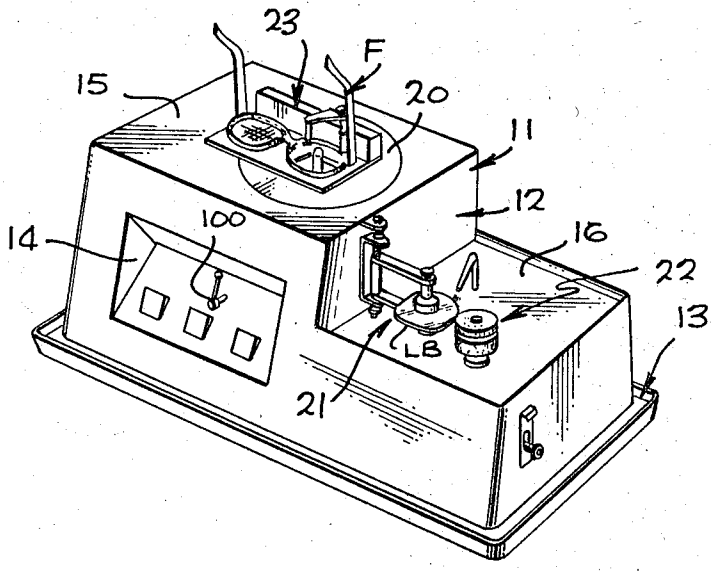
Jan. 19, 1971 E. H. NOVAK 3,555,739

MACHINE FOR SHAPING, SIZING AND FINISHING THE EDGE OF A LENS BLANK

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Fig. 1



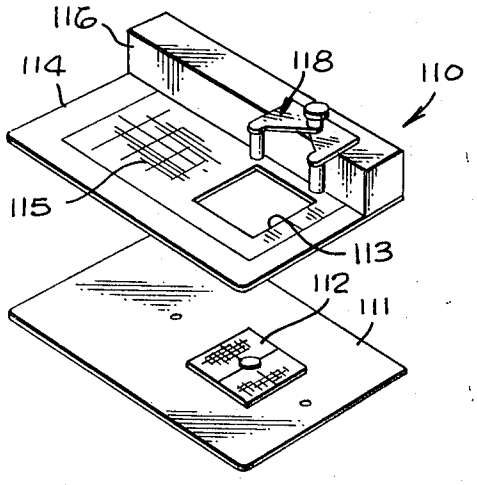
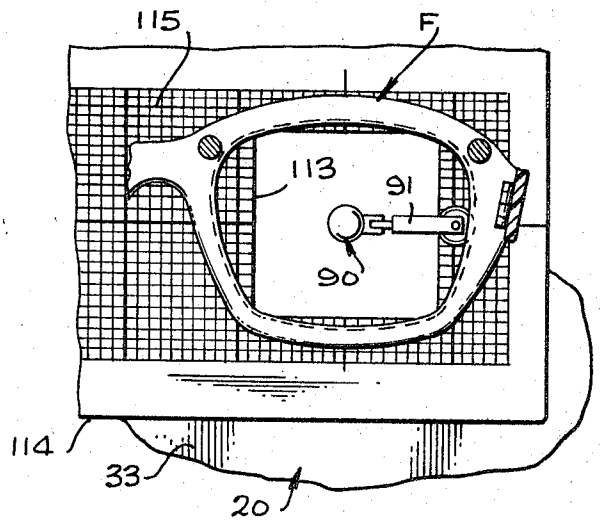


Fig. 2

Fig. 4



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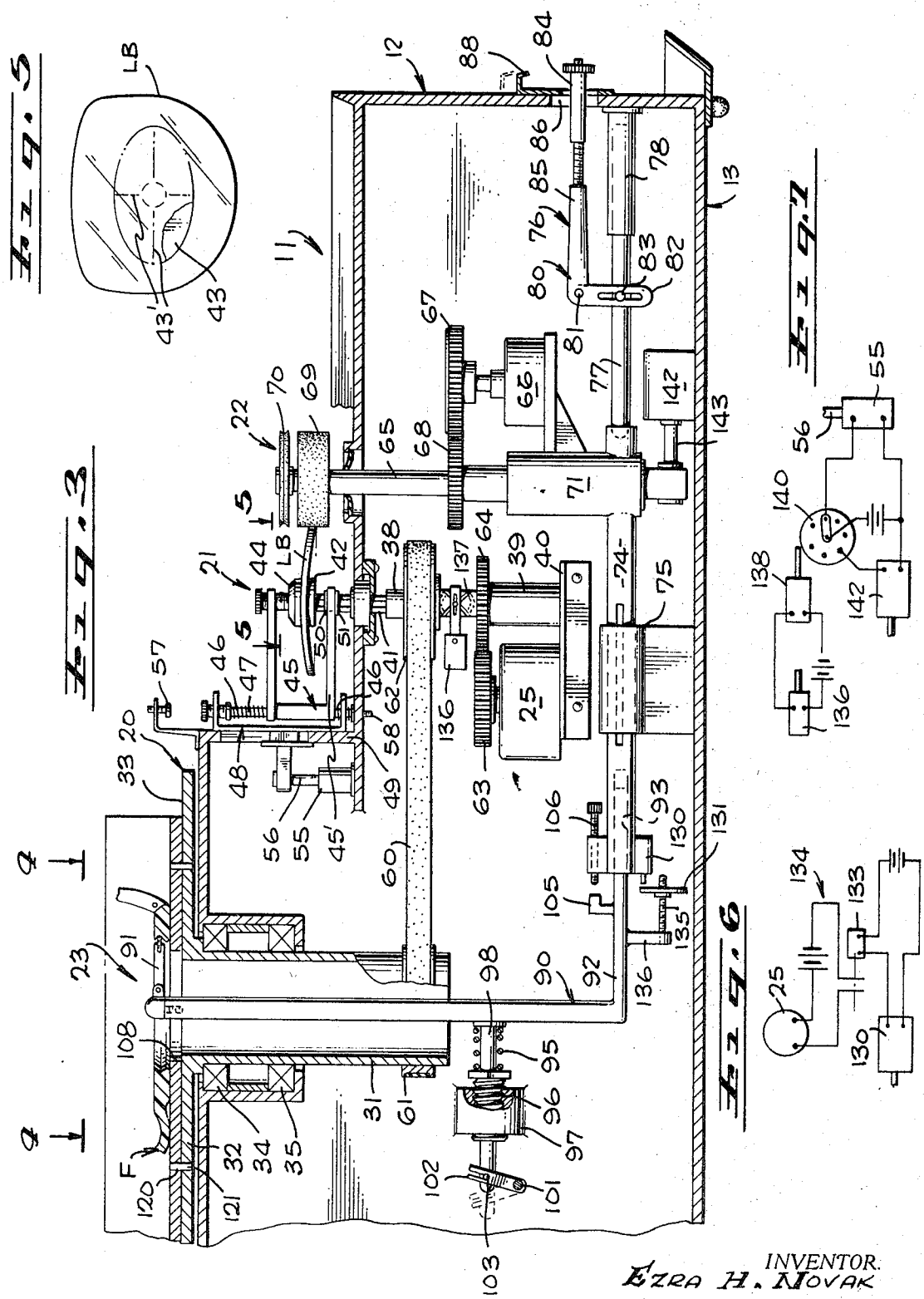


Fig. 5

Fig. 3

Fig. 7

Fig. 6

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MACHINE FOR SHAPING, SIZING AND FINISHING THE EDGE OF A LENS BLANK

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U.S. Cl. 51—101 11 Claims

ABSTRACT OF THE DISCLOSURE

A machine having a rotatable lens blank holder and a rotatable table to accommodate a spectacle frame with motor-driven mechanism for rotating these in synchronism and a motor-driven grinding wheel movable toward and away from the axis of rotation of the holder, a tracing assembly adapted to follow the spectacle frame lens opening and operatively connected to the grinding wheel to limit movement of the latter toward the holder, and means for momentarily operating the motor-driven mechanism for the rotary table and holder upon movement of the grinding wheel toward the holder to a predetermined spacing therefrom.

This invention has to do generally with machines for cutting or grinding to size an optical lens blank and beveling the edge thereof so that it will fit a given spectacle frame.

Heretofore, so far as I know, it has been the practice, in providing lenses for a given spectacle frame, to cut a pattern of the outline of a lens opening of the frame and use such pattern as a guide in grinding or otherwise cutting the optical lens blank to size and shape.

A primary object of the invention is to provide a novel machine in which the lens blank is ground or shaped directly from the spectacle frame by using the frame as a pattern, thereby greatly increasing convenience and eliminating the need for obtaining a pattern or making a special pattern.

A further object is to provide a machine in which the lens blank is ground to size and shape utilizing a tracing means which follows the contour of the spectacle frame together with means responsive thereto for controlling lateral movement of a grinding wheel assembly relative to a lens blank holder. Another object in this connection is to provide such a machine in which predetermined lateral movement of the grinding wheel assembly actuates means for rotating a rotary table on which the spectacle frame is mounted and a lens blank holder in synchronism.

A further object is to provide a novel machine embodying a rotary table on which the spectacle frame can be mounted and a rotatable lens blank holder coupled thereto and adapted to be driven in synchronism therewith together with a frame tracing assembly for following the contour of the lens opening and a grinding wheel assembly which is directly controlled by the frame tracing assembly.

Another object is to provide a novel method and novel apparatus for forming a lens blank to conform to the size and shape of a lens opening of a frame and with its major axes properly oriented with respect to the frame.

A further object is to provide a novel method and novel apparatus for forming a lens blank to conform to the size and shape of a lens opening in a frame and to achieve the correct placement of the optical center of the lens in the position desired by the practitioner.

In summary, the invention comprises a machine having a rotary table on which to place a spectacle frame and rotary lens blank holder which are intermittently rotated in synchronism, a frame tracing means for following the lens opening contour of the spectacle frame and a motor-driven grinding means controlled thereby, together with unique means for coordinating the movement of the grinding means with respect to the position of the tracing means, and novel means for intermittently rotating the table and holder.

These and other objects will be apparent from the drawings and the following description. Referring to the drawings:

FIG. 1 is an isometric view of a machine embodying the invention;

FIG. 2 is an exploded isometric view of a spectacle frame carrier;

FIG. 3 is a vertical longitudinal sectional view through the device of FIG. 1;

FIG. 4 is a fragmentary plan view on line 4—4 of FIG. 3, but on a larger scale;

FIG. 5 is a fragmentary plan view on line 5—5 of FIG. 3; and

FIGS. 6 and 7 are wiring diagrams.

More particularly describing the invention, numeral 11 generally designates the casing of a machine embodying the invention and this includes an upper portion 12 and a base or bottom wall 13. The casing may be of any desired shape but for convenience has been shown as generally rectangular in plan with a recessed front control panel 14, and a stepped upper wall forming an upper deck 15 and a recessed lower deck 16.

In general, the machine comprises a rotary table 20 upon which a spectacle frame F is mounted, a lens blank holder means 21, a grinding wheel assembly 22, and a tracing arm asembly 23. As will later be described in detail, the table 20 and lens blank holder means 21 are connected to be rotated in synchronism and are intermittently momentarily driven by a motor 25. The grinding wheel assembly 22 is mounted for movement toward and away from means 21, which holds the lens blank LB to be shaped, and the tracing arm assembly is mounted for movement radially of the axis of rotation of the table 20 in one plane. Additionally, the two assemblies 22 and 23 are connected so that the position of assembly 23 limits movement of the grinding wheel assembly 22 toward the means 21, thereby effectively controlling cutting of the lens blank.

Referring now more in detail to the parts of the machine, the rotary table 20 comprises a tubular member 31 with an external annular flange or top portion 32 at its upper end providing a table surface 33. Bearings 34 and 35 serve to journal the table.

The lens blank holder means 21 includes a hollow shaft 38 which is journaled in a suitable bearing 39 on a shelf 40 and has an extension 41 which telescopes within shaft 38 and is keyed thereto. The extension 41 supports a lower chuck element 42 which fits the upper end of such shaft and which is provided on its upper surface 43 with major axis lines 43' for orienting a lens blank LB.

An upper chuck element 44 is adjustably carried on a U-bracket 45 that in turn is mounted for limited vertical floating movement between springs 46 on a rod 47 forming part of a carrier bracket 48. The latter is mounted for limited vertical movement on wall 49 of the casing. Bracket 45 has a leg 45' with a bifurcated end to receive the shaft 41 between a collar 50 and a thrust bearing 51 which are fixed to the shaft. An actuator member 55 (which may be one or more solenoids) connected by the means 56 to bracket 48, serves to position the bracket in a selected position, or this may be accomplished manually. Any suitable means may be provided to limit movement of the bracket, such as screws 57 and 58.

The rotary table **20** and shaft **38** are connected to be driven in synchronism at a ratio of 1 to 1 by a cog or toothed belt **60** which extends around gear wheels **61** and **62** fixed to the table and shaft, respectively. Motor **25** drives shaft **38** intermittently through gears **63**, **64**.

The grinding wheel assembly **22** includes a vertical shaft **65** driven by a motor **66** through gears **67** and **68**. The shaft carries a suitable flat edge grinding wheel **69** and a bevel edging wheel **70** designed to be selectively used on the lens blank LB. The shaft **65** is journaled in a pedestal **71**. The latter is fixed to a horizontal bar **74** that is movable through a support **75**.

A weighted lever assembly **76** serves to yieldably urge the grinding wheel assembly to the left (FIG. 3), and this includes a rod **77** fixed to the end of bar **74** which is received in a cylindrical support **78** at its outer end. A bell crank type lever **80** is pivoted at **81** and has a slotted leg **82** to receive a pin **83** of rod **77**. An internally threaded weight **84** is adjustably mounted on the other arm **85** of the lever, which is threaded. The weight extends through an opening **86** in the casing and may be raised by hand and held up with the grinding wheel assembly retracted by means of a two-position apertured plate **88**.

The tracing arm assembly **23** includes an upright post **90** with a hingedly mounted removable tracing finger **91** at its upper end. At its lower end the post has a laterally extending rod section **92** which is received in a bore **93** of bar **74** of the grinding wheel assembly. A spring **95** serves to yieldably urge the tracing arm assembly radially with respect to the axis of rotation of the table **20**, the spring being interposed between an adjustable bushing **96** mounted in a support **97** and the post. The spring is disposed around a guide pin **98** slidable in the bushing. The assembly **23** may be manually retracted by a lever **100** (FIG. 1) fixed to the outer end of a shaft **101** to which is fixed a slotted lever **102** that receives a pin **103** in shaft **98**.

It is a particular feature of the invention that spring **95** be adjusted to exert substantially greater force than that exerted by the weight **84** and that in consequence the tracing finger will faithfully follow the groove of the spectacle frame.

The assemblies **22** and **23**, which are urged toward each other by the weight **84** and spring **95**, are limited in such movement by an adjustable abutment means comprising a stop **105** on rod section **92** and a screw **106** on member **74**.

If desired, a spectacle frame F may be mounted directly upon the rotary table and the lens opening centered with respect to the opening **108** in the table. However, this presents difficulties and I therefore prefer to provide a suitable frame carrier for the purpose. Referring to FIG. 2, I show a frame carrier **110** having a base **111** with a raised grid section **112**. The latter is received in an opening **113** of a grid table **114**. The table also has a grid delineated thereon, designated **115**, as a continuation of that on the base so that when the two parts are combined the frame may be readily positioned to orient the lens opening with respect to the opening in the grid table. An upright wall section **116**, which is preferably movably adjustable, carries an appropriate clamp **118** to secure the spectacle frame in place once it is located. The grid table of the frame carrier is lifted off the base and placed on the rotary table and properly oriented and held by depending pins **120** on the grid table which fit into bores **121** in the rotary table.

The motor **25**, which rotates the rotary table and the lens blank holder, is adapted to be momentarily energized periodically so as to advance or rotate these elements in increments. This may be accomplished in various ways, but, by way of example, a sensing microswitch **130** is used to close the normally open motor circuit when the assemblies **22** and **23** approach each other to the required amount for the particular lens blank to be cut. The switch **130** is shown mounted on bar **74** to be actuated by an adjustable member **131** on rod section **92**. Further, and merely as an example, the switch would control a relay **133** adapted to close the supply circuit **134** of motor **25**. Member **131** has been shown as an internally threaded disk on a threaded rod **135** in a support **136**.

Suitable means may be provided for supplying a liquid coolant and cutting compound to the area of contact between the grinding wheel and the lens blank, but this is not shown since it is well known.

In the operation of the device the spectacle frame, having first been centered and mounted on grid table **114**, is placed in position on the rotary table and the tracing finger adjusted to ride in the groove of the frame. A suitable lens blank LB is placed in position in the chuck means **42**, **44** with its major axes oriented similarly to those of the spectacle frame using axis lines **43'** of the lower chuck element as a guide. Adjustment is then made of the stop limits for frame **48** so that in its lower position the lens blank is positioned opposite the grinding wheel **69**. The grinding wheel motor **66** then may be started and the wheel cuts into the lens blank under the influence of weight **84** urging it toward the lens blank. This movement is limited by the closing of switch **130** which serves to momentarily energize motor **25** and thus rotate both the rotary table **20** and the lens blank holder means **21** a fraction of a turn. Such rotary movement of the lens blank holder causes the lens blank to act as a cam and urge the grinding wheel away from the center of the lens blank and from the tracing arm assembly **23**. The grinding wheel then cuts its way into the lens blank at the new location until switch **130** again closes, starting a new cycle. Motor **25** may be internally low-geared to rotate shaft **38** but a fraction of a revolution and hence both the spectacle frame and the lens blank rotate in very small increments of rotation. The amount of movement of the grinding wheel inwardly of the lens blank on each cycle will depend upon the position of the tracing arm assembly which in turn depends upon the shape of the spectacle frame opening being traced.

While bracket **46** may be shifted manually to position the lens blank opposite the edging wheel **70**, I show means for doing this automatically.

Such means comprises a switch **136** which operates each revolution of shaft **38** by following an endless spiral track **137** therein. This switch, when closed, energizes advancing solenoid **138** of a stepping switch **140**. The latter is connected so that in certain positions it completes a circuit through means **55**, which, when energized, moves frame **48** upwardly to position the lens blank opposite the edging wheel **70**. The stepping switch is also adapted, in certain positions to energize a solenoid **142** which is connected to the grinding wheel assembly by the armature extension **143**. Solenoid **142**, when energized, retracts the assembly.

With the above arrangement, the switch **140** and the solenoids **55** and **142** can be wired to cause the grinding wheel assembly to retract and the lens blank to move into place opposite the edging wheel after 1 or 2 revolutions of the work, and subsequently to cause grinding wheel assembly to retract and the lens blank chuck means to return to its original position. Also, if desired, a circuit may be included for stopping motor **66** which turns the grinding wheel shaft. As previously pointed out, the grinding wheel assembly **22** can be releasably locked in retracted position with the plate **88**.

The stop means **105** and **106** does not come into operation during a normal grinding operation, but rather serves as a positive mechanical safety stop under any conditions.

Although I have illustrated and described a preferred form of my invention, I contemplate that various changes and modifications can be made therein without departing

from the invention, the scope of which is indicated by the following claims.

I claim:

1. In a machine for shaping, sizing and finishing the edge of an optical lens blank to fit a given spectacle frame lens opening, a rotary table mounted for rotation and upon which the spectacle frame is adapted to be mounted, a rotatable lens blank holder, motorized means for driving said holder and table in synchronism, a lens-cutting means mounted for movement toward and away from said lens blank holder, a spectacle frame tracing means mounted for movement radially of the axis of rotation of said table, means yieldably urging said tracing means in one direction, means operatively connecting said tracing means and said lens-cutting means to limit movement of said cutting means toward the axis of rotation of said lens blank holder in direct relation to the position of said tracing means, and means yieldably urging said cutting means toward said lens blank holder with less effective force than the means urging said tracing means in said one direction.

2. The machine set forth in claim 1 in which means responsive to movement of said lens-cutting means is provided for controlling the motorized means for driving the rotary table and lens blank holder.

3. The machine set forth in claim 1 in which said rotary table and said lens blank holder have parallel axes of rotation, and in which said cutting means is located on the far side of said lens blank holder with respect to said rotary table.

4. The machine set forth in claim 1 in which said lens-cutting means comprises a motor-driven grinding wheel mounted for rotation on an axis parallel to the axis of rotation of said lens blank holder, and in which the means operatively connecting the tracing means and the lens cutting means comprises a direct slideable connection limiting the minimum space between the lens cutting means and the tracing means.

5. The machine set forth in claim 4 in which said motorized means for driving the holder and table includes an electric motor normally not energized, and in which means is prrovided for momentarily energizing said electric motor in response to movement of the lens cutting means toward the lens blank holder to a given point with relation to said frame tracing means.

6. The machine set forth in claim 1 in which said motorized means for driving the holder and table includes an electric motor normally not energized, and in which means is provided for momentarily energizing said electric motor in response to movement of the lens-cutting means toward the lens blank holder to a given point with relation to said frame tracing means.

7. In a machine for shaping, sizing and finishing the edge of an optical lens blank to fit a given spectacle frame lens opening, a rotary table mounted for rotation and upon which the spectacle frame is adapted to be mounted, a lens blank support holder shaft, means for securing a lens blank on the shaft, a drive connection between and insuring synchronous rotation of said table and said holder shaft, an electric motor for driving said holder shaft and table, a motor-driven grinding wheel adjacent said holder shaft and mounted for movement toward and away from the holder shaft, a spectacle frame tracing means mounted for movement radially of the axis of rotation of said table, means yieldably urging said tracing means in one direction, means operatively connecting said tracing means and said grinding wheel serving to limit movement of said grinding wheel toward the axis of said lens blank holder shaft in direct relation to the position of said tracing means, and means yieldably urging said grinding wheel toward said lens blank holder shaft said last-mentioned means being of less effective force than the means biasing said tracing means.

8. The machine set forth in claim 7 in which means responsive to the movement of the grinding wheel to a given point in its travel toward said holder shaft is provided for momentarily energizing said electric motor, said motor being normally not energized.

9. In a machine for shaping, sizing and finishing the edge of an optical lens blank to fit a given spectacle frame lens opening, a rotary table mounted for rotation and having an opening on its axis of rotation, means for mounting a spectacle frame on said table with a lens opening thereof generally overlying the opening in the table, a tracing means including a post extending through the opening in said table and normal to the plane of the table, a tracing finger carried by said post, said post being mounted for limited movement in a plane radially of the axis of rotation of the table, a motor-driven grinding wheel shaft carrying a grinding wheel, said shaft being parallel to said post and mounted for limited movement in the same plane as said post, means extending between said post and said shaft limiting the minimum spacing thereof, means yieldably urging said post toward said shaft, means yieldably urging said shaft toward said post with less force than the means yieldably urging the post toward the shaft, a lens blank holder shaft means, chuck means for releasably securing a lens blank to said lens blank holder shaft means, a drive connection between said table and said lens blank holder shaft means to insure synchronism of rotation, a motor for intermittently driving said table and said lens blank holder shaft means, a means operable in response to movement of said grinding wheel shaft toward said post to a predetermined point for momentarily energizing said motor.

10. In a machine for shaping, sizing and finishing the edge of an optical lens blank to fit a given spectacle frame lens opening, a rotary table mounted for rotation and upon which the spectacle frame is adapted to be mounted, a rotatable lens blank holder means including a vertically shiftable chuck means, normally inactive motorized means for driving said holder means and table in synchronism, a lens-cutting means mounted for movement toward and away from said lens blank holder means and including a motor-driven shaft carrying a grinding wheel and an edging wheel in axially spaced relation, a spectacle frame tracing means mounted for movement radially of the axis of rotation of said table, means yieldably urging said tracing means in one direction, means yieldably urging said cutting means toward said lens blank holder means with less effective force than the means urging said tracing means in said one direction, means for momentarily activating said motorized means upon movement of said lens-cutting means a predetermined amount toward the lens blank holder relative to the position of said tracing means, means for sensing revolutions of said lens blank holder means, and means responsive to said sensing means for shifting said chuck means whereby to bring a lens blank held therein into position opposite said edging wheel.

11. The machine set forth in claim 10 in which means is provided for retracting said cutting means in response to a signal from said sensing means.

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