Feb. 6, 1934. R. F. MALLINA 1,945,558

PHONOGRAPH RECORDING MACHINE

Filed Oct. 29, 1930 4 Sheets-Sheet 1

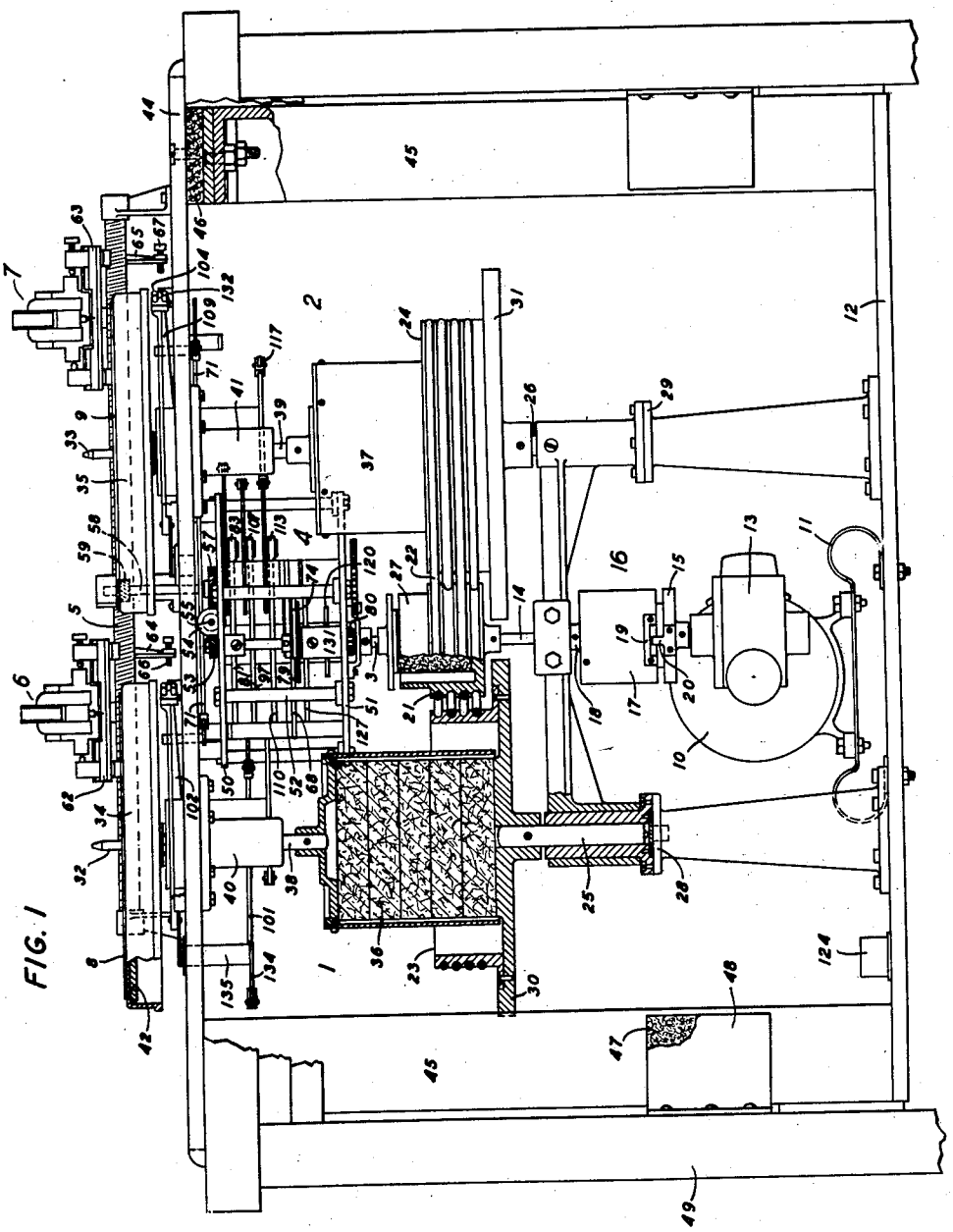

FIG. 1

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PHONOGRAPH RECORDING MACHINE

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FIG. 2

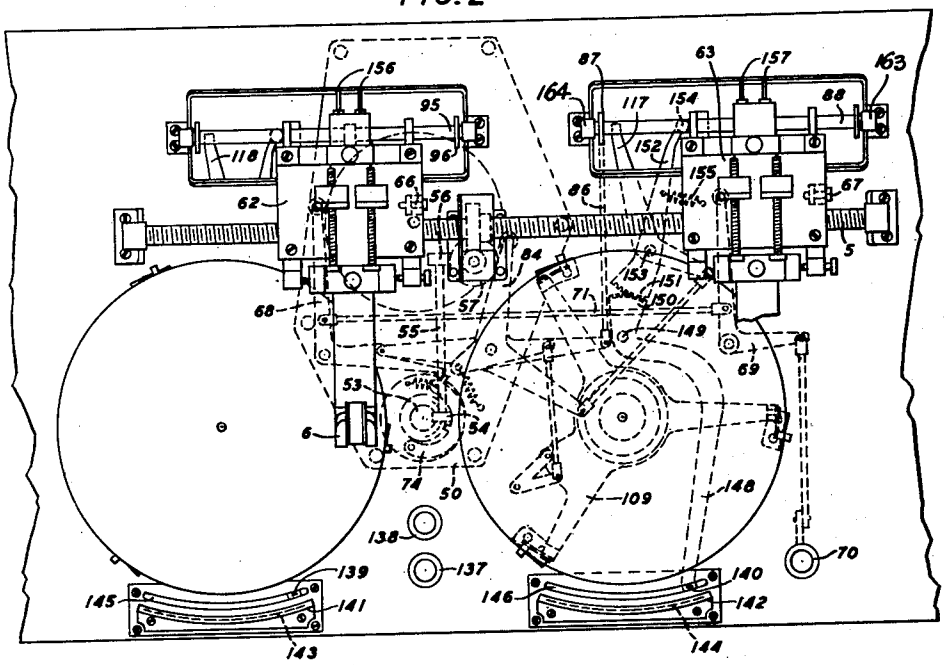
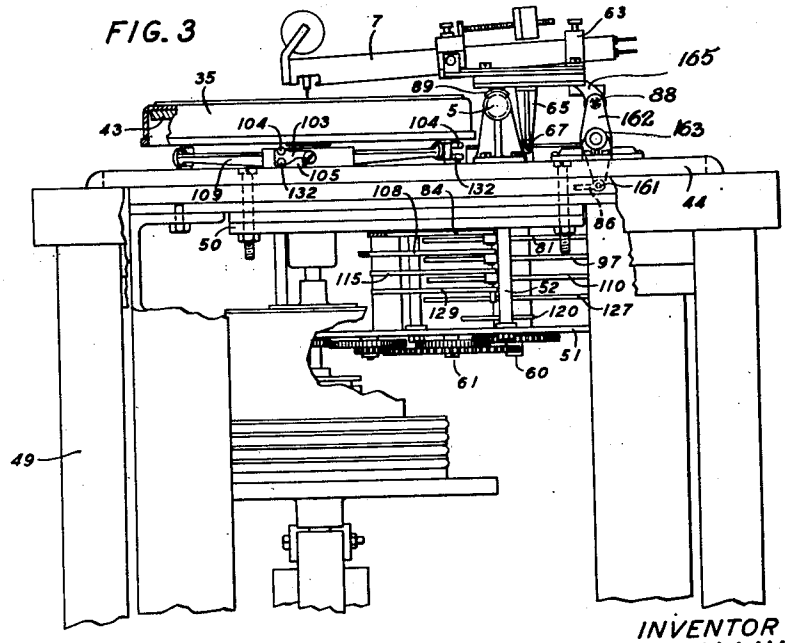


FIG. 3



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PHONOGRAPH RECORDING MACHINE

Filed Oct. 29, 1930 4 Sheets-Sheet 3

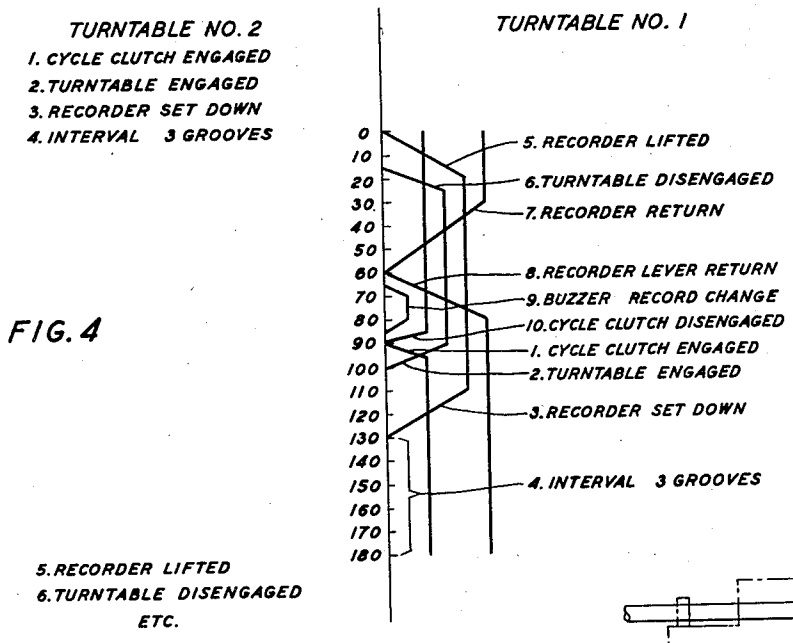

FIG. 4

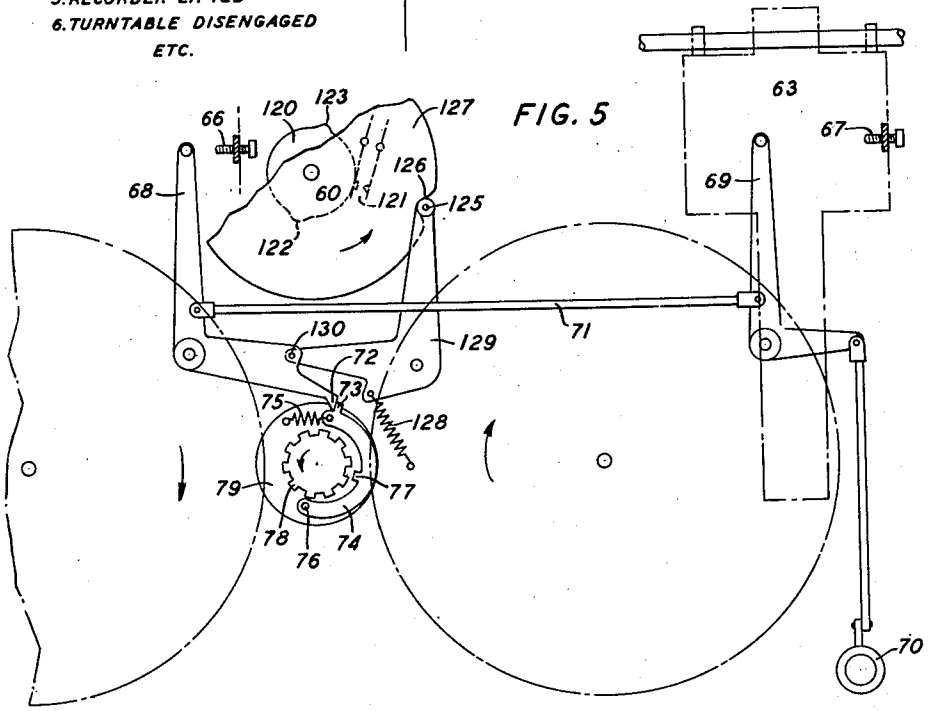

FIG. 5

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PHONOGRAPH RECORDING MACHINE

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FIG. 6

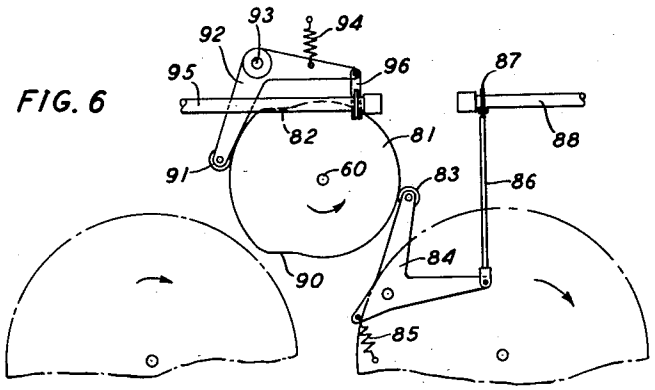


FIG. 7

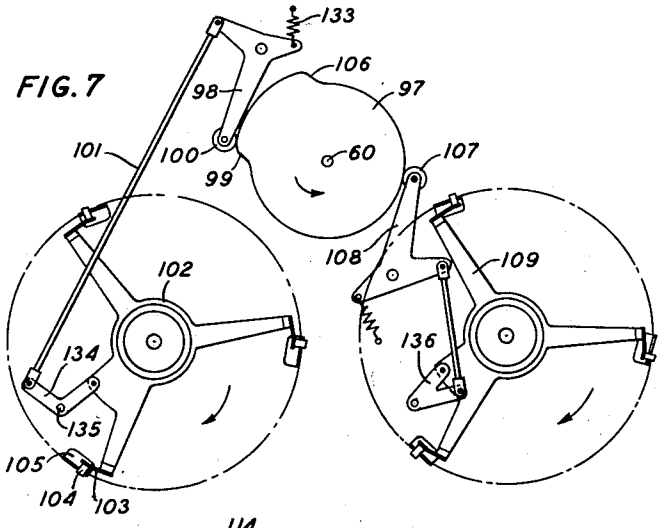
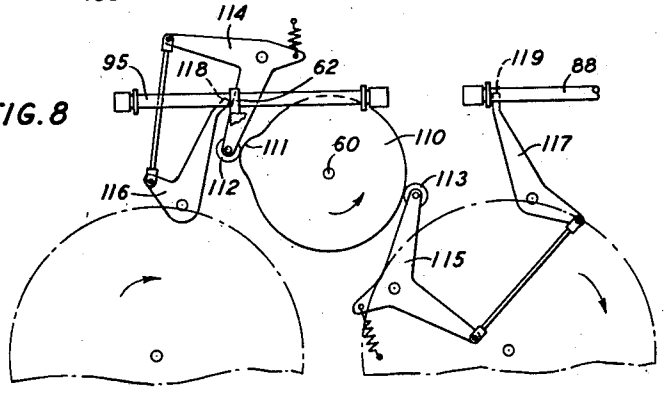


FIG. 8



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Patented Feb. 6, 1934 1,945,558

UNITED STATES PATENT OFFICE

1,945,558

PHONOGRAPH RECORDING MACHINE

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Application October 29, 1930. Serial No. 491,844

11 Claims. (Cl. 274—10)

This invention relates to phonograph recording machines and more particularly to those of the double turntable type which may be used for continuous recording.

The general object of the invention is to provide a machine of this kind which is essentially automatic in its operation and particularly adapted for use in telephone systems where it is desired to record conversations or receive a lengthy message or series of messages in the absence of an attendant.

Machines of this general nature are well known in the art but most of them are designed primarily for continuous reproduction rather than continuous recording and many of them require records with special grooves for initiating the automatic operation. Typical machines of this kind are shown in Patent 1,274,690 to Cortella, August 6, 1918, Patent 1,595,141 to Cortella, August 10, 1926 and Patent 1,361,718 to Grey, December 7, 1920. While certain of these machines of the prior art might be adapted for recording purposes they are in a number of respects not well suited for the purposes of the present invention.

According to this invention, the automatic operation of the machine is made independent of the type of record used by means of a series of cams on a shaft rotated by the driving motor which positively perform the various automatic operations in the proper sequence. An important feature of this machine is the arrangement whereby both recorders are operated together for a short time to provide a slight overlap in the records thereby avoiding the possibility of losing a portion of the message during the transition to the next recording blank. Both turntable shafts rotate continuously so that the load on the driving motor is approximately constant and light weight turntables are engaged and disengaged at appropriate times by the cam mechanism. The disengagement of the turntables permits records to be changed conveniently without stopping the machine. The turntables are readily removable when disengaged so that if necessary, as for instance when certain very thin records are employed, means for holding the record in contact with the turntable may be conveniently used. Such a machine is capable of making two records without attention and when the second one is nearing completion an audible signal warns the user that the records must be changed.

Further features of the invention are special vibration filters on the motor and turntable shafts and damping material between parts of the frame to eliminate vibrations of the turntables which would otherwise impair the quality of the records.

These and other features of the invention will be more clearly understood from the following detailed description and the accompanying drawings in which:

Fig. 1 is a front elevation of a disc recording machine in accordance with the invention;

Fig. 2 is a plan of the machine;

Fig. 3 is a side elevation;

Fig. 4 is a sequence chart showing the sequence of the various automatic operations; and

Figs. 5, 6, 7 and 8 are details of the various cams and associated mechanisms for carrying out the several automatic operations.

Referring now to Figs. 1, 2 and 3, it will be seen that the mechanism of this machine may be divided into several major divisions for purposes of description. These divisions are, the recording units 1 and 2, the centrally located shaft 3 for operating the cam assembly 4 and driving the lead screw 5 which moves the recorders 6 and 7 across the surface of the records 8 and 9 and the driving arrangement including the motor 10 for rotating these turntables and the shaft 3.

For high quality work with a machine of this kind it is of course essential that the turntables be rotated at a very uniform speed and that no vibrations, such as those originating in the motor and the driving gears, be permitted to reach the turntables. Accordingly, in the present arrangement, the motor 10 is mounted on a resilient spring member 11 which to a very large extent prevents motor vibrations from being transmitted to the bottom plate 12. The motor speed is reduced to a suitable value by worm gearing 13 and drives the shaft 14 through a fly-wheel 15 and a special mechanical filter 16.

This filter, like filter 36 shown in cross-section in Fig. 1 is composed of a number of layers of vibration absorbing material, such as felt, secured together to form a unit which serves as the sole transmitting link at this point. Such a unit is inherently critically damped with respect to torsional vibrations so that extraneous variations in the angular velocity of the driving shaft are not transmitted. In order to protect the filter from injury and improve its appearance it is preferably covered with a casing 17 which is secured at its top to an end member 18 and carries at the bottom a stop member 19 which is engaged by the projection 20 on the fly-wheel

15 if the filter is deflected torsionally too far in either direction.

Mounted on the upper end of the shaft 14 is a drum 21 having grooves in its periphery for the rope drive 22 which engages similar grooves on the drums 23 and 24 carried by the shafts 25 and 26 on the units 1 and 2. The shaft 14 also carries a second filter 27 which is very similar to filter 16 already described and prevents the vibrations or minor variations in speed such as those due to any disturbance in either of the units 1 and 2 from being transmitted to the shaft 3. The shafts 25 and 26 are supported on conventional thrust bearings 28 and 29 and at their upper ends carry metal rings 30 and 31 which supplement the fly-wheel action of the drums 23 and 24. The drums 23 and 24 transmit power through mechanical filters 36 and 37 (which are considerably larger but in all other respects similar to those already described) shafts 38 and 39 and thrust bearings 40 and 41 to the shafts 32 and 33. The turntables 34 and 35 are concave downwardly as shown in Fig. 1 and when the machine is operating they are caused to rotate by resting in frictional contact with constantly rotating turntable supporting members 42 and 43 which are keyed to the spindles 32 and 33.

From the foregoing description it will be seen that the weight of the machine is distributed between the bottom plate 12 and the top plate 44, that is to say, the driving motor and associated mechanism up to and including the lower portion of the shafts 38 and 39 are supported by the bottom plate 12 and the remainder of the machine, including the turntables and associated mechanism and the cam assembly, is supported by the upper plate 44 in thrust bearings 40, 41 and 131. As a further precaution for preventing the transfer of vibrations from the lower to the upper part of the machine bottom plate 12 is suspended from the upper plate 44 by the members 45 but separated therefrom by layers of felt 46. Any tendency of the members 45 to vibrate laterally is prevented by the layers of felt 47 between members 45 and the brackets 48 which are in turn secured to the outer frame 49 of the machine.

The cam assembly 4 is made up as a unit comprising the top plate 50 and the bottom plate 51 held together by spacer bolts 52 and is secured to the top plate 44. The shaft 3 extends upwardly through this assembly and terminates in a gear 53 which engages gear 54 on horizontal shaft 55. This shaft extends toward the back part of the machine and terminates in a gear 56, which engages a gear 57 on the vertical shaft 58 which carries also a gear 59 engaging the lead screw 5. The lead screw 5 and the turntable supporting members 42 and 43 are in constant rotation whenever the machine is operating. The various function cams which are described in detail below are carried on the cam shaft 60 which is driven intermittently through the train of gears 61 from the shaft 3.

The cycle clutch mechanism shown in Fig. 5 for making this intermittent connection will now be described. The recorder supporting mechanisms 62 and 63 are intermittently lowered into contact with the lead screw 5 in a manner to be described and at such times move the recorders 6 and 7 across the record surfaces from right to left. These mechanisms 62 and 63 carry downwardly extending members 64 and 65 terminating in set screws 66 and 67. A cycle of cam operations may be initiated either by means of one of these screws 66 or 67 coming into contact with the bell crank levers 68 or 69 or by manual operation of the "record" button 70. If either the button 70 or the set screw 67 initiates the operation a rotary movement will be imparted to the bell crank 69 thereby moving the rod 71 to the left and moving the bell crank 68 in a counterclockwise direction. It is also evident that the same result is obtained if set screw 66 comes in contact with bell crank 68. In either case the stop member 72 of the bell crank 68 is moved upwardly away from the projection 73 on the engaging lever 74 and the spring 75 rotates the engaging lever about its pivot 76 until the tooth 77 engages the rotating wheel 78 on the shaft 3. The engaging lever 74 is pivoted to the disc 79 which fits loosely on the shaft 3 but is integral with the gear 80 which drives the cam shaft 6 through the train of gears 61 as shown in Fig. 3. Assuming that the engagement of the cycle clutch was initiated by the screw 66, or in other words that the recording unit 1 has almost completed its record, the next operation to be carried out is the lowering of recorder 7 to provide the necessary overlap in the records before recorder 6 is lifted.

The cam and associated mechanism for carrying out these operations is shown in detail in Fig. 6. In order to carry out these various operations in their proper sequence it is of course necessary that the various cams as shown in Figs. 5 to 8 be located on the shaft 60 in the correct relative positions. No attempt has been made to indicate this correct relative position in Figs. 5 to 8 of the drawings since the exact relation of the cams will be made clear in connection with the sequence chart of Fig. 4 which will be described below. In order therefore to lower the recorder 7 into contact with its record it is necessary to assume that the recorder lift cam 81 is rotated in the direction indicated by the arrow to the point where the surface 82 is about to pass under the roller 83 of the bell crank 84. As this takes place it will be understood that the bell crank is rotated by the tension of the spring 85 in a counterclockwise direction so that the rod 86 is moved toward the rear of the machine. This rod terminates in a lever 87 which forms part of the linkages for raising and lowering the recorder mechanism 63. The lever 87 is connected by rods 88 and 161 to a similar lever 162 and this assembly is pivotally mounted in bearings 163, 164. The recorder mechanism 63 has a downwardly projecting member 165 through which rods 88 and 161 extend with a loose fit. Due to the thrust of rod 86 the assembly moves slowly in a counterclockwise direction as viewed in Fig. 3 so that the recorder mechanism 63 is lowered until the threaded member 89 (Fig. 3) is in contact with the threads of the lead screw 5. As cam 81 continues to rotate the leading edge 90 comes in contact with the roller 91 of the bell crank 92 and moves it in a clockwise direction about the pivot 93 against the tension of the spring 94 and shaft 95 is moved in a clockwise direction as viewed in Fig. 3 by means of the lever 96 so that the recorder 6 is lifted out of contact with the record and out of engagement with lead screw 5.

Referring now to Fig. 7 the turntable lift cam 97 has just rotated the bell crank 98 in a clockwise direction by means of the surface 99 engaging the roller 100. This motion has moved the bar 101 in an upward direction, turned bell crank 134 on its pivot 135 and rotated the spider 102

with a counterclockwise motion to the position shown. Each of the three arms of the spider 102 carries at its end a pivoted member 103 (see Fig. 3) having two outwardly extending projections or pins 132 and 104. When the spider 102 is in the extreme counterclockwise position the members 103 are supported in their upper position by pins 132 resting on the high portion of stationary cams 105 so that the pins 104 hold the turntable 34 out of contact with the turntable supporting member 42. As the cam 97 continues to rotate from the position shown, the roller 100 will come into contact with the surface 106, the bell crank 98 will be rotated in a counterclockwise direction due to the pull of spring 133 and the spider 102 will be given clockwise motion so that pins 132 slide down the inclined surfaces of the cams 105 thereby lowering pins 104 and permitting the turntable 34 to come into contact with the rotating member 42. Similarly it will be seen that if the roller 107 of the bell crank 108 is riding on the lower portion of the cam 97 as indicated in the drawings, the spider member 109 will be in its extreme clockwise position and the turntable 35 will be in engagement with the rotating turntable support 43, but as cam 97 rotates the surface 99 will turn the bell cranks 108 and 136 in a clockwise direction to move the spider 109 to its extreme counterclockwise position and thereby lift the turntable 35 out of engagement with the member 43.

Considering now the recorder return mechanism shown in Fig. 8, the recorder return cam 110 has a raised portion 111 which during each revolution successively engages each of the wheels 112 and 113 of the bell cranks 114 and 115 to turn the bell cranks 116 and 117 in a clockwise direction so that projections 118 and 119 engage the recorder supporting mechanism and slide them along the shafts 95 and 88 respectively to return the recorders 6 and 7 to their starting positions. In the drawings the bell crank 116 has completed its clockwise rotation so that the recorder mechanism 62, a portion of which is indicated in the drawings is in its extreme right hand position and is about to return to the same relative position as that in which bell crank 117 is shown.

Fig. 2 shows the position indicator pointers 139 and 140 which move in accordance with the recorder travel across a record. Alongside the pointers there are provided holders 141 and 142 in which cards 143 and 144 individual to the records may be placed and marked to indicate the length of each message or any other information desired. The pointers which extend upwardly through slots 145 and 146 in the top plate 44 as indicated are integral with members such as 148 in unit 2. Since this mechanism is the same for both units it is shown and described in connection with only one of the units. Member 148 turns about its pivot 149 and terminates at the other end in an arc having gear teeth 150 which engage similar teeth 151 on the member 152. This latter member is adapted to turn on a pivot 153 which is also the pivot for the recorder return lever 117. At the other end of member 152 a roller 154 is held in contact with the recorder supporting mechanism 63 by a tension spring 155. When this mechanism 63 moves from right to left, as when cutting a record, members 148 and 152 are slowly rotated to move the pointer 140 along the scale 142. When the recorder mechanism is returned to starting position as already described in connection with Fig. 8 the tension of spring 155 keeps the roller 154 in contact with the mechanism so that the pointer also returns to the right hand position. With this arrangement the scale is located in a convenient position for the operator and the linkages are such that the pointer motion is large enough to provide an accurate scale.

Now that the details of these mechanisms have been described, reference is made to the sequence chart of Fig. 4 which shows clearly the order and the duration of each of these automatic operations. Assuming that No. 1 unit has nearly completed its recording and that the member 67 has initiated the operation of the cycle clutch as already explained in connection with Fig. 5, No. 2 turntable will then be engaged in accordance with the description of Fig. 7. No. 2 recorder will then be set down in accordance with the description of Fig. 6 and both turntables will record simultaneously for an interval of three grooves. At the end of this time the surface 90 on the cam 81 will begin to lift the recorder 1 out of engagement with the record 9 on the turntable 35. This motion is completed with 20° of rotation and the recorder remains in this position until the cam shaft has rotated to the 110° position as indicated. After 15° of rotation of the cam shaft from its initial position turntable No. 1 is disengaged from the member 43 in the manner described in connection with Fig. 7 and remains disengaged until the cam shaft has rotated through 90° as indicated. During this interval the recorder is returned to its extreme right hand position by means of the mechanism shown in Fig. 8 and at the 65° position the buzzer cam 120 shown in Fig. 5 begins to close the contacts 121 by means of the raised portions 122 or 123. The closure of these contacts operates the signal device to advise the operator that a record has been completed and that it must be changed before this unit again goes into operation. This signal device 124 has been shown mounted into the machine but if desired it may be mounted externally of the machine in any convenient place. At the 85° position the contact 121 opens the signal circuit and at the 90° position the cycle is completed in the following manner. The pin 125 moves into the indentation 126 of the cycle clutch cam 127, so that spring 128 turns the bell crank 129 in a counterclockwise direction and by means of the connection with the bell crank 68 at pivot 130 the projection 72 is moved into the path of the rotating projection 73. Engaging lever 74 is thereby prevented from rotating further and turning about its pivot 76, withdraws the tooth 77 from its contact with the rotating wheel 78 so that no further rotation of the cam shaft 60 takes place until the cycle clutch is again engaged.

The recorders 6 and 7 may be of any desired type but electromagnetic recorders of the general nature of those described in Patents 1,663,884 and 1,678,116 to Harrison have been shown in the drawings for purposes of illustration. The windings of these devices are brought out to stud terminals 156 and 157 which provide a ready means for connecting the machine into the circuit in which it is to be used. This circuit may or may not be part of a telephone system but when used for recording two-way telephone conversations the machine will, in many cases, be located in the office of one of the talking parties. When this is the case the distant speaker's voice will often be weak as compared with the local speaker's so that some provision for equalizing the energy levels is very desirable. Various schemes of this sort have been proposed but the present machine

may be used in conjunction with any one of various circuits of this kind, as for instance, those disclosed in Patent 1,763,169 to Mathes, June 10, 1930.

The driving motor 10 of the machine is started and stopped by means of start and stop switch buttons 137 and 138. When putting the machine into service it will often happen that a record blank has been only partially used by the preceding message. If it is desired to begin the next message on a new blank the other unit may be quickly conditioned for use by pressing the "record" button 70 which, as already explained, will cause the cycle clutch to engage and carry out a sequence of operations in accordance with Fig. 4. That is to say, the idle turntable carrying the new blank is engaged, its recorder is set down, the other recorder is lifted and returned to starting position and the other turntable is disengaged until again required to begin recording in response to either a manual or an automatic operation of the cycle clutch.

From the foregoing description it will be evident that the recording operation may be carried on for any desired time without loss of any portion of a message, it being only necessary that the user or an attendant change the records at the proper times. The invention has been described with reference to a specific structure and arrangement of parts but it will be understood that the structure may be modified in various ways within the scope of the following claims.

What is claimed is:

1. In a continuous phonograph recording machine, a plurality of recording units each comprising a turntable, a rotating member and shifting means for the turntable comprising a plurality of cams and a spider member concentric with the turntable and cooperating with the cams, means for continuously driving the members and driven means cooperating with the shifting means for lowering and raising the turntables in and out of contact with their rotating members in predetermined sequence.

2. In a continuous sound recording machine a plurality of recording units each comprising a record blank, a record carrying member and a recorder, driving means for the units, cam mechanism operating the units in cyclic sequence, a clutch associating the driving means and the cam mechanism and a pivoted member operated by one of the recorders when a record is nearing completion for engaging the clutch.

3. In a continuous sound recording machine a plurality of recording units each comprising a record blank, a record carrying member and a recorder, driving means for the units, shaft having cams thereon for controlling the operation of the units and a clutch therefor associating the shaft with the driving means, a plurality of means for engaging the clutch including a manual control and an automatic control associated with each unit, a cycle cam on the shaft and means cooperating with the cam for disengaging the clutch.

4. In a continuous sound recording machine a plurality of recording units each comprising a record blank, a record carrying member and a recorder, driving means for the units, a cam shaft and a clutch therefor associating the shaft with the driving means, means operated alternately by the units for engaging the clutch, a cam on the shaft, means cooperating with the cam for raising and lowering the recorders in cyclic sequence, a cycle cam on the shaft and means responsive thereto for disengaging the clutch.

5. In a continuous sound recording machine a plurality of recording units each comprising a record blank, a record carrying member and a recorder, driving means for the units, a cam shaft and a clutch therefor associating the shaft with the driving means, means for engaging the clutch, a cam on the shaft and means cooperating with the cam for lowering one recorder into contact with the record of one unit and subsequently raising another recorder out of contact with the record of another unit.

6. In a sound recording machine a plurality of removable turntables and a plurality of continuously rotating turntable supporting members, driving means for the members and means operated by the driving means while a first turntable is rotating for lowering a second turntable into contact with its supporting member and subsequently raising the first turntable out of contact with its supporting member.

7. In a sound recording machine a plurality of removable turntables and a plurality of continuously rotating turntable supporting members, driving means for the members, a cam, a clutch for connecting the cam to the driving means, means for intermittently engaging the clutch and means individual to the turntables successively operated by the cam for starting and stopping the turntables.

8. In a sound recording machine a plurality of removable turntables and a plurality of continuously rotating turntable supporting members, driving means for the members, a cam intermittently rotated by the driving means, stationary cams and pivoted spider members under each turntable and linkages between the spider members and the rotating cam for starting and stopping the turntables.

9. In a sound recording machine a plurality of turntables, driving means therefor, a plurality of recorders and mechanisms for supporting and moving the recorders with respect to the turntables, a recorder position indicator for each turntable comprising an indicating arm extending under and terminating in front of the turntable and a pivoted member cooperating with the arm and actuated by the mechanism, a cam set in rotation by the mechanism just prior to the completion of its movement and means operated by the cam for restoring the recorder mechanism and the position indicator to their starting positions.

10. In a recording machine, a plurality of recording units each including a recorder and a turntable carrying a record blank, driving means for the units, a cam shaft and means operated prior to the completion of a record by the first unit for effecting rotation of the shaft, a cam on the shaft and means operated thereby for connecting the turntable of the second unit to the driving means, and other cam means associated with the shaft for disengaging the first recorder from the driving means.

11. In a recording machine, a plurality of recording units each comprising a recorder, a turntable carrying a record blank, a rotating turntable supporting member and means for holding the turntable above and out of contact with said member, common driving means for rotating the members and moving the recorders across the record blanks, a cam shaft, means operative while the first unit is recording for associating the shaft with the driving means, a

first cam on the shaft and means controlled thereby for lowering the turntable of the second unit into contact with its supporting member, a second cam on the shaft and means controlled thereby for lowering the recorder of the second unit into contact with the driving means and the record blank of the second unit and subsequently lifting the recorder of the first unit out of contact with its record and the driving means, a third cam on the shaft and means controlled thereby for returning the first recorder to its starting position, a fourth cam on the shaft and means controlled thereby to indicate the completion of a record and a fifth cam on the shaft and means controlled thereby for disconnecting the cam shaft from the driving means.

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