No. 730,986. PATENTED JUNE 16, 1903.

C. S. TAINTER.

GRAPHOPHONE.

APPLICATION FILED DEC. 29, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

FIG. 2.

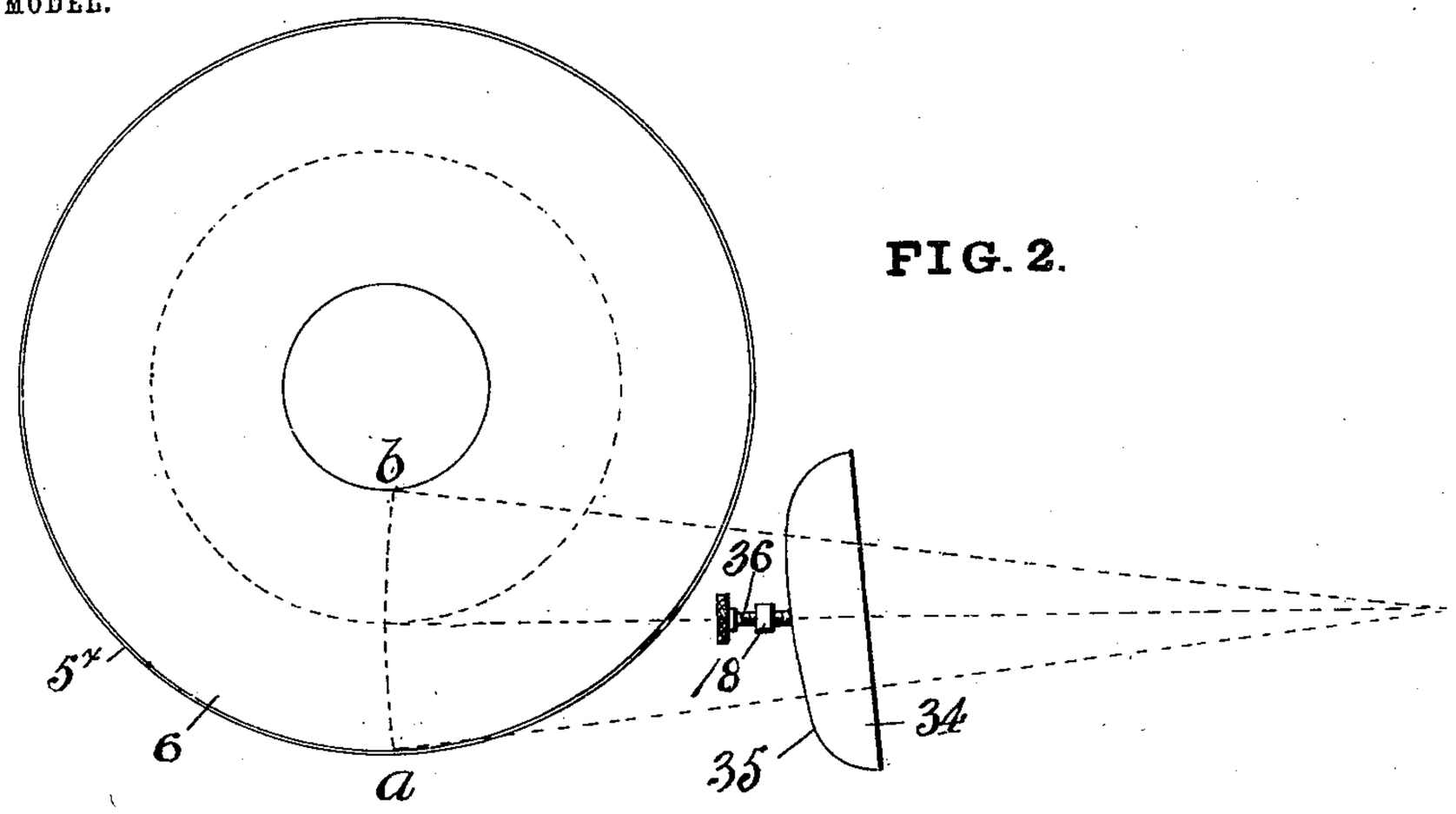
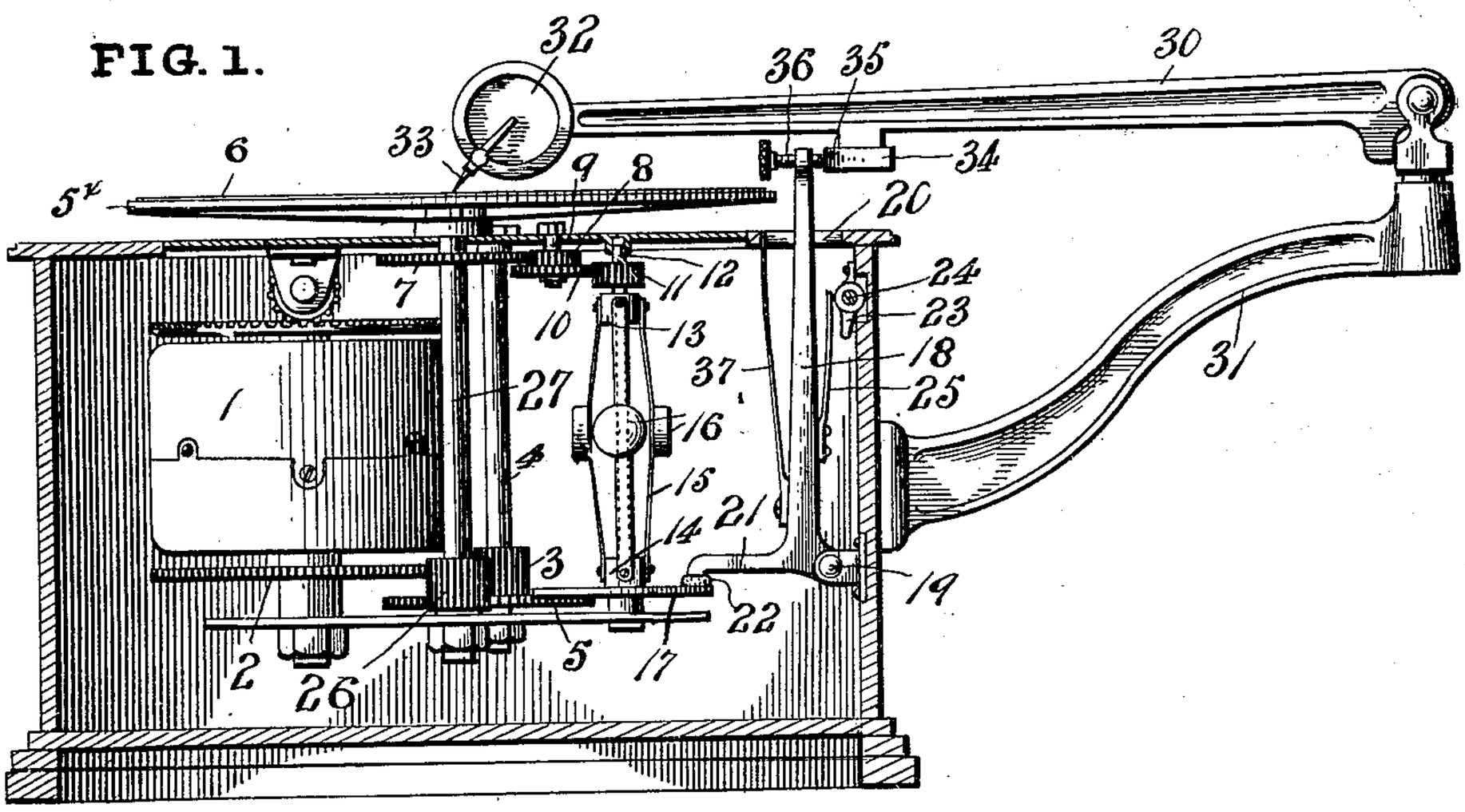


FIG. 1.



Inventor

Charles S. Tainter

Witnesses

Chas. K. Davies.

By Thompson & Co.

Attorney

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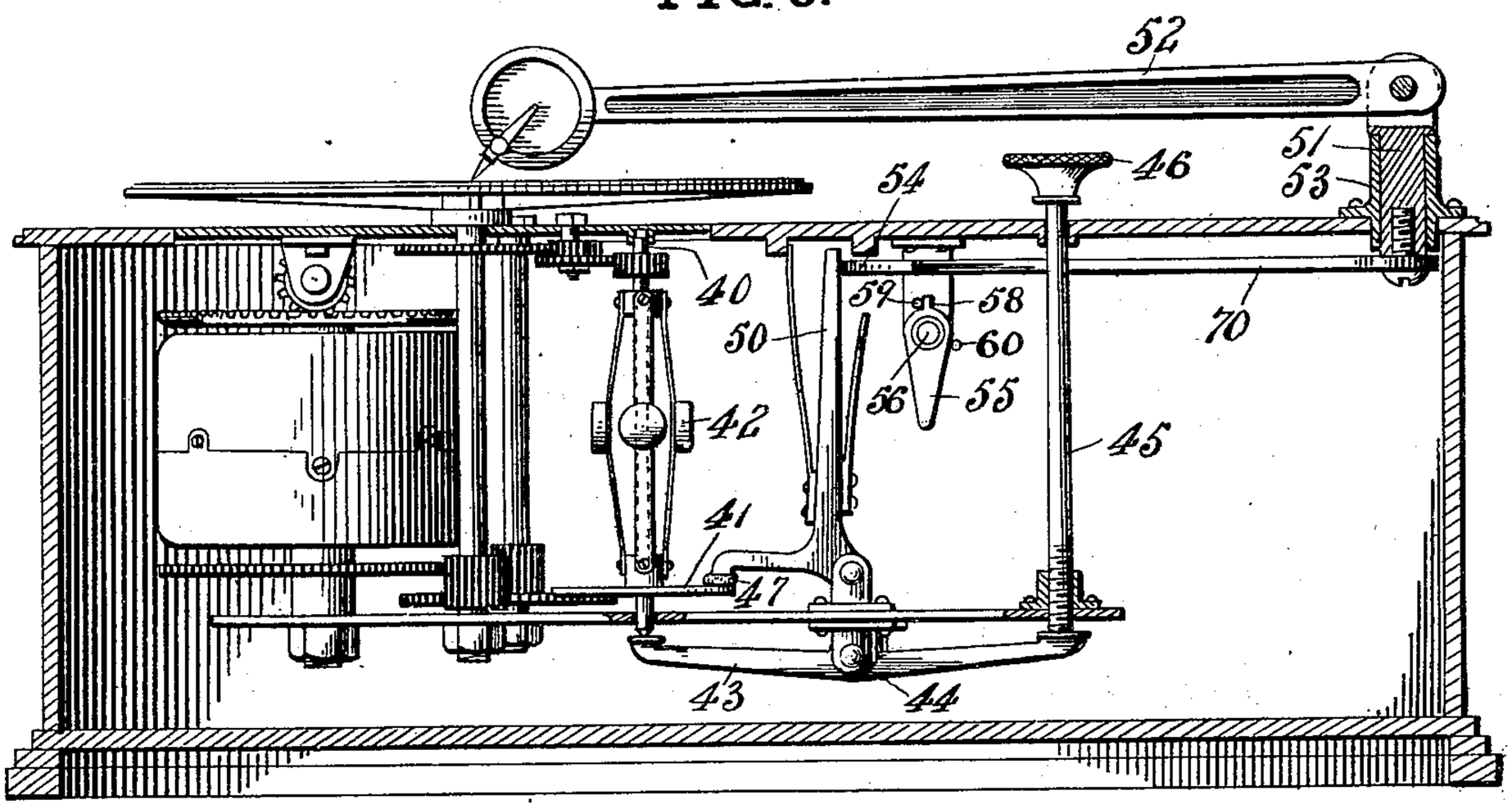
NO MODEL. 4 SHEETS—SHEET 2.

FIG. 3.



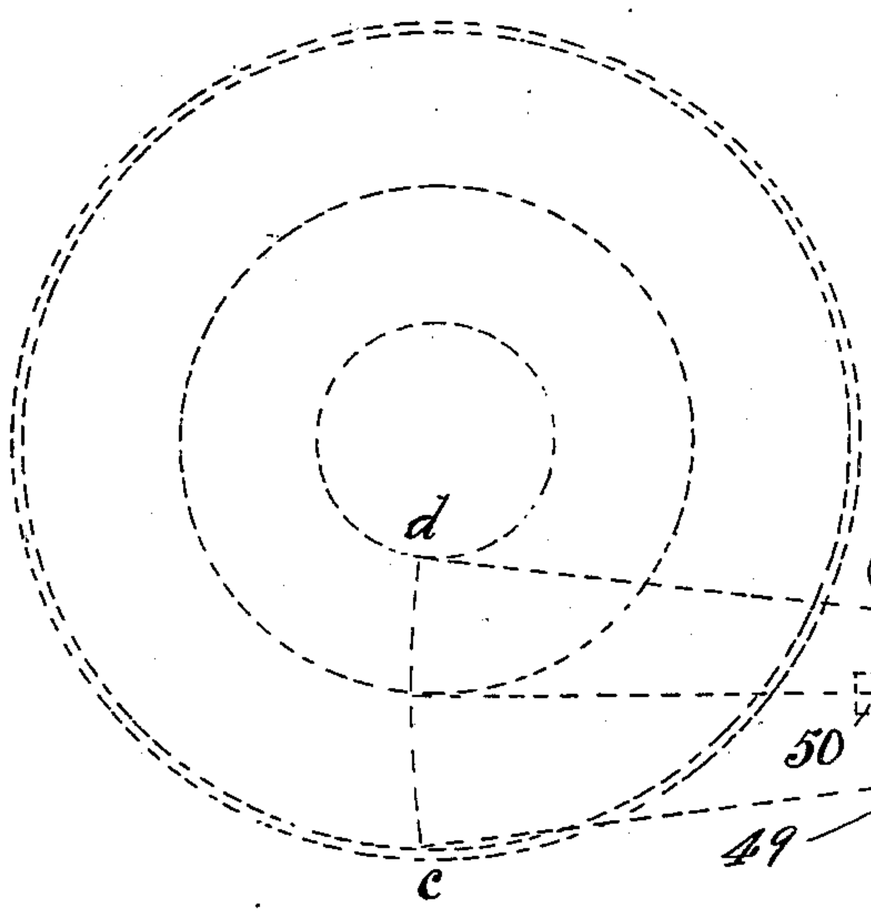


FIG. 4.

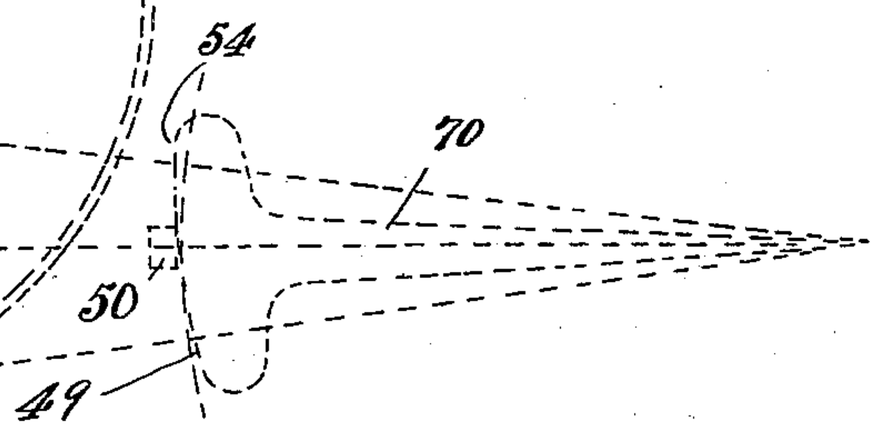
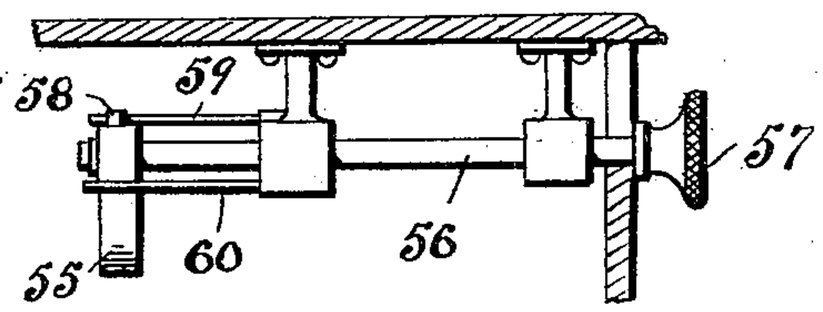


FIG. 5.



Witnesses

Chas. K. Davies.

Inventor

Charles S. Tainter

By Thompson

Attorney

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NO MODEL. 4 SHEETS—SHEET 3.

FIG. 7.

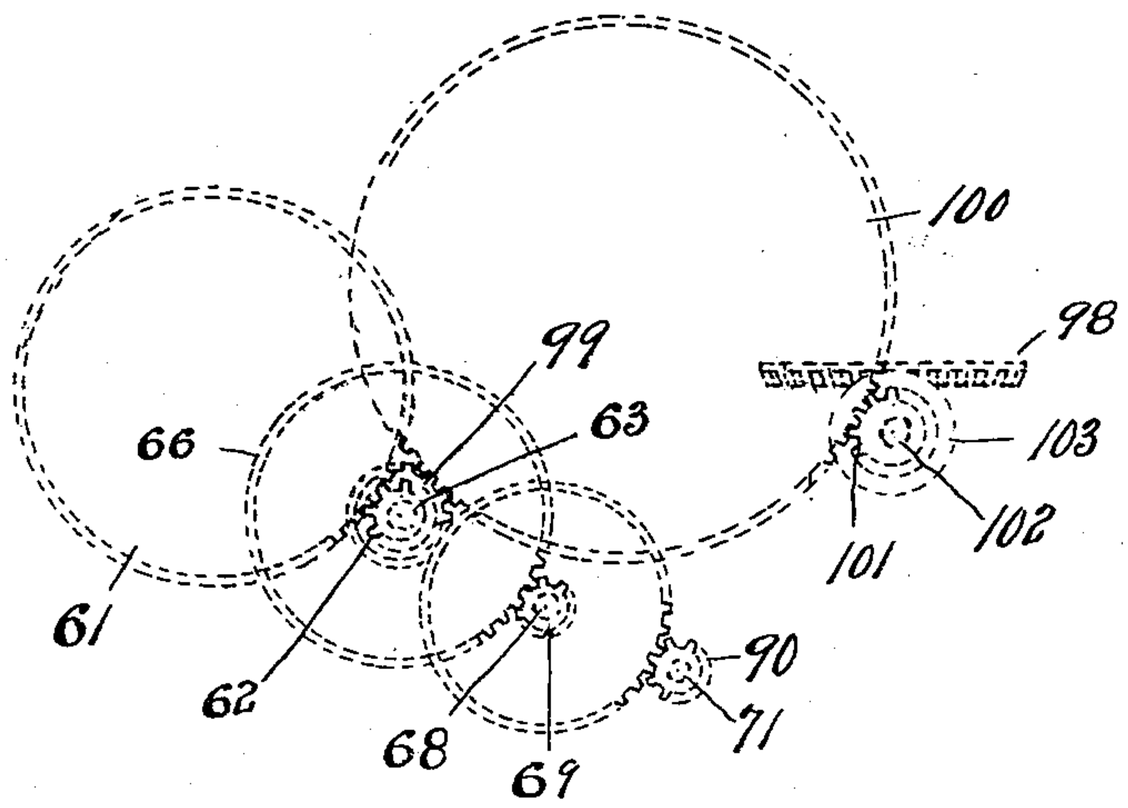
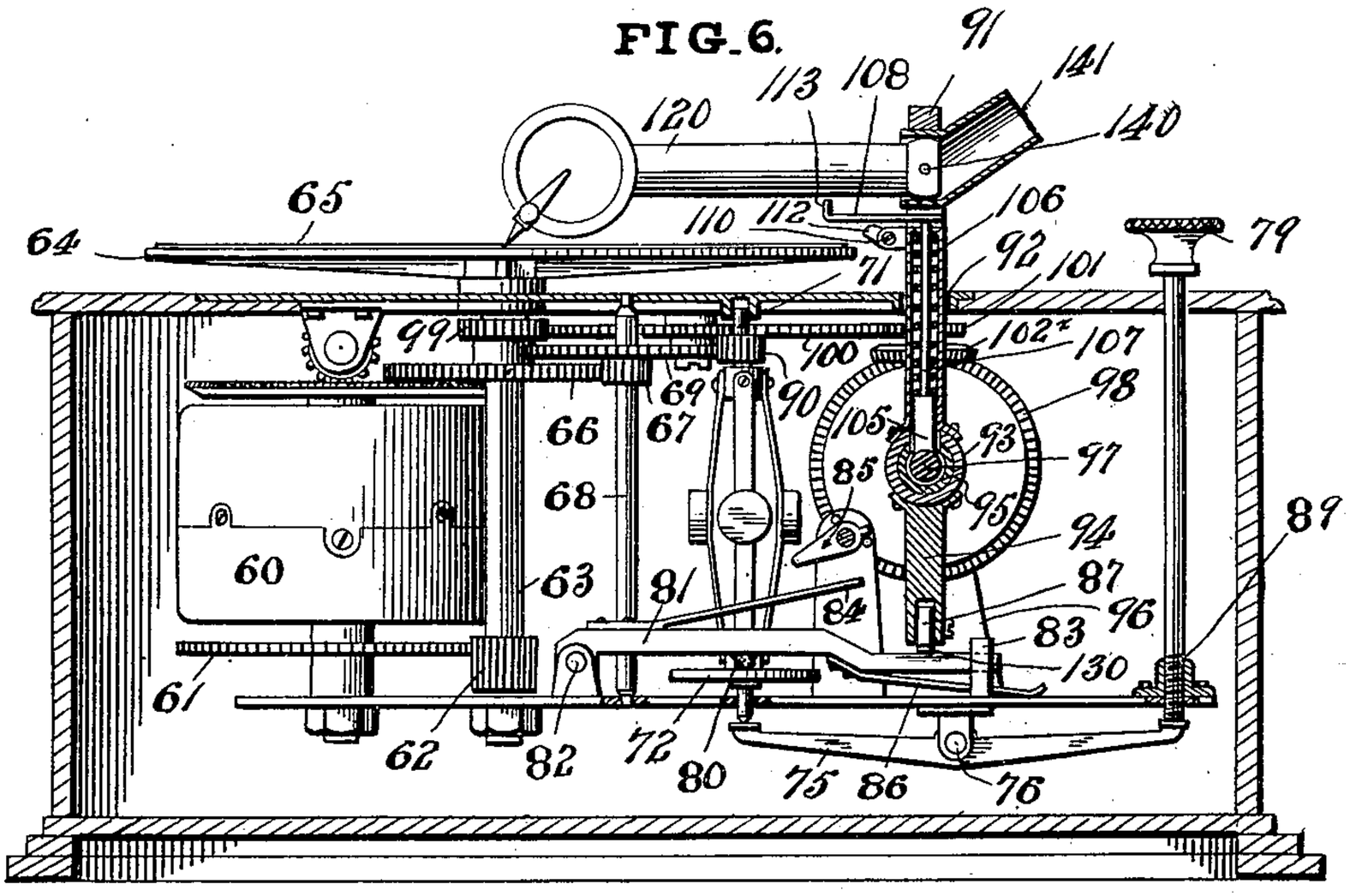


FIG. 6.



WITNESSES:

Chas. K. Davis.

INVENTOR

Charles S. Tainter

BY

Philip Mauro

Attorney

No. 730,986. PATENTED JUNE 16, 1903.

C. S. TAINTER.

GRAPHOPHONE.

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NO MODEL. 4 SHEETS—SHEET 4.

FIG. 9.

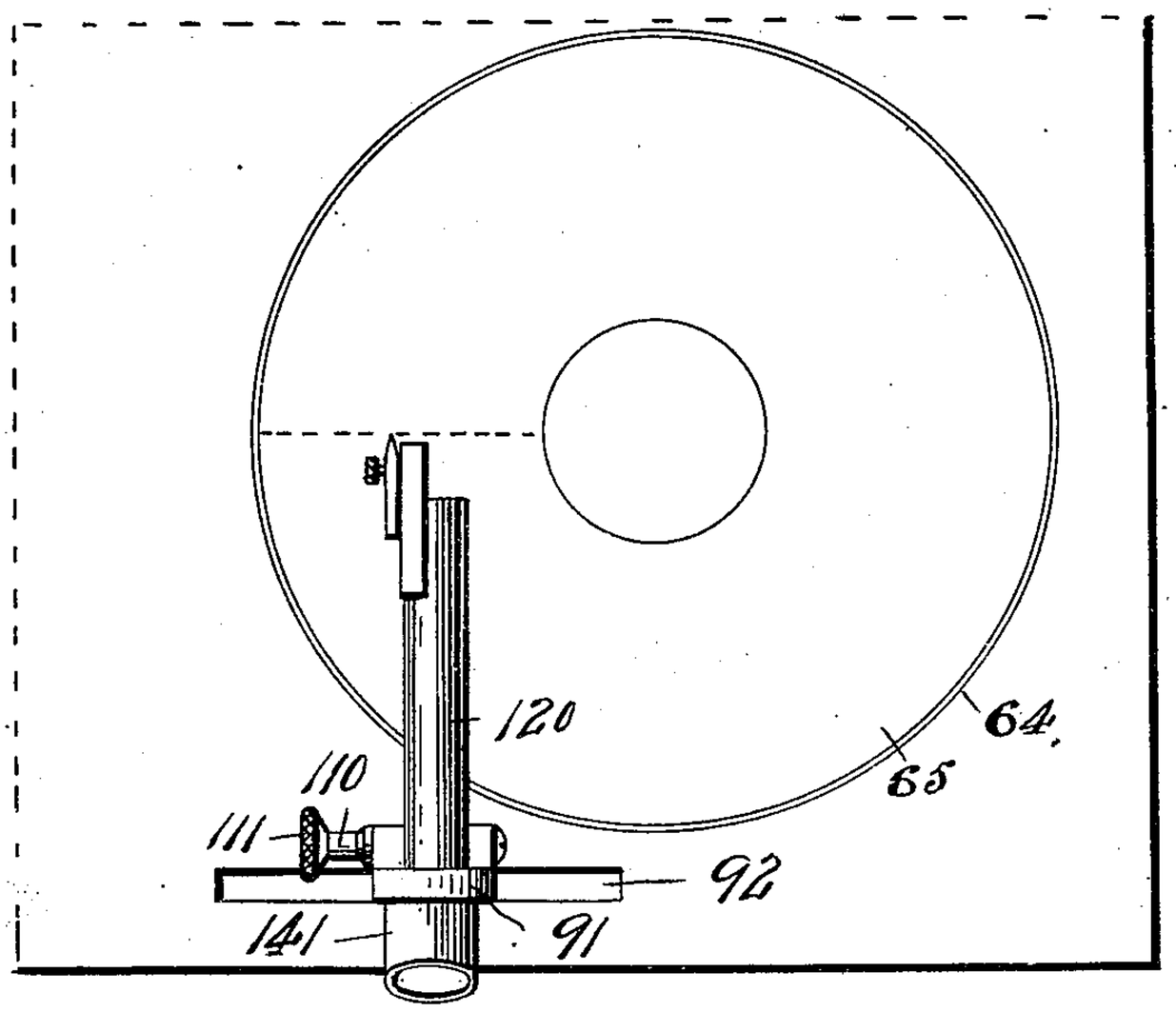
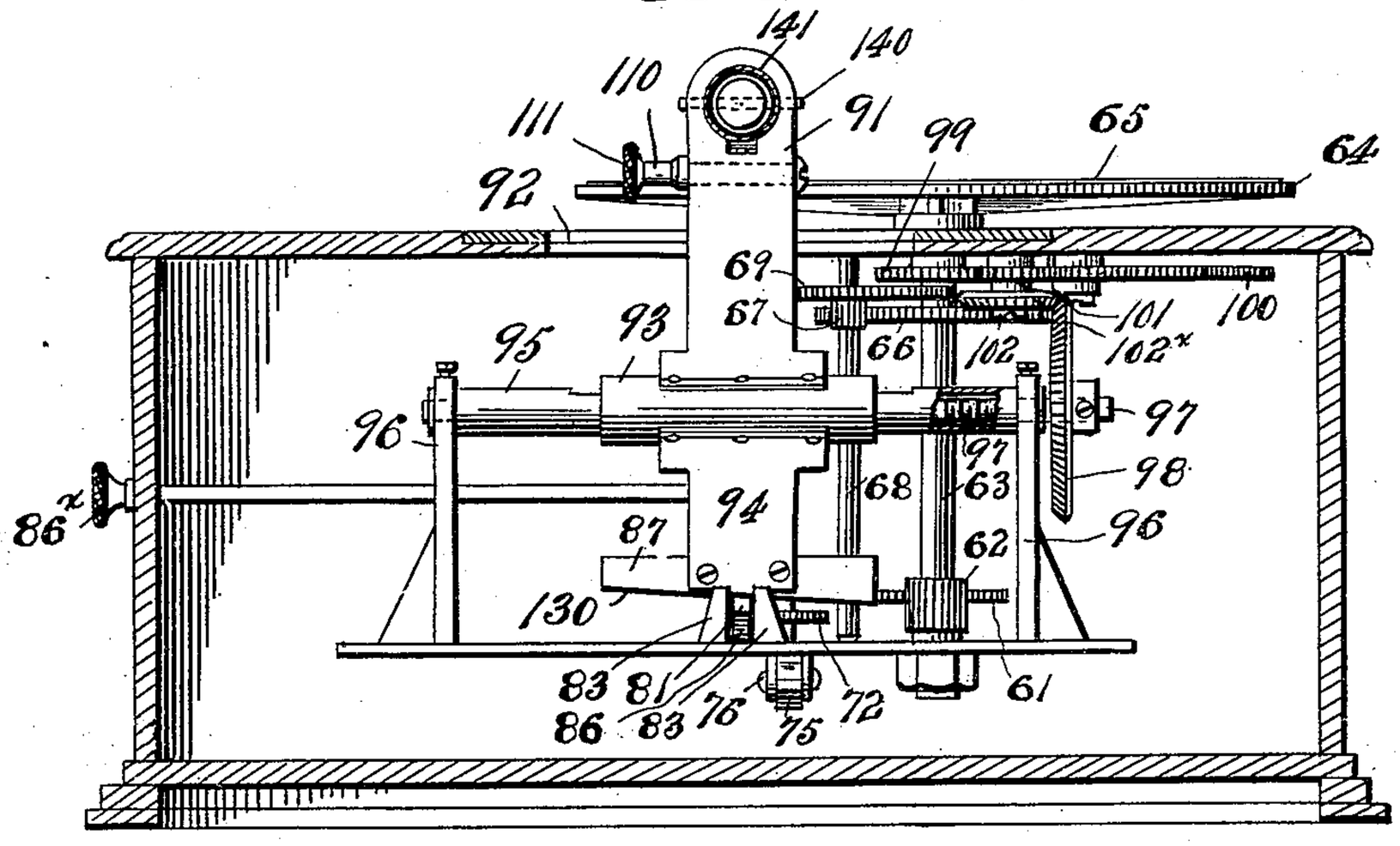


FIG. 8.



WITNESSES:
Chas. K. Davies.
Geo. L. Lewis

INVENTOR
Charles S. Tainter
BY
Thompson
Attorney

No. 730,986. Patented June 16, 1903.

UNITED STATES PATENT OFFICE.

CHARLES S. TAINTER, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO AMERICAN GRAPHOPHONE COMPANY, OF WASHINGTON, DISTRICT OF COLUMBIA, A CORPORATION OF WEST VIRGINIA.

GRAPHOPHONE.

SPECIFICATION forming part of Letters Patent No. 730,986, dated June 16, 1903.

Application filed December 29, 1902. Serial No. 137,024. (No model.)

To all whom it may concern:

Be it known that I, CHARLES S. TAINTER, of Washington, District of Columbia, have invented a new and useful Improvement in Graphophones, which invention is fully set forth in the following specification.

In talking-machines now commonly used, wherein the record of sound is made on a disk tablet, it is customary to rotate the tablet at a uniform speed, the desired uniformity being attained by suitable speed-regulating means associated with the driving-motor. The record, usually in the form of a groove, is formed on the face of the disk tablet in a volute or spiral commencing at the outer edge of the disk, where the speed of movement of the surface is greatest, and extending toward the center, where the speed of movement is least. It follows that the surface of the tablet at or near its outer edge will travel under a recording or reproducing stylus at much greater speed than the surface near the center of the tablet, the speed gradually decreasing as the recording or reproducing stylus moves toward the center of rotation. In other words, the record-disk will travel under the recorder or reproducer at a constantly-varying surface speed. In Patent No. 341,214, of May 4, 1886, to Bell and Tainter, we referred to advantages to be gained by giving the rotating record-disk a uniform surface speed under the recorder or reproducer and illustrated and described therein means for imparting the desired speed of rotation through a friction-wheel bearing against the under or rear side of a plate upon which the tablet rests, relative transverse movement being imparted to the friction-wheel and plate to cause said wheel to operate against the plate at a point directly opposite or under the recorder or reproducer bearing upon the tablet-surface. Similar means were shown and described in my Patent No. 385,886, of July 10, 1888; but this manner of rotating the tablet presents difficulties and objections, principally the necessity of relative transverse movement between the supporting-plate and friction-wheel, wherefore it has never, so far as I am aware, been commercially used to any material extent and could not be successfully applied to machines now upon the market.

According to my present invention I attain the desired uniformity of surface speed under the recorder or reproducer by providing means for automatically and gradually varying or changing the speed of the driving-motor to compensate for the constantly-changing position of the recorder or reproducer on the tablet-surface. As applied, for example, to the commercial disk form of machine employing disk tablets, wherein the volute sound-groove commences at the outer edge of the record-surface and extends toward the center, the means employed according to my invention act to gradually increase the speed of the motor. Should the record of sound extend in the opposite direction, the speed of the motor would be gradually decreased.

While my invention is herein shown and described principally with reference to machines employing flat disk records having the record formed on the face thereof in a simple volute or spiral, it is apparently applicable to machines employing any form of record-tablet the surface of which is not at all points at the same distance from the axis of rotation, or, in other words, employing a tablet wherein a sound-record formed thereon gradually becomes throughout its length more distant from or nearer to the axis of rotation. For example, it is applicable to machines employing tablets having concave, convex, conical, frusto-conical, or spherical surfaces on which the record is formed in a helico-volute.

The volume of sound reproduced from disk records with machines now commonly used gradually diminishes from the commencement to the end of the reproduction. This is due to the gradual diminution in surface speed as the reproducer moves toward the axis of rotation of the disk tablet. This diminution in volume, which is always more or less objectionable, is overcome by driving the record-disk at a uniform speed under the reproducer. Furthermore, as stated in Patent No. 341,214, referred to, by giving to the disk a uniform surface speed under the recorder

or by making the times of each rotation inversely proportional to the distance of the recorder from the center of the disk, the record of any given word or sound will be of the same length at whatever part of the disk it may be, and in this way it is possible to considerably increase the number of words or sounds on a given area.

As will be apparent, my invention is capable of many mechanical embodiments, several of which are shown in the accompanying drawings and will now be explained in detail to show how the invention is or may be applied.

Figure 1 is a view showing the casing in vertical section and the mechanism in elevation. Fig. 2 is a diagrammatic view showing the relative position of the speed-controlling cam and the lever actuated thereby when the reproducer has traversed about half the distance from the outer edge to the inner edge of the record. Figs. 3 and 4 are views similar to Figs. 1 and 2 of another embodiment of the invention. Fig. 5 is a detail of parts shown in Fig. 3. Figs. 6, 7, 8, and 9 show still another embodiment of the invention, Figs. 6 and 8 being views at right angles to each other, showing the casing in vertical section and the mechanism in elevation, Fig. 7 a diagrammatic view of the gearing employed for driving various parts, and Fig. 9 a top plan view, only part of the casing of the machine being shown.

Referring to Figs. 1 and 2, 1 is a drum inclosing the usual motor-spring for driving gear-wheel 2, which in turn meshes with pinion 3 on shaft 4. Gear 5 on shaft 4 meshes with pinion 26 on shaft 27, which projects at its upper end through the top of the casing and carries turn-table or plate $5^{\times}$, upon which the disk record-tablet 6 rests. A gear-wheel 7 at the upper end of shaft 27 meshes with a pinion 8 on the spindle 9, and gear 10 on said spindle meshes with pinion 11 on the governor-shaft 12. The governor, which is of the usual centrifugal friction type, comprises a collar 13, secured to shaft 12, said collar being connected with a second collar 14, free to move longitudinally on the shaft by spring-blades 15, each of which carries at its middle a weight 16.

17 is a friction-disk secured to or formed integral with collar 14 and adapted to be more or less elevated as the speed of the motor increases and the weights fly out by centrifugal action. The mechanism as thus far described is old and well known.

18 is a lever fulcrumed at 19 in a bracket secured to the inner surface of the casing, said lever extending upwardly through an opening 20 in the top plate of the casing. An arm 21 on the lever overhangs the edge of friction-plate 17 and carries a friction pad or stud 22, of leather, cork, or similar material, adapted to bear upon the surface of said disk as it rotates, and thereby control the speed of the motor.

23 is a starting and stopping device, consisting in this instance of an arm 23, carried by a spindle 24, which is mounted on a bearing secured to the inner face of the casing and projects at one end to the outside of the casing, where it is provided with a suitable thumb-nut, such as shown in Fig. 5. As shown in Fig. 1, the arm 23 is in position to permit the motor to run. To stop the motor, the shaft 24 is rotated by its thumb-nut to bring the arm 23 in a horizontal position, causing its outer end to bear upon the spring 25, secured to and extending along the side of lever 18, thereby moving the upper end of said lever to the left, Fig. 1, and forcing the friction-pad 22 down against the friction-disk 17 with such force as to completely stop the motor mechanism.

30 is a swinging arm swiveled at its outer end in the usual manner in a bracket 31, secured to the side of the casing.

32 is a reproducer carried at the free end of the said arm and provided with stylus 33, which rests upon the record-tablet 6.

34 is a plate secured to the under side of swinging arm 30, having its edge 33 disposed at an incline or obliquely to said arm. The end of a thumb-screw 36, passing through the upper end of lever 18, bears upon and is held in engagement with the edge 35 of plate 34 by the action of a spring 37, which constantly tends to force the upper end of the lever 18 to the right, Fig. 1. The tension of said spring 37 is, however, easily overcome in operating the starting and stopping device. As more clearly shown in Fig. 2, the edge 35 of the plate 34 is cam-shaped and adapted to so operate in conjunction with lever 18 as to gradually raise the friction-pad 22 as the reproducer travels from the outer edge of the record-tablet toward the center thereof along the line *a b*, Fig. 2, thereby permitting the speed of the motor to gradually increase to produce a uniform surface speed under the reproducer.

It will be understood that the shape and disposition of the acting surface of plate 34 may be so determined as to obtain this uniformity of surface speed under the reproducer with great accuracy. By turning the screw 36 the position of the friction-pad 22 may be changed (irrespective of the action of the cam) for the purpose of increasing or decreasing the initial speed of the motor, this adjustment of course in no way interfering with the operation of the cam or inclined surface in producing the desired uniformity of speed under the reproducer.

In the modified construction shown in Figs. 3, 4, and 5 the governor-shaft 40, on which the friction-disk 41 is adapted to be moved in a vertical direction by the weights 42 under the influence of centrifugal action, rests at its lower end in a bearing at one end of a rocker-arm 43, fulcrumed at 44. A screw 45, extending downwardly through the top of the casing, carries at its upper end a milled

head 46 and at its lower end passes through part of the motor-frame and bears on the other end of the rocker-arm 43, swinging said arm on its fulcrum and moving the shaft 40 longitudinally to raise or lower the same, causing the disk 41 to engage the friction-pad 47 at a lower or higher speed of the motor, whereby the initial speed of the motor may be adjusted without interfering with the automatic control of said speed, about to be explained. In the embodiment of the invention shown in these figures (Figs. 3, 4, and 5) the swivel-pin 51, on which the swinging arm 52 of the machine turns, projects downwardly through a bearing 53 into the casing. An arm or plate 70 within the casing is secured to the lower end of said pin, and therefore receives a swinging movement in a horizontal plane exactly corresponding to the swinging movement of arm 52. At its free extremity arm 70 has an inclined or cam-shaped edge or surface 54, against which the upper end of arm 50 bears, said edge being so disposed and shaped as to actuate the lever to gradually raise the friction-pad as the reproducer travels from the outer edge of the record-disk toward the inner edge thereof along the line *c d*, Fig. 4, thereby permitting the speed of the motor to gradually increase. The shape of the inclined or cam-shaped edge may, as before stated, be so determined as to produce an accurate uniformity of speed under the reproducer. The starting and stopping device 55 shown in Figs. 3 and 5 operates in the same manner as that shown in Figs. 1 and 2. It is carried by a shaft 56, adapted to be rotated by a milled head 57. A lug 58 on arm 55 engages pins 59 and 60 to limit the movement of the arm.

In the construction shown in Figs. 6, 7, 8, and 9 instead of employing an arm for the recorder or reproducer arranged to swing on a swivel-pin as it is fed by the grooved record-tablet, as in other figures of the drawings, mechanism is provided for feeding the arm carrying the recorder or reproducer independently of the record-tablet. 60 is a drum containing the motor-spring, as before, and driving a gear 61, meshing with pinion 62 on shaft 63, which projects at its upper end through the top of the casing and carries the turn-table or plate 64, upon which the record-disk 65 rests. A gear-wheel 66 on shaft 63 meshes with pinion 67 on shaft 68, and a gear 69 on said shaft meshes with a pinion 90 on the governor-shaft 71. The governor-shaft is provided with a friction-disk 72, adapted to be moved vertically thereon by the action of weights actuated by centrifugal force, as already described with reference to the other figures. Shaft 71, which is mounted in bearings so as to have slight longitudinal movement, rests at its lower extremity upon one end of rocker-beam 75, fulcrumed at 76, said beam bearing at its other end against the lower extremity of a screw 89, adapted to be turned by milled head 79. Adjustment of the screw moves the rocker-arm 75 on its fulcrum, so as to slightly raise or lower the governor-shaft 71 and cause the disk 72 to engage friction-pad 80 at a lower or higher speed of the motor, whereby the initial speed of the motor may be adjusted, as already described with reference to Figs. 3, 4, and 5.

81 is a lever fulcrumed at one end at 82 and at its other end working between two guide-lugs 83 83. This lever carries the friction-pad 80, above referred to. A spring 84, projecting upwardly from the upper side of the lever, is adapted to be engaged by the starting and stopping device 85, operated by milled head 86×, Fig. 8, in the same manner as the starting and stopping device shown in Figs. 3 and 5. A spring 86, secured to the under side of lever 81, tends to force said lever upwardly and hold it in engagement with the lower inclined edge of a plate 87, to be more fully referred to hereinafter.

91 is a carriage extending upwardly through a slot 92 in the top of the casing and comprising at its lower end a sleeve 93 and a depending arm 94, sleeve 93 fitting about tube 95, on which it is free to slide. Sleeve 93 is supported at opposite ends in standards 96 96 and incloses a feed-screw 97, carrying a bevel-gear 98 at one end. The feed-screw is rotated by the motor through pinion 99 on shaft 63, meshing with gear 100, which in turn meshes with pinion 101 on spindle 102. Bevel-gear 102× on said spindle drives bevel-gear 98, thereby rotating the feed-screw 97. Segmental nut 105, movable vertically in a hollow part of the carriage, is adapted to engage the feed-screw through a slot in the upper side of tube 95, a coiled spring 106 tending to force the nut downwardly into engagement with the feed-screw. A rod 107, extending upwardly from the nut through spring 106, has a horizontal arm 108 at its upper end. A spindle 110, adapted to be rotated in bearings on the carriage by a milled head 111, has a lug 112, adapted to engage under arm 108 and move it upwardly to disengage nut 105 from the feed-screw, so that the carriage can be moved to any desired position. By the same operation the upturned end 113 of arm 108 engages under and lifts the reproducer or recorder arm 120, thereby lifting the stylus of the recorder or reproducer from the record and avoiding injury to these parts when the nut is disengaged from the feed-screw and the carriage free to be moved independently thereof.

Plate 87, before referred to, is rigidly secured to the lower end of arm 94 and of course partakes of the movement imparted to the carriage. The lower edge 130 of said plate is inclined or slanted, so as to have a cam-like action upon the end of lever 81, upon which it bears, gradually depressing said lever to lower the friction-pad 80 should the feed of the machine be from the right to the left, Fig. 8, or permitting spring 86 to gradually raise the lever 81 and the friction-pad 80

if the feed is in the reverse direction. These variations in the position of the friction-pad 80 cause corresponding variations in the motor-speed, thereby producing a uniform surface speed under the recorder or reproducer.

The hollow recorder or reproducer arm 120, through which the sounds are conveyed, is mounted on a horizontal pivot 140 in a tubular socket 141 on carriage 91. The pivotal connection is sufficiently loose to permit slight lateral play of the arm. A horn or mouthpiece may be slipped onto the socket 141.

As will be apparent, my invention is applicable to machines adapted to record, as well as to reproduce, sounds and may be used in the production of records having either perpendicular or lateral undulations corresponding to sound-waves. It may also be used in reproducing from either of these types of records. Furthermore, it will be apparent that the principle of my invention is susceptible of many different mechanical embodiments and is not limited to the particular means herein shown and described.

What is claimed is--

1. In a machine for recording or reproducing sounds, a rotatable tablet having a surface of such form that a record of sound formed thereon along a volute or spiral line will vary in distance from the axis of rotation of the tablet, a recorder or reproducer operating in conjunction with the tablet, motor mechanism for rotating the tablet, and automatically-operating speed-controlling means varying the speed of the motor as the recorder or reproducer moves toward or from the axis of rotation of the tablet.

2. In a machine for recording or reproducing sounds, a rotatable tablet having a surface of such form that a record of sound formed thereon along a volute or spiral line will vary in distance from the axis of rotation of the tablet, a recorder or reproducer operating in conjunction with the tablet, motor mechanism for rotating the tablet, and automatically-operating speed-controlling means varying the speed of the motor to produce approximately uniform surface speed under the recorder or reproducer.

3. The combination with a rotatable tablet having different surface speeds at different points on its surface when rotated at a uniform axial speed, of a recorder or reproducer operating in conjunction with the tablet, motor mechanism for rotating the tablet, and automatically-operating speed-controlling means varying the speed of the motor according to the position of the recorder or reproducer on the surface of the tablet.

4. The combination with a rotatable tablet having different surface speeds at different points on its surface when rotated at a uniform axial speed, of a recorder or reproducer operating in conjunction with the tablet, motor mechanism for rotating the tablet, and automatically-operating speed-controlling means varying the speed of the motor to produce an approximately uniform surface speed under the recorder or reproducer.

5. In a machine for recording or reproducing sounds, a rotatable tablet having a surface of such form that a record of sound formed thereon along a volute or spiral line will vary in distance from the axis of rotation of the tablet, a recorder or reproducer operating in conjunction with the tablet, motor mechanism for rotating the tablet, and automatically-operating speed-controlling means increasing the speed of the motor as the recorder or reproducer moves toward the axis of rotation of the tablet or vice versa.

6. The combination of a rotatable support for a record-tablet, a motor for rotating said support, and automatically-operated speed-changing mechanism for varying the speed of the motor including a controlling device or part to which movements are imparted corresponding to the movements of the recorder or reproducer in tracking a spiral line on the record-tablet.

7. The combination of a rotatable support for a record-tablet, a motor for rotating said support, a recorder or reproducer, a support or carrier for the recorder or reproducer movable therewith as it tracks a spiral line on the record-tablet, and automatically-operated speed-changing mechanism for varying the speed of the motor including a controlling device or part having connection with the support or carrier and following the movements thereof.

8. The combination of a rotatable support for a record-tablet, a motor for rotating said support, a recorder or reproducer, an automatically-operated speed-changing lever movable to vary the speed of the motor, and a device or part controlling the movement of said lever to which device or part movements are imparted corresponding to the movements of the recorder or reproducer in tracking a spiral line on the record-tablet.

9. The combination of a rotatable support for a record-tablet, a motor for rotating said support, a recorder or reproducer, a support or carrier for the recorder or reproducer movable therewith as it tracks a spiral line on the record-tablet, an automatically-operated speed-changing lever movable to vary the speed of the motor, and a device or part having an inclined or cam-like edge or surface against which the lever bears and by which its movements are controlled said device or part having connection with the support or carrier and following the movements thereof.

10. The combination of a rotatable support for a record-tablet, a motor for rotating the same, a centrifugal frictional speed-governor for the motor comprising a disk rotated by the motor, centrifugal devices for axially moving the disk and a friction device bearing against the disk, a recorder or reproducer, and automatically-operated mechanism for changing the position of the friction device thereby varying the speed of the motor.

11. The combination of a rotatable support for a record-tablet, a motor for rotating the same, a centrifugal frictional speed-governor for the motor comprising a disk rotated by the motor, centrifugal devices for axially moving the disk and a friction device bearing against the disk and limiting the axial movement thereof, and automatically-operated means for changing the position of the friction device thereby varying the speed of the motor.

12. The combination of a rotatable support for a record-tablet, a motor for rotating the same, a centrifugal frictional speed-governor for the motor comprising a disk rotated by the motor, centrifugal devices for axially moving the disk and a friction device bearing against the disk and limiting the axial movement thereof, a lever carrying the friction device and automatically-operated lever-actuating means for moving the lever and changing the position of the friction device thereby varying the speed of the motor.

13. In a machine for recording or reproducing sounds, a rotatable tablet having a surface of such form that a record of sound formed thereon along a volute or spiral line will vary in distance from the axis of rotation of the tablet, a recorder or reproducer operating in conjunction with the tablet, a motor for rotating the tablet, a centrifugal frictional speed-governor for the motor comprising a disk rotated by the motor, centrifugal devices for axially moving the disk and a friction device bearing against the disk and limiting the axial movement thereof, and automatically-operating speed-controlling means gradually moving the friction device to permit the speed of the motor to gradually increase as the recorder or reproducer moves toward the axis of rotation of the tablet and vice versa.

14. The combination of a rotatable record-tablet, a motor for rotating the same, a recorder or reproducer operating in conjunction with the tablet, a frictional speed-governor for the motor comprising a disk rotated by the motor, centrifugal devices for axially moving the disk and a relatively stationary friction device bearing against the disk and limiting the axial movement thereof, a speed-adjusting device for changing the position of the friction device to determine the initial speed of the motor, and automatically-operating speed-controlling means gradually changing the position of the friction device to gradually vary the speed of the motor.

15. The combination of a rotatable record-tablet, a motor for rotating the same, a recorder or reproducer operating in conjunction with the tablet, a frictional speed-governor for the motor comprising a disk rotated by the motor, centrifugal devices for axially moving the disk and a relatively stationary friction device bearing against the disk and limiting the axial movement thereof, a speed-adjusting device for changing the position of the friction device to determine the initial speed of the motor, a starting and stopping device for forcibly pressing the friction device against the disk to stop the motor, and automatically-operating speed-controlling means gradually changing the position of the friction device to gradually vary the speed of the motor.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHARLES S. TAINTER.

Witnesses:
D. W. CADY,
F. H. GRAY.