June 29, 1926. 1,590,654

O. SMITH

AUTOMATIC PHONOGRAPH

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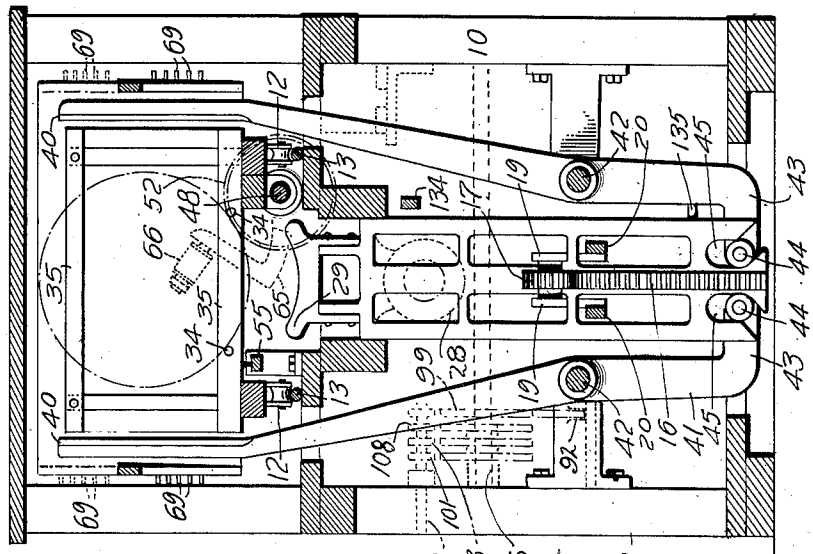


Fig. 2.

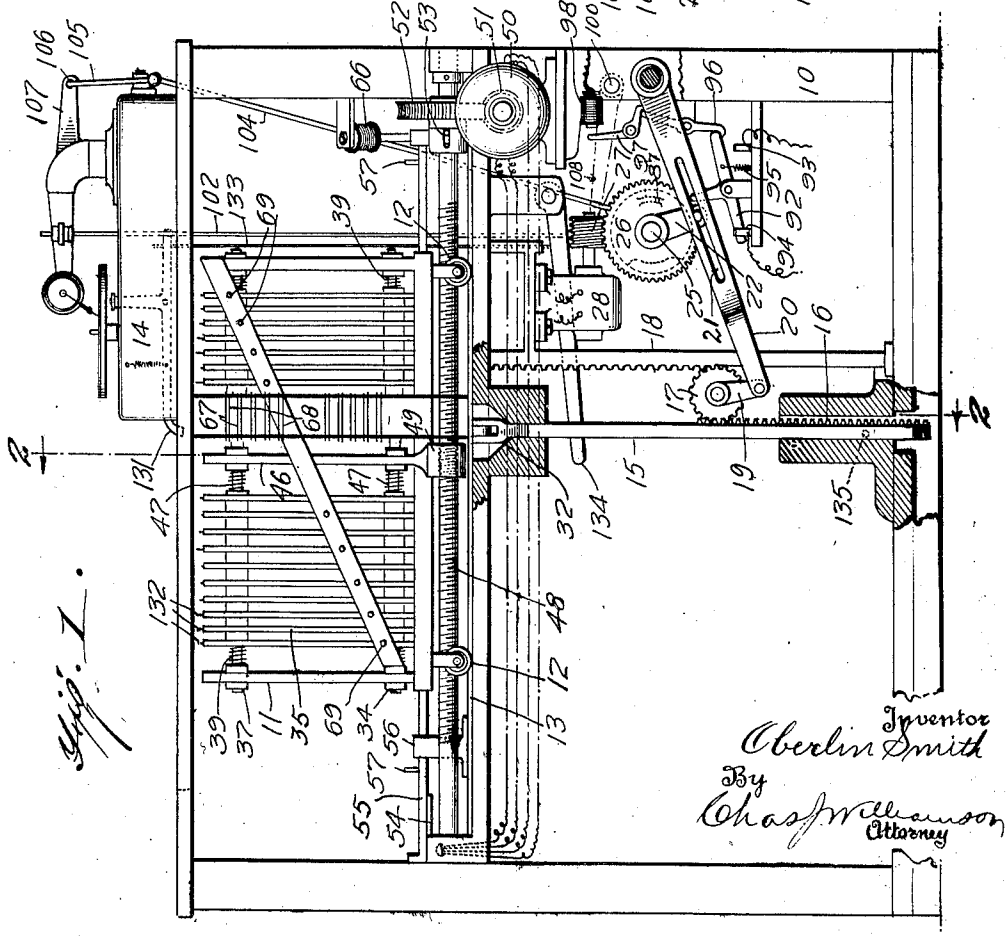


Fig. 1.

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AUTOMATIC PHONOGRAPH

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Fig. 4.

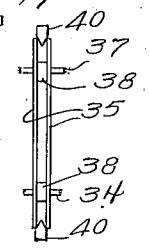


Fig. 3.

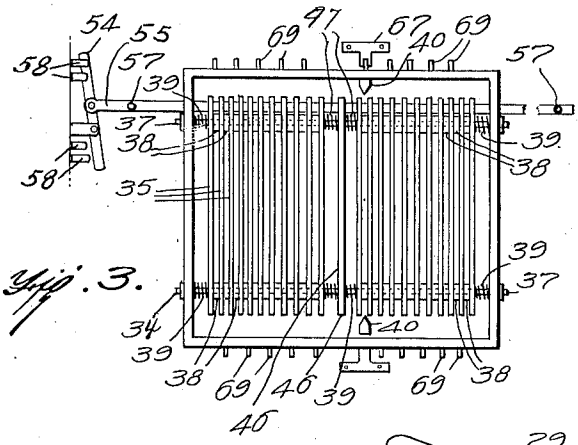


Fig. 10.

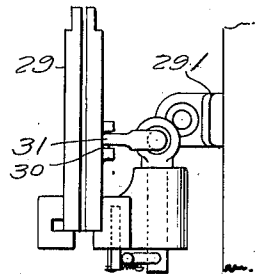


Fig. 9.

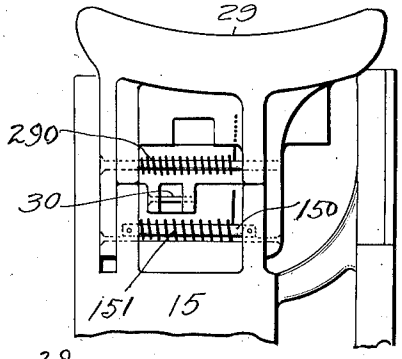


Fig. 8.

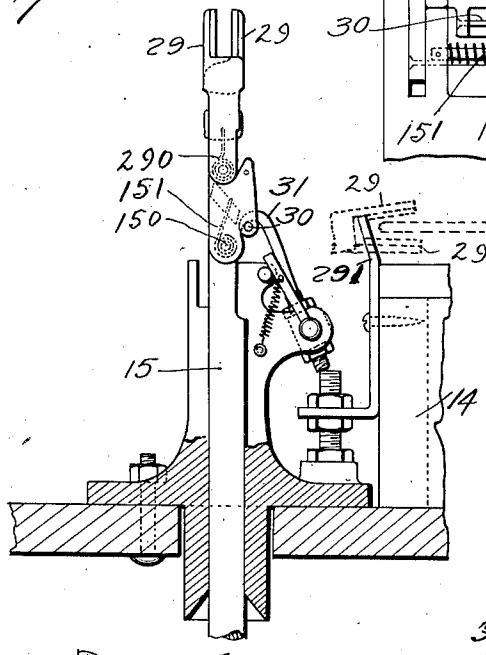


Fig. 11.

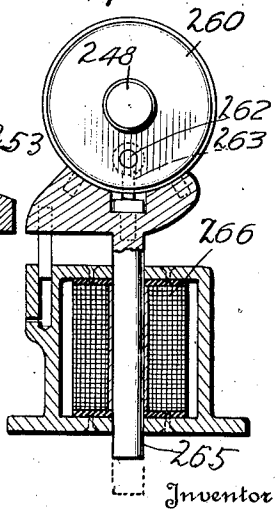


Fig. 13

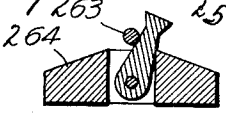
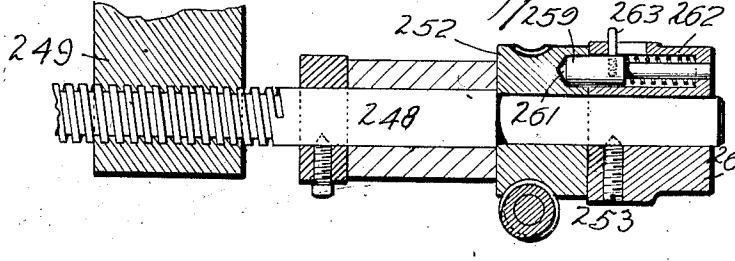


Fig. 12.



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AUTOMATIC PHONOGRAPH

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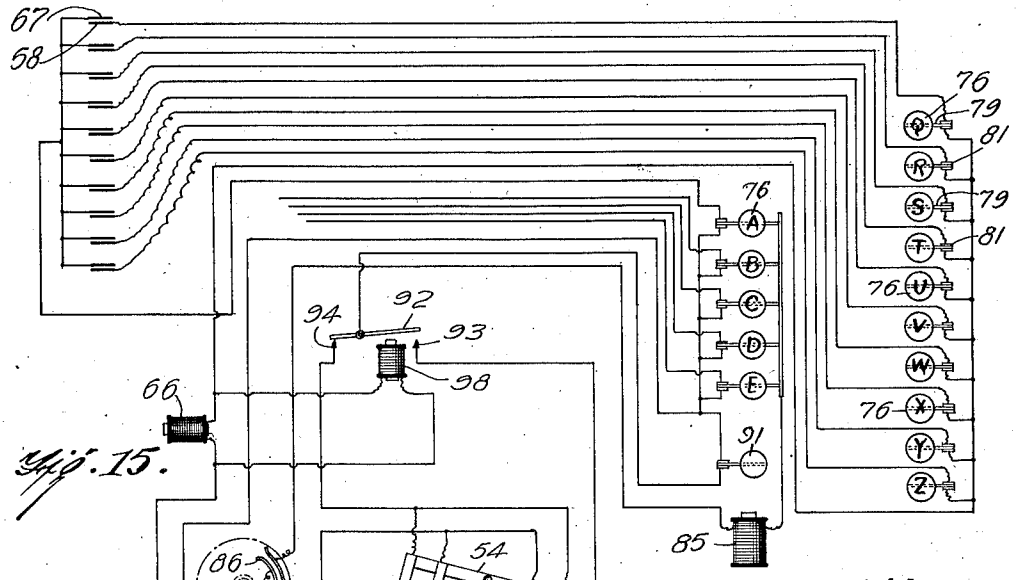


Fig. 15.

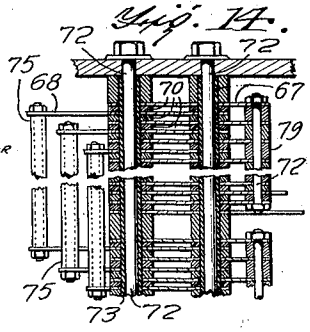


Fig. 14.

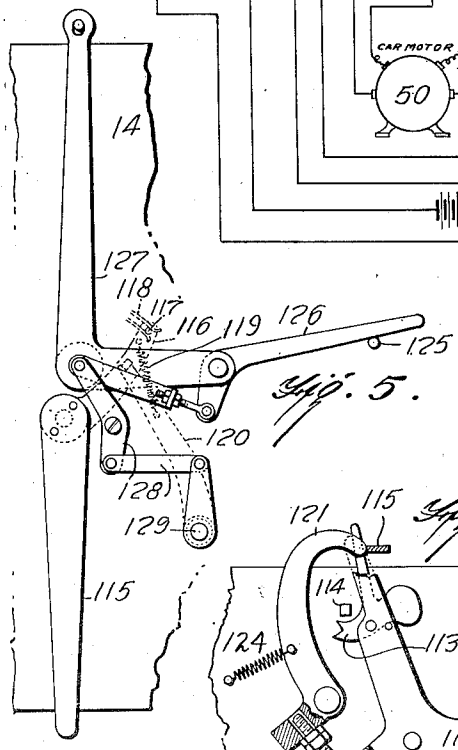


Fig. 5.

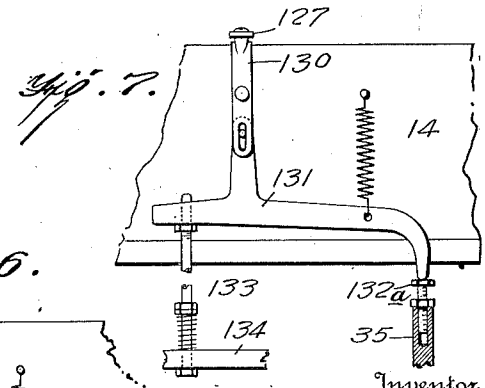


Fig. 7.

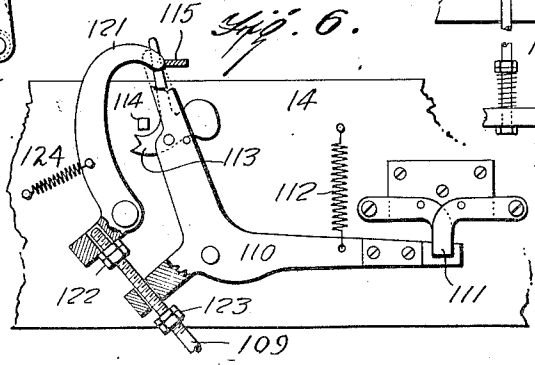


Fig. 6.

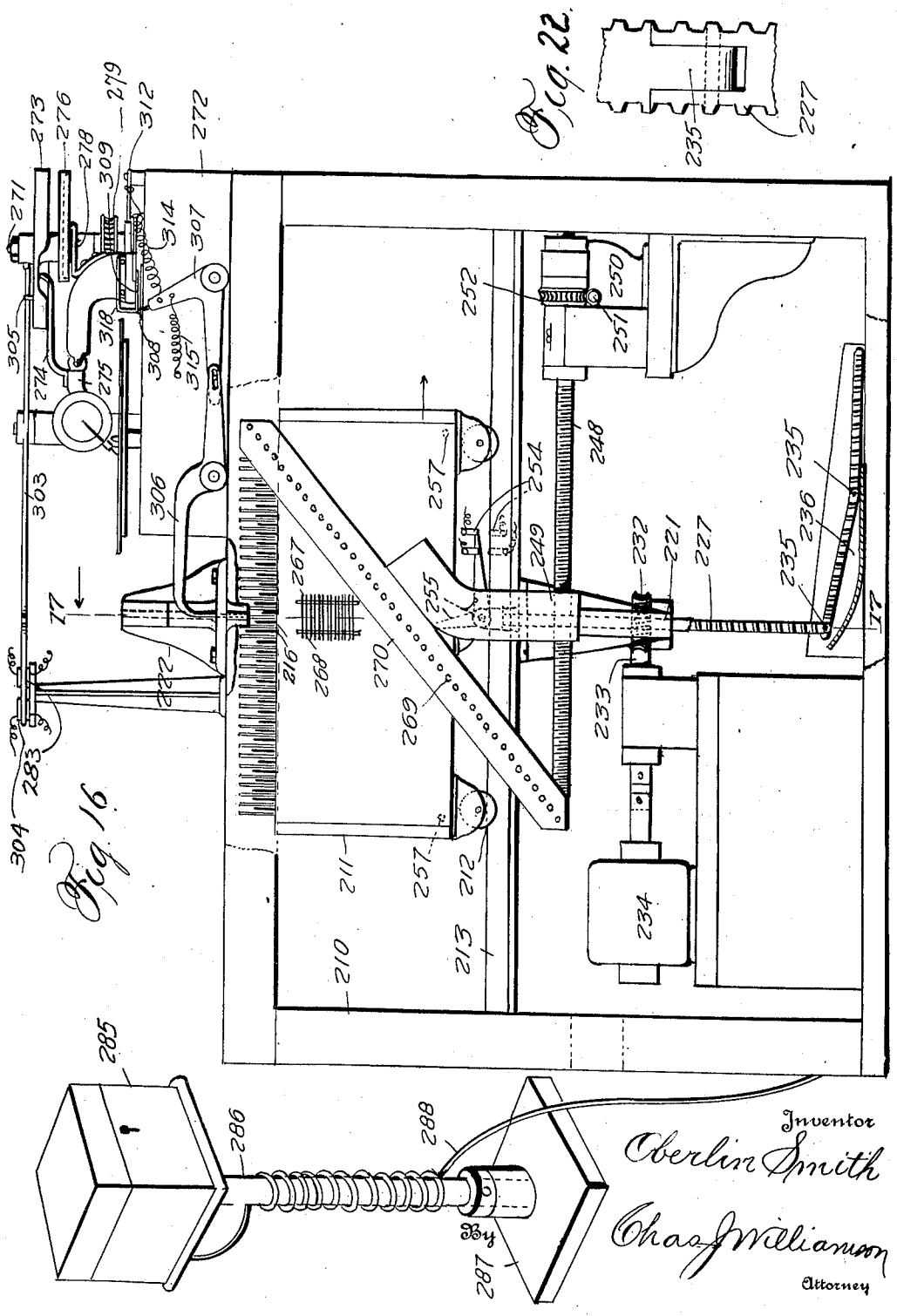
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AUTOMATIC PHONOGRAPH

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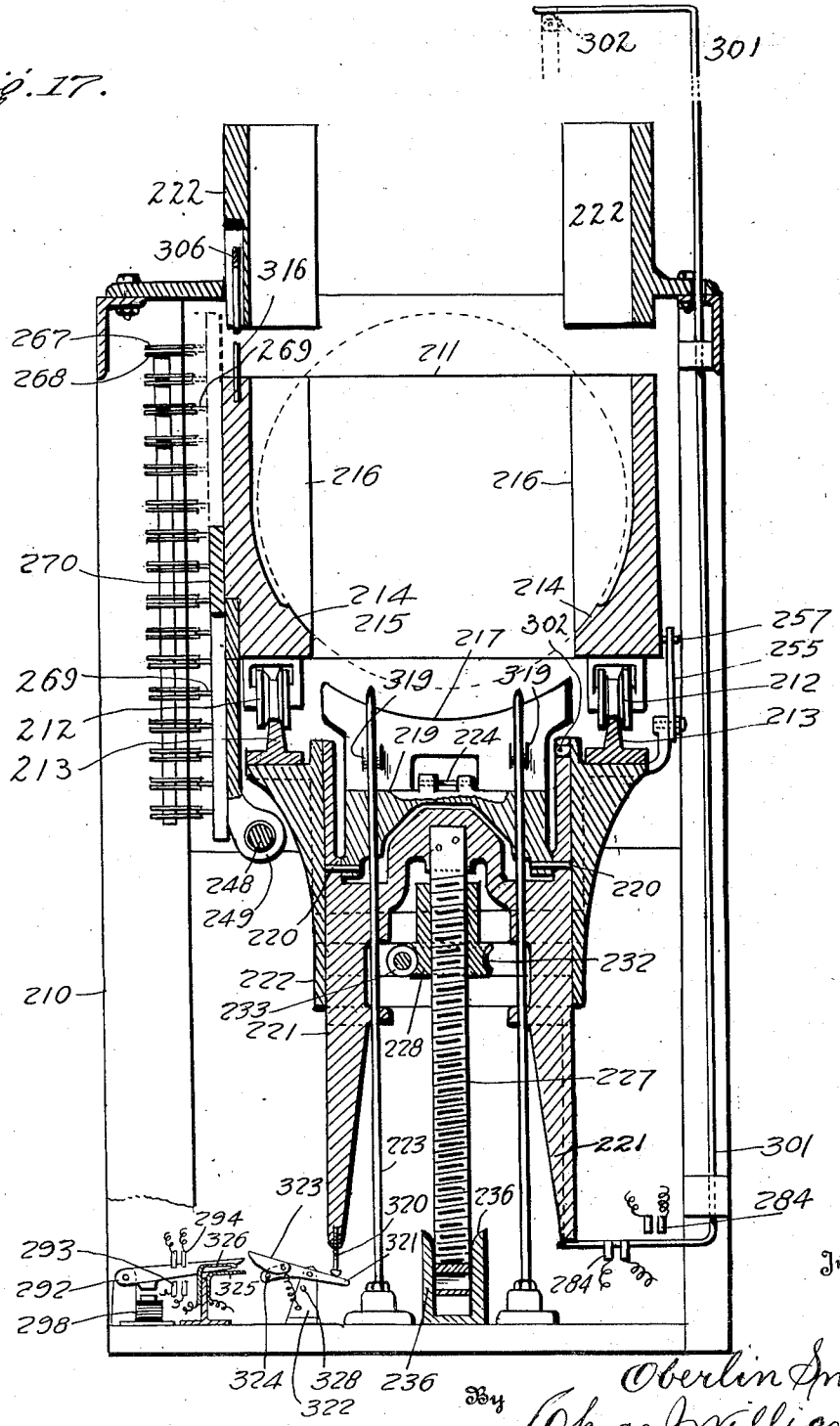
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Fig. 17.



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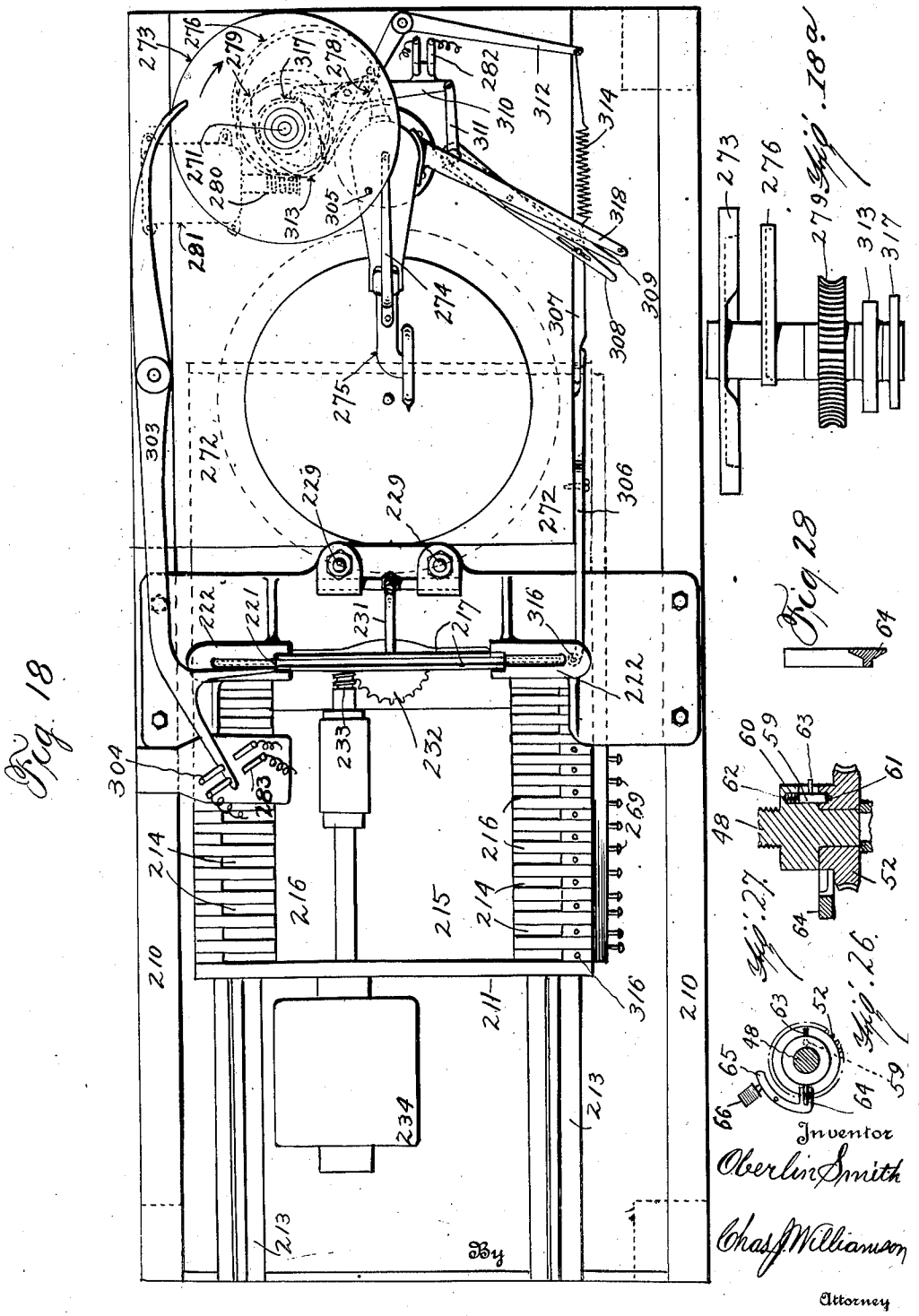
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Fig. 19.

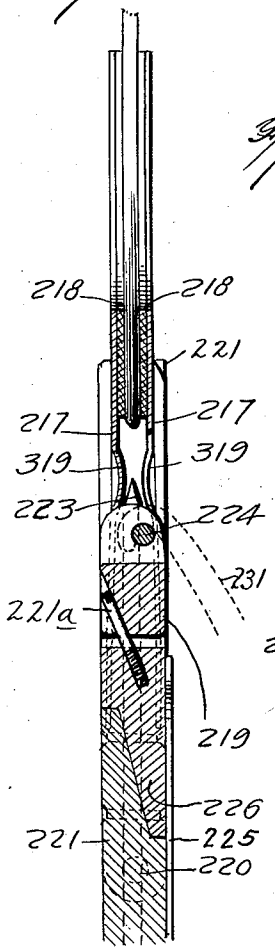


Fig. 20.

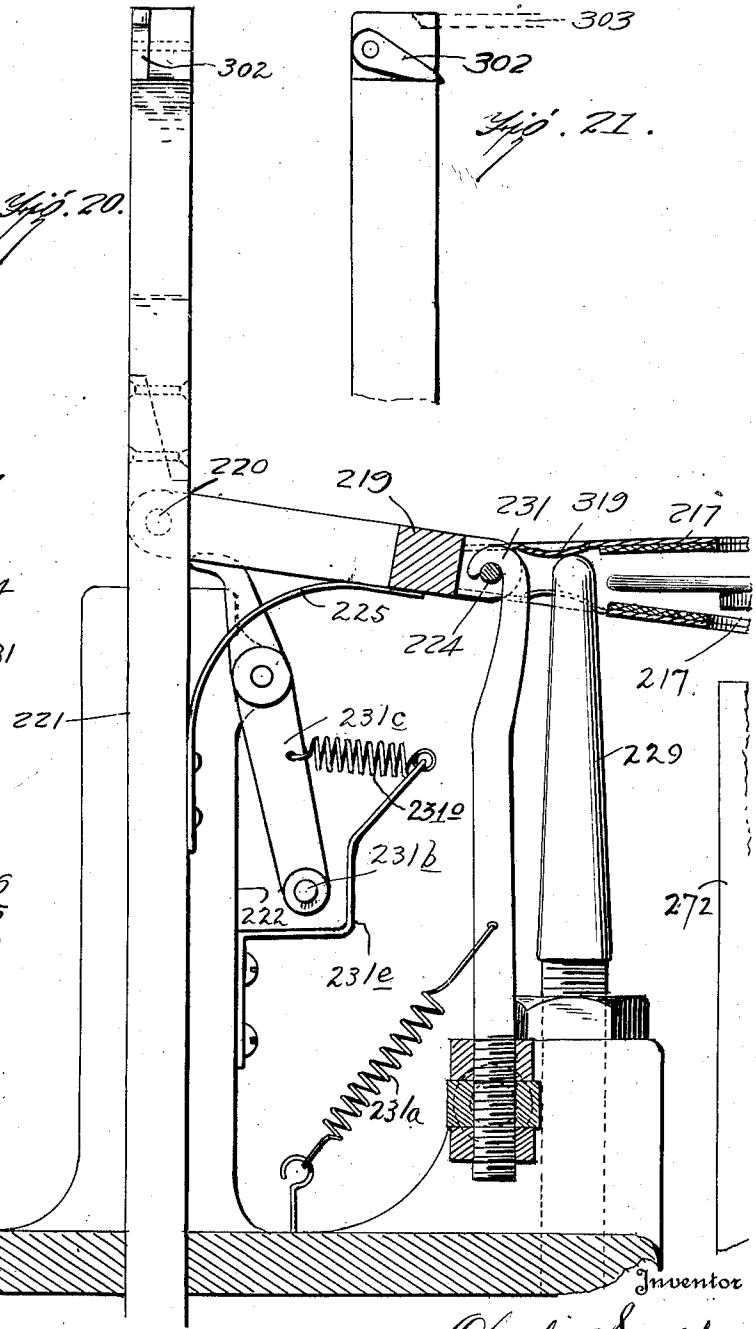


Fig. 21.

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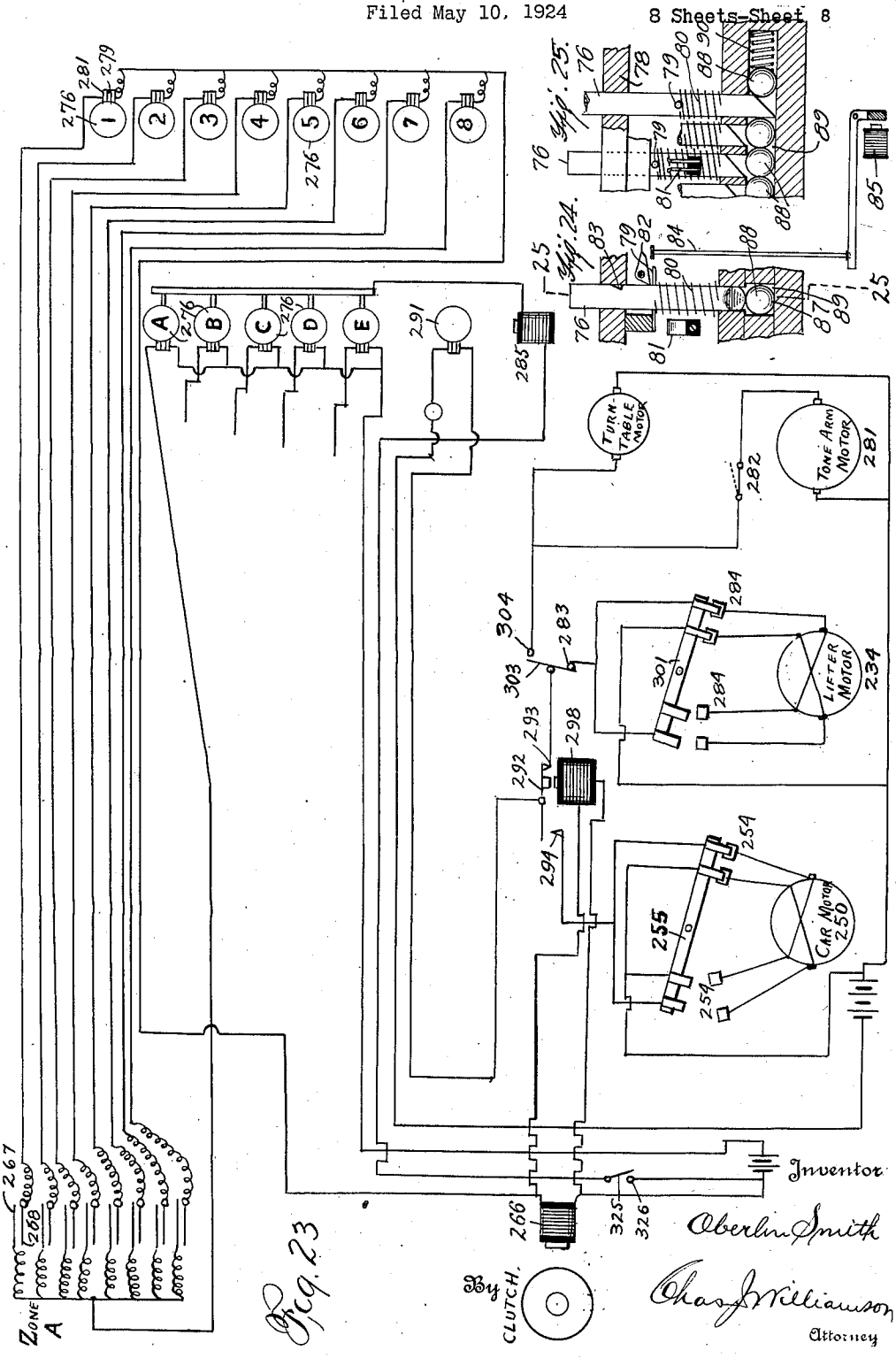


Fig. 23

Patented June 29, 1926. 1,590,654

UNITED STATES PATENT OFFICE.

OBERLIN SMITH, OF BRIDGETON, NEW JERSEY.

AUTOMATIC PHONOGRAPH.

Application filed May 10, 1924. Serial No. 712,317.

The main object of my invention is to reduce to the minimum the manual labor or effort required in the operation of phonographs and other instruments of entertainment presenting similar conditions in respect of applying and removing the operating member of the organization. Another object is to enable the application of the sound record or other operating member to and its removal from operating position by the manipulation of a controlling device, such as a keyboard, situated more or less remote from the instrument. A subsidiary but important object is to accomplish or achieve the other objects mentioned by mechanism that will be as simple as possible, having in view the operations to be performed.

The practical problems to be solved in the production of an automatic player instrument, such as a phonograph using the disk records, are a small bulk or size of the instrument to suit the requirements of the room sizes of dwelling houses with capacity for a large number of records, simplification of working parts to make original cost as low as possible and reduction to the utmost of liability of derangement of action under the usual or ordinary conditions of use, and absence of objectionable noises from the working of the mechanism.

My invention consists in whatever is described by or is included within the meaning or scope of the appended claims.

I have embodied my invention in a phonograph of the disk record type, and the drawings will be found illustrating such an embodiment, but it is to be understood, unless the claims, by proper construction, restrict to or define such an embodiment, that the scope of my invention is not to be limited to the phonograph embodiment. Briefly described, the embodiment of my invention shown in the drawings comprises a phonograph using the disk-type record, and as usual, consisting of a turntable and a swinging tone-arm, a reciprocating reservoir or magazine in which a large number of records are placed, compactly in a straight line, power driven means for taking a record from the magazine, transporting it to and placing it upon the turntable and then removing it from the turntable and restoring it to its proper place in the magazine, and a keyboard comprising a collection of keys by whose manipulation the selection and removal of a desired record in the magazine is accomplished, the keyboard connection with the mechanism controlled thereby being electrical and thus the keyboard being possible of location at any desired distance from the phonograph.

In the annexed drawings:

Fig. 1 is a side elevation of apparatus embodying my invention, the enclosing casing or housing being omitted;

Fig. 2 is a vertical section on the line 2—2 of Fig. 1;

Fig. 3 is a top plan view of the record-carrying car;

Fig. 4 is a detail view in plan of a portion of said car showing adjacent partitions spread ready to lift a record to the phonograph turntable;

Figs. 5, 6 and 7 are detail views of the phonograph control devices;

Figs. 8 to 10 are detail views of the disk gripper mechanism;

Figs. 11, 12 and 13 are detail views of the car motor clutch;

Fig. 14 is a detail view of the switch arrangement for stopping the car;

Fig. 15 is a diagrammatic view illustrating a circuit arrangement suitable for the apparatus illustrated in the preceding figures;

Fig. 16 is a side elevation of another embodiment of my invention the illustration being similar to Fig. 1;

Fig. 17 is a vertical section on the line 17—17 of Fig. 16;

Fig. 18 is a top plan view of the apparatus shown in Figs. 16 and 17;

Fig. 18[a] is a detail side view of the cams;

Fig. 19 is a detail view in section of the upper part of the disk lifter in its lowered position;

Fig. 20 is a like view showing the parts after the disk has been placed on the turntable;

Fig. 21 is a detail view partly in section of the upper end of one of the lifter arms;

Fig. 22 is a detail view of the joint that flexibly connects the sections of the lifter screw;

Fig. 23 is a diagrammatic view of the circuit arrangement that may be used with the apparatus shown in Figs. 16 to 22;

Fig. 24 is a detail view in vertical section of a portion of the circuit closing key mechanism;

Fig. 25 is a view in section on the line 25—25 of Fig. 24.

Figs. 26 to 28 are detail views of the clutch device of the machine of Fig. 1.

Referring to the drawings, in detail, and in particular to what is shown in Figs. 1 to 15, a skeleton frame-work 10, is shown which may be of wood and will preferably be enclosed by a finished cabinet of wood, or other material, and within the upper part of said frame is a horizontally traveling carriage, 11, which has rollers, 12, on its underside that run on horizontal tracks, 13, that extend lengthwise of the frame-work, and said car constitutes a traveling magazine, or holder, for the desired number of disk records supported on edge in the car and which by the movement of the latter are, respectively, brought to a record-transferring device by which a selected record is lifted from the car and placed upon the turntable of the phonograph, 14, on the top of the frame-work and when the record has finished playing returns the same to its proper place in the car, as hereinafter more fully described.

The record transferring device which collectively for brevity I term the "lifter" comprises a pincer-like gripper mounted upon the upper end of a vertically sliding carrier, 15, which may be a flat open frame having a rack, 16, in mesh with a gear, 17, that also meshes with a parallel stationary rack, 18, which gear is supported by a link, 19, pivoted to the end of a lever, 20, by whose oscillation the gear is moved vertically over the stationary rack and thereby movement imparted by its rotation to the lifting carrier rack, the latter being thus given a movement that is multiplied over that which it would receive if the lever should be directly connected with the lifter carrying rack. The lever, 20, has a slot, 21, which is engaged by a crank, 22, on a shaft, 25, to which is fixed a worm wheel, 26, in mesh with and receiving motion from a worm, 27, on the armature shaft of an electric motor, 28, whose operation is automatically controlled as hereinafter explained to cause the up and down movement of the lifter at the appointed time.

The lifter gripper (see Figs. 1, 2, 8, 9 and 10) comprises a pair of jaws, 29, (see Fig. 8) normally closed by a coiled spring, 290, pivoted to each other and pivoted to the upper end of the lifter frame, 15, by a pin, 150, to one of which jaws is attached a pin, 30, which as the gripper ascends engages a relatively stationary hook, 31, with the result that the gripper is swung from the vertical position in which it is held by a spring, 151, to a horizontal position to deposit the record on the turntable of the phonograph and release it. One jaw is moved upward to free it from the record on the turntable by contacting with a post, 291, fixed on the phonograph, 14, and the other jaw is carried slightly below the record. When the playing of the record has finished and the gripper starts to descend the first effect is to free the pin, 30, from the hook, 31, and allow its jaws to clamp the edge of the disk on the turntable and then the gripper swings upward with the gripped record and next descends to lower the record to its place on the car, whereupon the jaws release the record by an opening movement produced by contact of the tails of the jaws with the sides of a V-shaped opening, 32, (see Fig. 1) in a relatively stationary guide supported by the frame in the path of the descending jaws.

The disk records are supported in the car in a vertical position by resting upon two parallel rods, 34, (see Figs. 1 to 4) which extend horizontally from end to end of the car, each record being supported in a vertical position between two vertical partitions, which for lightness sake are each formed of upper and lower parallel strips, 35, through the lower ones of which the disk supporting rods, 34, pass and through the upper ones of which parallel horizontal rods, 37, pass all said rods being suitably attached at their ends to the ends of the car. Adjacent partitions have between them spacing washers, 38, on the rods which provide just enough space to receive a record disk without a close fit, which spaces however are insufficient to receive the lifter gripper. The partitions are therefore slidably mounted upon the various rods so that any two adjacent partitions may be spread apart the necessary distance to permit the entrance between them of the lifter and to allow that action sufficient space is left between the end partition and the end of the car and upon the rods in such space is a coil spring, 39, which yields when force is applied to a pair of adjacent partitions and which when such force is removed returns the partitions to their normal position. The spreading apart of adjacent partitions may conveniently be accomplished by a wedge device thrust between adjacent partitions on opposite sides, such device as shown in the drawings comprising wedges, 40, on the upper ends of two similar levers, 41, situated on opposite sides of the car and having each a pivot, 42. Each lever, 41, at its lower end has an inwardly projecting arm, 43, with a roller, 44, in the path of a cam slot, 45, at the lower end of the lifter bar or frame, 15, the sides of the cam slot being shaped so that when the lifter ascends the wedges will be forced between a pair of partitions, before the gripper lifts high enough to pass over the lower edge of the record disk, and when the lifter descends and after the gripper passes from between the partitions said levers will be swung to withdraw the wedges from between adjacent partitions. The wedges, 40,

are so shaped that when they are thrust in between a pair of partitions they remain between them until they are forcibly and positively withdrawn by their described outward movement.

It will be evident that if the car were provided with fixed partitions, adjacent ones of which being spaced apart to allow the passage between them of the gripper, the car would have to be of great length, its length being several feet should the car have a capacity of fifty records and as the car must travel a distance substantially equal to its length the frame of the machine would have to be substantially double the length of the car, and it would therefore be so long as to be impracticable. By my construction of movable partitions which allows the spacing between adjacent partitions to be practically that of the thickness of the disk record and making the partitions quite thin, I am able to reduce the length of the car and the length of the machine to bring the construction within commercially practicable limits. To avoid the necessity of moving all the partitions and the disks between them when the space between any pair of partitions is to be widened, the partitions may be arranged in groups, two for example as shown in the drawings, this being accomplished by a stationary vertical partition, 46, at midlength of the car between which on opposite sides and the adjacent movable partitions are placed coil springs, 47.

The longitudinal travel of the car may conveniently be accomplished by a screw, 48, (see Fig. 1) extending beneath the car and engaging a nut, 49, that may conveniently be attached to the stationary partition, 46, the screw being rotated by an electric motor, 50, the armature shaft of which has a worm, 51, meshing with a worm wheel, 52, loosely mounted on the screw shaft but adapted to be clutched thereto by a clutch 53, on said shaft when in the operation of the machine, the car is to be moved. The motor, 50, is of a reversible type and when the car reaches its limit of travel in either direction it operates a switch, 54, in the motor circuit which reverses the direction of revolution of the motor. Such reversal may be accomplished readily by the mechanism shown in the drawing which comprises a longitudinally slidable rod, 55, (see Figs. 1, 2 and 3) which is supported by guide arms, 56, below the car and which extends beyond the car at each end and has near each end a stud or pin, 57, which when the car nearly reaches its limit of movement is engaged by the end of the car and is shifted in the direction of movement of the car. At one end said bar, 55, is pivoted the movable blade or lever of switch, 54, which when moved in one direction by the travel of the car closes the circuit through one set of contacts, 58, and when moved in the opposite direction by the travel of the car closes the circuit throughout another set of contacts, 58. The clutch, 53, has a construction that will revolve the screw, 48, in either direction. Said clutch (see Figs. 26 to 28) comprises a clutch slide, 59, mounted to slide parallel with the screw axis in an enlargement, 60, of the screw alongside of the worm wheel, 52, and in the side of the latter is a hole, 61, into which the slide is urged by a coil spring, 62. Projecting radially outward from the clutch slide is a pin, 63, which by the revolution of the shaft engages one side or the other of a double wedge or cam, 64, on a lever, 65, when said lever is moved to place the wedge in the path of the pin, 63. Normally the lever, 65, is in a position which removes the wedge or cam, 64, from the path of the clutch pin, 63, and it is moved into such path by an electro-magnet, 66, in a circuit which includes a normally open switch that is closed automatically by the travel of the car when the car has moved to a point which presents a selected record above the lifter. There is such a switch for each disk record in the car and it includes a pair of spaced blades, 67, and 68, stationarily mounted and a stud or pin, 69, mounted on and carried by the car so that when by the travel of the car a particular stud enters between such switch blades, the clutch operating magnet will be energized and the clutch, 53, will be disconnected from the screw shaft. The series of pairs of switch blades are arranged vertically and the studs, 69, are spaced apart vertically in an inclined series as shown best in Fig. 1, and, preferably, as conducing to compactness, the switch plates are divided into two groups one on either side of the car, and there is a series of studs on each side of the car.

Should a lead wire be provided for each record, it will be seen that a great number of wires would be required, as many as fifty-one in an apparatus having fifty record stalls. To diminish greatly the number of wires I arrange the pairs of switch blades, 67, and 65, into groups, those of the same group being connected in parallel and thus having a common lead wire. Thus with fifty stalls it will be convenient to arrange the pairs of switch blades, 67, and 68, in groups of ten. This group arrangement may be carried out as shown in Figs. 14 and 15 of the drawings by mounting the pair of blades, 67, and 68, properly insulated from each other by fibre washers, 70, in a vertical series upon a pair of vertical post-like supports, 72, said supports being insulated from the blades by a fiber tube, or sleeve, 73. Referring to Figs. 14 and 15, it will be seen that the circuit for each group of switch blades, 67, includes a manual switch, such as one of the push

pin type, which controls the supply of the current to the circuit including the group and in addition to that switch, there is a switch for each set of lower blades, 68, which must manually be operated to supply current to a particular set of blades of each group so that in the operation of the apparatus, the proper group switch and the proper individual switch of that group must be operated to supply current only to that pair of blades which is related to the record to be taken from the magazine. The lower blade, 68, of each switch is connected by a brass conducting tube, 75, with the corresponding lower blade of each group so that the push-button designated as Q, for instance, when depressed puts the lower switch blade of each switch group in a circuit containing the button, the same principle being carried out with R, S, T, etc. Thus it will be seen that pushing button "A" and button "Q" would energize the two blades of only one switch, through which the current would pass when the proper pin or stud in the turret engaged such blades.

The keyboard includes two series of similar push buttons one series for the group, designated A to E and the other series for the group designated Q to Z. Each push button, 76, (see Figs. 24 and 25) is vertically slidable in guides in a frame, 78, each having a diametrically extending pin, 79, against which one end of a coil spring, 80, bears to lift the push button, and which pin also serves when the push button is depressed to enter between insulated switch plates, 81, and thereby close the circuit of which such switch plates form a part. The pin, 79, also forms an upstop to limit the upward movement of the push-button by its spring. When depressed to circuit closing position the push-button is secured by a pivoted latch, 82, weighted to fall in a notch, 83, in the side of the push-button. The latch, 82, (see Figs. 24 and 25) is automatically released at an appropriate time in the operation of the machine by a trip finger, 84, which is moved into contact with the latch by the action of an electromagnet, 85, in a circuit that is momentarily closed by a contact pin, 87, on a cam having a switch, 86, mounted on the motor driven shaft, 25, of the lifter mechanism, (see Figs. 1, 2 and 15) and when the latch, 82, is released the push-button moves upward and breaks the circuit from movement of the push-button by its spring.

It is important that only one push-button or key of a series be depressed at a time. I, therefore, provide a key arrester which permits but one key at a time to be depressed and effects the locking of all the other keys against being depressed, and as a further precaution against careless or improper manipulation of the keys, when a key is depressed it is held by its latch with its upper end about flush with the top of the frame plate through which it passes so that no portion projects that would allow manipulation by the finger. The key arrester comprises a series of movable blocks, preferably in the form of balls, 88, of the same number as the keys and mounted in a race, 89, below the keys in which the balls are yieldably moved in one direction by a coil spring, 90, at one end of the race in such position that when all the keys are lifted there is a ball directly below each key. The end of the key towards the ball is beveled from one side to the other so that the pointed end of the key is bound to strike the surface of the ball to one side of a vertical plane through the ball center and thus certainty of action is assured.

Besides the two series of push-buttons there may be (see Fig. 15) an additional push-button or key, 91, of similar construction for controlling the current to the keyboard and the machine.

When the lifter descends and reaches the bottom of its stroke, by a suitable mechanism which includes a switch lever, 92, (see Fig. 15) that in alternation engages contacts, 93, and, 94, the circuit through the lifter motor is broken thus stopping further descent of the lifter and the circuit through the car moving motor, 50, is closed and placing such circuit in condition to again start the car propelling motor, 50, but such motor is not put in operation because at the time the circuit is thus closed at the switch contact, 94, the circuit through the switch, 86, is momentarily closed to energize the magnet, 85, to release all depressed keys and thus open the circuit that was closed through such depressed keys. The switch lever, 92, is acted upon by a spring, 95, that tends to move it to close the circuit through contact, 93, (see Figs. 1 and 2) and break it through contact, 94, and said lever, 92, is latched in the position to open the circuit at the contact, 93, and close it at the contact, 94, by a pivoted latch, 96, which is restrained in latching position by a strip dog or trigger, 97, which is tripped to release the latch, 96, by an electromagnet, 98, in the same circuit with the clutch rod operating magnet, 66. so that simultaneously both magnets will be energized with the result that the car moving motor will be stopped and the lifter motor started. The movement of the switch lever, 92, to cut out the lifter motor and to cut in the car moving motor is accomplished by a cam, 99, on the lifter motor driven shaft 25.

The automatic raising and lowering of the tone arm to place the reproducer stylus into and out of working position on the record and the swinging of the tone-arm back to starting position after finishing a record and the automatic starting and stopping

of the phonograph motor are accomplished by cams, fixed side by side on the lifter motor driven shaft, 25, (see Figs. 1 and 2) movement being imparted by the cams at the appropriate times to a corresponding number of levers, pivoted upon a common stud, 100, secured suitably to the frame, 10. Movement of one lever, 101, is transmitted through a rod, 102, to the tone-arm for lifting the latter; movement of another lever, 103, is transmitted through connections that include a rod 104, bell crank lever, 105, and link, 106, connected with a radial finger, 107 on the tone-arm to swing the tone-arm to starting position; and movement of the third lever, 108, is transmitted by a rod, 109, (see Fig. 6) to a switch lever, 110, which alternately engages a contact, 111, in the circuit to the lifter motor, 28, and actuates devices that control the phonograph motor circuit, these two circuits being alternatively opened and closed. The switch lever, 110, is acted upon by a spring, 112, that tends to close the circuit at contact, 111, to cut in the lifter motor and the lever is held in position to open the circuit by a latch, 113, (see Figs. 5 and 6) that engages a projection 114, on the side of the phonograph. The latch, 113, is automatically released when the record finishes playing by being struck by a lever, 115, pivoted to the top of the phonograph beneath the turntable. The lever, 115, has an arm, 116, beneath the phonograph top which has a contact pin, 117, that is movable into and out of contact with switch blades, 118, in the phonograph motor circuit, and thus by the movement of the lever, 115, the phonograph motor is cut into and out of circuit. A coil spring, 119, attached to the lever arm, 116, tends to swing the lever in the direction to cause it to strike the latch, 113, and to open the circuit at the contacts, 111, and the lever is held against such tendency and in circuit closing position and by a latch, 120, which is automatically released as hereinafter explained when the end of the record groove is reached. It is desirable to have the phonograph turntable speed up before the tone arm is lowered to place the needle in contact with the record. This is accomplished (see Fig. 6) by having the rod, 109, which moves switch lever, 110, act upon a lever, 121, pivoted to the phonograph side, with one extremity in position to engage the lever, 115, to swing the lever, 121, to move the lever, 115, into circuit closing position, before rod, 109, acts to swing switch lever, 110 to open the circuit at contact 111, in the lifter motor circuit. There is a shoulder in the form of a nut, 122, on the rod, 109, which acts on lever, 121, before a shoulder in the form of the nut, 123, on rod, 109, acts on the lever 110. A coil spring 124 moves lever, 121, against the push rod, 109.

As has been stated when the needle reaches the end of the record groove in playing, the latch, 120, is moved to release the arm, 116, which carries the contact pin, 117. On the underside of the tone arm is a projection, 125, that engages a lever, 126, pivoted to one end of a lever, 127, pivoted to the phonograph top beneath the turntable and which by an arrangement 128, of levers and links is connected with the pivot, 129, to which the latch, 120, is connected.

The time of engagement of the lever, 126, by the tone arm projection is determined automatically according to the length of the record groove of each particular record. This is done by the following described mechanism. The lever, 127, (see Fig. 7) at one end is engaged by the finger, 130, of a lever, 131, pivoted to the side of the phonograph, one end of which lever is adjacent the path of a series of pins, 132, on the top of the car partitions, and when engaged by such a pin the lever, 131, is rocked and thereby the lever, 127, is moved to place the free arm of the lever, 126, (see Fig. 5) nearer to or further from the tone arm projection, 125. There is a pin for each record in the car and the pins project a distance related to the terminal point of the record groove of the record, and the position to which the lever, 126, is shifted by the movement of lever, 127, depends upon the amount of projection of the pin above the car. The pins, 132, are readily attached to and removed from the car partitions by providing the latter with holes into which the pins are inserted, and all the holes are of the same depth so that pins of different length will project different distances above the car. The pins are of assorted lengths which respectively, are equal to the distance radially between the outer turn of the record grooves and the innermost turn, and accordingly a pin having such length is placed in the hole in the car at the stall having the record which suits the length of pin selected. Thus the free arm of the lever, 126, by the action of the pin appropriate to the record being played will be placed in a position relative to the tone arm projection, that when the end of the record has been reached such projection, 125, will strike the lever, 126, and rock the same and thereby release the latch, 120, to open the phonograph motor circuit. If desired the pins may be in the form of screws, as shown in Fig. 7, where a screw, 132^a, engages a threaded hole in the partition, 35, and being a screw it may be adjusted to place its top at the proper level to actuate the lever, 131.

The lever, 131, (see Fig. 7) is connected by a rod and spring connection, 133, with a lever, 134, whose free end is in position to be engaged by a pin or projection, 135, (see Figs. 1 and 2), on the lifter when the latter

is in record lifting position, and thereby the end of the lever, 131, is placed and yieldingly held by the spring connection, 133, in position for engagement by a pin, 132, at other times the lever, 131, being held so that its end will not be struck by the pins and a scraping action of the pins on the lever will be avoided.

The circuits to some extent are shown in Figs. 1 and 2, but a better idea thereof may be obtained from Fig. 15 which is a diagram thereof.

Referring to that embodiment of my invention shown in Figs. 16 to 25 it will be found to have features of construction that render it preferable to the previously described embodiment of my invention in such matters as simplification of structure and compactness and freedom from noise in operation. A skeleton frame-work, 210, is employed with parts made of angle iron within the upper part of which is a horizontally traveling carriage, 211, with wheels or rollers, 212, on its under side that run on horizontal tracks, 213, extending lengthwise of the frame work and said carriage is the traveling magazine or holder for the desired number of disk records. The disks are held separated from one another and in a vertical position on the car (see Fig. 17), each disk at opposite sides resting upon shoulders 214 separated by a space, 215, to expose the lower portion of a disk for engagement by the lifter mechanism, and to space adjacent disks apart what I shall term sectional partitions, 216, of thin wood are used, these partitions at opposite sides of the car extending no further inward than the shoulders, 214, so that in the path of vertical movement of the disk lifter there is no obstacle and ample space is provided between adjacent disks to accommodate the lifter without undue lengthening of the car which would be necessary should the partitions extend completely across from side to side of the car between adjacent disks, as in the case of the car shown in Figs. 1 to 4 and I avoid the necessity of the spreading arrangement shown in such figures.

The lifter (see Figs. 17 and 19) comprises a pair of opposing similar spring plates, 217, normally spaced apart a sufficient distance to receive a disk between them to hold the same with sufficient friction which is afforded by a covering, 218, of felt, or the like, on the disk-engaging side, these gripping plates being attached near their lower ends to a rigid supporting bar, 219, which is pivoted by horizontal pins, 220, with a vertically movable carrier, 221, which slidably fits on its outer sides between frame supported guides, 222. Guide rods, 223, pass through guide holes in said carrier and are fixed at their lower ends to the bottom of the frame-work, 210. The upper parts of said guide rods are wedge-shaped and engage cam surfaces, 319, on the plates, 217, when the gripper is in its lowermost position, and thus cause the opening of the gripper to release the record when in its stall in the car.

The gripper carrying bar, 219, (see Fig. 20) has a horizontal pin, 224, which as the gripper approaches its highest limit of movement is engaged by a spring-held hook, 231, stationarily supported on the frame-work which as the ascending movement of the gripper is completed causes the gripper to swing down to a horizontal position to place the disk carried thereby upon the turntable of the phonograph, what is then the upper gripper plate, 217, being engaged by the tops of two stationary posts, 229, and such gripper plate thereby lifted to free the record lying in position upon the turn-table and what is then the lower gripper plate, 217, carried sufficiently below the record to leave the record clear, as shown in Fig. 20. When the gripper is swung downward, as has just been explained, it moves against a spring, 225, which normally holds the gripper in its vertical position against a stop pin, 221^a, shown in Fig. 19 screwed to the lifter, 221.

Referring particularly to Fig. 20, the hook, 231, has a light spring, 231^a, connected to it which tends to pull the hook towards the gripper. In the path of such movement of the hook, 231, by the spring, 231^a, is a stop, 231^b, on a lever, 231^c, pivoted to one of the upper guides, 221. The lever, 231^c, is yieldingly pulled by a spring, 231^o, to place the hook stop, 231^b, in hook arresting position except when the hook, 231, is to engage the pin, 224, on the gripper carrying bar, 219, and at that time the lever, 231^c, is moved in opposition to the pull of the spring, 231^o, by the engagement of the upper end of the lever, 231^c, by the upper end of the lifter, the lever, 231^c, thereby being moved to the position shown in Fig. 20, which removing the stop, 231^b, from the hook, 231, permits the spring, 231^a, which acts upon the hook, to move the hook into engagement with the pin, 224, when the parts are in the position shown in Fig. 19. In Fig. 20, the parts are shown in the position after the hook, 231, has engaged the pin, 234, and by the ascent of the gripper after such engagement, the gripper is swung down to the position shown in Fig. 20, from the position shown in Fig. 19. The swing of the lever 231^c, under the pull of its spring, 231^o, from the position shown in Fig. 20, to place the stop, 231^b, in position to hold the hook, 231, against the pull of the spring, 231^a, is limited by contact with the arm, 231^e, which projects from one of the guides, 221, and to the upper end of which is connected one end of spring, 231^o.

The gripper carrier at or near its upper end is fixed to a vertical screw, 227, (see

Fig. 17) which extends downward and passes through a nut, 228, mounted to revolve in bearings supported by the frame which nut on its periphery has a worm wheel, 232, which is engaged by a screw or worm, 233, connected to or forming a part of the armature shaft of an electric motor, 234, (see Fig. 16) which is reversible so that it may revolve the nut in either direction to raise or lower the screw, 227. The screw, 227, is made flexible transversely, as by being made of sections of suitable length that are hinged together by a joint, 235, such as that best shown in Fig. 22, so that when the lifter is in its lowermost position a considerable portion of the length of the screw will lie horizontally, as shown in Fig. 16, and thus make unnecessary the extreme height of the apparatus which would be caused if a rigid screw of the necessary length should be employed. The lower flexible portion of the screw, 227, is engaged by a guide, 236, at the bottom of the machine which causes the proper flexing of the screw as the latter descends.

As in the other embodiment of my invention illustrated the longitudinal travel of the car is produced by a screw, 248, which engages a nut, 249, fixed to the car, the screw being rotated by an electric motor, 250, the armature shaft of which has a worm, 251, meshing with a worm wheel, 252, loosely mounted on the screw shaft but adapted to be clutched thereto by the clutch, such as is best shown in Figs. 12 and 13. The clutch shown in Figs. 12 and 13 is substantially similar to that shown in Figs. 26 to 28, but it is operated by a solenoid, 260. The car motor, 250, is of the reversible type, and is in a circuit that includes an automatic switch similar to that of the apparatus illustrated in Fig. 1, and (see Figs. 16 and 23) comprises a lever, 255, shiftable by pins, 257, on the car, 211, to move it alternately into and out of engagement with opposite pairs of switch blades, 254.

The running of the car motor, 250, is under the control of switches that as in the case of the other form of my invention shown and described hereinbefore are controlled by studs, 269, mounted on the car but which in the case of the apparatus shown in Figs. 16 et seq. are all mounted on a single bar, 270, at one side of the car. The circuit arrangement which is illustrated in Fig. 23 for the control of the car motor is the same as in the other embodiment of my invention described hereinbefore and the corresponding parts in Fig. 23 are designated with the same reference numerals with the prefix of the numeral "2".

For controlling the movement of the record-engaging needle up and down and the return of the tone arm to supporting position after a record has been played I employ two cams driven by an electric motor in an automatically controlled circuit. These cams are mounted one above the other on a vertical shaft, 271, supported on the phonograph housing, 272, the upper cam, 273, coacting with a finger, 274, attached to a portion, 275, of the tone arm hinged to swing vertically and the cam, 276, for swinging the tone arm sidewise acting upon a finger, 278, fastened to such tone arm. Upon the shaft, 271, is a worm wheel, 279, engaged by a worm, 280, on the armature shaft of the electric motor, 281, which is in a circuit (see Fig. 23) that includes a switch, 282, that is automatically actuated to cut the motor, 281, into and out of circuit at the appointed times, as in the apparatus of Figs. 1 to 15.

The circuit to the lifter-motor includes a set of reversing-switches, 284, as does the car-motor circuit, which are operated by means of the lifter, 221, (see Fig. 17) striking the horizontal arms of a rod, 301, at both the top and bottom of its stroke. The rod contains a properly insulated conductor forming a knife-switch in connection with the blades, 284, for reversing the lifter motor. The lifter-motor then, thru its worm, 233, and worm-wheel, 232, revolves the nut on the folding-screw, 227, causing the lifter to ascend. The spring-held jaws as they leave the stationary pointed rods, 223, engage the record and proceed to carry it to the top of the machine, where the jaws are engaged by the stationary-hook, 231, and caused to place the record on the spindle of the turntable.

As the lifter, 221, reaches the top of its stroke, in addition to operating the reversing switch to start the lifter downward, a bevelled end dog, 302, (see Figs. 17 and 21) pivoted in a slot in the lifter, engages the end of a horizontally pivoted lever, 303, on top of the phonograph, forces it from the switch, 283, (see Fig. 18) in circuit with the lifter motor, into the switch, 304, in circuit with the turntable and cam-motor, 281, breaking the circuit to the lifter-motor and closing the circuit to the turntable and cam-motors at the same time causing the opposite arm of the lever, 303, to be placed in the path of a vertical pin, 305, in the top face of the tone arm cam, 273, said pin being to reverse the action of the bevelled-end lever, 302, at the proper time.

The various cams, 273, 276, etc., (see Fig. 16) are now revolving on the vertical stud or shaft, 271, by means of the electric motor, 281, thru its worm, 280, and worm-wheel, 279. The cam, 276, during a half revolution causes the tone-arm to swing so that the needle is a short distance inside the outer periphery of the record and the cam 271, is so timed as to cause a gentle lowering of the tone-arm with its needle on to the face of the record during half of its

revolution. As in the case of the other form of my invention, the timing of the record for the varying lengths of music is accomplished by a system of pegs, 316, placed in vertical holes along the front side of the car at its top. The holes are all of one depth, and the pegs vary according to the distance the inner music groove is from the outer edge of the record. The feeler-levers, 306, and, 307, are pivoted on the side of the phonograph housing, 272, and are connected to the horizontal positioning lever, 308, pivoted on top of the phonograph housing, 272, on which is pivoted a trip-lever, 309, (see Fig. 18) connected to the switch-lever, 310, by a link, 311. The horizontal-feeler operating lever 312, pivoted on top of the phonograph housing has one arm in contact with and is operated by the cam, 313, and is connected to the positioning lever, 308, by a coil pulling spring, 314, and the feeler-lever, 307, is caused to hold the lever, 312, against the cam, 313, by means of another coil spring, 315, (see Fig. 16) on the front of the phonograph housing; this spring, 315, being weak enough to cause spring, 314, not to expand until the feeler lever, 306, is in contact with the timing peg, 316, in the car.

All of the aforesaid motions from the various cams having been accomplished by half revolution of the vertical cam-shaft, 271, the switch lever, 310, is moved by its cam, 317, into circuit breaking position so as to cause the cam-motor, 281, to stop until the tone-arm (by the music grooves) is carried toward the center of the record until the extension arm, 318, which has a vertical projection below it strikes the trip lever, 309, closing the circuit to the cam motor, 281. raising the tone-arm and swinging it out to its normal position. The swivel joint that connects the link, 311, (see Fig. 18) to the trip lever, 309, is located exactly above the pivot of the positioning-lever, 308, so that in placing the positioning lever to suit the length of music the relative position of the switch lever, 310, is not changed.

The vertical cam shaft, 271, is now making the second half of its revolution, and just as it finishes, the vertical pin, 305, projecting above the cam, 273, strikes the incline on one end of the horizontal lever, 303, moving the opposite arm of the said lever out of the turn-table motor and cam motor switch blades, 304, breaking said circuit, and into the lifter-motor-switch, 283, closing that circuit, and causing the lifter to descend after the jaws or grippers, 217, have closed on the record and tipped to its vertical position.

When the record is within a few inches of its normal position in the car, 211, the wedge-shaped surfaces, 319, on each jaw, 217, (see Figs. 17 and 21) strike the pointed rods, 223, forcing the jaws apart and allowing the record to be left free on its bearing surfaces in the car. The lifter with its gripper continues to descend until it is below the records in the car, at which time the adjustable screw, 320, (see Fig. 17) in the bottom of the lifter strikes one arm of the throw-out-lever, 321, pivoted on the bracket 322, screwed to the floor of the machine. On the opposite arm of the throw-out-lever, 321, is pivoted a pawl, 323, of non-conducting material such as fibre, the underside of which rests on a horizontal pin, 324, projecting from the throwout-lever, 321, said pawl as it swings upward, being held firmly to the throwout-lever, 321, causes the switch-lever, 292, to swing from contact with the switch blades, 293, breaking the circuit to the lifter motor, 234, and to swing in contact with the switch blades, 294, closing the circuit to the car-motor, 250. The opposite leg of the lifter, 221, at the same time strikes the lower arm of the rod, 301, and moves the switch contacts in position to cause a reversing of the lifter-motor, 234, so that it is ready to ascend. However, (see Fig. 17) as the pawl, 323, swings upward to cause the transferring of the current from the lifter-motor, 234, to the car-motor, 250, it also strikes the lower flexible blade, 325, of the throwout-switch, 326, forcing the same in contact with its upper blade, closing the circuit to the magnet, 285, in the keyboard, which when energized causes the release of all the depressed keys, and therefore breaks the entire circuit to the machine.

It must be remembered that the reversing switches, 284, of the lifter-motor have been placed in position to cause the ascension of the lifter, 221, when the current is again turned on; the switch-lever, 292, has been placed in position to cause the current to pass thru the car motor, 250, and the pawl, 323, after actuating the switch lever, 292 and closing the blades, 325, and, 326, on account of the arc in which it swings, snaps by both the blades, 325, and the switch-lever 292, leaving the switch-lever free to be acted upon by the magnet, 298, and leaves the flexible blade, 325, free to return by its own spring to circuit-breaking position, so that all is in readiness for the next selected record. The pawl, 323, pivoted on the throw-out-lever, 321, is necessary, so that when the lifter, 221, again ascends, the pawl will not act as the throwout lever, 321, swings downward to its normal position against the stop, 328.

The key operated mechanism which is illustrated in detail in Figs. 24 and 25 is the same for both embodiments of my invention shown in the drawings and has already been described in detail. Preferably as providing a simple and inexpensive construction to take care of the considerable

length of wire running from the key-board to the apparatus, I mount the key-board casing, 285, upon a vertical round standard or shaft, 286, which is journaled at its lower end in a floor base, 287, so that it may be revolved to form a windlass for winding the flexible wire, 288, upon or off the same according to the distance the key-board is placed from the instrument.

Certain features of the embodiment of my invention illustrated herein, appear in my application No. 525,669 filed December 29, 1921, some of which are described in detail herein and other features are disclosed in such application which are not described herein and which relate to automatic devices for controlling the action of the phonograph, and no claim is made herein to matter common to the two applications which is properly in said other applications.

In regard to what is shown in Figs. 1 to 16 and 24 and 25 this application is a continuation of my application No. 593,782 filed October 11, 1922.

What I claim is:

1. A sound reproducing machine of the kind described comprising phonograph player mechanism, a magazine for a collection of player devices movable between certain extreme limits, automatic means for moving said magazine, means to transfer selected player devices between the magazine and the player mechanism, and means manually operable at will comprising control devices related, respectively, to definite points within such limits of movement of the magazine for causing the stoppage of the magazine at selected points.

2. In a machine of the kind described, the combination of a phonograph player mechanism that includes a turntable, a reciprocating car for a collection of player devices, a device to transfer selected player devices between the car and player mechanism, to which the selected player device is presented by the reciprocating car, and automatic means for causing reciprocation of the car and the transfer device.

3. In a machine of the kind described, the combination of a phonograph player mechanism that includes a turntable, a reciprocating car for a collection of player devices, a device to transfer selected player devices between the car and player mechanism, to which the selected player device is presented by the reciprocating car, motor means operatively connected with the car and the transfer device and hand-actuated means to set the motor means in operation.

4. In a machine of the kind described, the combination of a phonograph player mechanism that includes a turntable, a reciprocating car for a collection of player devices, a device to transfer selected player devices between the car and player mechanism, to which the selected player device is presented by the reciprocating car, motor means operatively connected with the car and the transfer device, hand-actuated means to set the motor means in operation, and automatic means to stop the operation of the motor means.

5. In a machine of the kind described, the combination of a phonograph player mechanism that includes a turntable, a reciprocating car for a collection of player devices, a device to transfer selected player devices between the car and player mechanism, to which the selected player device is presented by the reciprocating car, motor means operatively connected with the car and the transfer device, hand-actuated means to set the motor means in operation, and automatic means to stop the operation of the motor means comprising separate clutches for the car and the transfer device.

6. In a sound reproducing machine of the kind described, the combination of phonograph player mechanism, a reciprocating car for a collection of player devices, means to transfer selected devices one at a time between the car and the player mechanism, car reciprocating means, and means under the control of the car to stop the travel thereof with reference to said transfer device.

7. In a sound reproducing machine of the kind described, the combination of a phonograph player mechanism, a reciprocating car for a collection of player devices, car reciprocating means, electric means, including a car-actuated switch, for controlling the movement of said car, and means to transfer selected devices, one at a time, between the magazine and the player mechanism.

8. In a sound reproducing machine of the kind described, the combination of a phonograph player mechanism, a reciprocating car for a collection of player devices, car reciprocating means, electric means for controlling the movement of said car including a switch that comprises a plurality of stationary members and a plurality of members to co-act therewith, carried by the car, and means to transfer selected devices, one at a time, between the player mechanism and the car.

9. The combination in a sound reproducing machine of the kind described, of a phonograph player mechanism, a reciprocating car for a collection of player devices, movable to present the respective devices at a point for removal, automatic means to selectively stop said car at such point, to present a desired player device thereat, and car-reciprocating means.

10. The combination in a sound reproducing machine of the kind described, of a phonograph player mechanism, a reciprocating car for a collection of player de-

vices, movable to present the respective devices at a point for removal, automatic means to selectively stop said car at such point, to present a desired player device thereat, said means being under the control of the car, and car-reciprocating means.

11. The combination in a sound reproducing machine of the kind described, of a phonograph player mechanism, a reciprocating car for a collection of player devices, movable to present the respective devices at a point for removal, automatic means to selectively stop said car at such point, to present a desired player device thereat, said means including a car controlled electric switch and car reciprocating means.

12. In a machine of the kind described, the combination of phonograph player mechanism including a turn table, a reciprocating car for a collection of records, means to transfer records between the car and the turn table, automatic means to selectively present records to such transfer means, automatic means to control the operation of the turn table and car-reciprocating means.

13. In a machine of the kind described, the combination of phonograph player mechanism including a turn table, a reciprocating car for a collection of records, means to transfer records between the car and the turn table, automatic means to selectively present records to such transfer means, automatic means to control the operation of the turntable and the movement of the tone arm, and car-reciprocating means.

14. In a sound reproducing machine of the kind described, the combination of phonograph player mechanism, a reciprocating car for a collection of player devices, movable to and from a point for the delivery of selected player devices, electric means for controlling the movement of said car to such point comprising a plurality of switch devices, electrically connected in groups, switches for the respective groups and car reciprocating means.

15. In a sound reproducing machine of the kind described, the combination of a phonograph player mechanism, a reciprocating car for a collection of player devices, movable to and from a point for the delivery of selected player devices, electric means for controlling the movement of said car to such point comprising a plurality of automatic switches, electrically connected in groups, manual switches for the respective groups, and car-reciprocating means.

16. In a sound reproducing machine of the kind described, the combination of phonograph player mechanism, a reciprocating car for a collection of player devices, movable to and from a point for the delivery of selected player devices, electric means for controlling the movement of said car to such point comprising a plurality of switch devices each comprising a pair of stationary contacts, said switch devices being in groups, a movable contact, electrical connections between groups of switch devices, including switches controlling all the switch devices of a group, corresponding in number to the number of groups, a switch controlling the circuit of each member of a group, and car-reciprocating means.

17. In a machine of the kind described, a magazine for disc records comprising spaced partitions between pairs of which a record may be supported, means for moving a record from between the partitions and means for temporarily increasing the space between adjacent partitions.

18. In a machine of the kind described, a magazine for disc records comprising spaced partitions between pairs of which a record may be supported, means for moving a record from between the partitions and means for temporarily increasing the space between adjacent partitions, said pairs of partitions being arranged in independent groups.

19. In a machine of the kind described, a magazine for disc records comprising spaced partitions between pairs of which a record may be supported, means for moving a record from between partitions and means for temporarily increasing the space between the adjacent partitions, actuated by said record moving means.

20. In a machine of the kind described, the combination of a magazine for a plurality of disc records, and record transporting means comprising a reciprocating gripper, two rack-bars, one of which is stationary, and the other is movable, the movable one being connected with the gripper, a gear meshing with both of said rack-bars, and means for bodily moving said gear over the stationary rack-bar.

21. In a machine of the kind described, a car having supports for a plurality of disc records, a motor, a driving connection between the motor and the car to reciprocate the car, and car controlled means for reversing the direction of travel of the car by the motor.

22. In a machine of the kind described, a car having supports for a plurality of disc records, an electric motor, a driving connection between the motor and the car to reciprocate the car, and car controlled means for reversing the direction of travel of the car by the motor comprising a switch in the motor circuit and a member connected with the switch to operate the same that is alternately moved in opposite directions by the car.

23. The combination in a sound reproducing machine of the kind described, of phonograph player mechanism, a traveling magazine for a collection of player devices mov-

able to and from a point for the delivery of a selected player device, and electric means for controlling the movement of said magazine comprising a group of side by side manual switches having finger operated keys and a key arrester that permits movement of only one key at a time.

24. The combination in a sound reproducing machine of the kind described, of a phonograph player mechanism, a holder for a collection of player devices, means to control the transfer of player devices to said player mechanism comprising a plurality of finger-operated keys, anyone of which normally is free to be operated, and a key arrester that prevents movement of other keys during the operation of one key.

25. The combination in a sound reproducing machine of the kind described, of a phonograph player mechanism, a holder for a collection of player devices, means to control the transfer of player devices to said player mechanism comprising a plurality of finger-operated keys, anyone of which normally is free to be operated, a key arrester that prevents movement of other keys during the operation of one key, a latch device to hold an operated key in the position to which it is moved, and automatic means to release said latch device.

In testimony whereof I hereunto affix my signature.

OBERLIN SMITH.