outside of the spool, and a shaft passing through the middle of the spool, said shaft having ridges on its exterior surface to engage the innermost convolution of said spool, and means to rotate said shaft.

18. In combination, an endless strip, part of which is wound spirally into a spool, advancing means engaging a portion of the strip outside of the spool, and means to vibrate the spool as the strip is being advanced to prevent binding of the convolutions of said spool.

19. In combination, an endless strip, part of which is wound spirally into a spool, advancing means engaging a portion of the strip outside of the spool, means to vibrate the spool as the strip is being advanced to prevent binding of the convolutions of said spool, means to guide the innermost convolution of the spool to one side of the plane of said spool, and means to guide a portion of said strip adjacent the outermost convolution of said spool, back to the plane of said spool.

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