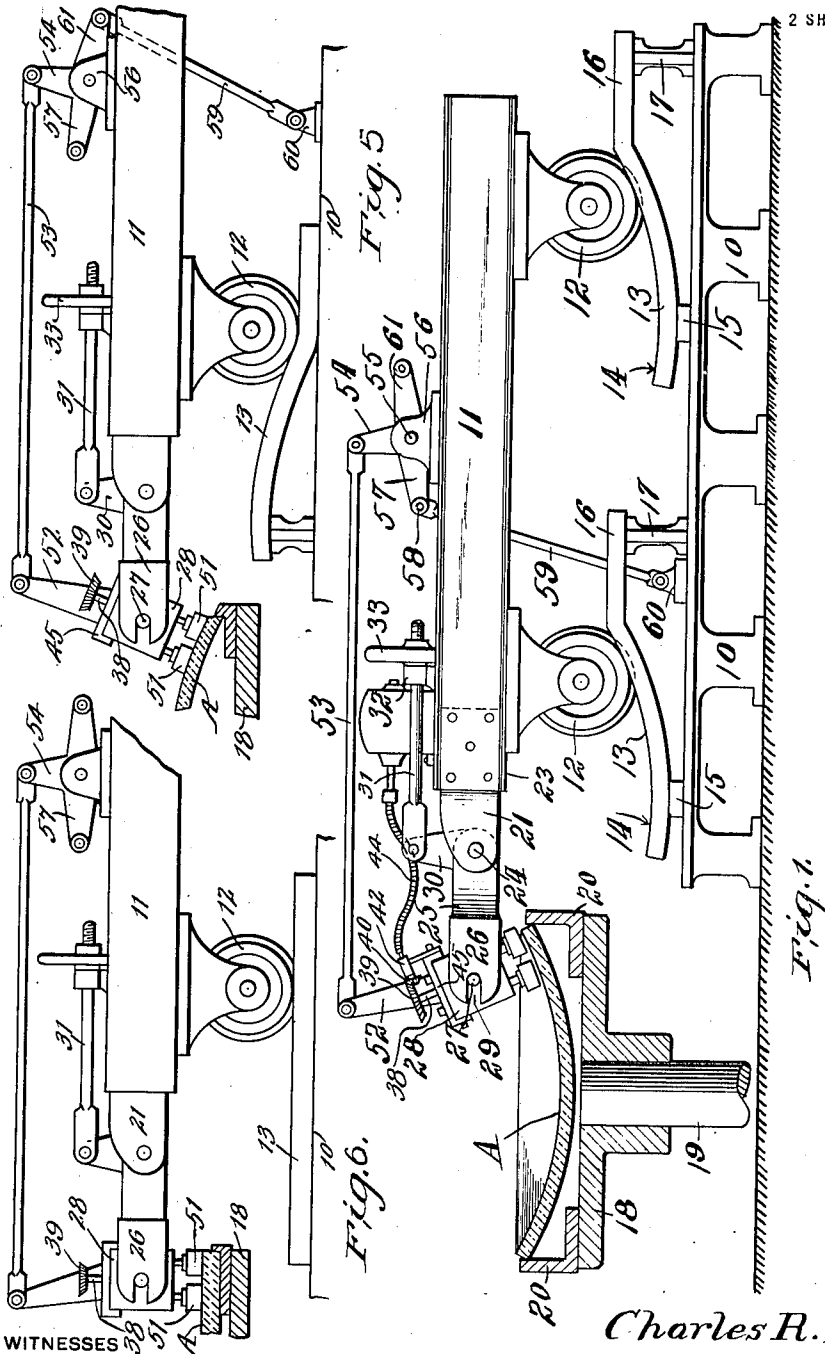


C. R. HAZEL.
GRINDING AND POLISHING MACHINE.
APPLICATION FILED APR. 20, 1916.

1,281,001.

Patented Oct. 8, 1918.

2 SHEETS—SHEET 1.



WITNESSES

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INVENTOR

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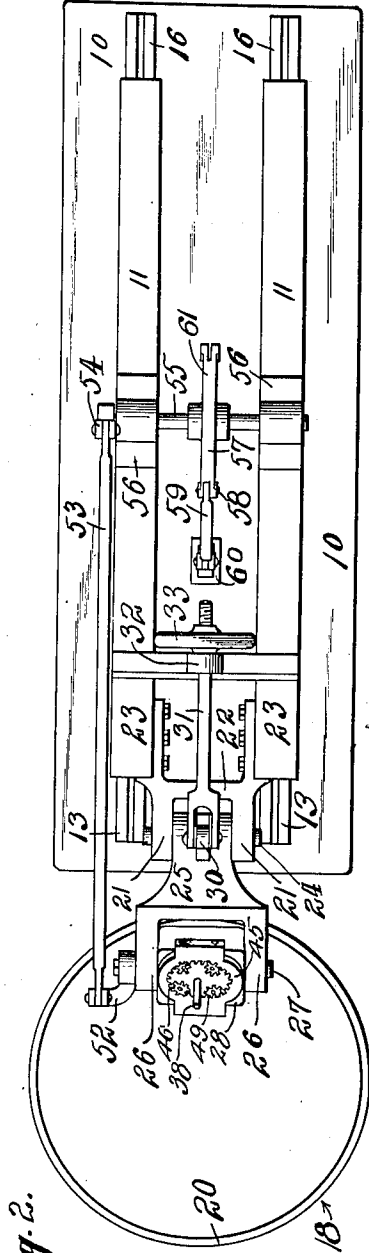


Fig. 2.

WITNESSES

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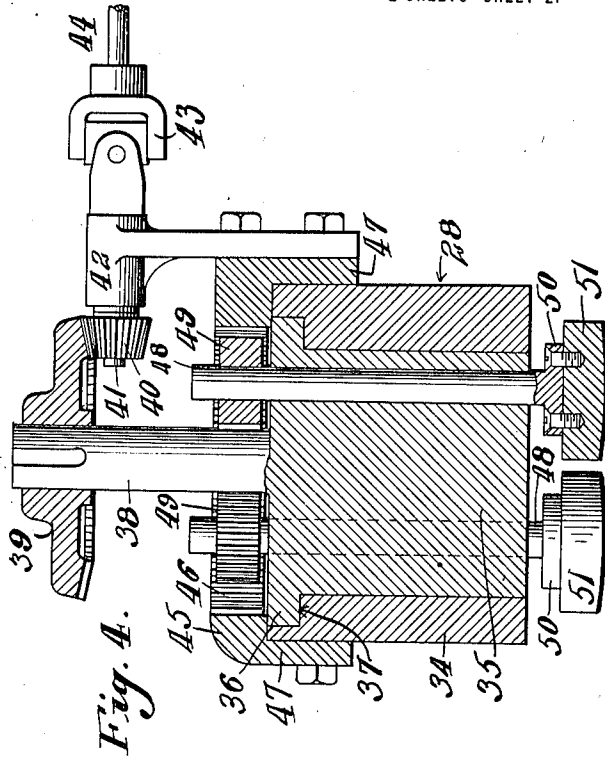


Fig. 4.

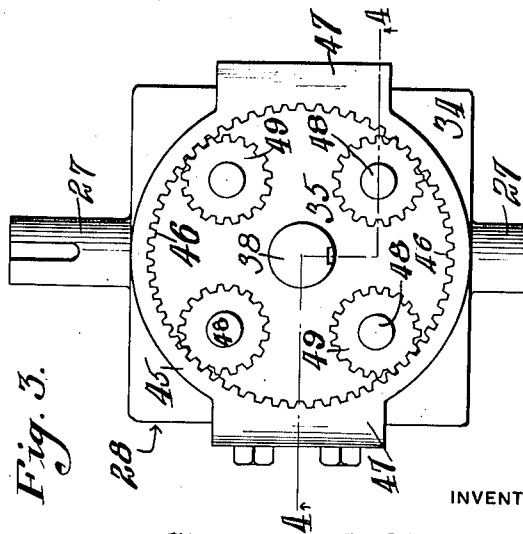


Fig. 3.

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CHARLES R. HAZEL, OF CHARLEROI, PENNSYLVANIA.

GRINDING AND POLISHING MACHINE.

1,281,001.

Specification of Letters Patent.

Patented Oct. 8, 1918.

Application filed April 20, 1916. Serial No. 92,496.

To all whom it may concern:

Be it known that I, CHARLES R. HAZEL, a citizen of the United States, residing at Charleroi, in the county of Washington and State of Pennsylvania, have invented certain new and useful Improvements in Grinding and Polishing Machines, of which the following is a specification.

This invention relates to a machine for grinding and polishing glass and has for its principal object to provide a machine that is simple in construction, strong and firm though relatively light in weight and comparatively inexpensive to construct.

Another object of the invention is to provide such a machine with a grinding head that carries a plurality of independent grinding and polishing members that revolve each upon its axis as it travels over the surface to be ground and polished.

A further object of the invention is to provide a machine with means whereby various articles having a parabolic surface either concavely or convexly formed, such as large lenses for searchlights and the like, may be quickly and accurately ground and polished by the automatic movements of the machine.

A still further object of the invention is to provide an adjustable means whereby the machine may be quickly and easily changed to fit the machine for grinding objects having different curvatures and also plane surfaces.

With these objects in view and others to be set forth hereinafter in the following detailed description, the invention consists in the novel construction, combination and arrangements of parts illustrated in the accompanying drawing in which:

Figure 1 is a side elevation of the complete grinding machine,

Fig. 2 is a top plan view of the same,

Fig. 3 is a plan view of the grinding head enlarged,

Fig. 4 is a vertical cross sectional view of the same on the line 4—4 of Fig. 3,

Figs. 5 and 6 are views illustrating modifications of the invention.

Referring to the drawings by numerals, 10 indicates a strong, rigid and low bed or base over which travels in a longitudinal direction a carriage 11 mounted on flanged wheels 12 that travel over and are guided

by tracks or rails 13 removably secured on the base 10.

The tracks or rails 13 have curved tread surfaces 14 that are true arcs of circles, the radii of which are equal and have a length that is dependent upon the curvature of the surface to be ground. The tracks 13 are removably connected to the base so that when needed tracks having different radial lengths may be substituted. In Fig. 1 the tracks or rails 13 have a concaved tread and are supported at their lower ends upon blocks or sleepers 15 carried by the bed 10 while the upper ends of said rails are extended rearwardly in a horizontal direction and in the same plane for a short distance to form a support for the carriage when the latter is withdrawn from operation on the article being ground. These higher and horizontal ends 16 of the rails 13 are carried on pillow blocks or other suitable supports 17. When articles having convexed surfaces are to be ground, tracks or rails having a reverse or convexed tread are employed in which case the horizontal portions 16 of said rails would be fastened directly to the bed 10, as clearly shown in Fig. 7.

In front of the bed 10 and a short distance therefrom is a revolving table 18 mounted upon a vertical shaft 19, the upper surface of said table lying in a horizontal plane parallel to the top or upper surface of the bed 10. The table 18 may be raised and lowered by moving the shaft 19 longitudinally in any well-known manner by any suitable means familiar to those skilled in the art to accommodate the article to be ground and is provided on its upper surface with means 20 of any suitable kind to secure firmly upon the table the article A to be ground. In the drawing this article is shown as a searchlight lens, the inner or concaved surface of which is being ground and polished.

At the front end of the carriage 11 are two forwardly projecting lugs 21 which may as shown be formed integrally with a cross brace 22 that joins the forward ends of the side beams 23 of the carriage 11. Pivottally mounted between the lugs 21 on the bearing pin 24 is a forwardly projecting supporting arm 25 forked at its free end to form side bearings 26 for journals 27 that project in opposite directions from the grinding head 28. The journals 27 are seated as

shown in Fig. 1 in slots 29 cut in the bearings 26. Projecting upwardly from the pivotal end of the arm 25 is a shorter arm 30 to which is pivoted a rod 31 that extends rearwardly through a bracket 32 on the carriage and beyond the bracket is threaded for a hand wheel 33 which upon being turned in one direction or the other will through the connections described rock the arm 25 on its pivot and raise or lower the grinding head 28.

The grinding head 28 shown enlarged in Figs. 3 and 4 comprises a rectangular shell or casing 34 having a circular opening extending vertically therethrough to receive a revolving member 35 having on its upper end a laterally projecting flange 36 seated in a groove 37 in the casing and serving to support said revolving member within said casing. Projecting laterally from opposite sides of the casing 34 are the journals 27 upon which the head 28 rocks. A shaft 38 extends upwardly from the revolving member 35 and in the axis thereof a short distance above the head 28 and has a beveled gear 39 keyed on its upper end which is driven by a pinion 40 on a short shaft 41 turning in a bearing 42 attached to the head 28 and driven through a flexible or other suitable coupling 43 from a shaft 44 connected to some suitable source of power.

On the top of the casing 34 of the head 28 is an annular rack 45 having internal teeth 46 and two laterally projecting and downwardly turned lugs 47 that bear against and are bolted to the sides of the casing 34. Through the revolving member 35 from top to bottom thereof and parallel with its axis of revolution are a plurality of shafts 48, four being shown in the drawings, a pinion 49 being fastened to the upper end of each shaft and meshing with the teeth of the annular rack 45. The lower end of each shaft 48 has a head 50 thereon to which is secured a grinding block 51, the under surface of which is curved to suit the surface to be ground.

One of the journals 27 projects beyond its bearings 26 and has keyed thereon an upwardly projecting arm 52 connected at its free end by a reach rod 53 that extends rearwardly to a shorter arm 54 on one end of a horizontal cross shaft 55 mounted in bearings 56 on the carriage 11. A lever 57 is mounted midway of its ends on the shaft 55 and is connected at one end 58 with a radius bar 59 that extends downwardly toward the bed 10 and is pivoted in a bearing 60 on said bed.

In operating the invention so far described assuming a lens such as A is to be ground on its concaved surface, rails or tracks such as 13 having the proper curvature are fastened to the bed 10 and the carriage 11 mounted thereon. The hand wheel 33 is turned to

adjust the grinding blocks 51 to the surface to be ground and the carriage 11 pushed forwardly along the rails 13 manually or by any suitable power means. This forward movement of the carriage imparts to the blocks 51 a double movement in a curved path, which movements combined will describe a parabolic curve over the surface of the lens A. These combined movements are caused by the carriage traveling over the curved tread 14 of the tracks 13 and the rocking movement of the head 28 on its journals 27 as the radius bar 59 vibrates and rocks the lever 57 and shaft 55 which through arms 52 and 54 and reach bar 53 rocks said head. Suitable abrasive materials are employed with the grinding blocks 51 to reduce the surface of lens, the latter being turned by the table 18 during the whole course of the grinding operation. After grinding the surface is polished by the use of felt or other well known material attached to the under side of the block 51 or other supporting means for the felt. After the grinding operation and after the polishing operation or at any time during the progress of these operations if it be desired to suspend work for any time, the carriage may be drawn back until the wheels 12 are supported on the horizontal portions 16 of the rails 13.

Should the convex surface of the lens A be placed in position to be ground, the rails 13 would be removed and other rails having a convexed tread of proper radius be substituted therefor, as shown in Fig. 7, and the radius bar 59 connected to the other arm 61 of the lever 57. With this change convexed surfaces of parabolic form may be ground as readily as concaved surfaces.

Against the under sides of the beams 66 is bolted an annular rack 45^a having internal teeth 46^a which mesh with pinions 49^a on vertical shafts 48^a rotating in the head 28^a. The lower end of each shaft 48^a has fixed thereon a head 50^a against the under surface of which is secured a runner or grinding member 51^a. Each head 50^a has an eccentrically formed disk 69 to which the runner 51^a is attached whereby said runner is given an eccentric as well as a rotary movement when the shaft 48 revolves.

Below the runners 51^a is a revolving table 18^a supported upon a shaft 19^a.

The operation of this form of machine for grinding plane surfaces is self-evident from the description of the various parts and the previous description of the operation of the preferred form of the invention. The runners 51^a are elevated above the surface being ground and forced against said surface with any desired pressure by a lever 70 pivoted in bearings on the top beam 65 and having a forked end 71 that straddles the vertical bar 62 below a collar 72 thereon. A downward

movement of the lever 70 will raise the runners 51^a and a reverse movement lowers them upon the surface being ground, the pressure being regulated or adjusted by moving the lever.

It is evident that the form of machine illustrated in Fig. 1 may be used to grind plane surfaces by a very slight change. This change consists in mounting the carriage 11 on horizontal rails, as in Fig. 6, disconnecting the radius bar 59 entirely from the lever 57 and securing the head 28 rigidly on the arm 25. With this slight change plane surfaces may be ground and polished either by moving the carriage to and fro where the surfaces are very large or by causing the carriage to remain stationary and depending wholly upon the rotation of the table 18 to bring the various portions of the surface to be ground beneath the grinding blocks.

I claim—

1. In a machine of the class described, a grinding and polishing head movable transversely over the face of an article to be operated upon in line with the sectional contour of said face, means for simultaneously swinging the head in the plane of movement, means for positively rotating a part of said head, and a group of grinding and polishing elements carried by said rotatable part each being positively rotated about its axis by means engageable with the non-rotatable part of the head.

2. In a machine of the class described, a grinding and polishing head movable transversely across the face of an article to be operated upon in line with the sectional contour of said face and simultaneously adapted to swing in the plane of said movement, a rotatable bearing carried by and forming a part of said head, means for positively rotating said bearing, and a group of grinding and polishing elements carried by said bearing, each element being positively rotated about its axis by means engaging the non-rotatable part of the head.

3. In a machine of the class described, a grinding and polishing head movable transversely over the face of an article to be operated upon in line with the sectional contour of said face, means for simultaneously swinging said head during its transverse movement, means for positively rotating a part of said head, and a group of grinding and polishing elements carried by said rotatable part, each element being positively rotated about its axis by means engaging the non-rotatable part of the head.

4. In a machine of the class described, a grinding and polishing head movable transversely over the face of an article to be operated upon in line with the sectional contour of said face, means for simultaneously swinging said head while reciprocating, means for positively rotating a part of said

head, a group of grinding and polishing elements carried by said rotatable part, each element being positively rotated about its axis by means engaging the non-rotatable part of the head, and means for rotating the article being operated upon.

5. In a machine of the class described, a grinding and polishing head movable over the face of an article to be operated upon in the plane of said face, a swinging casing in which said grinding head rotates, a plurality of independently rotatable grinding and polishing elements carried by said head, a pinion fixed to each of said elements, means for positively rotating said head, a gear ring within the casing engaging said pinions and rotating each of said grinding elements through the rotation of said head, a rotating table for supporting the article under treatment, and means for adjusting the position of said grinding head relative to said table.

6. In a machine of the class described, a grinding and polishing head, grinding elements therein, a reciprocable carriage supporting said head, means for causing said carriage to reciprocate in a curved path, and means for swinging said head, both the reciprocating and swinging movements being simultaneous and in line with the direction of movement of said carriage.

7. In a machine of the class described, a grinding and polishing head, grinding elements thereon, a reciprocable carriage supporting said head, means for causing said carriage to travel in a curved path, and means for rocking said head on said carriage.

8. In a machine of the class described, a grinding and polishing head, grinding elements thereon, a reciprocable carriage adjustably supporting said head, means for causing said carriage to travel in a vertically curved path, and means for rocking said head on said carriage about a horizontal axis.

9. In a machine of the class described, a grinding and polishing head having a rotatable portion, grinding elements carried by said rotatable portion and collectively rotatable with said head and about their own axes, a reciprocable carriage adjustably supporting said head, positive driving means for collectively rotating said grinding elements, and means on the non-rotatable portion of said head for individually rotating said elements.

10. In a machine of the class described, a grinding and polishing head, grinding elements mounted in said head, each rotatable about its own axis and collectively rotatable about the axis of said head, a reciprocable carriage adjustably supporting said head, means for causing said reciprocating carriage to travel in a curved path, means for

rocking said head on said carriage, and positive driving means for collectively and individually rotating said grinding elements.

11. In a machine of the class described, the combination of a reciprocable carriage, curved tracks for directing the reciprocatory movement of said carriage and maintaining it at all times in a horizontal plane, a grinding and polishing head adjustable on said carriage, grinding elements carried by said head, and positive driving means for collectively and individually rotating said grinding elements.

12. In a machine of the class described, the combination of a reciprocable carriage, curved tracks for directing reciprocatory movement of said carriage and maintaining it at all times in a horizontal plane, a grinding and polishing head mounted on said carriage and adapted to rock about a horizontal axis, a vertically adjustable support for the polishing head pivoted on said carriage, and operating mechanism for rocking said head as the carriage is reciprocated.

13. In a machine of the class described, the combination of a reciprocable carriage, curved tracks for directing the reciprocatory movement of said carriage and maintaining it at all times in a horizontal plane, a grinding and polishing head mounted on said carriage and adapted to rock in a vertical plane, a vertically adjustable arm pivoted on said carriage for supporting the grinding head, manually operable means for adjusting said arm, grinding elements supported in said head, positive driving means for collectively and individually rotating said grinding elements, and means for rocking said head as the carriage is reciprocated.

14. In a machine of the class described, the combination of a reciprocable carriage, a grinding head supported by said carriage, adapted to swing in the plane of reciprocation of said carriage, curved tracks for guiding the reciprocatory movement of said carriage, and a radius bar connected to the grinding head for simultaneously swinging said head with the reciprocation of the carriage.

15. In a machine of the class described, the combination of a reciprocable carriage, a grinding and polishing head supported by said carriage and adapted to swing in the plane of reciprocation of said carriage, ver-

tically curved tracks for guiding the reciprocatory movement of said carriage, a radius bar pivoted at one end to a fixed bearing, an elbow lever on said carriage connected to the free end of the radius bar, and a connection between said elbow lever and said head for swinging the same.

16. In a machine of the class described, the combination of a reciprocable carriage, a grinding and polishing head vertically adjustable thereon and adapted to rock about a horizontal axis, vertically curved tracks for guiding the reciprocatory movement of said carriage, horizontal extensions from said tracks to support said carriage when at rest, a radius bar, a lever pivoted on said carriage to which said radius bar is connected, an arm on said head, and a link connecting said lever and arm for rocking said head as the carriage is reciprocated.

17. In a machine of the class described, a grinding and polishing head therefor comprising a casing, journals projecting from said casing upon which it is adapted to rock, a rotating member carried by said casing, means for positively rotating the same, a plurality of rubbing elements supported by said rotating member, a pinion carried by each of said rubbing elements, and a rack fixed within said casing and engaging said pinions for individually rotating the rubbing elements coincidentally with the operation of the rotating element.

18. In a machine of the class described, a grinding and polishing head comprising a casing having journals thereon by which it may be rocked in a vertical plane, a rotating member supported in said casing, a plurality of rubbing elements supported in said rotating member, a pinion on each of said rubbing elements, an annular rack secured within said casing and engaging each of said pinions, and means for positively turning said rotating element to collectively revolve the polishing elements and through said rack and pinions individually revolve the same.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES R. HAZEL.

Witnesses:

GEORGE F. RYLAND,
S. T. CHESTER.