

No. 750,460.

PATENTED JAN. 26, 1904.

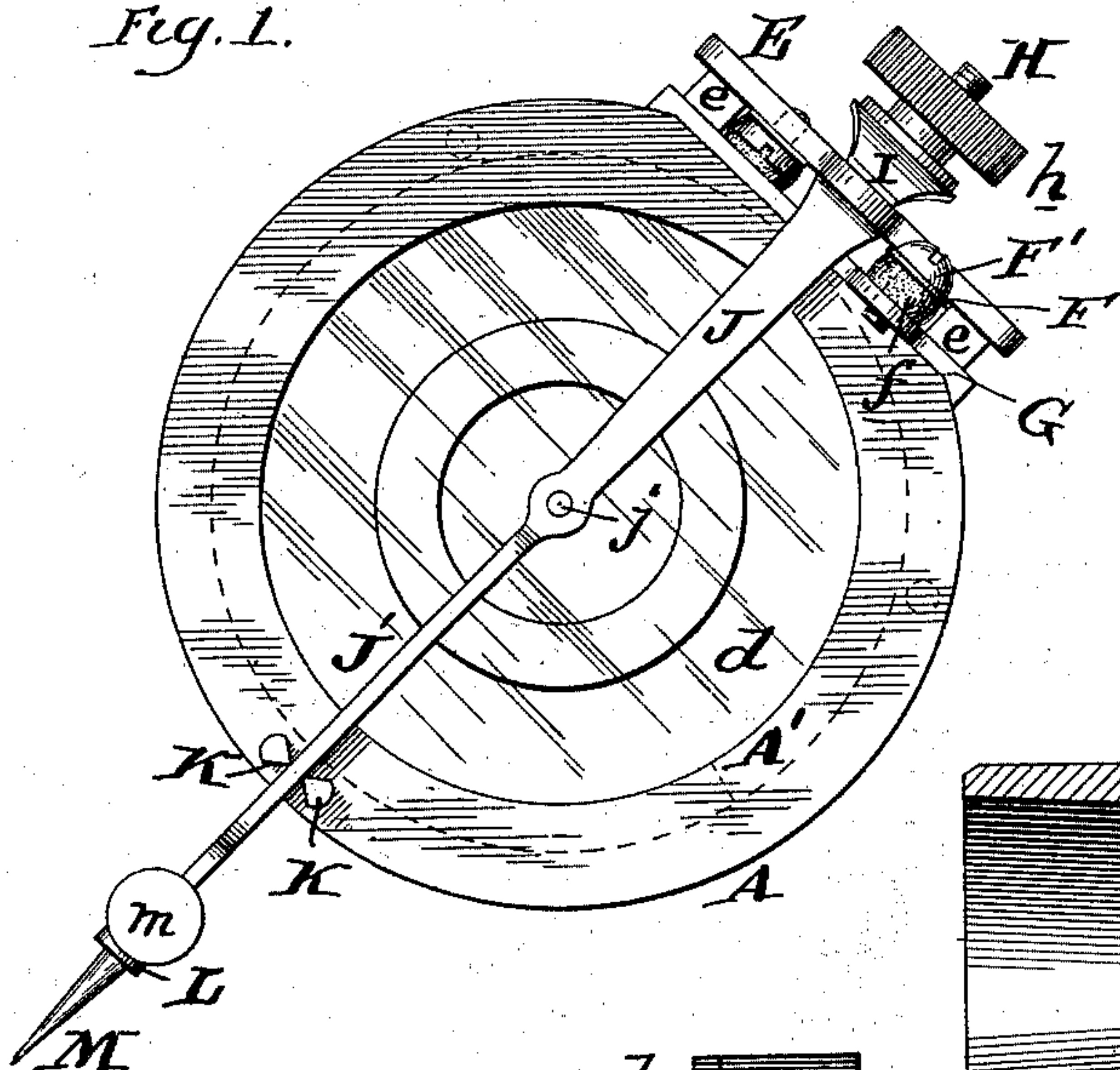
H. JONES.

SOUND RECORDING AND REPRODUCING MACHINE.

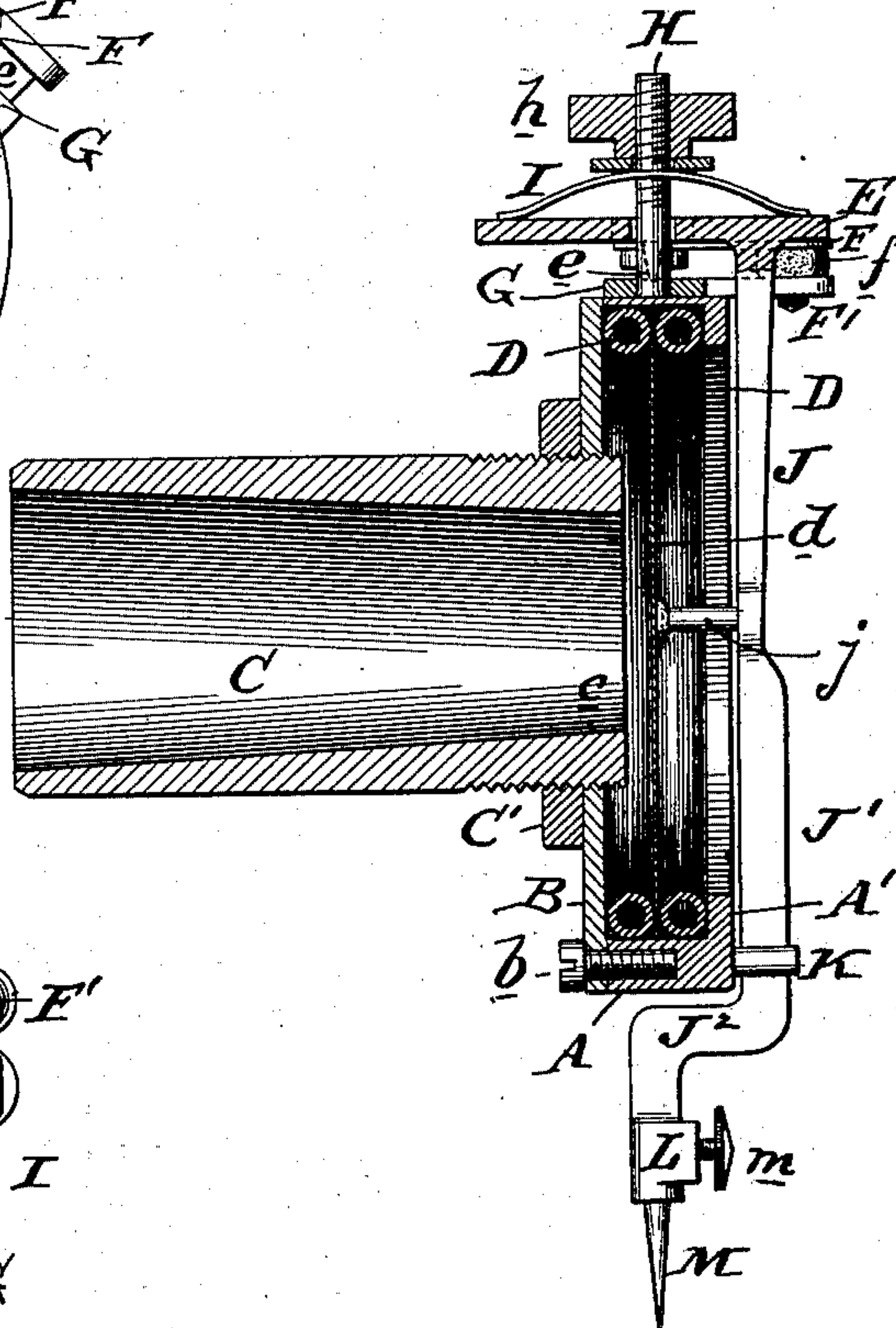
APPLICATION FILED DEC. 7, 1900.

NO MODEL.

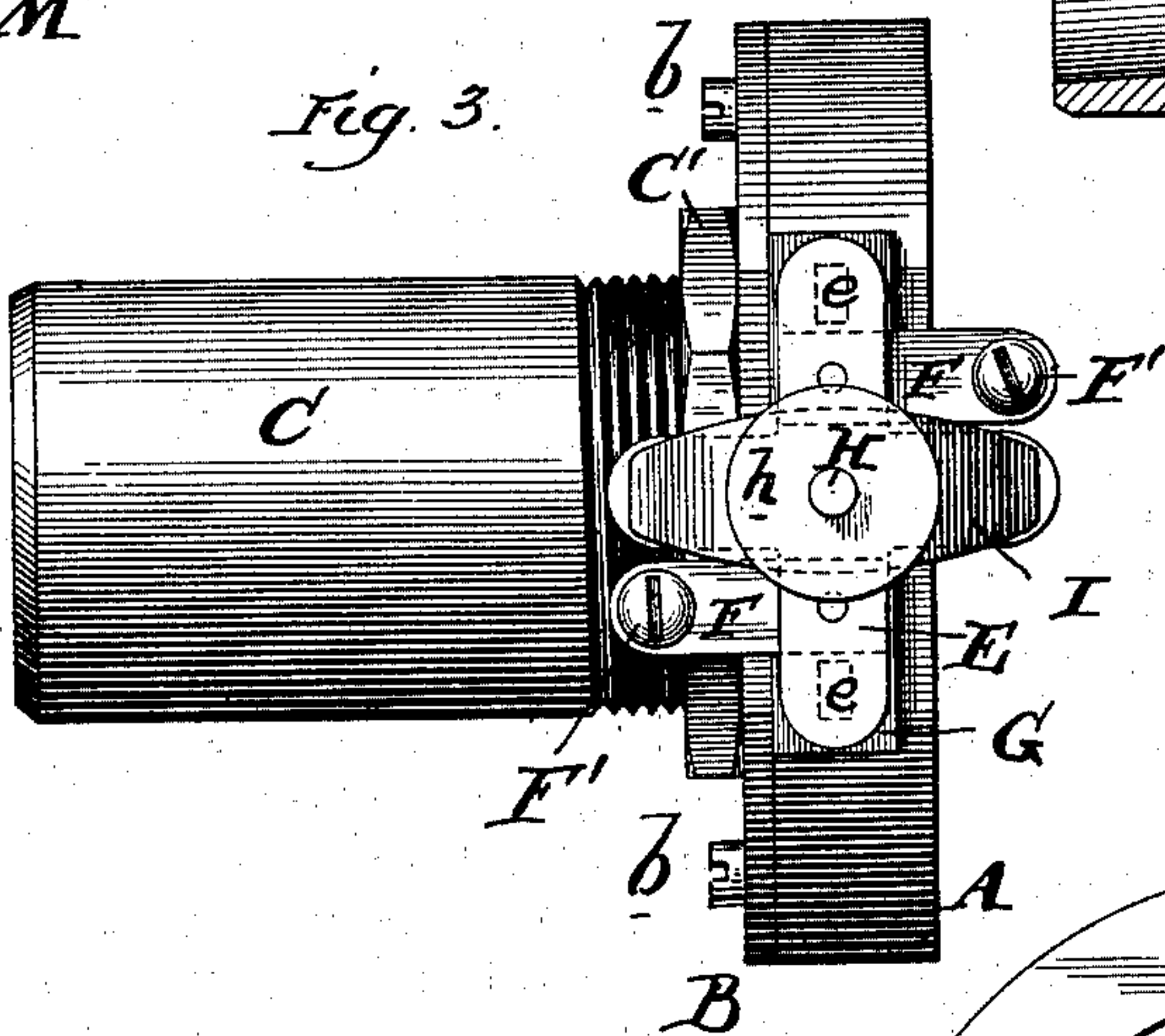
*Fig. 1.*



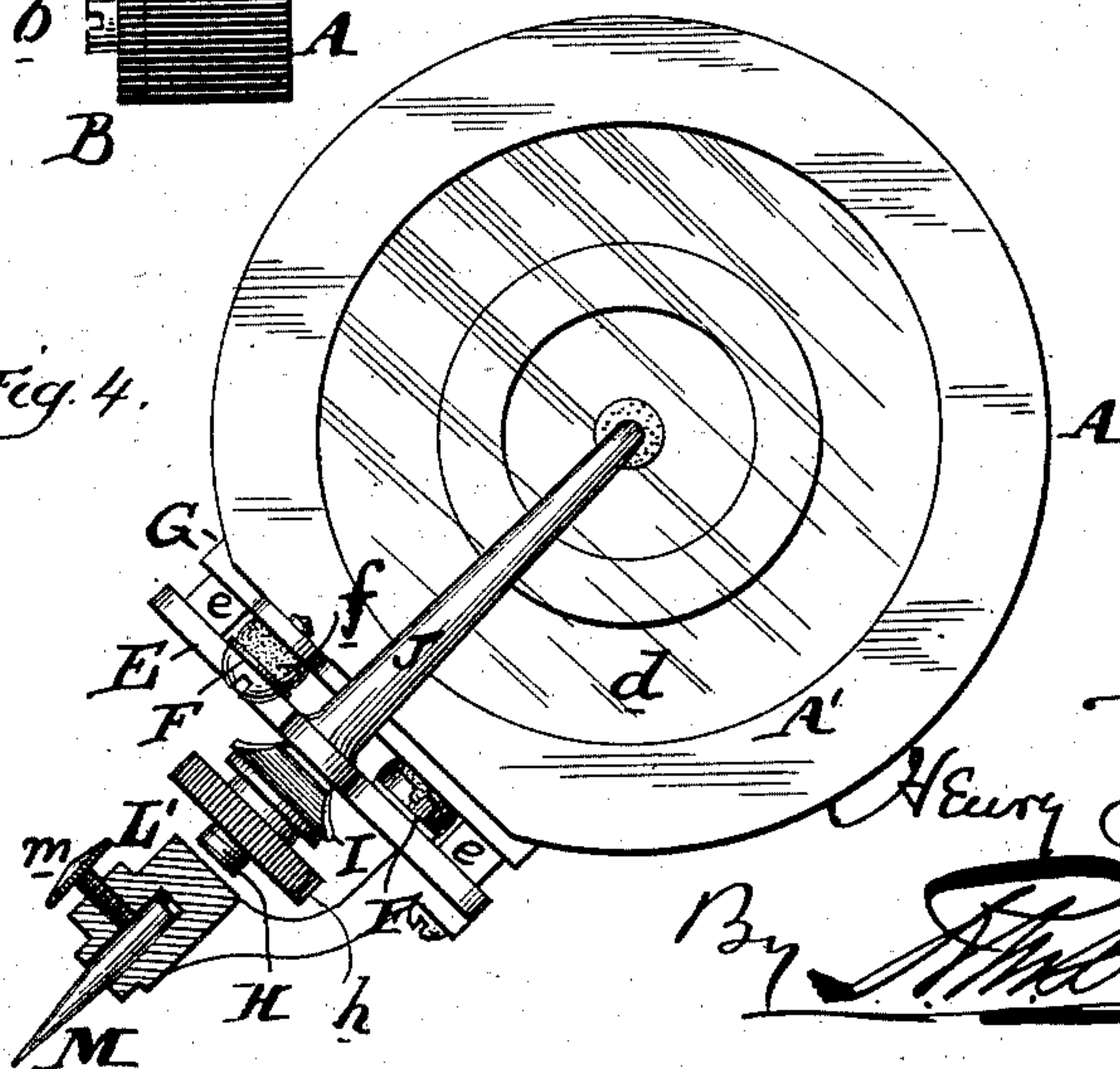
*Fig. 2.*



*Fig. 3.*



*Fig. 4.*



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## SOUND RECORDING AND REPRODUCING MACHINE.

SPECIFICATION forming part of Letters Patent No. 750,460, dated January 26, 1904.

Application filed December 7, 1900. Serial No. 39,031. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY JONES, of the city and county of Philadelphia, State of Pennsylvania, have invented an Improvement in Sound Recording and Reproducing Machines, of which the following is a specification.

My invention has reference to sound recording and reproducing machines; and it consists of certain improvements which are fully set forth in the following specification, and shown in the accompanying drawings, which form a part thereof.

My invention more specifically relates to that portion of sound recording and reproducing machines known as the "sound-box," and comprehends certain improvements therein for more perfectly securing accurate records and also for producing the proper vibrations from the previously-prepared record to secure the perfect reproduction of articulate sounds, of music, &c., with the avoidance of the metallic or scratchy sounds which are so common in instruments of this class and which materially interfere with the articulation.

In carrying out my invention I provide a sound-box of a suitable construction whereby the diaphragm may be readily inserted and removed without bending it and at the same time maintaining it of a diameter equal to the full internal diameter of the box. I further support the diaphragm upon elastic cushions without bending or springing it out of shape and connect it to the stylus-lever by a suitable wax or other plastic connection. The stylus-lever is pivoted at one end of the box in such a manner that its fulcrum is in alinement with the plane of the diaphragm and is supported in such position by means of adjustable spring connections. The free end of the lever is bent over in such a manner as to bring the stylus also into alinement with the plane of the diaphragm, whereby the stylus, the diaphragm, and the pivot-points of the stylus-lever are in the same plane common with the diaphragm, so that any vibration of the diaphragm will cause the vibrations of the stylus to be in exact accordance with those of the center of the diaphragm, according to whether the instru-

ment is used for recording or reproducing. In addition to the spring-supports for the stylus-lever above mentioned an additional adjustable spring is employed for varying the tension put upon the stylus-lever to regulate its response to movement, the said spring being readily adjustable independently of the other two balance-springs which hold the stylus-lever in its normal position upon the sound-box.

My invention also comprehends other details, all of which will be better understood by reference to the drawings, in which—

Figure 1 is a front elevation of a sound-box for recording embodying my invention. Fig. 2 is a sectional elevation of same. Fig. 3 is a plan view of same, and Fig. 4 is an elevation similar to Fig. 1 of a modification of my improvements more especially adapted for reproducing sounds.

A is the sound-box proper and consists of a circular body having an inwardly-directed flange A' of considerable depth.

D D are two cushions, of tubular rubber, fitted to the interior circular walls of the box A and supporting between them the diaphragm *d*, of mica or other suitable flexible material, which has a diameter substantially equal to the internal diameter of the box A.

B is the back plate and is secured to the box A by means of the screws *b*. When the plate B is removed, the rubber cushions D and the diaphragm *d* may be inserted into the box A from the back without in any manner springing or weakening the diaphragm, and the pressure of the plate B upon the rubber cushions D holds the diaphragm normally in central position.

C is the tubular extension to which the horn is attached and is screwed into the back plate B and locked in position by a lock-nut C', whereby its inner end may be adjusted nearer to or farther from the diaphragm *d*, as desired. The interior of this tube C is provided with a conical aperture *c*, which may be smaller at the end adjacent to the diaphragm *d* than at the other end. The extent of the opening of the tube adjacent to the diaphragm may be



varied to suit different records. For example, in those adapted to produce heavy sounds the aperture *e* should be smaller than in those cases where light delicate sounds are to be reproduced. This tube is readily removable and when desired may be replaced by another having a different-sized aperture. Furthermore, it may be adjusted to or from the diaphragm to increase or decrease the sound.

10 J is the stylus-lever and is connected at one end with a plate E, extending back over the sound-box and provided with knife-edges *e e* at considerable distance apart, which act as fulcrum by rocking upon the fulcrum-plate G, attached to the sound-box. These fulcrum are so arranged as to be in alinement with a plane through the diaphragm *d*.

F F are two springs secured to the stylus-plate E and projecting in opposite directions and having their free ends held down under the action of adjusting-screws F', which pass through the springs and into extensions of the fulcrum-plate. Rubber cushions *f* may be interposed between the springs F and the fulcrum-plate and surrounding the screws F' for more perfectly securing the proper adjustment and preventing any possibility of rattling of the springs in connection with the adjusting-screws. The lever J is provided with an inwardly-directed stud *j*, provided, if desired, with an enlarged head which is brought close to the diaphragm, and said stud is secured thereon by wax or other plastic compound. In the case of a recording sound-box the stylus-lever J is extended beyond the stud *j*, as indicated at J', and the free end is turned inward below the sound-box, as at J<sup>2</sup>, and provided on said end with a stylus-socket L, having a clamping-screw *m* for holding the stylus M, the proportions of the parts being such that the stylus is also in alinement with the plane passing through the diaphragm D. It will now be seen that any vibration imparted to the diaphragm will cause the stylus to swing to the right or left in exact accordance with the vibrations of said diaphragm at its central part, and the extent of these vibrations to one side or the other will be precisely in accordance with what they should be to correspond to the vibrations necessary to the diaphragm. When this instrument is employed to record sound, the records so produced will be of precisely the character, which will in turn when operating with a sound-box of the same general character, but for producing sounds, produce exact counterparts of the sounds which were employed in making the record. These constructions therefore are especially advantageous in use in connection with records adapted for gramophones. Having once adjusted the springs F for normal work, it is undesirable to tamper with them when adjusting the sound-box for records of soft or loud tones. To provide an additional means for ready adjustment for

more positively or firmly holding the stylus against vibration, or vice versa, I provide a leaf-spring I, the free ends of which press upon the stylus-lever plate E on opposite sides of the fulcrum *e*, so as to force said fulcrum more firmly upon their supports and to secure a greater spring resistance to the oscillation of the plate in either direction. The spring I is held in place by a stud H, projecting from the sound-box and having thereon an adjusting-nut *h*, adapted to be screwed down upon the central portion of the spring I, so as to vary its tension. The stud H passes through a large hole in the plate E and does not interfere with its vibrations. It will be understood that by means of this additional adjusting-spring a greater or less adjustment may be secured for the stylus-lever J, whereby a greater or less power exerted thereon by the diaphragm is required to operate the stylus. It will also be observed that the action of this spring I, as well as the springs F, is to apply a spring action upon each side of the fulcrum *e*, so as to properly balance the stylus-lever. While the adjustments of the springs F are independent and must be made with judgment, so as to cause the stud *j* to take its proper position relatively to the diaphragm *d*, the adjustment of the spring I is much more simple and may be secured readily without fear of disturbing the preliminary adjustment made with the springs F.

While I prefer to use the rubber cushions *f*, surrounding the adjusting-screws F', the said cushions may be dispensed with, if so desired.

The extension J' of the stylus-lever is made flat and may be guided between two knife-edged pins K K on the sound-box to stop any lateral movement of the lever, this being intended for use in the particular construction employed for recording, because the length of the stylus-lever between its fulcrum-point and the stylus-point is much greater than in the case of the stylus-lever when employed for reproducing sounds.

The general construction of my sound-box when employed for reproducing sounds is the same as that above described; but in this case the box is preferably turned around and the stylus-clamp L' directly connected with the plate E, as shown in Fig. 4. In the first case the stylus-lever was a lever of the third order, while in the latter case the stylus-lever is a lever of the first order; but otherwise the construction is precisely the same, and the stylus-point or knife-edge *e* and the diaphragm all lie in the same plane, so as to secure the same relative action of the diaphragm upon the stylus or the stylus-point upon the diaphragm.

By the construction herein shown, in which the box A has the inwardly-directed flange A' on its open end and a removable back plate B the diaphragm *d* may be of the largest size possible with a given box and be readily in-



serted without injuring it. Furthermore, the circular rubber cushion D upon the open side of the box is well shielded and protected against any possible accidental displacement, (which was not the case with my previous sound-box, shown, for example, in my patent No. 628, 813, of July 11, 1899). The construction here described is simple and inexpensive and at the same time secures the best relative arrangement and adjustment of the parts for accomplishing the desired results.

While I prefer the construction shown, I do not limit myself to the minor details thereof, as they may be modified in various ways without departing from the spirit of the invention.

What I claim as new, and desire to secure by Letters Patent, is as follows:

1. In a sound recording and reproducing machine, a sound-box having a circular interior an inwardly-directed flange at its outer end and open at its inner end, combined with a diaphragm having a diameter approximately equal to the internal diameter of the box, circular rubber cushions arranged upon each side of the diaphragm close to its periphery and inclosed within the circular box, a stylus-lever adapted to be operated by the diaphragm and having fulcrum pivoted to the sound-box in alinement with the plane of the diaphragm-springs projecting upon each side of the fulcrum for holding the same down to their seats and producing an elastic resistance to the movement of the stylus-lever in either direction, a stylus-point detachably secured to the stylus-lever and arranged in the same plane with the diaphragm and fulcrum of the stylus-lever, and guiding knife-edges K, K for holding the stylus-lever against vibrations in a direction parallel with the plane of the diaphragm.

2. In a sound recording and reproducing machine, a sound-box having a circular interior an inwardly-directed flange at its outer end and open at its inner end, combined with a diaphragm having a diameter approximately equal to the internal diameter of the box, circular rubber cushions arranged upon each side of the diaphragm close to its periphery and inclosed within the circular box, a stylus-lever adapted to be operated by the diaphragm and having fulcrum pivoted to the sound-box in alinement with the plane of the diaphragm, springs projecting upon each side of the fulcrum for holding the same down to their seats and producing an elastic resistance to the movement of the stylus-lever in either direction, and an additional adjusting-spring acting upon the structure carrying the stylus-lever on opposite sides of the plane through the diaphragm and fulcrum, and an adjusting device to vary the tension on both ends of the springs simultaneously.

3. In a sound recording and reproducing machine, a sound-box containing a diaphragm,

combined with a rearwardly-extending tubular part having a conical interior with the smallest end adjacent to the diaphragm, means for adjusting and locking the said tubular extension in definite position upon the sound-box whereby the inner end thereof is brought nearer to or farther from the diaphragm but at all times held out of contact therewith, and a suitably-arranged stylus and lever adapted to be operated by the diaphragm.

4. In a sound recording and reproducing machine, a sound-box case having a diaphragm and a back plate, a stylus-lever and stylus adapted to be operated by the diaphragm, and a detachable rearwardly-extending cylindrical part having a conical aperture in which the smallest end of the aperture is adjacent to the diaphragm and the inner end of the cylindrical part projects beyond the inner face of the back plate of the case.

5. In a sound recording and reproducing machine, a sound-box having a diaphragm, a stylus-lever and stylus adapted to be operated by the diaphragm, springs carried by the stylus-lever plate and extending upon opposite sides of a plane through the pivots, adjusting-screws extending through the free ends of the springs for attaching them to the sound-box or an extension thereof, and an adjustable spring device having extensions acting upon the fulcrum-lever plate upon each side of a plane through the fulcrum whereby an increased or decreased resistance may be exerted simultaneously to oppose to a more or less degree a movement of the stylus-lever in either direction.

6. In a sound recording and reproducing machine, a sound-box having a diaphragm, a stylus-lever and stylus adapted to be operated by the diaphragm, springs carried by the stylus-lever plate and extending upon opposite sides of a plane through the pivots, adjusting-screws extending through the free ends of the springs for attaching them to the sound-box or an extension thereof, and a common adjustable spring device having extensions acting upon the fulcrum-lever plate upon each side of a plane through the fulcrum whereby an increased or decreased resistance may be exerted simultaneously to oppose to a more or less degree a movement of the stylus-lever in either direction, said spring devices consisting of a leaf-spring I having its ends resting upon the stylus-lever plate, a vertical stud H carried by the sound-box and screw-threaded, and an adjustable nut h adapted to the stud and operating upon the middle portion of the leaf-spring.

7. In a sound recording and reproducing machine, the combination of a sound-box having a diaphragm, with a stylus-lever J connecting with the diaphragm and provided with a plate E having pivots e e, springs F, F, projecting in opposite directions from the plate E



and a plane through the fulcra-pivots parallel to the diaphragm, adjusting-screws  $F'$  for varying the tension of said springs, and rubber cushions  $f$  surrounding the adjusting-screws  $F'$  and adapted to receive the spring  $f$ .

8. In a sound recording and reproducing machine, a sound-box having a diaphragm, combined with a stylus-lever extending transversely across the open end of the sound-box and connecting with the central part of the diaphragm and having one end pivoted to the sound-box in the plane of the diaphragm and having the other end provided with a stylus-point also in the plane of the diaphragm.

9. In a sound recording and reproducing machine, a sound-box having a diaphragm, combined with a stylus-lever extending transversely across the open end of the sound-box and connecting with the central part of the diaphragm and having one end pivoted to the sound-box in the plane of the diaphragm and having the other end provided with a stylus-point also in the plane of the diaphragm, spring devices for holding the pivoted end of

the stylus-lever to the sound-box, and guides  $K, K$ , for holding the opposite end of the stylus-lever against vibration in a direction parallel to the plane of the diaphragm.

10. In a sound recording and reproducing machine, the combination of a sound-box having a diaphragm, with a stylus-lever structure pivoted to the sound-box at widely-separated places by fulcra-pivots arranged in the plane of the diaphragm a bow or leaf spring  $I$  having its ends acting upon the stylus-lever structure on opposite sides of the pivot-points and plane of the diaphragm, a stud  $H$  carried by the sound-box, and an adjusting-nut  $h$  on said stud acting on the central portion of the spring  $I$  for varying the resistance to movement of the stylus-lever in either direction.

In testimony of which invention I have hereunto set my hand.

HENRY JONES.

Witnesses:

ERNEST HOWARD HUNTER,  
J. W. KENWORTHY.