No. 761,061. PATENTED MAY 31, 1904.

F. E. COLLINSON.

APPARATUS FOR GRINDING AND POLISHING TORIC LENSES.

APPLICATION FILED OCT. 4, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

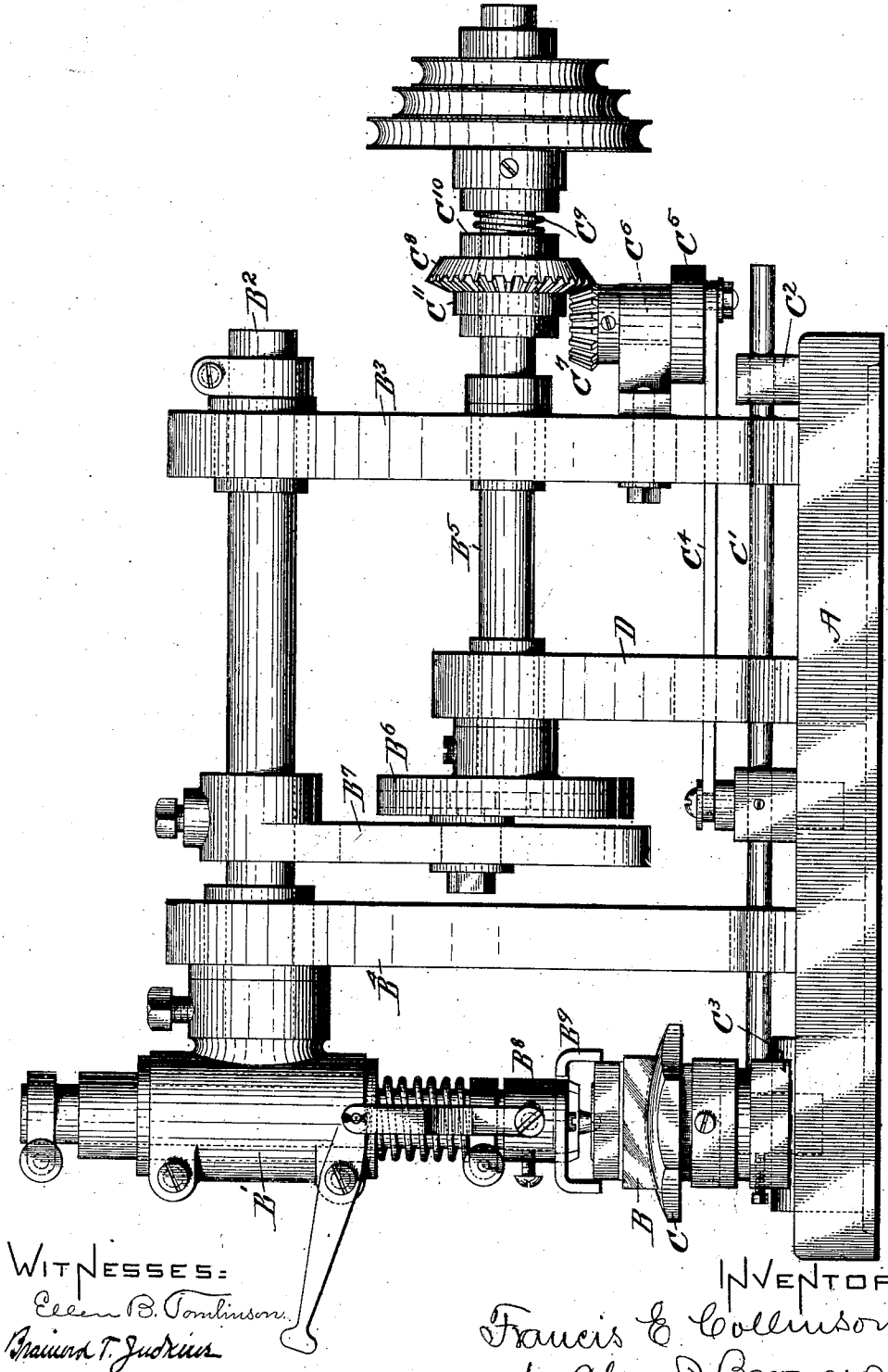


FIG. 1.

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Eleen B. Tomlinson.

Braward T. Judkins

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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NO MODEL. 3 SHEETS—SHEET 2.

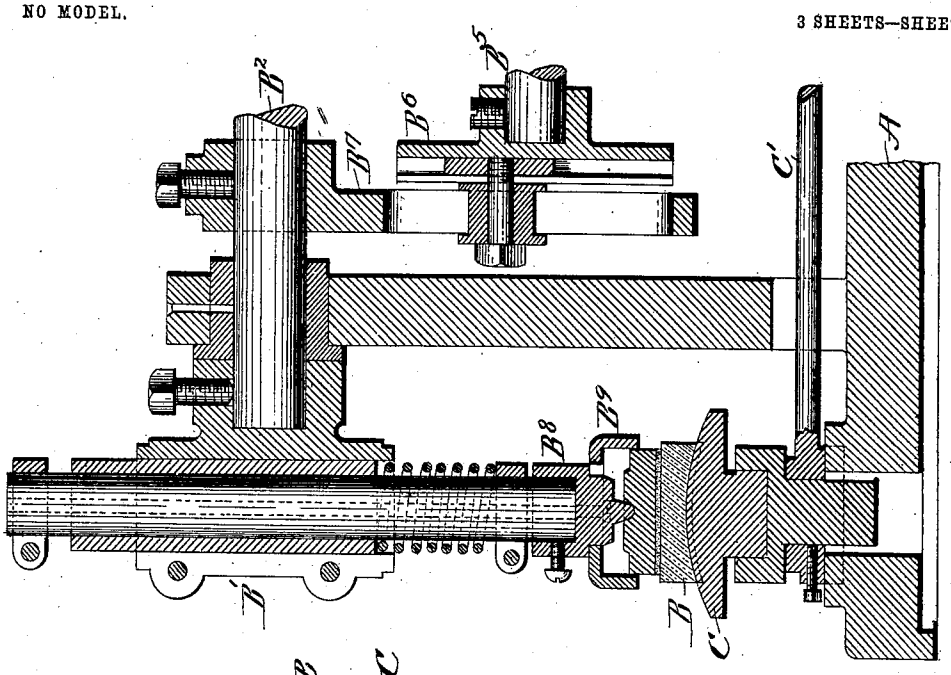


Fig. 4.

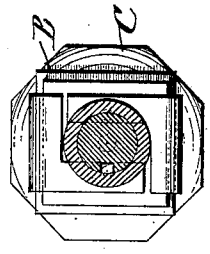


Fig. 3.

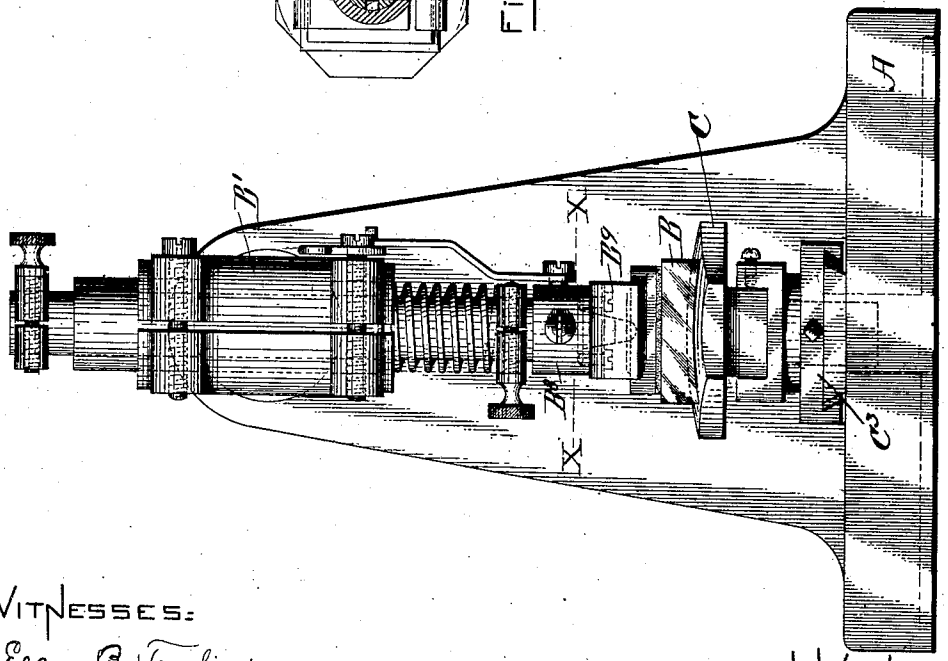


Fig. 2.

WITNESSES:

Eleanor B. Tomlinson.

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NO MODEL. 3 SHEETS—SHEET 3.

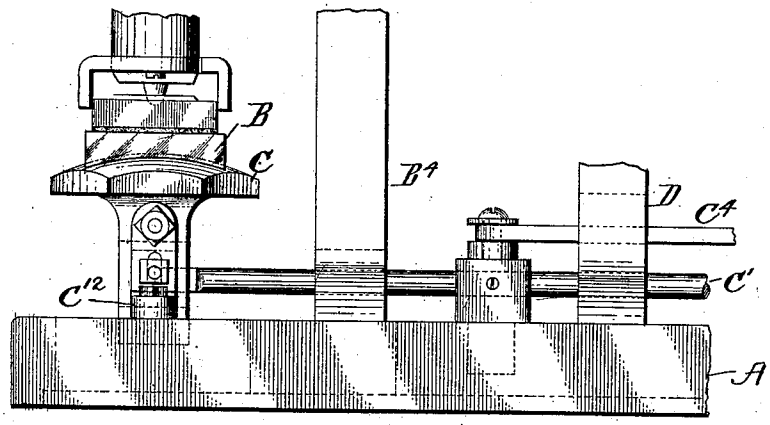


Fig. 5.

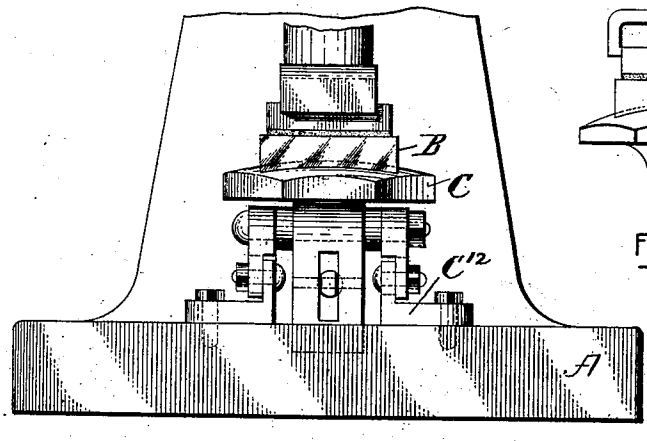


Fig. 6.

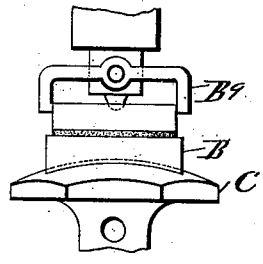


Fig. 7.

WITNESSES:

Ceem B. Tomlinson.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 761,061. Patented May 31, 1904.

UNITED STATES PATENT OFFICE.

FRANCIS E. COLLINSON, OF WAKEFIELD, MASSACHUSETTS.

APPARATUS FOR GRINDING AND POLISHING TORIC LENSES.

SPECIFICATION forming part of Letters Patent No. 761,061, dated May 31, 1904.

Application filed October 4, 1902. Serial No. 125,901. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS E. COLLINSON, a subject of the King of Great Britain, but having declared my intention of becoming a citizen of the United States, and a resident of Wakefield, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Apparatus for Grinding and Polishing Toric Lenses, of which the following is a specification.

In grinding or polishing a lens, whatever be its character, it is necessary to place the piece of glass to be treated, which I will hereinafter speak of as the "work," in rubbing contact with a properly-shaped tool and to establish a relative motion between the tool and the work. In the case of a spherical lens this relative motion may include both translation and orientation; but in the case of a lens having a definite axis or axes orientation is not permissible. I have found that in polishing a lens if the relative motion between the work and the tool be of a periodic type fine lines will be discernible upon the surface of the finished lens, due to and indicating the periodic character of the motion.

My present invention relates to improvements in methods and means of automatically grinding and polishing cylindrical or toric lenses, whereby the relative motion between the work and the tool shall be arbitrary, as distinguished from periodic, in character, while at the same time being entirely free from orientation.

By "periodic" motion I have meant such a motion as repeats itself. Thus taking any given point on the tool, if the motion is such as to cause that point to describe a given path on the surface of the work, which I will call a "cycle," and to cause that given point on the tool to retrace the same path or cycle upon the surface of the work, repeating this operation throughout the polishing of the lens, then the tool may be said to have a periodic motion relative to the work. When I have spoken of "orientation" I have referred to a relative turning of the tool and work. Thus if a given straight line be arbitrarily chosen in the tool for purposes of reference and another line be arbitrarily chosen in the work for the same purposes then an orientation of the tool with respect to the work would simply amount to a motion which would change the angle of these two lines of reference with respect to each other.

In polishing spherical lenses mechanically and automatically the tracing of fine lines upon the lens-surface due to any periodic character in the motion of translation may easily be avoided by combining a motion of orientation with such motion of translation; but in the polishing of cylindrical and toric lens-surfaces orientation is not permissible, and therefore some other means must be devised to prevent the formation of these fine lines upon the surface of the finished work. By my present invention I accomplish this by automatically producing what I term an "arbitrarily relative motion of translation of the tool and work without orientation." In the specific embodiment of the invention herein particulary described such arbitrary character of the motion of translation is secured by permitting slip or lost motion to occur between the driving mechanism and the mechanism directly controlling the motion of relative translation of the work and tool.

In the drawings, Figure 1 is a side elevation of a machine embodying my improved apparatus whereby my improved method of grinding may be practiced. Fig. 2 is a view in elevation of the head end thereof. Fig. 3 is a view in section upon the line $x\,x$ of Fig. 2. Fig. 4 is a vertical section transverse to Fig. 2. Figs. 5, 6, and 7 are views of a modification of a portion of the head end of the machine, which will be hereinafter more fully described.

In the drawings, A represents the base or frame of the machine, B the work, and C the tool. The work B is moved by the head B′, attached to the rock-shaft B^2, rocking in bearings in standards B^3 B^4. Rocking motion of this shaft is produced from the main driving-shaft B^5, which turns in the standards B^3 D, by means of the rocker-arm B^7, eccentrically attached to the disk B^6, mounted upon and revolved by the shaft B^5. The range of this rocking motion may be varied by making the point of attachment of B^7 and B^6 more or less

distant from the center of B^6. The work B is glued or otherwise suitably secured to a metal backing-piece, which in turn is loosely and removably attached to the head B′ by means of a spring work-holder B^8, provided with means, such as the fork B^9, for preventing orientation of the work while moving in its normal path. For the same reason the work-holder itself is keyed within a slot in the head B′, (see Fig. 3,) so that the work-holder may move up or down in the head without twisting.

The tool C is formed to correspond to the form of the lens to be produced. It is moved transversely to the path of motion of the work B by means of the sliding rod C′, which is caused to reciprocate in bearing C^2 at one end, while supported and guided by the gibbed block C^3 (see Fig. 2) at the opposite end. Reciprocating sliding motion is imparted to this rod by means of the connecting-rod C^4, mounted eccentrically upon the disk C^5, which in turn is mounted upon the shaft C^6, engaging through the pinion C^7 with the beveled gear C^8 upon the main driving-shaft B^5. If this gear C^8 were tightly mounted upon the shaft B^5, the relative times of the motions of the work and tool would always be the same and periodic motion or relation would result. To prevent this and to have a change in the relative times of these motions occur arbitrarily or at times not predetermined, the gear C^8 is attached to the shaft B^5 only by the pressure of a spring C^9 bearing against a collar C^{10}, connected to the gear C^8, which is free to slide upon the shaft B^5, the spring-pressure thus forcing the gear C^8 into frictional contact with a collar C^{11} upon said shaft B^5. By suitably regulating the spring-pressure, slip between the gear C^8 and the collar C^{11} occurs arbitrarily or at unpredetermined times under the varying pressure between the tool and the work, and thus operates to vary the relative times of the motions of the tool and the work automatically and arbitrarily.

I believe it to be clear that by substituting for the slip connection above described a mutilation of either the gear C^8 or the pinion C^7, or both, a certain change in the relative time of the motions of the tool and work will result; but such change would still occur at predetermined intervals. While these intervals might be sufficiently long to considerably lessen the degree to which the injurious fine lines would be produced upon the surface of the finished work, yet the apparatus would still be periodic and to that extent objectionable and imperfect.

In the modification of the apparatus shown in elevation at Figs. 5, 6, and 7 the sliding motion of the rod C′ is caused to impart a rocking motion to the tool C. This is accomplished by mounting the tool pivotally upon a standard or post C^{12}, secured upon the base A. (See Fig. 6.) By this construction it will be seen that a rocking motion is imparted to the tool, which is transverse to the rocking motion imparted to the work, but that orientation is prevented, as before. Moreover, the relative times of these motions will be still automatically varied by reason of the variation in time of motion of the sliding rod C′.

I claim—

1. In a machine for grinding and polishing a lens having a definite axis or axes, the combination of a tool formed to correspond to the form of the lens to be produced, means for establishing a rubbing contact between this tool and the work, and means for automatically and arbitrarily producing a relative motion of translation between these parts, and at the same time preventing orientation.

2. In a machine for grinding and polishing a lens having a definite axis or axes, means for automatically and simultaneously moving the work and the grinding-tool in transverse paths, and means for automatically and arbitrarily varying the relative times of such motions.

3. In a machine for grinding and polishing a lens having a definite axis or axes, means for automatically and simultaneously moving the work and the grinding-tool in transverse paths, and means for automatically and arbitrarily varying the relative times of such motions through the medium of slip or lost motion as set forth.

In testimony whereof I have hereunto subscribed my name this 1st day of October, 1902.

FRANCIS E. COLLINSON.

Witnesses:

CHARLES C. KURTZ,

ELLEN B. TOMLINSON.