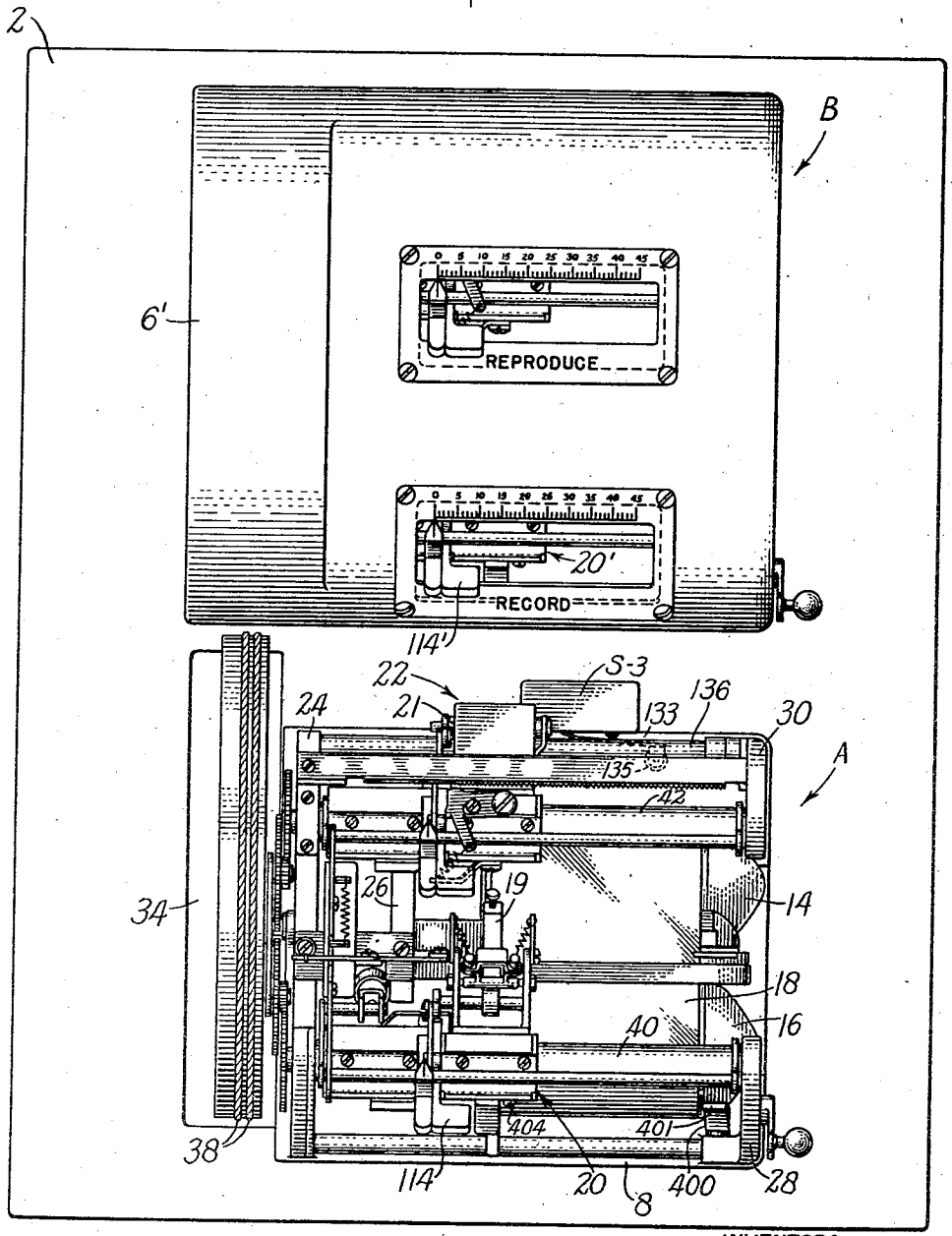
Oct. 8, 1946. S. YERKOVICH 2,409,006

PHONOGRAPH

Original Filed Jan. 15, 1943 5 Sheets-Sheet 1

Fig. 1.



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PHONOGRAPH

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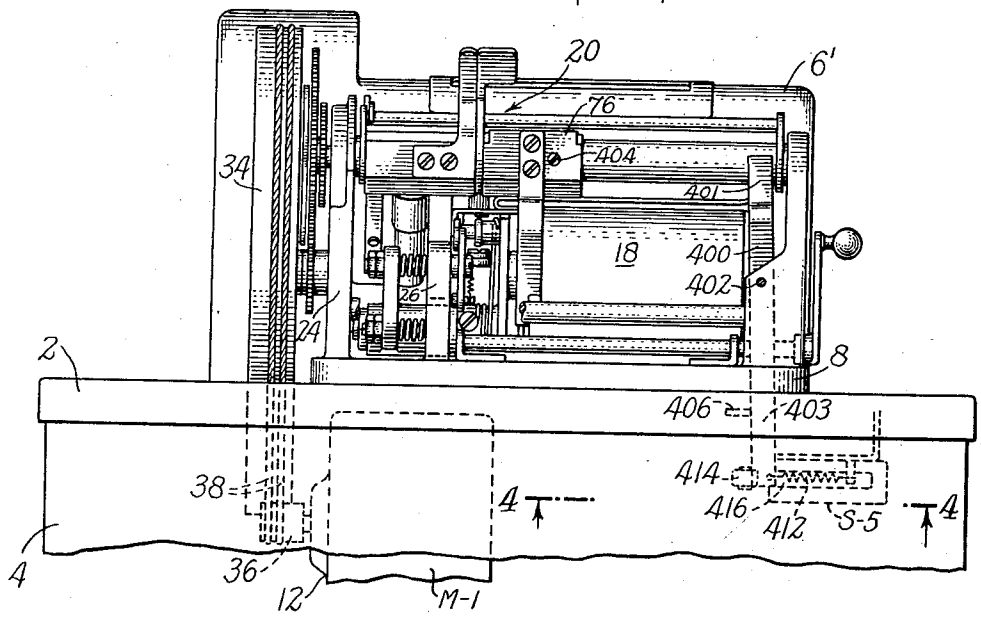
Fig. 2.



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PHONOGRAPH

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Fig. 3.

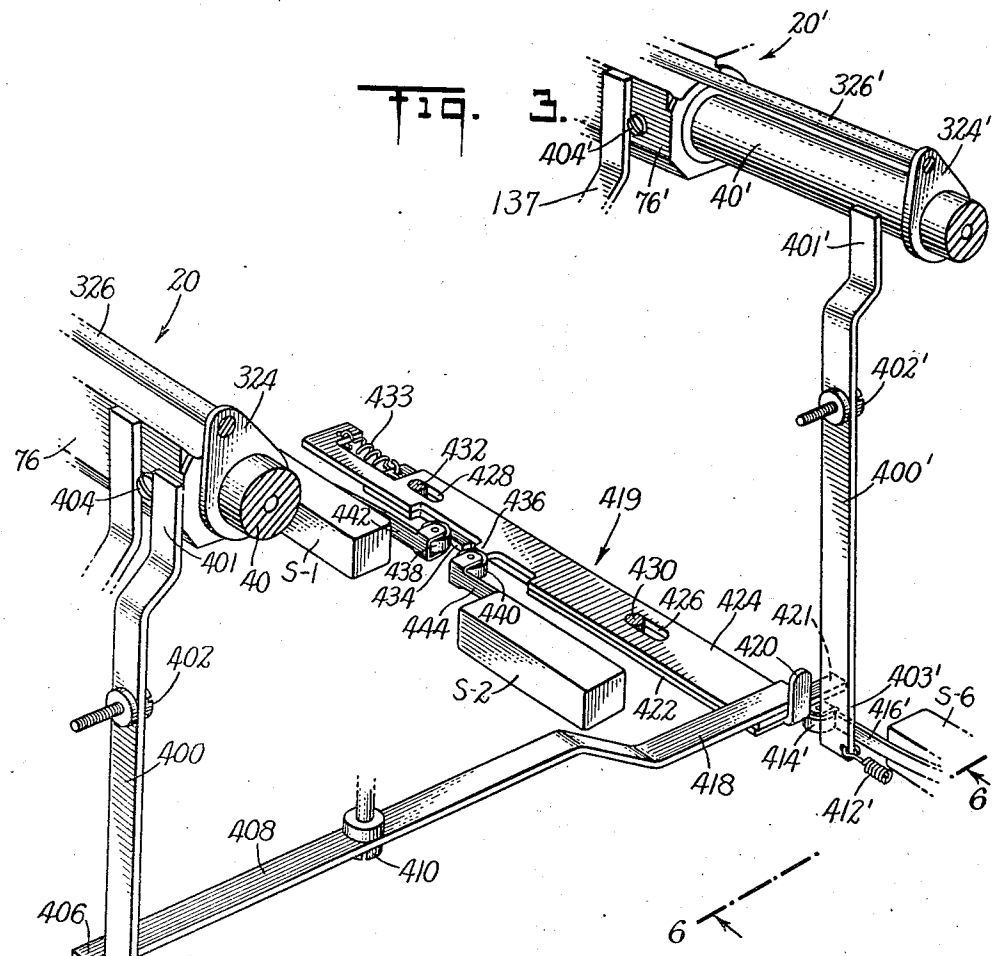
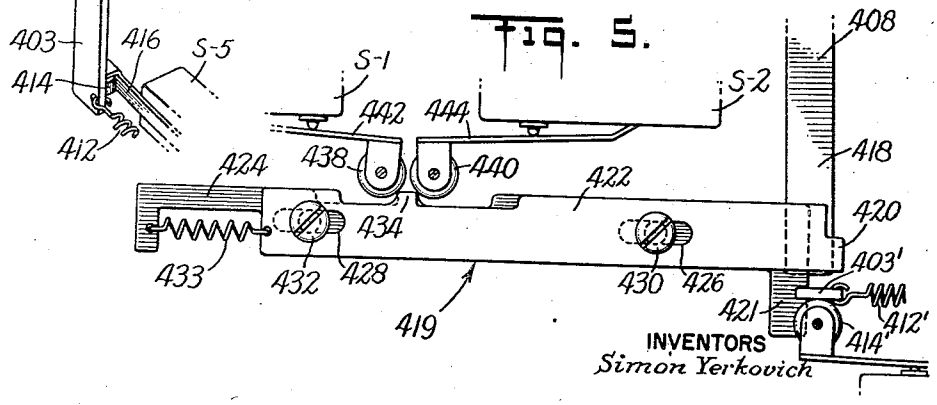


Fig. 5.



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PHONOGRAPH

Original Filed Jan. 15, 1943 5 Sheets-Sheet 4

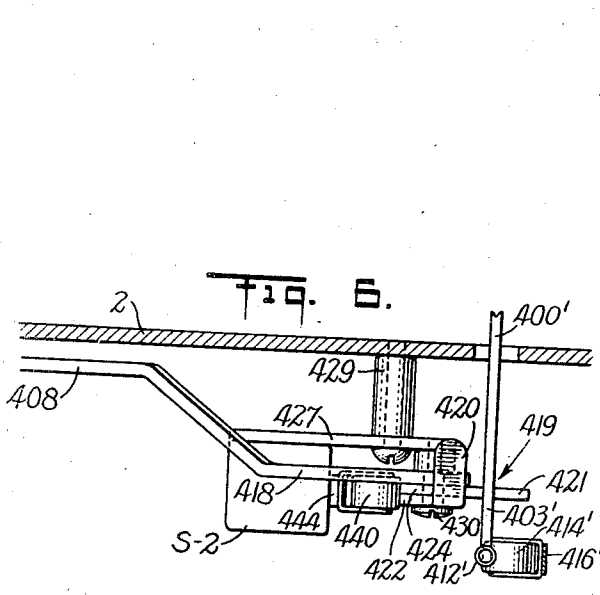


Fig. 5.

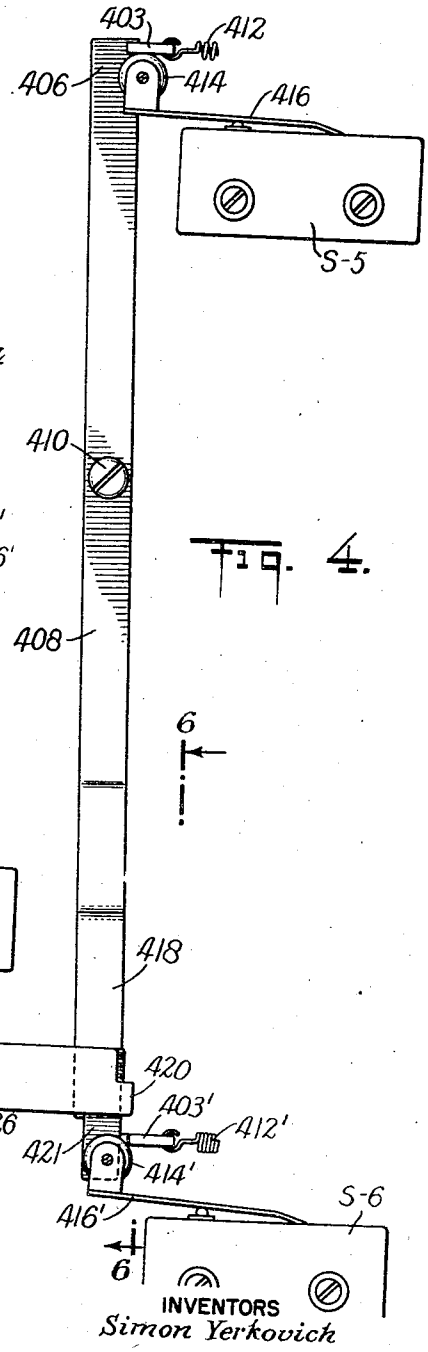
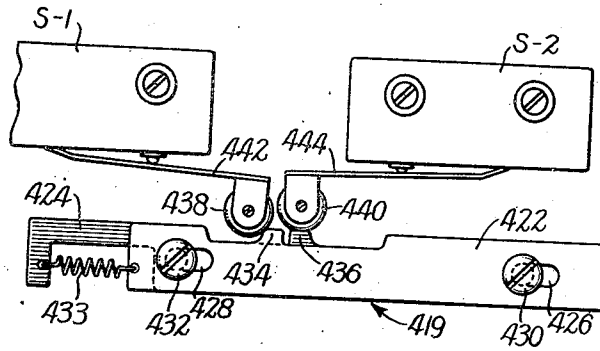


Fig. 4.



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PHONOGRAPH

Original Filed Jan. 15, 1943 5 Sheets-Sheet 5

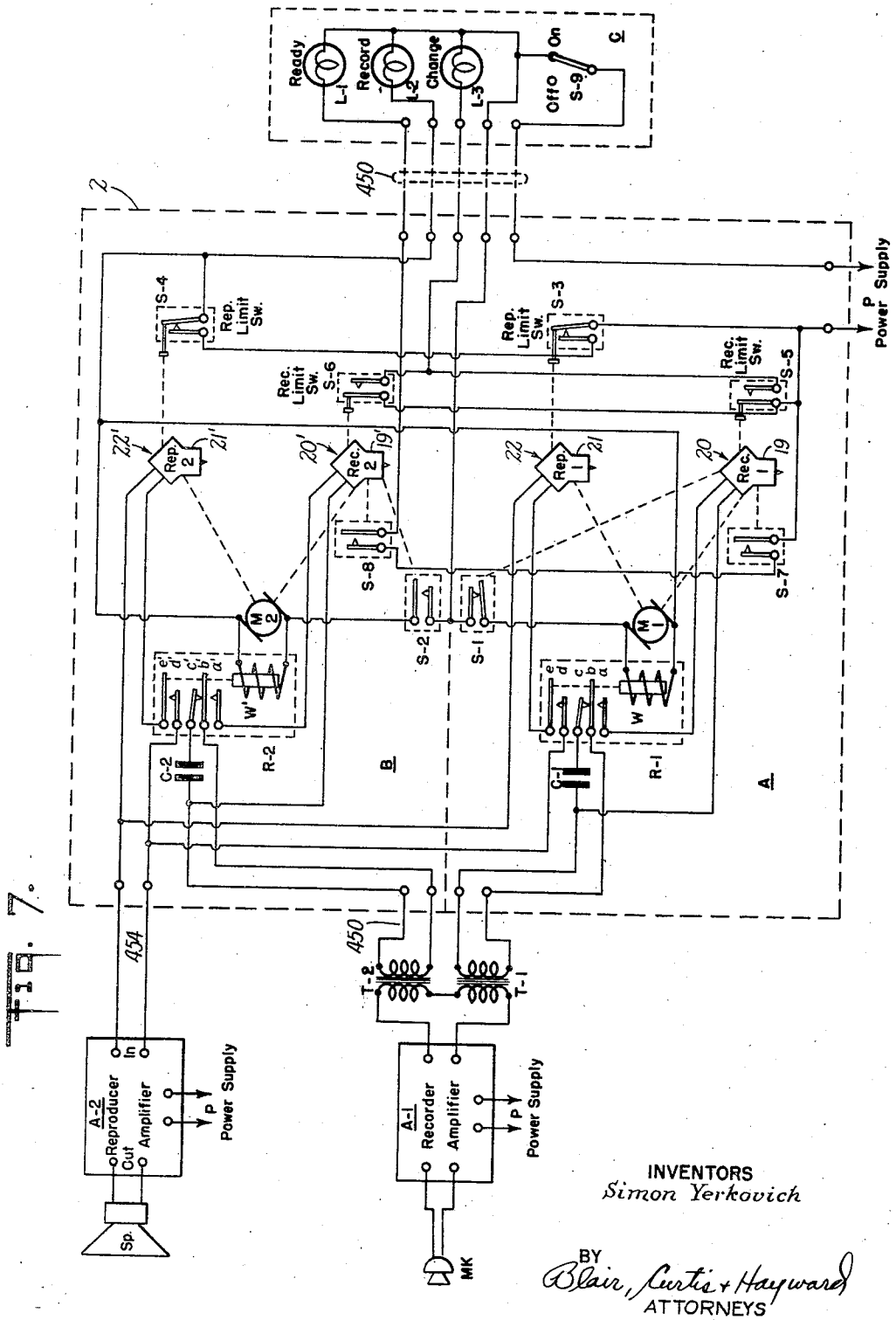

Fig. 7.

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Patented Oct. 8, 1946

2,409,006

UNITED STATES PATENT OFFICE

2,409,006

PHONOGRAPH

Simon Yerkovich, Fairfield, Conn., assignor to Dictaphone Corporation, New York, N. Y., a corporation of New York

Original application January 15, 1943, Serial No. 472,448. Divided and this application February 1, 1945, Serial No. 575,657

3 Claims. (Cl. 274—11)

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This invention relates to phonographs, and more particularly to machines for continuously recording speech and other sounds and for recording the same.

The present application is a division of patent application Serial No. 472,448, filed January 15, 1943, now Patent No. 2,371,116.

Continuous recording of lengthy speeches, telephone conversations, radio broadcasts, airport control orders, and the like, has been accomplished in the past by the use of dual phonograph units of the type shown, for example, in U. S. Patent 2,026,398 to Norton et al., entitled, "Twin phonograph."

One of the objects of the present invention is to provide an improved machine of the above nature which is simple, practical, and easy and convenient to operate, and which is rugged and dependable under even the most severe operating conditions.

Continuous recording machines of this type are frequently used for "logging" purposes, i. e., for making a permanent record of all that transpires at some given station for record and future reference purposes. It is desirable for this type of operation that the machine be designed to use an inexpensive, single-use record blank upon which a permanent record may be formed, rather than the wax cylinder type record usually used. It is also desirable that a permanent record blank of this type be of such construction as to permit easy filing for future reference, and be of such size as to occupy a minimum of space when thus filed. A record blank having these advantageous properties for such use is the endless loop or belt record made of cellulosic material of the type designed for use with the improved dictating machine disclosed in copending patent application Serial No. 366,849, now Patent No. 2,318,328, granted May 11, 1943, entitled "Phonograph."

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

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

The invention may be more readily understood by reference to the accompanying drawings, showing one of the various possible embodiments of this invention, in which

Fig. 1 is a top plan view of a twin phonograph embodying the present invention, with the cover

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of one of the dual units A and B removed to disclose a portion of operating mechanism;

Fig. 2 is a front elevation thereof showing a portion of the supporting base;

Fig. 3 is a skeletonized perspective view of the control mechanism for automatically operating the two phonograph units of the machine in sequence;

Fig. 4 is a bottom plan view of a portion of the mechanism shown in Fig. 3 taken in the direction of arrows 4—4 in Fig. 2;

Fig. 5 is a fragmentary bottom plan view similar to a portion of Fig. 4 but showing certain of the parts thereof in the positions they assume during a different portion of the cycle of operation of this mechanism;

Fig. 6 is a vertical section taken substantially on line 6—6 of Figs. 3 and 4; and

Fig. 7 is a wiring diagram showing schematically certain mechanisms and devices for remotely controlling a machine constructed in accordance with the present invention.

Similar reference characters refer to similar parts throughout the different views of the drawings, and similar portions of machines A and B are indicated by the same reference characters except that those on machine B are primed.

Before describing the present invention in detail it may be well to give consideration to certain of the more general aspects of twin phonograph operation and control. One of the principal uses of this type of machine is to record continuously, matter of such length that it cannot be recorded on a single record blank. Accordingly, two duplicate phonograph units are employed, each having a suitably driven record blank support, and a carriage movably mounted to traverse a recorder unit across the record blank to impress a sound record groove thereon. A suitable mechanism is employed to cause alternate operation of the two units in such manner that when the record blank in one is nearly exhausted, the other is automatically put in operation to commence recording on a second record blank on the second unit. The first machine unit is then stopped, the first record blank removed, and a third record blank substituted therefor. This alternate operation of the two machine units and substitution of fresh record blanks, may be continued until the end of the speech or message, or carried on indefinitely if it is desired continuously to "log" all transactions at a given point.

The present invention provides a novel arrangement of electrical and mechanical elements in a dual phonograph machine which operates

automatically to provide such automatic sequential operation for continuous recording purposes. It also provides an improved record supporting, driving, and handling arrangement which permits the use of a novel type of flexible endless loop record blank on which it is possible to record considerably more material than can be put on the usual wax cylinder record tablets previously used in such machines. Furthermore, the machine is arranged to permit reproduction while the machine is recording, and even to permit simultaneous playback of the matter being recorded.

Referring to Figs. 1 and 2 of the drawings, the twin phonograph, chosen to illustrate the present invention, comprises a sub-base 2 hinged or otherwise mounted on a support 4. A pair of identical recording and reproducing machines which are herein referred to as units A and B, respectively, are suitably secured side by side to the sub-base 2. These two units A and B are interconnected and interlocked by automatic change-over mechanism for effecting sequential operation, as will hereinafter be described in connection with Figs. 3, 4, 5 and 6.

In the following description, it should be understood that the details described with reference to one of these units A or B are exactly duplicated in the second unit and, therefore, that the following description of one unit applies in every way to the other unit, except for the description of certain particular mechanical and electric connections relating to the automatic change-over mechanism. In Figs. 1 and 2, phonograph unit A is shown with its cover removed so as more clearly to show its internal structure. Normally the unit is provided with a cover similar to cover 6' on unit B.

In general, each of the phonograph units A and B essentially comprises a driving motor M which, through suitable driving mechanism hereinafter to be described, drives one of a pair of parallel horizontal drums or mandrels 14 and 16 which tautly support a flexible endless loop record blank 18 and drive it past a recorder unit 19 mounted on a carriage, generally indicated at 20, and a reproducer unit 21 mounted on a carriage, generally indicated at 22, which units may be independently and selectively traversed across the length of the record blank 18 by means of a suitable pair of feed screws, to impress on the record a helical sound groove while making a record, and to follow such a helical sound groove in reproducing a record.

Record supporting structure

Referring to Figs. 1 and 2, phonograph unit A is mounted on a horizontal base plate 8 (best seen in Fig. 2) suitably secured to the sub-base 2. A pair of parallel vertical frame members 24 and 26 project upwardly from base plate 8 near and parallel to its left-hand end, and two other parallel vertical frame members 28 and 30 project upwardly from the right-hand corners of base plate 8, as shown in Fig. 1. These frame members 24, 26, 28 and 30 form the principal supports for most of the operating mechanism of the phonograph. The driven mandrel 14 is secured to a drive shaft suitably rotatively supported in bearings carried by left-hand frame members 24 and 26. A combination fly-wheel and driving pulley 34 is secured to the other end of the drive shaft. Pulley 34 is connected to a driving pulley 36 on the shaft of driving motor M—1 by means of an endless-cord type belt 38 provided with a suitable crossover arrangement and tightening idler such, for example, as that shown in the above-mentioned Patent No. 2,318,828.

Recorder and reproducer mountings and drives

Recorder carriage 20 and reproducer carriage 22 are each slidably mounted for traversing movement across the record 18 substantially parallel to the axis of the driving cylinder 14 on guide rods 40 and 42, respectively. Guide rod 40 extends from vertical frame member 24 at the left end of the machine to vertical frame member 28 at the right end thereof, and guide rod 42 extends from frame member 24 to frame member 30, as shown in Fig. 1. These guide rods 40 and 42 are tubular and within them suitable feed screws are rotatably supported. Suitable slots along the side of each of the guide bars provide access in well known manner to the feed screws.

The feed screws are driven by a suitable gear train assembly from drive shaft 32 which is suitably chosen with respect to the speed of the driving motor 12 and the desired speed of rotation of the driven record mandrel 14 and the pitch of the feed screws, so that the carriages 20 and 22 are traversed at proper speed with respect to the desired linear speed of record 18.

The feed screws respectively traverse the recorder carriage 20 and the reproducer carriage 22 across loop record 18.

The reproducer carriage structure 22 supports a suitable reproducer unit.

As shown in Fig. 1, a switch S—3 is mounted on the base 8 adjacent a reproducer guide bar 136 near the right-hand end thereof. This switch S—3 is provided with a switch operating arm 133 carrying an operating roller 135 which is adapted to contact an extension 137 on the reproducer carriage when the reproducer carriage reaches its most advanced position. As will hereinafter be described, this switch S—3 and a corresponding switch S—4 on machine B are so connected in the machine circuit as to deenergize their respective machine motors M—1 and M—2 when either of the reproducer carriages 22 or 22' reaches its most advanced position, thus preventing jamming of the reproducer feed nut with the reproducer feed screw and also preventing the reproducer stylus from cutting through thin flexible loop record 18.

For better understanding of the construction and mode of operation of the above mentioned parts, reference may be made to said application Serial No. 472,448.

Change-over mechanism for continuous sequential operation

An improved mechanism is provided for automatically operating machines A and B in sequence so as to permit continuous recording for indefinite periods of time. In general, this mechanism functions in a manner similar to mechanism for a like purpose described in the above-mentioned U. S. Patent No. 2,026,398. Assuming that fresh record loops are mounted in both of the machines A and B, that their recorder carriages 20 and 20' are in their initial or left-hand positions, and that the recording operation is commenced; when the recorder carriage 20 of machine A approaches its limit of travel, it actuates a change-over mechanism to start the motor running on machine B and thus commence recording on machine B. For a short interval of time thereafter, both machines simultaneously record the same matter on their respective record blanks thus providing a slight overlap of the recorded matter.

The recorder carriage 20 of machine A then continues its travel to its most advanced position, where the change-over mechanism stops the operation of the driving motor of machine A while machine B continues to record. If the fully recorded record on either machine is always replaced with a fresh record and its recording carriage is moved back to its initial position, this overlap and change-over operation will be repeated whenever the recorder carriage of the other machine reaches a properly predetermined advanced position.

In the present case sequential operation is accomplished automatically by means of the mechanism shown in skeletonized perspective in Fig. 3 and in plan and partial section in Figs. 4, 5 and 6. First referring to Figs. 2 and 3, a vertical lever 400 is pivoted near its center, on the side of the end frame member 28 by a pivot screw 402 in such a position that its upper end 401 will engage a stop 404, projecting from the body 76 of the recorder carriage 20, slightly in advance of the position which the stop would attain when the carriage reaches the end of its traverse across the record blank 18. The lower end 403 of this lever 400 contacts one end 406 of a horizontal lever 408 pivotally mounted along the under side of the base 8, by a pivot screw 410, to rotate the lever 408 clockwise, referring to Fig. 3, or counterclockwise, referring to the bottom view in Fig. 4, when carriage stop 404 picks up the upper end 401 of lever 400 and rotates it clockwise, with reference to Figs. 2 and 3. Lever 400 is normally biased counterclockwise, as shown in Figs. 2 and 3, by a tension spring 412 so that its upper end 401 is normally swung toward the carriage 20. The lower end 403 of lever 400 is also positioned adjacent a roller 414 mounted at the end of an operating lever 416 of a switch S—5, the function of which will be hereinafter described, so that the switch S—5 is operated when the carriage 20 reaches the limit of its advance across the record 18. The other end 418 of the lever 408 contacts the upturned end 420 of the lower member 422 of a laminated control bar, generally indicated at 419, comprising two flat parallel members 422 and 424, as shown in Figs. 3, 4, 5 and 6. Similarly machine B is provided with a vertical lever 400' pivoted on a pivot screw 402' to the side of the end vertical frame member 28' so that it is adapted to be rotated in a clockwise direction, referring to Fig. 3, when its upper end 401' is contacted by a stop 404' mounted on the body 76' of the recorder carriage 20' of machine B. The lower end 403' of pivoted lever 400' is attached to a spring 412' which normally biases the lever counterclockwise. This lower end 403' of the pivoted lever 400' is adapted to strike an extension 421 which projects perpendicularly from the side of the upper slidable control bar 424, and to press against this projection 421 and thereby move the upper control bar 424 to the left, when the carriage stop 404' strikes the upper end 401' of lever 400' and rotates it as the carriage moves toward the most advanced position of the carriage on the guide bar 40'. Likewise, the lower end 403' of lever 400' is adapted to move past a roller 414' on a switch operating arm 416' connected to a switch S—6 to operate this switch as the carriage 20' reaches its end position.

Referring to Fig. 6, the two members 422 and 424 of laminated control bar 419 are slidably mounted on the under side of a horizontal plate 427 secured to the base member 2, by supporting

posts 429. These members 422 and 424 are slidably attached to plate 427 by means of shoulder screws 430 and 432 which pass through registering elongated slots 426 and 428 provided in the respective plates and are threaded into the bottom of plate 427. These two parallel control members, under normal operating conditions, move as a single bar 419 because their ends opposite the ends having the projections 420 and 421 are joined by a tension spring 433. The lower bar 422 is provided with a projecting cam portion 434 positioned to cooperate with a roller 438 attached to the switch operating arm 442 of a normally open motor control switch S—1. Similarly the upper slidable bar 424 is provided with a cam-like projection 436 which cooperates with a roller 440 carried by the switch operating arm 444 of a normally open motor control switch S—2. When recorder carriage 20 is manually returned to its initial or left-hand position after operation of the change-over mechanism to the position shown in Figs. 3 and 4, the vertical pivoted lever 400 rotates in a counterclockwise direction, as seen in Fig. 3, under the influence of the bias spring 412 and its lower end 403 moves out of contact with the end 406 of the horizontal pivoted lever 408. Lever 408, however, will maintain the position shown in Figs. 3 and 4. The parallel slidable control bars 422 and 424, acting as a unitary structure 419, also will remain in their extreme right-hand position, as seen in Fig. 4, because of the pressure of the roller 438 on the inner or left edge of the cam projection 434, this roller, in effect, acting as a detent to hold these control members in the position to which they have been carried.

The complete operation of this change-over mechanism can best be understood by reference to Figs. 4 and 5. As will hereinafter be described, switches S—1 and S—2 are connected in series, respectively, with motors M—1 and M—2 of machines A and B, respectively. These switches are normally open and are closed to energize their respective motors when the rollers 438 and 440 are moved respectively to the high points of their operating cams 434—436. Assuming that at the start of a recording sequence the carriage 20' of machine B is idle and stands in its initial position at the left-hand end of guide rod 40' and that machine A is in operation with its carriage 20 moving toward the right-hand end of the machine, then when the carriage stop 404 of machine A strikes pivoted lever 400, this lever is gradually moved to the position shown in Fig. 3, causing shifting of lever 408 ultimately to move the lower control bar 422 to the right to the position best shown in Fig. 4. Since at this time the carriage of machine B stands in its initial position, the other pivoted lever 400' remains in its normal position out of contact with the projection 421 on the upper slidable control bar 424, which has gradually moved with control bar 422 to its extreme right-hand position, moving roller 440 on switch S—2 up to the top of cam 436, thus closing switch S—2 and putting motor M—2 in operation. By the time control bar 422 has reached its right-hand position, roller 438 on switch S—1 has moved down off the top of the cam-like projection 434, thus moving switch operating lever 444 away from switch S—1 to open this switch and thus deenergize motor M—1. This is the condition shown in Fig. 4. In this condition, machine B is recording and machine A has come to a stop with its carriage 20 in its extreme right-hand position. The stylus control lever 114, Fig. 1, may then be moved to "neutral" position, the carriage

on machine A manually moved to its left-hand or initial position, the completely recorded record ejected, a fresh record placed on the machine, and the recording stylus control lever 114 again moved to its "record" position.

At this point it should be understood that for a short period of time while the control levers 114 and 114' of the two units are sliding to the right, the rollers of both switch levers will ride along the tops of their respective cams 434 and 436, causing the circuits of both motors to be in closed condition. This provides for the slight overlapping of recording mentioned above.

After deenergization of No. 1 motor, recorder carriage 20' of machine B continues to move in a right-hand direction until the stop 404' on the carriage strikes the vertical lever 400'. This causes the lower end 403' of lever 400' to move in a left-hand direction, as seen in Fig. 4, into contact with the projection 421 on the upper slidable control bar 424 so that this control bar 424 is moved in a left-hand direction, as seen in Fig. 4. Inasmuch as the horizontal pivoted lever 408 is free to rotate because the lower end 403 of the vertical pivoted lever 400 has been moved away from lever 408, the lower slidable control bar 422 will be moved with control bar 424 to the left, its right angle projection 420 contacting the end 418 of control lever 408 and carrying it with it to its left-hand position. As the combined control bars 422 and 424 are gradually moved to the left, with the continued advance of recorder carriage 20', roller 438 rides up on the cam-like projection 434, thus operating switch S—1 to close the circuit to motor M—1, causing the latter to start operating and thus commencing a new recording on machine A.

Machine B will still be recording because roller 440 has not as yet moved off of the top of projection 436. Thus again there will be a short period of time when both machines are recording the same sounds and so providing an overlap between the end of one record and the beginning of another.

As the recorder carriage 20' of machine B moves further toward its end position after roller 438 has moved up to the top of cam projection 434, roller 440 will move off of the top of cam projection 436, thus opening switch S—2 and deenergizing the motor M—2 of machine B, to stop recording on machine B and leaving the recorder carriage of machine B at the end of its path of right-hand travel. If now the recorder carriage 20' of machine B is then moved to its initial or left-hand position and a fully recorded record is replaced by a fresh record blank, then when the carriage of machine A again reaches the end of its travel, the automatic change-over mechanism will repeat the operation just described in the reverse sense, roller 440 first rolling up on cam projection 436 to close switch S—2 to energize motor M—2 and shortly thereafter roller 438 moving off the top of cam projection 434 to open switch S—1 and deenergize motor M—1, thus returning the mechanism to the position in which it is shown in Fig. 4. This sequential operation will continue so long as the recorder carriages 20 and 20' are manually reconditioned each time a record is completed.

If, perchance, reconditioning is neglected and the second recorder carriage moves to the end of its travel before the first recorder carriage is returned to its initial position, means are provided for automatically shutting off both machines to prevent jamming of the control mechanism and possible damage to the motors of the machine. This is accomplished by reason of the resilient coupling provided between the relatively movable members of the two-part slidable control bar 419. Assuming the mechanism to be in the position shown in Fig. 3, with recorder carriage 20 at its final position, and that recorder carriage 20' then moves to its final position, the stop 404' will, as described above, strike the upper end 401' of the vertical lever 400' and move the lower end 403' of this lever in a left-hand direction to strike the projection 421 on the upper slidable control bar 424. Under these conditions, the lower control bar 422 will be locked in the position shown in Fig. 4 because the lower end 403 of vertical pivoted lever 400 is held rigidly against control bar 422 by the carriage 20. Because members 422 and 424 are separate units joined merely by the spring 433, this spring 433 will yield to permit upper member 424 to move to the left to its extreme position, while the lower slidable control bar 422 remains in its right-hand position, as shown in Fig. 5. In this new position of the parts, roller 438 of switch S—1 is positioned off and to the left of cam projection 434, holding switch S—1 in open condition. Cam projection 436 of bar 424 has moved to the left beyond roller 440 of switch S—2 permitting roller 440 to move off and to the right of cam projection 436, to open switch S—2. Thus, under these circumstances, both of the motors will be deenergized and, due to the yielding connection between members 422 and 424, this result is accomplished without injury to any part of either machine unit or to the interconnecting change-over mechanism.

Switches S—5 and S—6 are normally open switches and, as will be described hereinafter, are closed by movement of the respective recorder carriages to terminal position to operate signal lights indicating that the corresponding carriage should be returned to its initial position to receive a fresh record blank and be reconditioned for recording.

Indication system and electrical connections

A continuous recording machine of the type herein described is preferably arranged to be controlled from a position remote with respect to the machine itself, and therefore it is desirable that signals be arranged at the remote control station to indicate the condition of the machine. Referring to Fig. 7, a remote control station C is connected by a five-wire cable 450 to machines A and B mounted on base 2 (indicated by dotted lines), and in turn the machines A and B are connected by four conductors 452 and two conductors 454 to a recorder amplifier A—1 and a reproducer amplifier A—2, respectively. The remote control station C is provided with three indicator lamps L—1, L—2 and L—3, and a main control switch S—9 for turning the entire machine on or off. The main control switch S—9 connects all of the various circuits of the recording machines A and B with a power supply P.

Indicator lamp L—1 is a "ready" signal. It is connected in series with switches S—7 and S—8 across the power supply P. These switches, as described in above mentioned application 472,448, are closed by movement of the recorder control levers 114 and 114' to "record" position. Thus, this "ready" lamp is lighted only when both of the recorders are conditioned for recording so that the entire machine is in proper state for continuous operation.

Indicator lamp L—2 is the "record" lamp which

is lighted when either machine A or B is actually recording. This lamp is connected in series with normally closed reproducer controlled limit switches S—3 and S—4 and in parallel with the circuits of both motors M—1 and M—2 so that it is lighted whenever either of the motors is energized, thus indicating that either machine A or machine B is actually in operation.

Indicator lamp L—3 is the "change" indicator lamp. It is connected across the power supply P in series with parallel-interconnected recorder controlled limit switches S—5 and S—6. When either recorder carriage 20 or recorder carriage 20' reaches the limit of its travel, i. e., its extreme right-hand position, referring to Fig. 1, one or the other of these switches is closed and lamp L—3 indicates that it is necessary to change the record on one of the machines if further continuous recording is desired.

As previously described, switches S—1 and S—2 are connected in series respectively with motors M—1 and M—2. In turn these circuits are connected in parallel with each other and in series with switches S—3 and S—4 across the power supply P, as shown in Fig. 7. Since switches S—3 and S—4 are normally closed, so long as this condition obtains, either motors M—1 or M—2 will be in operation, whenever main switch S—9 is closed, depending upon the position of the automatic change-over mechanisms. Switches S—3 and S—4 are closed throughout all normal operations of the machine, except when one (or both) of the reproducer carriages 22, 22' has been operated or otherwise moved to the end of its path of travel. When this occurs both motor circuits will be broken and remain open until the respective reproducer carriage (or carriages) has been returned manually toward its initial left-hand position.

In the above referred to Norton Patent 2,026,398, a switching arrangement is disclosed operable by operation of the change-over mechanism selectively to connect the dual recorder units to input sound translation means only when the respective dual motor units of the machine are energized. This function is accomplished in accordance with the present invention by the relay arrangements R—1 and R—2 disclosed in Fig. 7. The present switch-over system, in addition, automatically substitutes a condenser load upon the recorder amplifier in place of the load of a recorder unit disconnected from the amplifier by the relay. Also as disclosed herein, the reproducer units of the dual machines are selectively connected for operation by the same relay mechanism, which will now be described.

The windings W and W' of the relays R—1 and R—2 are connected in parallel, respectively, with motors M—1 and M—2 so that they are energized whenever their respective motors are in operation. Relay R—1 is provided with five contacts *a*, *b*, *c*, *d* and *e*, and relay R—2 with contacts *a'*, *b'*, *c'*, *d'* and *e'*. Contacts *a*, *b* and *c* form a single pole double throw switch and contacts *d* and *e* a single pole single throw switch. These contacts are arranged so that when winding W is deenergized, contacts *b* and *c* are closed, and contacts *a* and *b* and contacts *d* and *e* are open, as shown in Fig. 7. On the other hand, when motor M—1 of machine A is energized, contacts *b* and *c* are opened and contacts *a* and *b* and contacts *d* and *e* are closed, connecting recorder 19 of machine A through a transformer T—1 to the output of the recorder emplifier A—1, the input of this amplifier being connected to the source of the vibrations to be recorded such as the microphone MK; and the reproducer 21 of machine A is connected to the input of the reproducer amplifier A—2, the output of which is connected to a suitable translating device such as speaker Sp. When machine B is energized and machine A deenergized by operation of the change-over mechanism, with the consequent deenergization of relay R—1 and return of its contacts to the condition shown in Fig. 7, recorder 19 of machine A is disconnected from the output of transformer T—1 and a condenser C—1 is connected across the transformer T—1; and reproducer 21 is disconnected from the input of amplifier A—2 through the opening of contacts *d* and *c*. Simultaneously, through the energization of relay R—2, recorder 19' of machine B is connected to the secondary of a transformer T—2, the primary of which is connected in series with the primary of transformer T—1 across the output of recorder-amplifier A—1; and reproducer 21' of machine B is connected to the input of reproducer-amplifier A—2. Upon a further operation of the sequence mechanism to deenergize machine B and energize machine A, the reverse action takes place, the secondary of transformer T—2 being disconnected from recorder 19' and connected across a second condenser C—2. The substitution of condensers C—1 and C—2 for recorders 19 and 19' provides a substantially constant load across the secondary to transformers T—1 and T—2 when their respective recorder units are disconnected therefrom.

As many possible embodiments may be made of the above invention without departing from the scope thereof, 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.

I claim:

1. In apparatus of the class described, wherein duplicate normally successively operable sound recording machines, each comprising a record support and a recorder carriage, are each driven by a separate electric motor, in combination, independent switches for connecting a source of power with either or both of said machines motors, and mechanism operable by the respective carriages to operate said switches comprising two relatively movable cam bars adapted respectively to operate the respective switches and spring connected normally to act as a single bar, one being moved by the other, and separate shifting means to transmit carriage movement to the respective bars, said mechanism being operable by one of said carriages as it approaches the end of its record to start the motor of the other machine and being further operable by said one carriage to stop the motor of the first operated machine after further travel of said carriage, and said mechanism also being operable by the other of said carriages during travel first to start the motor of the first machine and then to stop the motor of the second machine.

2. The combination of two duplicate successively operated sound recording machines, each comprising a record support, a recorder carriage, an electric driving motor, and a motor control switch; with mechanism comprising a pair of relatively slidable members respectively having means to control the respective switches; a pair of separate levers to transmit carriage movement to the respective slidable members; and spring

means connecting and biasing said members normally to act as a single member responsive to the operation of said carriages for controlling operation of said switches to successively start and stop the respective motors.

3. The combination of two duplicate successively operated sound recording machines, each comprising a record support, a recorder carriage, an electric driving motor, and a motor control switch; with mechanism comprising a pair of relatively slidable members respectively having means to control the respective switches; a pair of separate levers to transmit carriage movement

to the respective slidable members; spring means connecting and biasing said members normally to act as a single member responsive to the operation of said carriages for controlling operation of said switches to successively start and stop the respective motors; and respectively independently operable in response to operation of said carriages to control operation of said switches to stop both of said motors when both of said carriages have completed their traverse with respect to the record.

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