

(No Model.)

3 Sheets—Sheet 1.

J. W. MACKINTOSH.  
PHONOGRAPH.

No. 503,610.

Patented Aug. 22, 1893.

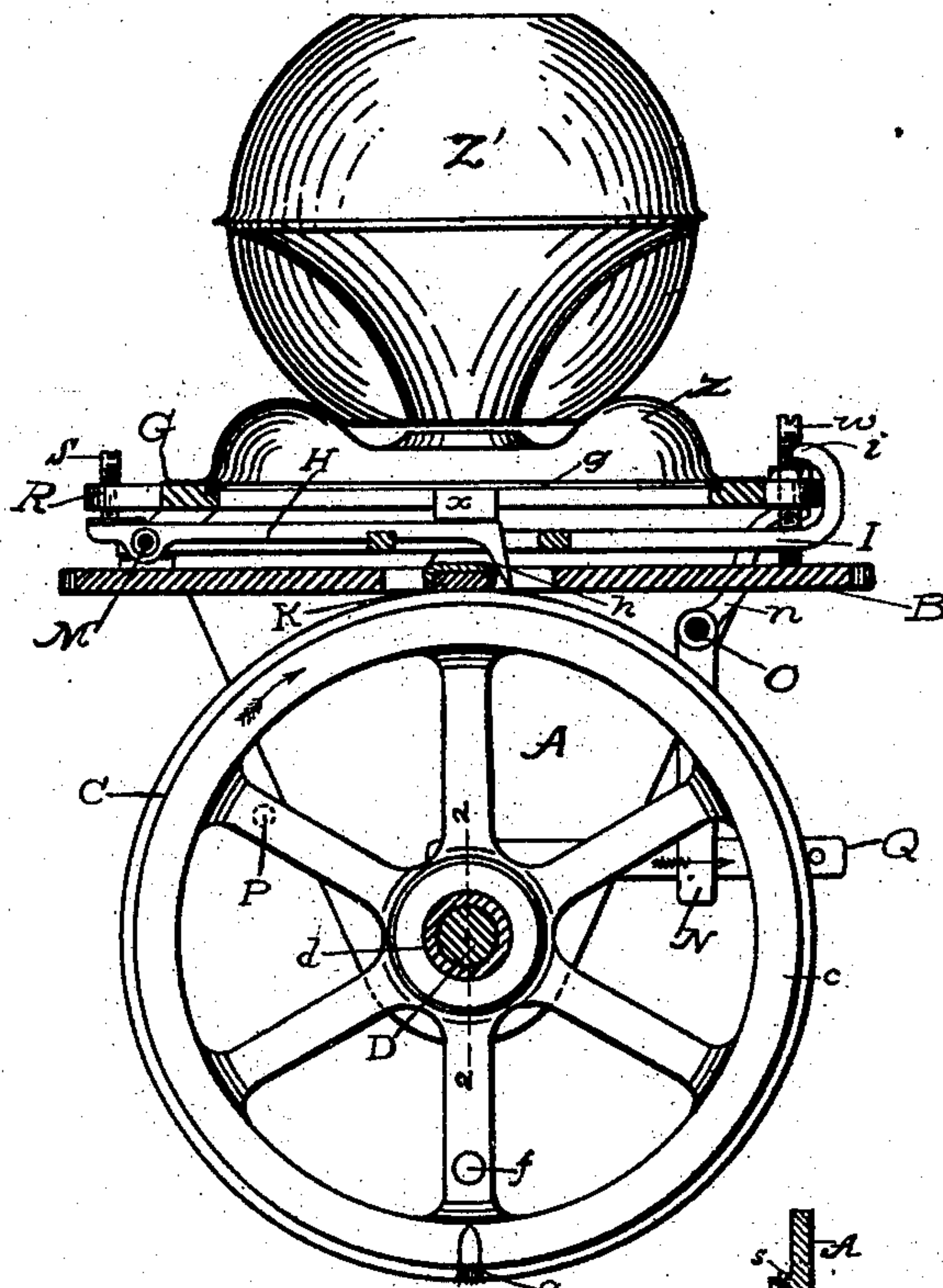


Fig. 1.

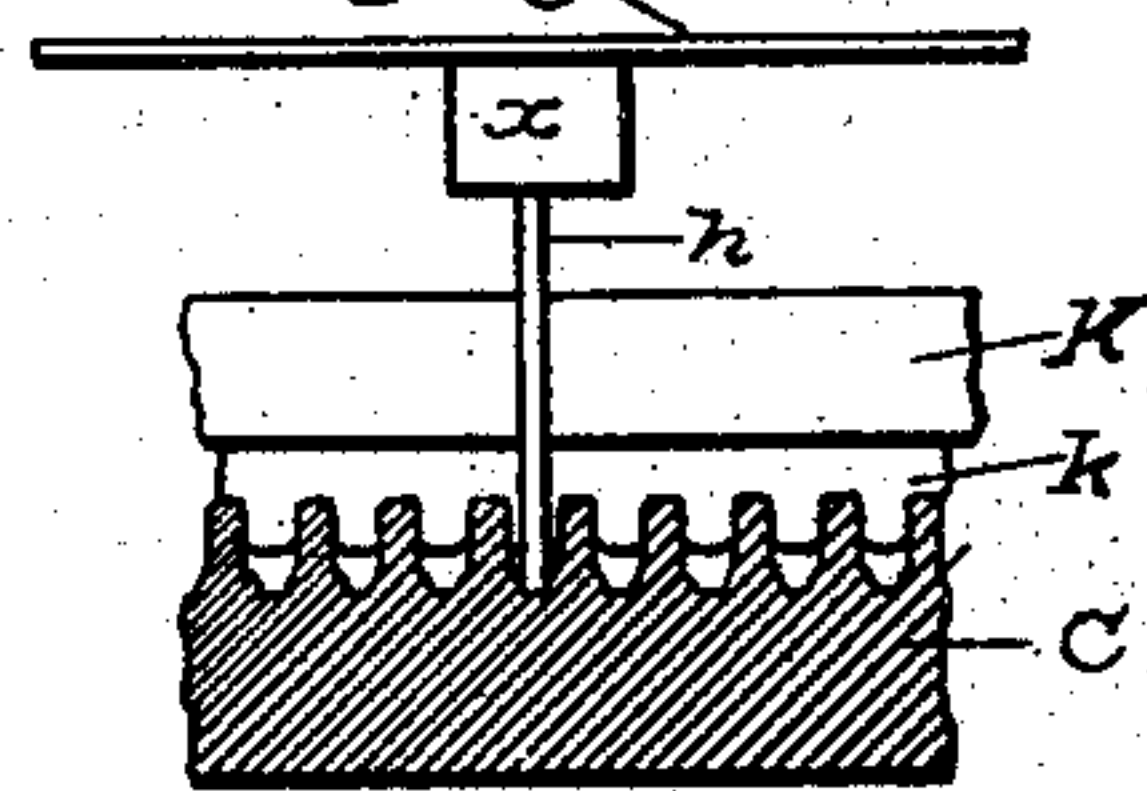


Fig. 3.

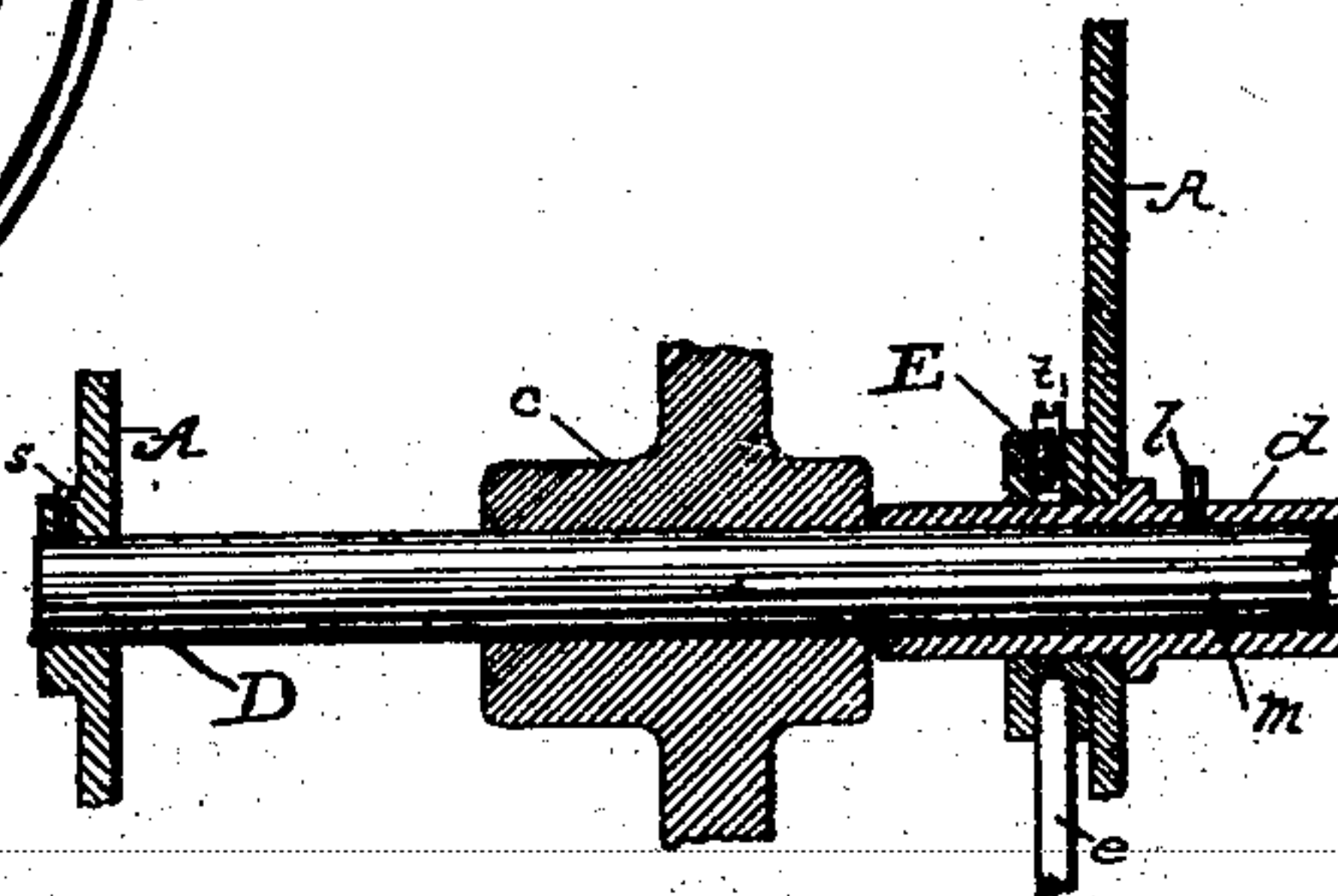


Fig. 4.

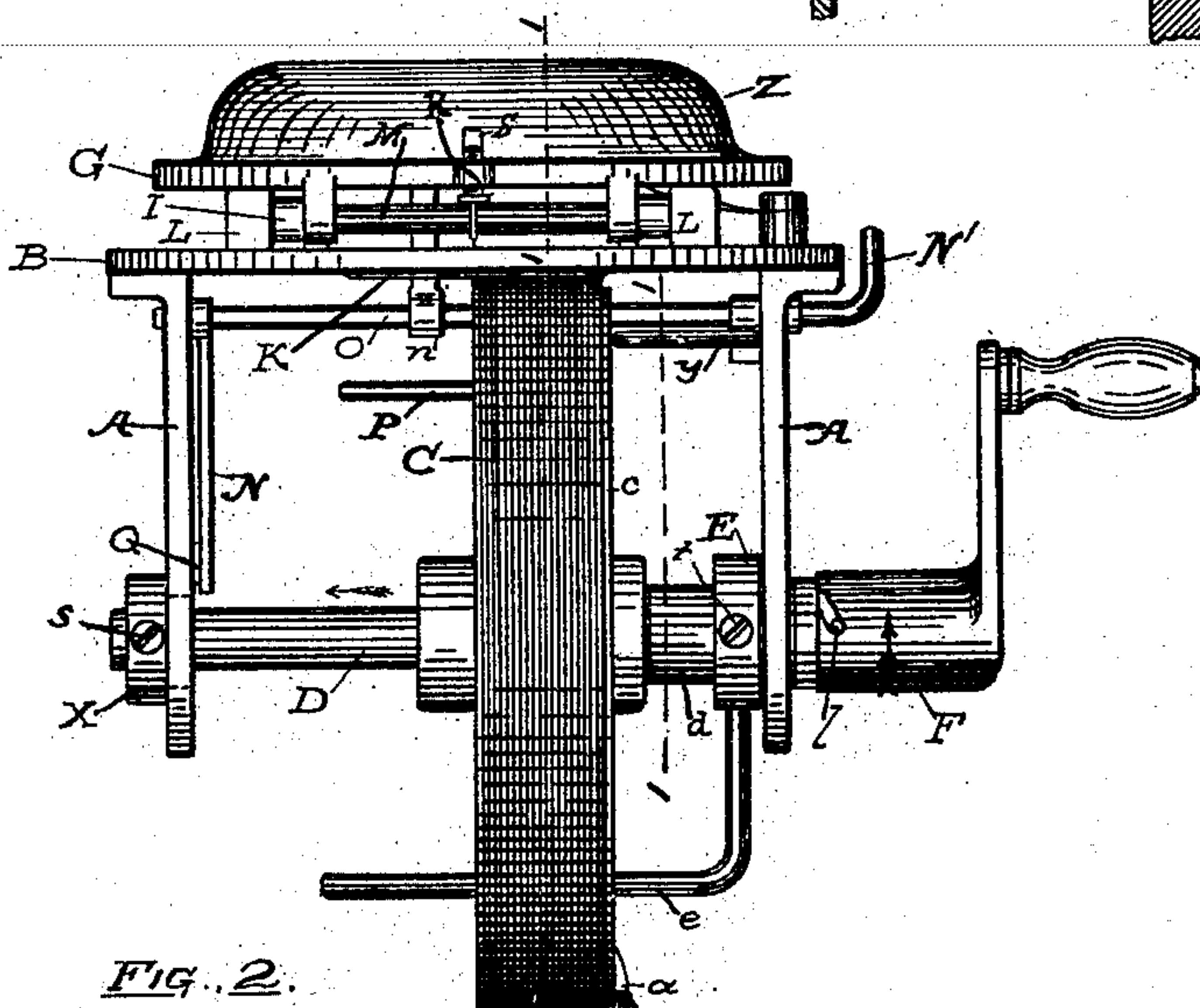


Fig. 2.

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(No Model.)

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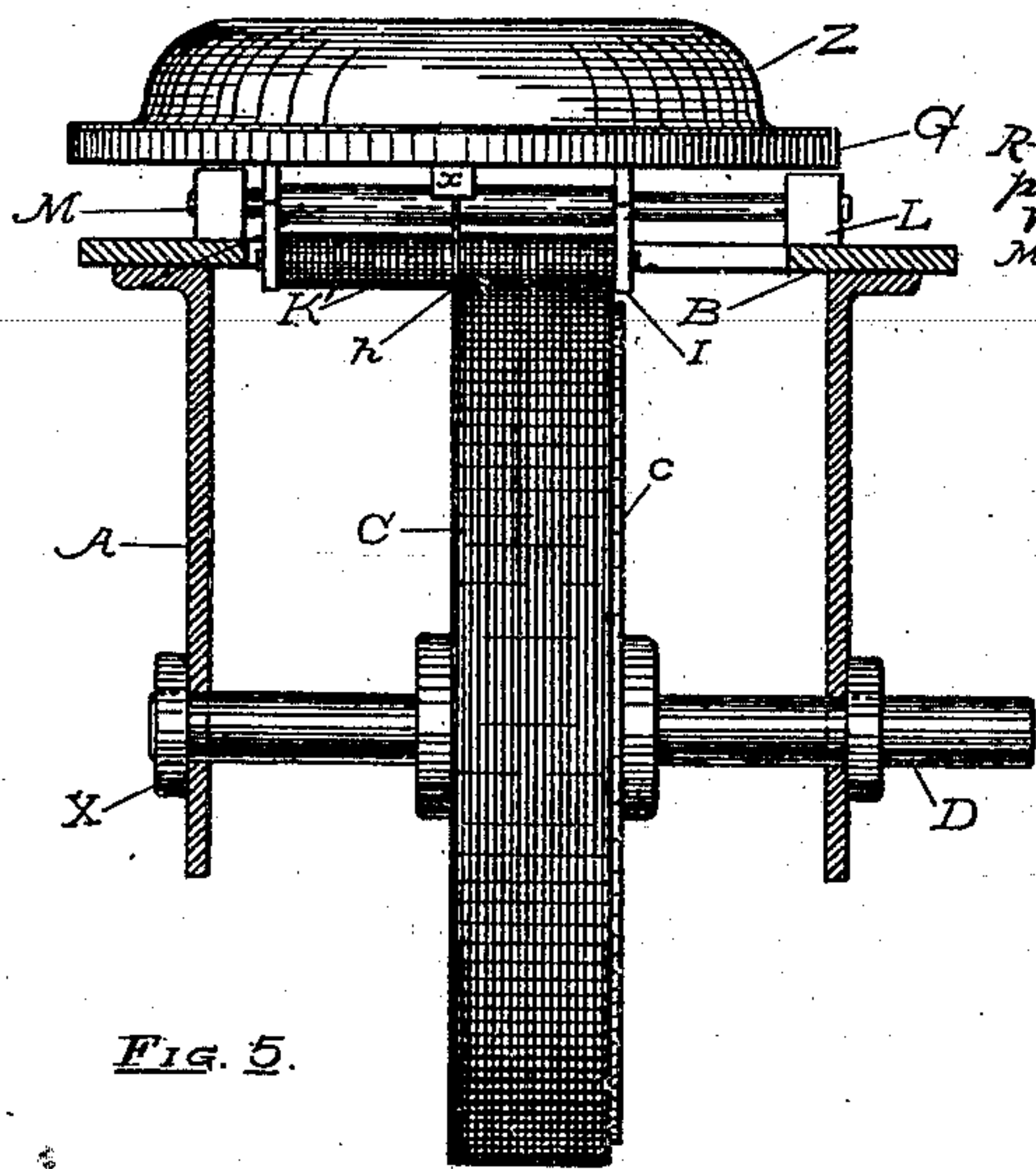


Fig. 5.

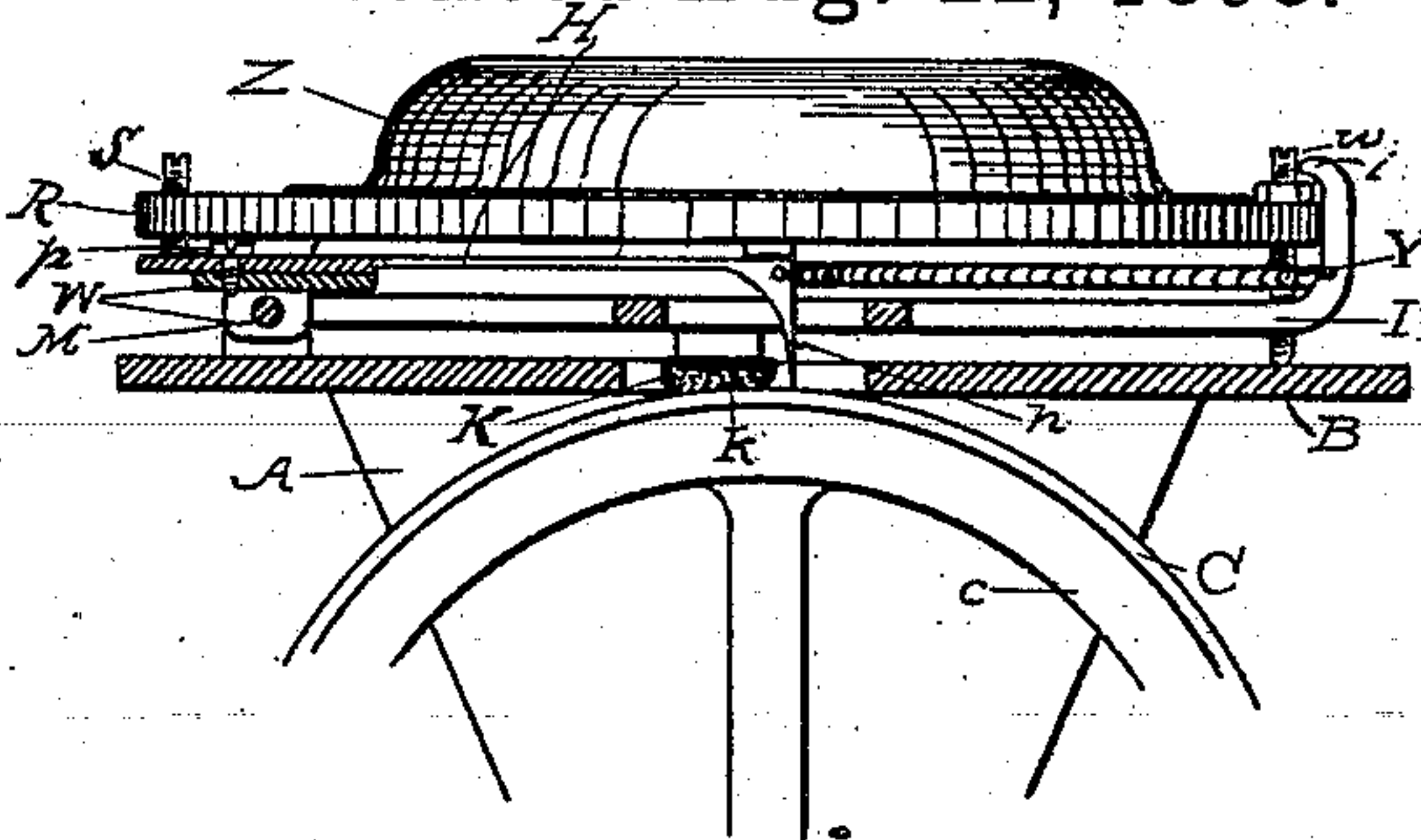


Fig. 6.

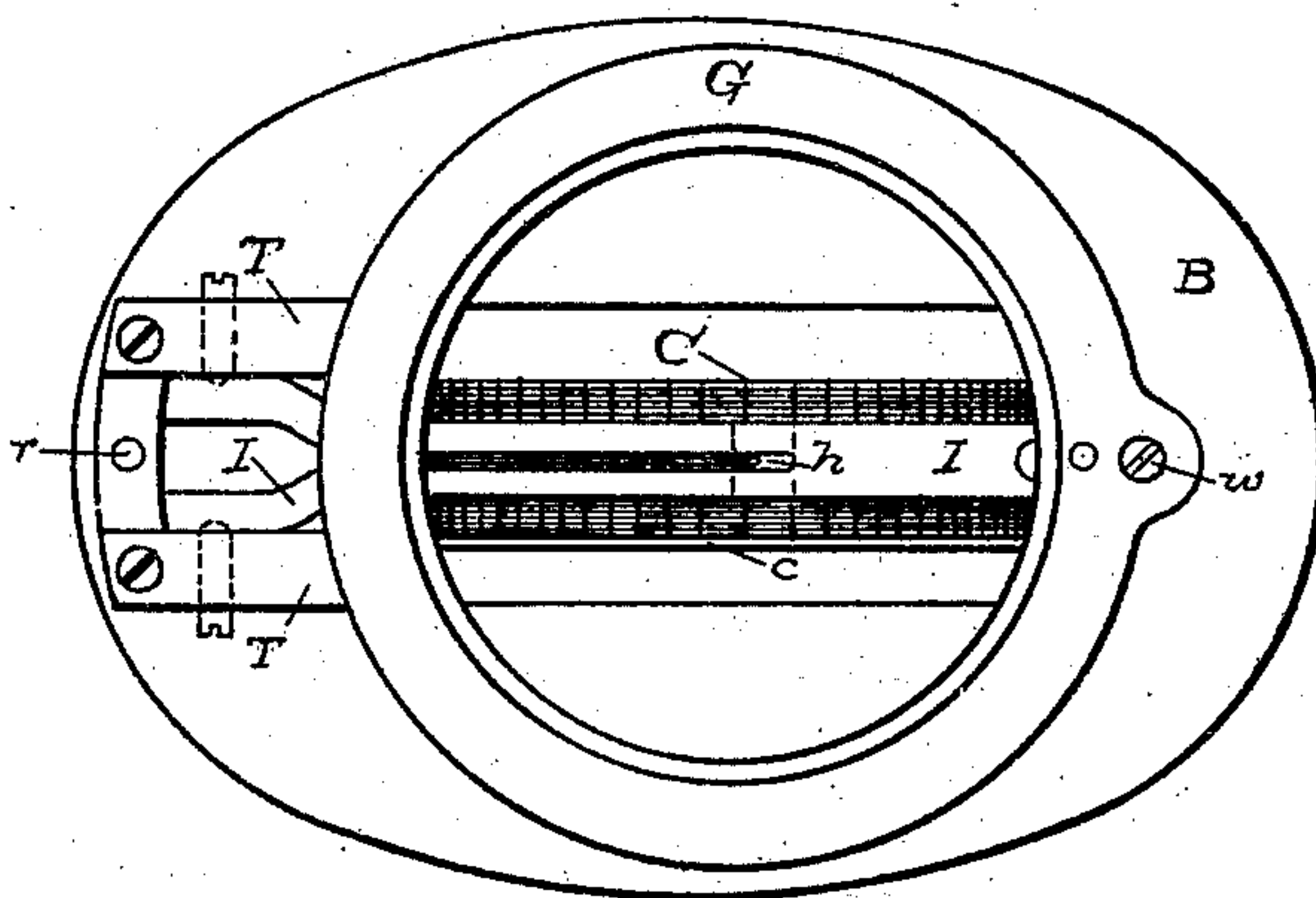


Fig. 8.

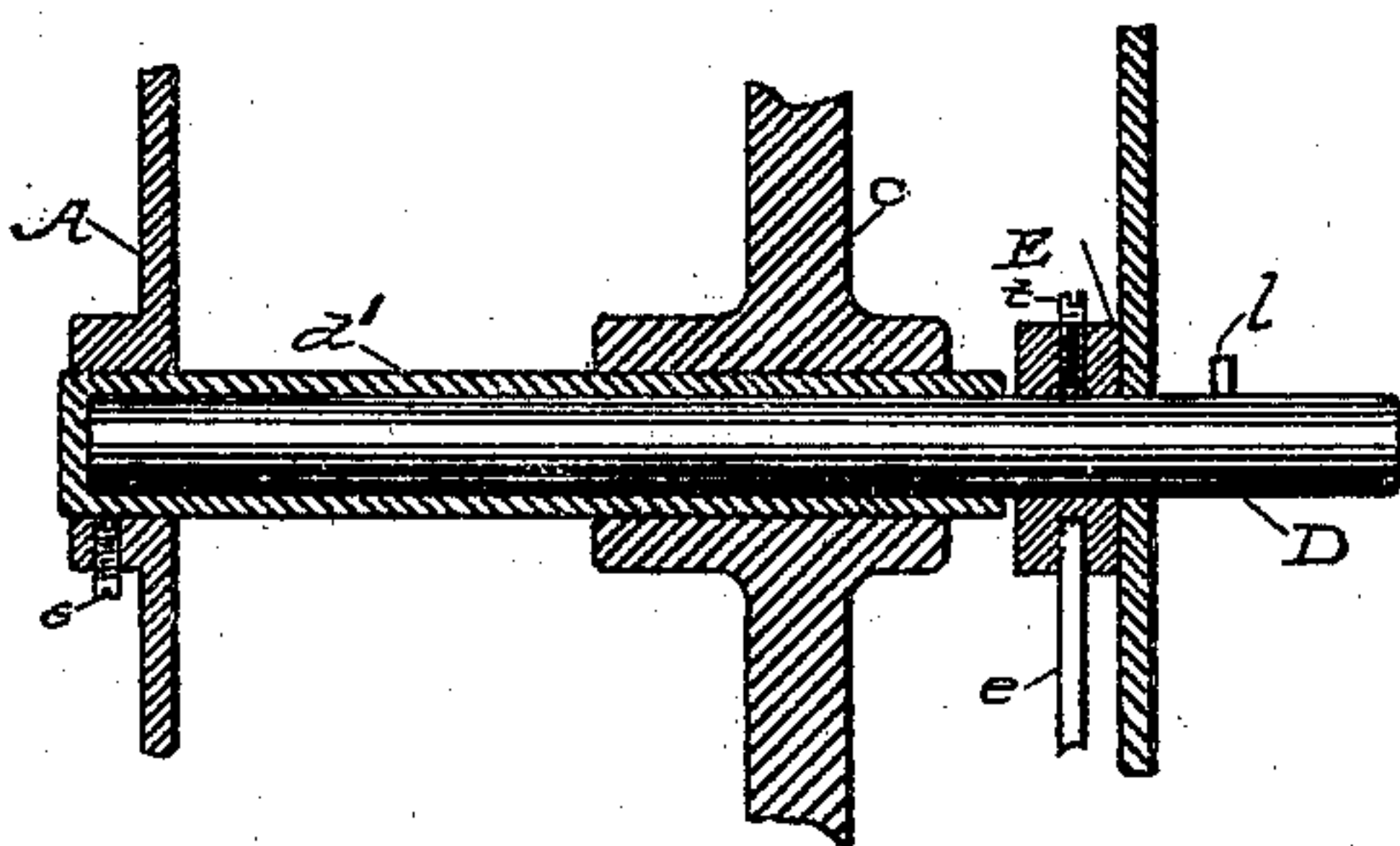


Fig. 9.

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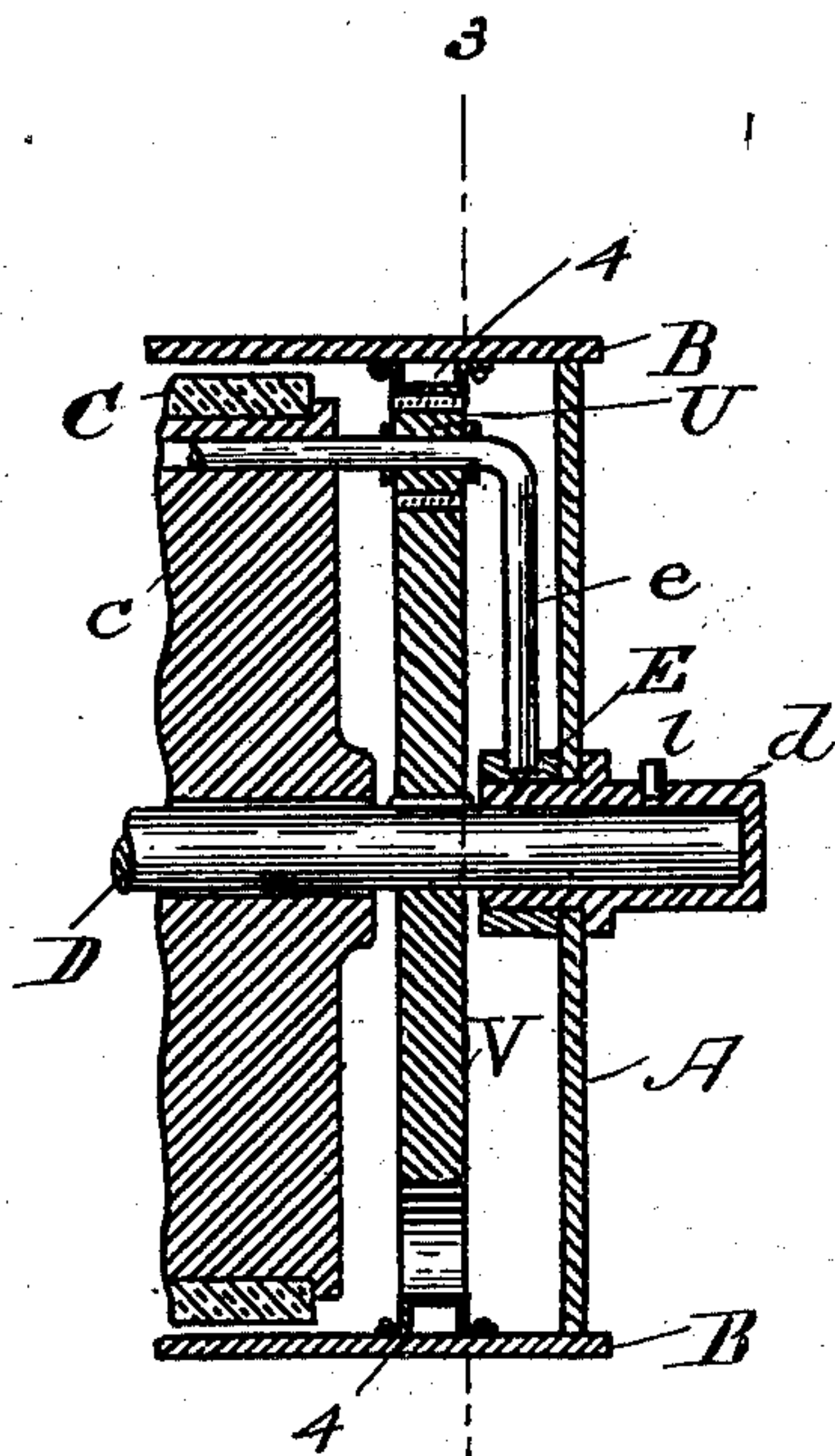


Fig. 7.

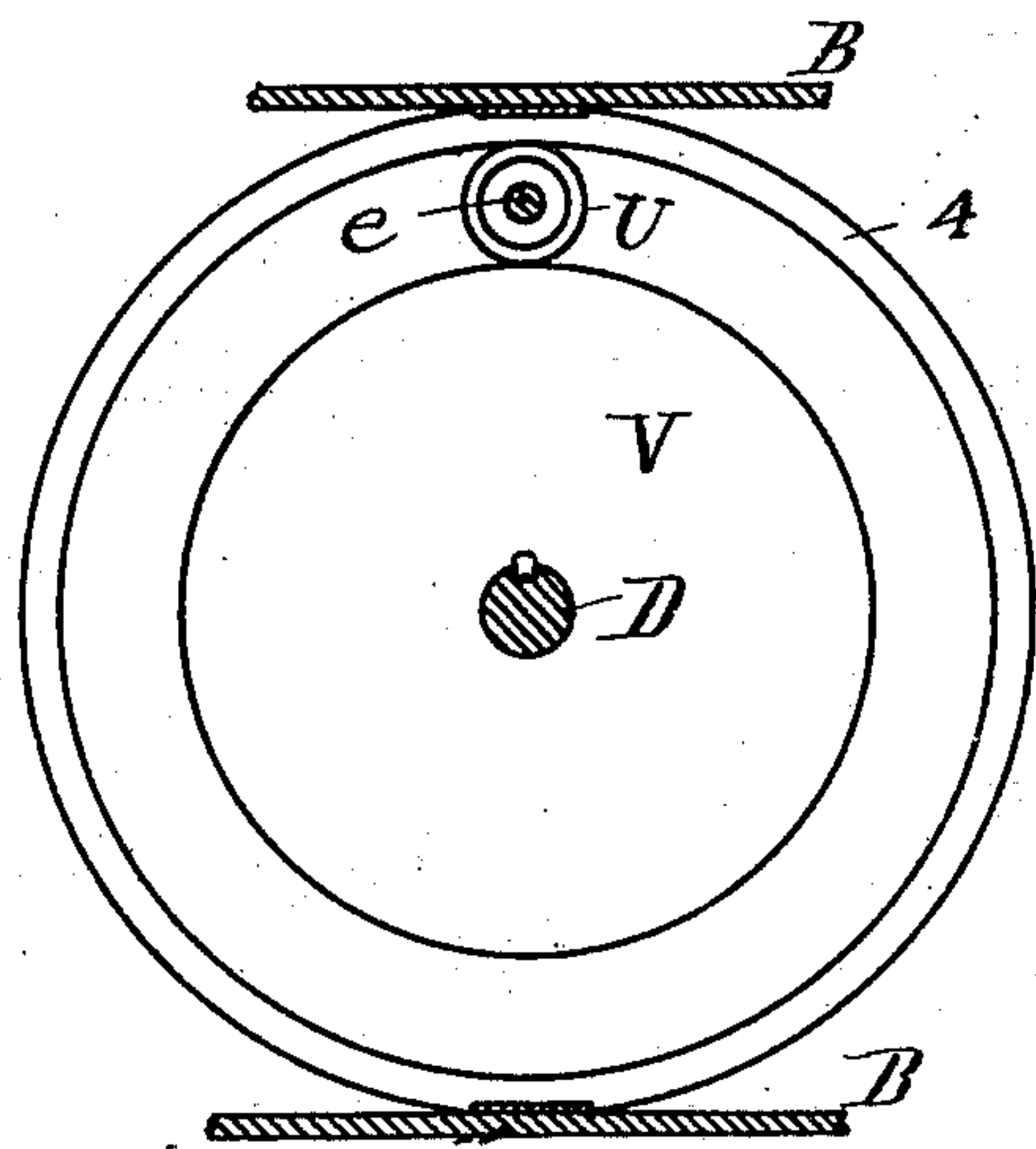


Fig. 7a.

WITNESSES  
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# UNITED STATES PATENT OFFICE.

JOHN W. MACKINTOSH, OF BROOKLINE, MASSACHUSETTS.

## PHONOGRAPH.

SPECIFICATION forming part of Letters Patent No. 503,610, dated August 22, 1893.

Application filed September 6, 1892. Serial No. 445,202. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN W. MACKINTOSH, of Brookline, in the county of Norfolk and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Phonographs, of which the following description, in connection with the accompanying drawings, is a specification.

My invention relates to the simplification of the instrument known as the phonograph for the purpose of making it commercially available not only as to cost, but also as to durability and ease of manipulation, particularly when used in dolls or other images to reproduce speech or other familiar sounds.

Heretofore in the construction of machines of this kind there has been difficulty in so accurately adjusting the reproducing stylus with relation to the line of indentations representing the sound-vibrations upon the record-plate, as to insure perfect coincidence between the point of the stylus and such line of indentations upon each successive return of the stylus to the beginning of the record; also, on account of the shallowness of the depression along the line of such indentations, there has been the constant liability to imperfect operation in the reproduction of sounds by reason of the stylus running upon the space between the lines of indentations on the record-plate or partially upon such space, or of jumping across such space from one part of the line to another, thus leaving a portion of the indentations untouched by the stylus and causing a discontinuous or broken reproduction of the recorded sound waves; and this difficulty was greatly increased by even slight abrasions of the surface of the record-plate, or by accidental dents or scratches therein. One of the chief reasons why the reproducing stylus could not be adjusted and controlled so as to drop upon the record of sound-vibrations in perfect alignment with its line of indentations at the beginning of each successive repetition was, because the operation of traversing the record-plate with the stylus was effected by devices which acted upon parts of the machine other than the record surface itself, and one feature of my invention consists in employing the ridges which define the spiral groove in the record-plate, in conjunction with a feeding device which engages with said ridges,

to cause the stylus to traverse the record formed in the bottom of said groove, and in order to make said ridges more enduring, I preferably, make the record plate or cylinder of a metal such, for instance, as an alloy of tin, or other material more enduring than wax, which has heretofore been largely used for record plates. I also prefer to cut said groove in a ring or disk which may be readily removed or replaced in the phonograph. By cutting such a groove in a metal or other enduring phonogram-blank and making the record in the bottom thereof several advantages are gained over prior constructions, namely: the record is better protected from injury by the ridges which define the continuous groove, the reproducing stylus is directed to the record and guided thereon with almost absolute certainty; the tops of the ridges are so narrow that the stylus will not rest thereon and at the same time the upper portion of the said ridges can be utilized as a means for causing the reproducing stylus to traverse the record.

I have found that when it is desired to slide a rotating cylinder longitudinally upon its axle or shaft, it is accomplished much more easily when the axle is still, or has a rotation in the same direction, but of different speed from that of the cylinder, than when the two are rotated at the same speed and in the same direction. Another feature of my invention is therefore to clamp the axle firmly to the frame of the machine, and turn the phonogram cylinder thereon by an interlocking arm of independent driving mechanism, which may be supported upon the same axle; or, to support and move the said cylinder upon a stationary sleeve, within which may turn one end of the shaft that carries the driving mechanism. The stationary axle is a benefit in the operation, however the cylinder is rotated thereon, or however it is caused to move longitudinally thereof, for it will be found advantageous even when the phonograph cylinder is caused to slide longitudinally of its axle by means of the feed-block applied to a screw thread cut upon the hub of the cylinder as in some of the prior constructions.

It will be readily understood that the diaphragm, the reproducing stylus and the feed-block may be caused to move from side to



side and thus traverse the stylus across the record, by lengthening the pintle on which they are all pivoted, and holding the deeply grooved cylinder rigidly upon the shaft by which it is rotated.

Another though minor improvement is the use of a small brush, preferably attached to the cylinder at the edge at which the record is finished to clean the stylus when it leaves the record and a rod to act as a scraper to clean said brush, as hereinafter described.

Referring to the drawings in which I have illustrated the embodiment of my improvements in specific form, Figure 1, is a vertical section of all parts of the apparatus excepting the cylinder, on lines 1—1 Fig. 2, and viewed from the right hand side of said Fig. 2. Fig. 2, is an elevation of the apparatus viewed from the left hand side of Fig. 1 with the globular resonating chamber removed. Fig. 3, is a greatly enlarged view of a portion of the grooved record-plate or ring, the feed-block and stylus, the record-plate being in section. Fig. 4, is a vertical section of the shaft and immediately surrounding parts on line 2—2 Fig. 1. Fig. 5, is an elevation of the cylinder and feed-block, the latter in the form of a small cylinder or roll, and the lengthened pintle on which the diaphragm-holder, &c., may slide. Fig. 6, is an elevation of a portion of the machine, with a portion of the frame, the feed-block arm and stylus arm, in section, showing the stylus arm pivoted on a vertical pivot to permit an independent movement in a horizontal plane. Fig. 7, is a sectional view of the cylinder and a simple construction for giving the shaft a motion different from that of the cylinder by means of friction disks. Fig. 7<sup>a</sup> is a vertical section on line 3—3 Fig. 7, showing a side elevation of the friction disks to give the shaft a different motion from that of the cylinder. Fig. 8, is a plan view, of the diaphragm-holder, feed-block and stylus arm, pivoted upon a supplemental vertical pivot, permitting them all to swing in an arc in a horizontal plane over the record. Fig. 9, is a vertical section of the parts of the machine immediately surrounding the shaft, showing the stationary sleeve on which the cylinder may slide and be rotated, and within which the shaft may turn.

In designating the several parts of the machine the same letters or figures are used in each view.

A are the two side portions of the frame of the apparatus which support the shaft or axle for the cylinder and driving mechanism; B the top part of the frame upon which the diaphragm-holder, the arm of the reproducing stylus and of the feeding-device are pivoted; C the grooved record surface or phonogram.

c is the phonogram cylinder.

D is the shaft or axle upon which the cylinder is supported and rotated; E the driving disk, which interlocks with the cylinder c by

a hole *f* in one of its spokes and causes it to rotate upon its axle.

F is the crank or key by which the driving mechanism is turned.

As illustrated in Figs. 2 and 4 the driving disk E is secured to a sleeve *d*, by a set-screw *t*, which sleeve is turned by the engagement of the key F with a projecting pin *l*, (see Fig. 2.) In this construction the sleeve *d* turns upon the shaft D which is held in a fixed position by the screw *s*, and through the disk E and its arm *e* the cylinder *c*, is turned upon that shaft. In the construction shown in Fig. 9 the cylinder *c*, is supported upon a sleeve *d'* within which the shaft D turns, the disk E being secured directly to the shaft by the set screw *t*. In this arrangement the phonograph cylinder is rotated and slides upon the sleeve instead of upon the shaft.

In Figs. 7 and 7<sup>a</sup>, U is a small disk which turns upon the arm *e*, and V is a large disk keyed to the shaft D. A ring 4, attached to the frame of the apparatus, surrounds the two disks, and is of such a size as to hold the disk U closely between its inner surface and the disk V; thus as the arm *e* is turned, in the operation of turning the cylinder *c*, the disk U will move with said arm, and will be rotated thereon by the frictional contact of said disk with the ring 4, and by the contact of the disk U, with the disk V, the latter will also be caused to rotate and with it the shaft D, in the same direction, in the construction shown, but at a different speed from that at which the cylinder *c* turns. The shaft may be given a different speed of rotation in the opposite direction, and serve the desired purpose. The disk U may be covered with india-rubber to increase the friction between it and the disk V and ring 4. Gears may be used in place of friction disks, but the latter are preferable as they are practically noiseless.

G is the diaphragm-holder or frame; *g*, the diaphragm.

H is the stylus arm, *h*, the reproducing stylus.

I, is the arm or lever which supports the feeding-device or feed-block K, provided with a raw-hide covering *k*.

L, are the lugs secured to the top B of the frame of the machine, and in which the ends of the pintle M, have bearings; the diaphragm-holder, the stylus-arm and feed-block lever, all being pivoted upon that pintle.

N is a lever pivoted to one of the side pieces A and by the operation of which the diaphragm-holder is raised. In order to have this raising lever act more uniformly upon the diaphragm-holder, its pivot O may be extended across the space between the two parts A and the upper portion *n* of the raising-lever secured to the said pivot at a position as nearly in line with the stylus-arm as the other parts of the apparatus will permit.

Upon the cylinder *c* is a projecting finger P (see Fig. 2) and when the cylinder is re-



involved, as indicated by the arrow, Fig. 1, and advanced longitudinally upon its axle, as indicated by arrow Fig. 2, in reproducing the recorded sound waves, this finger will strike the lower end of the lever N and move it, as indicated by arrow Fig. 1, thus causing the other end *n* to raise one side of diaphragm-holder, turning it upon the pintle M at the other side. The lever N, is prevented from being thrown too far outward by the friction of a spring Q. In a piece R which projects from the diaphragm-holder beyond the pintle M is a screw S, which will strike upon the projecting rear end of the stylus-arm when the diaphragm-holder is raised by the lever N as described. And by adjusting this screw S the relative height to which the stylus will be raised by the action of the diaphragm-holder can be determined. Also by extending the feed-block lever and turning its end over the edge of the diaphragm-holder in a hook *i* the feed-block may be raised from contact with the cylinder by the same upward movement of the diaphragm-holder, but this should occur after the stylus has been disengaged from the record. Thus it will be seen that by the movement of the lever N, in the direction indicated, the diaphragm, the stylus and the feeding-device may be successively raised or moved away from the cylinder and leave it free to slide longitudinally upon its shaft, and by the reverse movement of the lever N which may be effected by the projecting releasing finger N', the feed-block, the stylus and the diaphragm will be successively lowered, but in the reverse order. A small piece of india rubber *x* is attached to the center of the diaphragm and immediately over the stylus, to provide an elastic contact between them, and by means of a screw *w*, at the side of the diaphragm-holder, opposite the pintle on which it tilts, the pressure of the diaphragm upon the stylus may be regulated.

In Fig. 5, is illustrated a construction whereby the diaphragm, its holder, the feed-block and stylus are traversed across the surface of the record cylinder. The pintle M, is lengthened as shown at the right hand side; the feeding-device is in the form of a small cylinder or roll K'; and the cylinder *c*, being securely fastened upon its shaft D, will, when it is rotated to produce the recorded sound vibrations, cause the diaphragm, feed-block, stylus and their connected parts, to move to the right across the face of the cylinder.

As shown in Fig. 8, T is a supplemental frame which supports the diaphragm-holder, the feed-block and the stylus, and which is pivoted to the top portion B of the frame of the apparatus by a vertical pivot *r*, upon which the said supplemental frame T, with the several parts which it supports may be swung across the face of the record cylinder where it is rotated by the action of the interlocking ridges upon the feed-block and the said cylinder.

In Figs. 1 and 2, *a* is a small brush attached

to the edge of the cylinder *c*, near its periphery, in such a position that it will strike across the point of the stylus after it has completely traversed the record surface and passed off the edge of the cylinder. This brushing will clear from the point of the stylus any dust and dirt which it may have scraped from the grooves of the cylinder. And when the cylinder has been returned to its initial position this brush *a*, will be cleaned by striking across the projecting wire *y*, during the first revolutions of the cylinder.

In Fig. 6 is illustrated the construction whereby the stylus has an independent lateral swing, the stylus arm being held by a pivot *p*, in the supporting piece W, which turns upon the pintle M, in the same manner that the stylus-arm does in the constructions previously referred to. Y is a spiral spring with one end attached to the stylus arm opposite to the pivot *p*, and the other end to the hooked portion of the feed-block arm, and by this spring the stylus will be properly held while being cleaned by the brush *a* and also will be started into the record groove in a proper manner.

For the purpose of conveniently oiling the shaft D, it is slightly flattened or grooved for a short distance inward from the end at which the key is applied, as indicated at *m*, Fig. 4.

In Fig. 1, Z' is a resonating chamber and Z a supplemental chamber over the diaphragm.

The construction and arrangement of the shaft D and its supporting parts illustrated in Figs. 1, 2, and 4 will be found very simple and convenient for the purpose of removing and replacing the cylinder *c*, when it is desired to renew or change the record ring, for by loosening the screw *s*, the shaft may be pushed through the sleeve *d*, sufficiently far to allow the cylinder *c* to slip off the end and be turned down upon the horizontal portion of the arm *e*, from which it can be readily removed. When constructed with a sleeve *d'* as shown in Fig. 9, both the screws *s*, and *t*, should be loosened when the cylinder is to be removed.

The form of the ridges and grooves in the record-plate and the feed-block, and the manner in which they are interlocked, is clearly shown in the enlarged view Fig. 3, and will not need further explanation.

I claim—

1. In a phonograph, a stationary cylinder-shaft, a record-cylinder normally free to slide longitudinally thereof and to be rotated thereon, independent mechanism to rotate said cylinder, and external mechanism to engage therewith and cause it to move longitudinally on said shaft, substantially as described.

2. In a phonograph, a record-cylinder and driving-mechanism therefor, a stationary axle upon which both are supported and rotated, and a feeding-device which causes said cylinder to move longitudinally of said axle when rotated thereon substantially as described.

3. In a phonograph, a phonogram-cylinder,



a supporting-shaft, mechanism to move the cylinder longitudinally of its shaft and mechanism for giving the said cylinder and its shaft differential rotary motion for the purpose substantially as described.

4. In a phonograph, a cylinder-shaft, a cylinder which is normally free to slide and to rotate thereon and is provided with a spiral groove of substantial depth upon its periphery, and a record of sound-vibrations within said groove, a feeding-device which engages with the ridges between the cylinder-grooves to control its sliding movement upon the shaft, and driving-mechanism to rotate the cylinder thereon, substantially as described.

5. The combination in a phonograph, of a phonogram-cylinder which has a spiral groove in its periphery, a stationary axle therefor, driving-mechanism to turn the cylinder thereon, and a grooved feeding-device which engages with the grooved surface of the phonogram and gives the cylinder an advancing motion longitudinally upon its axle, substantially as described.

6. In a phonograph, a phonogram-cylinder, a supporting-shaft upon which it is normally free to slide longitudinally, a feeding-device independent of the stylus, and mechanism to cause it automatically to engage with the grooved periphery of the phonogram whenever the reproducing stylus is in contact with the record thereon, substantially as described.

7. In a phonograph, having a diaphragm for reproducing sound-waves, a cylinder which carries a phonogram provided with a spiral-groove with a record of sound-vibrations in the bottom thereof, a ribbed feeding-device held between the said diaphragm and cylinder and adapted to engage with or be disengaged from the ridges on the said cylinder, and a reproducing-stylus normally held in a position with relation to the ribbed feeding-device which will locate the point of the stylus and the apex of one rib of the said feeding-device in a single plane which is perpendicular to the diaphragm, substantially as described.

8. In a phonograph for reproducing sound-vibrations a diaphragm held in a hinged frame, a reproducing point attached to a pivoted lever and supported thereby between the phonogram and the diaphragm, but unattached to the latter; a ribbed feed-block which co-operates with ridges upon the phonogram and an automatically operated disengaging lever by which the diaphragm-frame is first raised and the reproducing point and feed-block are successively disengaged from the phonogram, when it is to be returned to its initial position, substantially as described.

9. In a phonograph, a record-plate provided with a continuous groove of substantial depth in its surface and a record of sound-vibrations in the bottom of said groove, a stylus which substantially fits the record portion of the groove and an independent feeding-de-

vice which engages with the tops of the ridges which define the groove and thereby causes a traversing motion between the stylus and record-plate when the phonograph is operated.

10. In a phonograph, a reproducing diaphragm, a phonogram containing a record of sound-vibrations in a groove thereon, and a stylus between said diaphragm and phonogram supported independently of each upon an arm held by a pivot upon which it is adapted to swing in the arc of a circle in a plane parallel to the surface of the diaphragm, substantially as described.

11. In a phonograph, the combination with a phonogram or record of sound-vibrations and a reproducing-stylus, of mechanism which causes the stylus to traverse the said record, and a stylus-cleaning brush which is automatically caused to strike across the point of the said stylus after each complete traversing of the record thereby, substantially as described.

12. In a phonograph, having a record of sound-vibrations and reproducing-stylus, mechanism which causes the stylus to traverse the said record, an automatically operating stylus-cleaning brush and a scraper therefor, substantially as described.

13. In a phonograph, provided with a record-plate containing a record of sound-vibrations in a groove thereon, a reproducing-stylus supported upon an arm held by a pivot upon which it is adapted to swing in the arc of a circle in a plane parallel to the surface of the diaphragm, a stylus-cleaning brush, and a spring to hold the stylus in position for the action of said brush, substantially as described.

14. In a phonograph, the phonogram-cylinder normally free to slide longitudinally of its shaft and provided with a spiral ridge which defines its record groove, and a ribbed feeding-device which has a cylindrically concave contact surface to engage with said spiral ridge and which is supported by pivots which are parallel to its own axis and that of the record cylinder, substantially as described.

15. The combination in a phonograph, of a cylinder provided with a spiral groove upon its record surface, a feeding device provided with a ribbed surface which is the counterpart of a section of the grooved surface of the cylinder and engages therewith, a stationary shaft on which the cylinder may turn and slide, a diaphragm-holder hinged to the phonograph-frame and adapted to be automatically raised by the movement of the said cylinder and thereby successively raise the reproducing stylus and the said feeding-device, substantially as described.

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