

May 11, 1937.

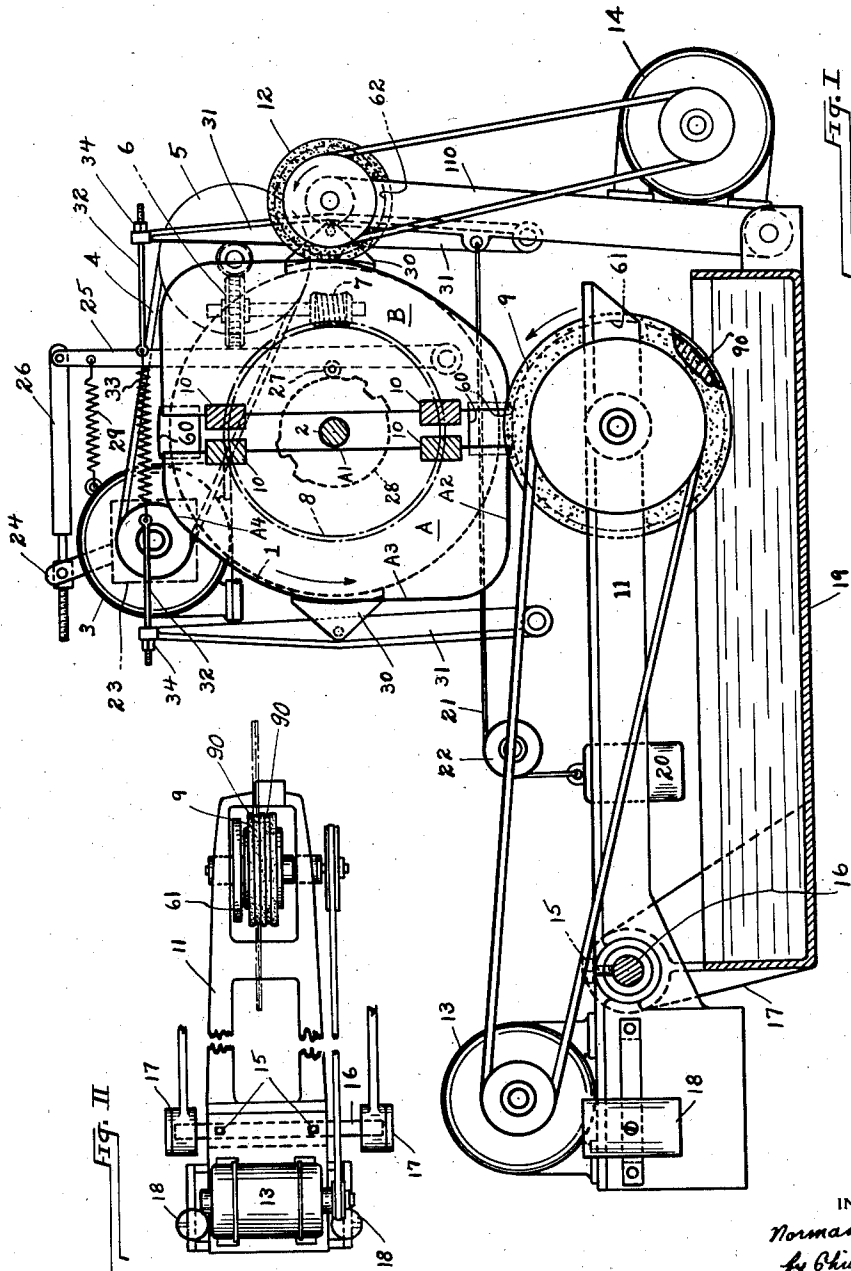
N. H. KLAGES

2,080,280

EDGE GRINDING MACHINE

Filed Aug. 19, 1935

3 Sheets-Sheet 1



INVENTOR
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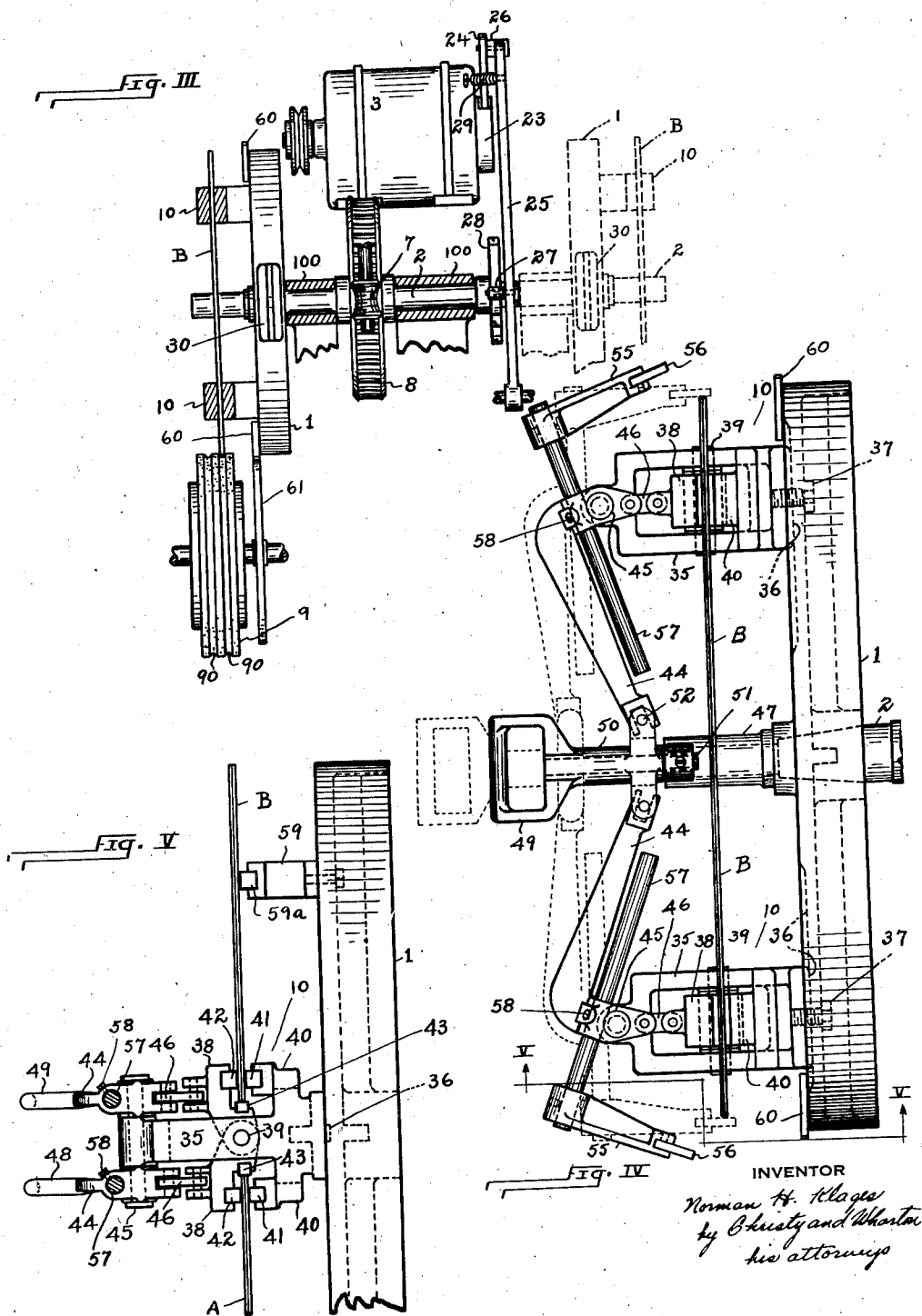
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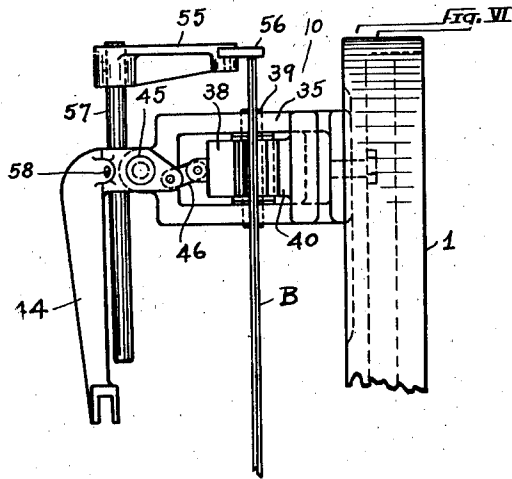
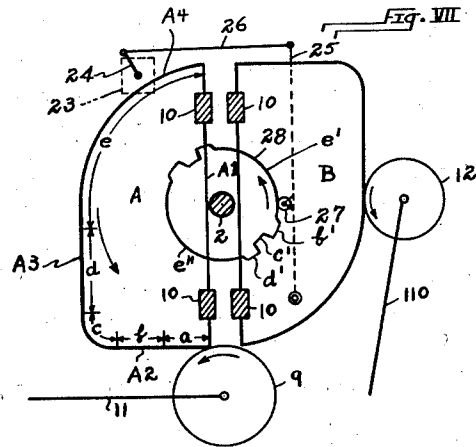
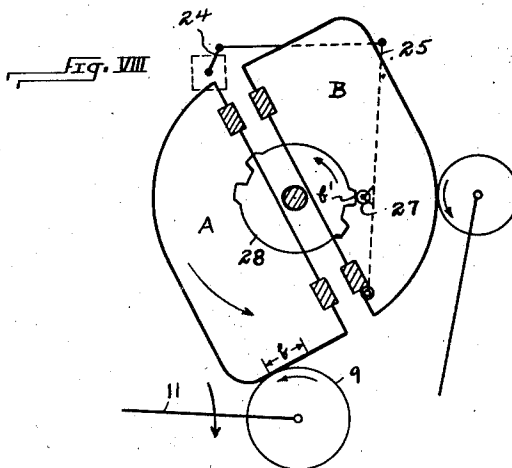
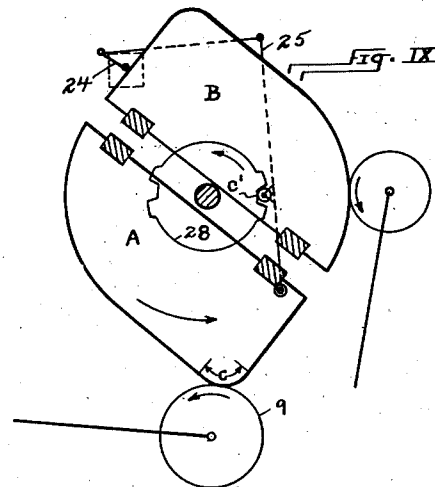
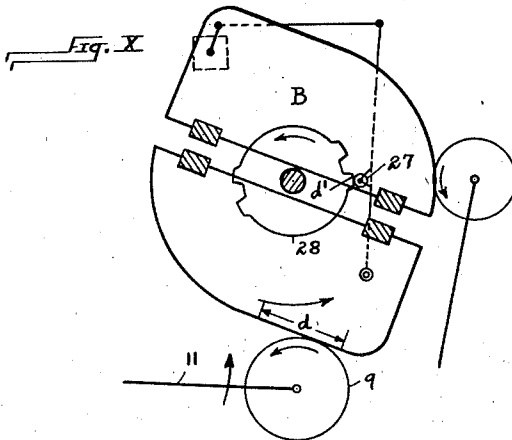
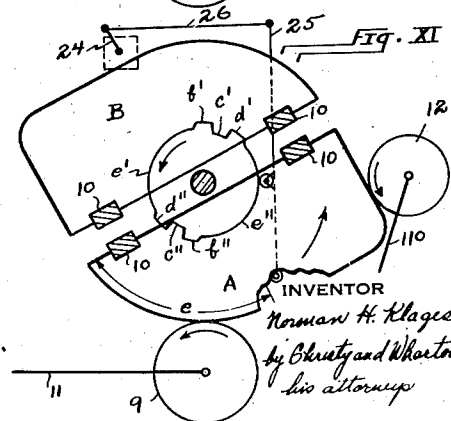
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UNITED STATES PATENT OFFICE

2,080,280

EDGE-GRINDING MACHINE

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Application August 19, 1935, Serial No. 36,791

19 Claims. (Cl. 51-105)

My invention relates to grinding and polishing machines, particularly to machines for grinding and polishing peripheral edges, such as the peripheral edges of glass sheets and plates.

5 The invention is found in particular refinements and elaborations in grinding machine structure, in consequence of which the plates and sheets, or other articles to be peripherally dressed, may be more readily and accurately
10 installed in the machine, and may be more easily removed therefrom, while the machine is in operation. Additionally, finer and more uniform work is done, and greater output is obtained. A machine embodying my invention is economical to construct and operate, and, save for the manual introduction and removal of the work, the operation of the machine is automatic.

The invention has been developed in a machine for dressing automobile window panes, particularly shatter-proof window panes—panes comprising in integral assembly two sheets of glass with an interposed sheet of non-friable material, such as celluloid. By way of illustration and not limitation, the invention will be described in such embodiment.

25 Such a machine is illustrated in the accompanying drawings, in which Fig. I is a view thereof, partly in front elevation and partly in vertical section. Fig. II is a fragmentary view, showing to smaller scale the mounting for the grinding wheel of the machine in plan from above. Fig. III is a fragmentary view, showing on equal scale with Fig. I particular elements of the machine in side elevation, and indicating portions of the machine frame in vertical section. Fig. IV is a view in side elevation, showing in detail and to larger scale the rotary work support of the machine, and illustrating in dotted lines particular elements of the support in alternate positions of service. Fig. V is a fragmentary view of the work support, as it appears on the broken plane V—V of Fig. IV. Fig. VI is a view, comparable with Fig. IV, and showing fragmentarily one set of the work-securing devices of the support in open or release position. And Figs. VII to XI are diagrammatic views, illustrating successive stages in the grinding operation.

My machine embodies means for rotatably supporting a plurality of panes of glass, in this case two panes A and B, as shown in Fig. I. The form or shape of the panes A and B is typical of the shatter-proof window panes used in automobiles today.

55 Considering pane A in particular, it will be

understood that it is approximately rectangular in outline, including four edges A1, A2, A3, and A4. The edge A1 is substantially straight, while the other three edges A2, A3, and A4 include both straight and curved portions, which form in effect a single, continuous peripheral edge. In practice the straight edge A1 is not, ordinarily, ground and finished, but the remainder of the periphery of the pane is, and my machine is adapted to dress such periphery quickly and nicely.

The work support of the machine consists of a cylindrical body or disc 1 (cf. Fig. III), which is secured to a horizontal shaft 2, and carries a plurality of clamping devices 10. (The devices 10 are shown diagrammatically in Figs. I and III, but appear in structural detail in Figs. IV to VI). A variable speed electric motor 3 is connected to the shaft 2, and the connections include a belt 4, a pulley 5, speed-reducing gearing 6, and a worm pinion 7 that meshes with a worm-gear 8 fixed upon the shaft. The clamping devices 10 secure the panes A and B to the disc 1, with the two panes lying in common plane and normal to the axis about which the supporting disc 1 is rotatable, and with the common plane of the two panes lying spaced from and parallel to the plane of said supporting disc, cf. Fig. III. As may be perceived in Fig. I, the panes A and B are so relatively positioned in plan that the outer peripheral edge portions (A2, A3, A4) of the two panes form a substantially continuous periphery, a periphery approximating a circle. It will be observed that the normally unfinished edges (A1) of the two companion panes extend substantially radially or diametrically of the axis 2 about which the pane-supporting structure is rotated, and that the pane-securing devices 10, positioned at (or extending) substantial intervals from and on opposite sides of the shaft 2 embrace and clamp these edges, within the compass of the approximate circle formed by the edges to be dressed.

The arrangement of the panes A and B, in itself, is considered to involve nothing of patentable moment, inasmuch as the grinding art for years has realized the advantages to be gained by rotatably mounting several pieces of work in common plane, and in such arrangement that the edges or faces of the several pieces are presented to a rotating grinding wheel in circular succession. The invention lies in particular refinements and elaborations.

A grinding wheel 9 is rotatably mounted at

the distal end of a counter-poised arm or frame 11, and a polishing wheel 12 is rotatably borne by the upper end of an arm 110. The two wheels 9 and 12 are adapted to bear yieldingly against the substantially continuous periphery formed by the two panes A and B, and motors 13 and 14, respectively, are organized to rotate the wheels at relatively high speed, while the motor 3 rotates the two panes, as one, at relatively slow speed. During such rotation, note the arrows in Fig. I, the outer peripheral edges of the two panes are progressively acted upon, first by the grinding wheel 9 and then by the polishing wheel 12, and, under the treatment of these wheels, the desired edge portions of the panes are dressed.

More specifically, the arm or frame 11 is secured, by means of set-screws 15, to a shaft 16; the shaft is rotatably trunnioned in stationary standards 17; the motor 13 is mounted on the frame, as shown in Fig. I, and is belted to the grinding wheel in usual way. The motor 13, together with two or more adjustable weights 18, on one side of the shaft 16, so far over-balances the weight of the supporting arm and grinding wheel on the other side of the shaft that the wheel is urged yieldingly upward, to exert the desired, delicately sensitive pressure of the wheel against the peripheries of the two panes A and B. While the panes are slowly rotated in engagement with the rapidly rotating grinding wheel, the counter-poised arm swings up and down, in accommodation to variations from a true circle in the periphery of the assembled panes. Advantageously, two (or more) grooves 90 are provided in the face of the grinding wheel, and these grooves are such in shape and size as to grind the edge of the glass to the desired contour. When, in service, one groove becomes worn and of inaccurate contour, the position of the grinding wheel relatively to the pane-supporting disc 1 is adjusted, whereby the other groove in the wheel is brought to position for engagement with the glass. In this case, such adjustment is made by loosening the screws 15, and shifting the frame 11 bodily along its supporting shaft 16 (cf. Fig. II).

A pan 19, including a pool of water or other suitable liquid, is arranged beneath the arm 11, and in service such pool is effective to keep the work-engaging periphery of the grinding wheel wet, in the usual and desired manner. Alternately, a jet of water may be directed against the periphery of the wheel, and the pan may serve as a basin to catch the drippings.

The arm 110, which carries the polishing wheel 12, is pivotally secured at its lower end to the frame of the machine. The driving motor 14 is secured to the arm in such position that the weight of the motor tends to swing the arm clockwise; this tendency of the motor's weight is, however, opposed and minutely exceeded, by means of a counterweight 20, hanging on a cable 21, trained over an idler pulley 22, and connected to the arm, as shown in Fig. I. By virtue of this arrangement the polishing wheel is held in the desired yielding contact with the edge of the glass.

It is important to note that the wheel-supporting arms 11 and 110 are of relatively great length, and that in the case of each arm the distance from the axis of the wheel to the axis about which the arm swings is equal to or exceeds the maximum diameter of the panes with respect to the center of pane rotation. And it will be further

noted that the counter-weighted portion of the arm 11 is relatively short, and that the weight of the motor and counter-weights, aggregating over 700 pounds, is effective upon an exceedingly short moment arm. These features are valuable in providing the desired, delicately sensitive engagement of the grinding wheel against the glass.

Referring to Fig. VII, it will be understood that the outwardly presented edge of the pane B has, during the slow rotation of the work-supporting disc 1, completed its sweep across the rapidly rotating grinding wheel 9, and is still in the course of engagement with the polishing wheel 12, while the edge of pane A is entering engagement with the wheel 9. As has been already mentioned, the aligned edges of the two panes to be dressed merely approximate a true circle. Indeed, the edges A2, A3 and A4 of each pane comprise a succession of rectilinear and curved edge portions a, b, c, d, and e, and the curved portions c and e are of different curvatures. I have found that the angular velocity of the work relative to the angular velocity of the grinding wheel must be varied in these succeeding edge portions, in order to gain a uniformly ground product. And I have further discovered that such variation in velocity may be advantageously obtained by holding the speed of the grinding wheel constant, and varying the speed of rotation of the pane-supporting disc 1. Returning to Figs. I and III, the means which are provided to this end will be considered.

The motor 3 is equipped with a speed-varying rheostat or brush-rack 23 (diagrammatically indicated, but of well-known sort), which is regulated by means of an angularly movable arm 24. The distal end of arm 24 is pivotally tied to the upper end of a vertical arm 25, by means of a connecting rod 26; the arm 25 is articulated at its lower end to the frame of the machine, and carries intermediate its vertical extent a wheel 27. (It may be remarked that, in the main, the framework of the machine has been omitted from the drawings, for the sake of clarity, and the supporting frame for the shaft 2 is only fragmentarily indicated, at 100, in Fig. III. Obviously, the engineer will know how to provide such framework and gear housings as are required.) The shaft 2, as has been indicated above, carries the disc 1 on its anterior end; intermediate its ends it carries the worm-gear 8; and on its posterior end a cam-plate 28 is secured. The periphery of the cam-plate is engaged by the wheel 27 on arm 25, and a tension spring 29, effective upon the arm, serves to maintain the cam-riding wheel in such engagement. It will be perceived, therefore, that the motor 3 is effective to rotate the work support (1, 10) and the cam-plate (28) in unison, and that during such rotation the cam-plate, in conjunction with the spring 29, is effective to swing the arm 25 to and fro upon its pivot. Thus, the rheostat arm 24 is shifted and the speed of the motor 3 (and, in consequence, the angular velocity of the rotating work support) is automatically varied. And it follows that, by properly designing the cam-plate 28, the desired changes in the velocity of the rotating work support may be effected automatically.

In Fig. VII, as has been noted, the edge of pane A is shown entering engagement with the rotating grinding wheel 9. During the slow rotation of the panes, the edge portion a moves into the aligned groove 90 of the grinding wheel, and the cam-riding wheel 27 rides in engagement with a

circular arc e' , provided in the periphery of the rotating cam 28. Manifestly, while the wheel 27 engages the arc e' —a peripheral cam portion of constant radius—the arm 25 remains stationary, and the angular velocity of panes A and B remains substantially constant. Such constant angular velocity of the panes is desired as long as the edge portion a remains in contact with the grinding wheel. Continued rotation of the panes brings the edge portion b into contact with the grinding wheel. By comparing Figs. VII and VIII, it will be understood that, during the progressive travel of the edge portions a and b across the grinding wheel, the radial distance from the point of contact of the wheel with the glass to the center of pane rotation progressively increases. In consequence, the grinding wheel is slowly and progressively urged downward, swinging the counterpoised arm 11 clockwise, and effecting an increase in the pressure of the wheel against the edge of pane A. It also follows that such progressive increase in radius (assuming the angular velocity of the panes to be constant) effects an increase in the tangential speed of the edge of the pane against the rotating grinding wheel. In order to adjust the abrading effect of the wheel to these varying conditions, the angular velocity of the assembled panes is reduced; that is to say, a raised segment b' is provided on the cam-plate, and it engages in sequence the cam-riding wheel 27. In consequence, the arm 25 swings into the position shown in Fig. VIII, the rheostat arm 24 is thrown into speed-reducing position, and the angular velocity of the panes is reduced to and held at desired value while the edge portion b is traversing the grinding wheel.

Upon further rotation of the work support, the sharply curved edge portion c of pane A advances into engagement with the grinding wheel, and, due to the relatively acute curvature of this edge portion c , the action of the grinding wheel is more concentrated, and tends to abrade away the edge of the glass more rapidly than elsewhere in the periphery of the pane. To meet this condition, the periphery of cam-plate 28 is provided with an arcuate portion c' of reduced radius, whereby, as the edge portion c enters engagement with the grinding wheel, the arm 25 is swung into the position shown in Fig. IX, and the rheostat arm 24 is thrown into speed-accelerating position. The extent of the arc c' on the cam-plate is such that the angular velocity of the two panes is held at accelerated value while the edge portion c is passing over the grinding wheel. Thus compensation is made in accelerated speed for the intensification of the grinding action.

Next, as the edge portion d enters engagement with and is moved across the grinding wheel, the radius or radial distance of the edge of the pane A from the center of pane rotation progressively decreases, the counter-poised arm 11 swings upward, and the pressure of the wheel against the glass is reduced. Upon considering Fig. X, it will be understood that such progressive decrease in radius and the upward swing of the grinding wheel causes the point of tangency of the edge of the pane against the wheel to shift from right to left. It will further be apparent that, if the angular velocity of the assembled panes is constant, this progressively decreasing radius of the edge portion d with respect to the center of pane rotation tends to decrease the tangential velocity of the edge portion d with respect to the grinding wheel, while said right-to-left shifting of the

point of tangency tends, to lesser degree, to increase such tangential velocity. To meet these conditions, the rotary speed of the pane is decreased, and to such end a raised portion d' is provided on the cam-plate, and by such means the speed-controlling mechanism is shifted into speed-reducing position.

During the travel of the edge portion e across the rotating grinding wheel, Fig. XI, the speed of rotation of the panes may be constant, i. e. of normal or average value, and in the cam-plate an arcuate portion e'' cooperates with the spring 29 (Fig. I) in maintaining the speed-regulating linkage 24, 25, 26 in average-speed position.

Upon further reference to Fig. XI, it will be perceived that the already ground edge of pane B moves from engagement with the polishing wheel 12, and thus is completely finished, at approximately the same time that the edge portion e of pane A enters engagement with the grinding wheel 9. While the uninterrupted rotation of the two panes continues, the finished pane B is removed and a pane ready to be dressed is introduced in its place. The cam-plate 28 is provided with portions b'' , c'' , and d'' , to operate the speed-regulating mechanism for the newly introduced pane, in the same manner that cam portions b' , c' , and d' operated such mechanism during the grinding of pane A. When the edge portion e of pane A passes from engagement with the grinding wheel, the arcuate cam portion e'' is effective to hold the speed of the work support at average value while the initial edge portion (a) of the newly introduced pane is being ground—just as the cam portion e' (Fig. VII) held the work support speed at average value when the pane A was moving through its initial stage of contact with the wheel. In the above-described manner, my machine is operated continuously, to grind and polish the edges of glass panes.

The rotary support 1 is provided with two cams 60 which are adapted, during the continuous rotation of the panes A and B, to engage discs 61 and 62, idly mounted on the axes of the abrading wheels 9 and 12, respectively. The engagement of these cams with the idler discs 61 and 62, as indicated in Fig. I, maintains the desired space relationship between the rotating work support and the grinding and polishing wheels at the times when the interval at which the two panes are spaced apart comes opposite the faces of the wheels.

It may be remarked that the variations produced in the angular velocity of the panes A and B (during their common rotation through 360 degrees) do not interfere with the efficiency of the constantly rotating polishing wheel 12.

In the usual machines for doing this sort of work, the engagement of the grinding wheels with the edges of the panes is established and maintained by means of pattern cams. While there may be several reasons why the work in such grinding machines tends to vibrate and chatter, I have found that the pattern cams comprise a prime contributory cause. In accordance with my invention the use of such cams is eliminated, and, as already indicated, the engagement of the wheels 9 and 12 with the work is a free yielding engagement—there are no cams positively defining the positions of the wheels against the peripheries being dressed. I further inhibit vibration of the work, by imposing a motor-opposing drag upon the driven parts.

Such drag may be applied by braking means, and, advantageously, the braking effect is applied to the rotating parts between the driving motor and the driven work. And I have further discovered that the braking drag is most effective when applied on the anterior end of the shaft 2—the end adjacent to which the panes are supported. In this case, two brake shoes 30 are organized to bear in opposition upon the peripheral edge of the disc 1; an arm 31 is provided for the support of each shoe, as shown in Fig. 1; the arms 31 are pivotally secured at their lower ends to the frame of the machine (not shown), and their upper ends are interconnected by means of rods 32 and a tension spring 33. The rods 32 are adjustable laterally of the arms (note nuts 34) for varying the tension of the spring 33, and by such adjustment the magnitude of the constant, motor-opposing drag may be regulated.

Turning to Figs. IV to VI, the structure of the work-securing devices 10 will be considered in detail. Two frame elements 35 are rigidly mounted upon the disc 1; each frame element is secured to the disc by means of tongue-and-slot engagement 36 and a screw 37; the slot (38) extends diametrically of the disc, and each frame element 35 may by loosening screw 37 be adjusted longitudinally of the slot, to adapt the machine for various sizes of panes. As appears to best advantage in Fig. V, a pair of clamping jaws 38, 38 is pivotally mounted on a pin 39 in each frame element 35; the jaws extend from opposite sides of the frame element, and severally cooperate with stationary jaw members 40 integrally embodied in the frame element. Each stationary jaw 40 includes a rubber block 41, and each swinging jaw 38 carries a rubber block 42, and in service the inner edge of each pane A and B is embraced by the jaws 38, 40 (Fig. IV) of two pairs of jaws (one pair upon each of the two frames), and is clamped between the rubber blocks 41, 42 (Fig. V) embodied in such jaws. Additionally, the jaws 38 are provided with rubber blocks 43, upon which as stops the introduced panes make engagement, as shown in Fig. V. Means are provided for swinging the jaws 38 between release and clamping positions, and such means are operable to effect the simultaneous movement of the upper jaws 38 (as considered in Fig. V) in the two frame elements 35 (Fig. IV) independently of the movable lower jaws 38 mounted in such frame elements. That is, the two pairs of jaws 38, 40, clamping the edge of one pane, may be operated independently of the jaws that secure the opposite pane, whereby the panes may be individually introduced to and removed from the continuously operating machine, as mentioned in the foregoing description.

More specifically, a bell-crank lever 44 is provided for each jaw 38; the two bell-crank levers for the upper and lower jaws 38 in each frame element 35 are pivotally secured to the frame element above and below, by means of a common pivot pin 45 (Fig. V); and links 46 pivotally connect the work arms of the bell-crank levers severally with the associated jaws 38, while the power arms of the two levers extend toward the axis of disc rotation and toward a cylindrical boss 47 (Fig. IV) projecting axially from the face of disc 1. Mounted on opposite sides of the boss 47, and extending in parallelism with (though spaced from) the axis of the boss, are two rods 51. One of such rods appears in Fig.

IV, and the other lies in alignment behind it. Upon these rods severally two handles 48 and 49 (Fig. V) are mounted to slide. The power arms of the upper pair of bell-crank levers 44 (as seen in Fig. V) are connected to the upper handle 49, while such arms of the lower pair of bell-crank levers are connected to the lower handle 48. The connection of each pair of bell-crank levers to its associated handle will be understood in Fig. IV—the end of the power arm of each lever engages the handle, by means of a slot-and-pin connection 52. The handles 48 and 49 are severally adjustable, to operate either the upper or lower pair of clamps 38, whereby either pane A or pane B may be removed and another substituted.

In the operation of the machine, the attendant observes when one of the two rotating panes (such as the pane B in Fig. XI) has been finished, and, while the panes continue to rotate, he pulls the appropriate handle (48 or 49), to open the pair of jaws 38 which secures the finished pane in the machine. Thus, as indicated in dotted lines in Fig. IV, the bell-crank levers 44 are swung, and the links 46 are shifted into the position indicated in Fig. VI, with the consequence and effect that the jaws 38 are swung about their mounting pins 39 into release position. The finished pane is removed from the machine, and another inserted.

In further refinement of my work-supporting structure, I mount a rubber-tipped caliper arm 55 on each bell-crank lever 44. The organization is such that, when either handle 48 or 49 is pulled into pane-replacing position, the corresponding pair of caliper arms 55 is shifted into the position indicated in dotted lines in Fig. IV. In such position the tips 56 of the caliper arms afford work-centering means. By virtue of the caliper arms 55, the pane being introduced may be quickly and accurately centered in the horizontal, while the blocks 43, by engaging the lower edge of the pane, afford an exact centering of the pane in the vertical. When the pane is properly positioned between the caliper arms, the appropriate handle (48 or 49) is thrust inward, swinging the jaws 38 into closed position and clamping the pane securely in place, and restoring the caliper arms to their illustrated full-line positions in Fig. IV.

Advantageously, elongate rods 57 are employed to secure the caliper arms 55 to the bell-crank levers 44. Each rod 57 is axially adjustable in the levers, and a set-screw 58 serves to secure the rod in adjusted position. By virtue of this arrangement, the caliper arms may be adjusted for panes of different sizes.

Conveniently, one or more blocks 59, including rubber inserts 59a, may be secured to the face of the disc 1, as shown in Fig. V, to support the panes outward of their edges which are embraced by clamps 38, 40.

I contemplate that the machine may be constructed as a twin unit; that is to say, the shaft 2 may be extended rearwardly of the cam 28 and equipped with a second work-supporting disc 1. The dotted lines in Fig. III illustrate such organization fragmentarily. Of course, duplicate sets of abrading wheels 9 and 12 are required at the rear of the machine, but a single motor 3 and a single speed-regulating mechanism 24—28 are thus adapted to effect the desired operation of two work supports.

While the machine described is designed for finishing the edges of glass panes or plates, it is

to be understood that the principles of my invention will prove valuable in machines of other particular adaptations. In the following claims the term "plate" is intended to include not only glass panes and plates, but plates of other materials and articles of other categories having edges or surfaces which lend themselves to the above described operation.

I claim as my invention:

1. Apparatus for finishing the edges of glass plates, said apparatus including a rotary support, said support including a body portion extending in a plane normal to the axis of its rotation, means for securing a plurality of plates in a plane spaced from and parallel to the plane of said body portion and with peripheral edge portions of individual plates forming together an approximate circle, a tool held in free or unguided yielding engagement with said last-mentioned edge portions of the plates, means for rotating said support, and means operating during the rotation of the support for inhibiting vibration of the peripherally engaged plates.

2. Apparatus for finishing the edges of glass plates, said apparatus including a support for rotatably mounting a plurality of plates with their peripheral edges lying in common plane, and with particular inner edge portions of individual plates extending in approximately radial direction with respect to the axis of plate rotation and with particular outer edge portions of the several plates extending in approximately circular direction with respect to such axis; a plurality of work-securing devices carried by said support and adapted to engage each of said radially extending inner edge portions of the plates in regions lying substantial intervals from and on opposite sides of said axis, means for rotating the support at varying angular velocity, a tool yieldingly engaging the outer edge portions of said plates, said work-securing devices being severally operable, to admit of removal and introduction of individual plates during support rotation, and means cooperating with said support for inhibiting vibration of the engaged plates.

3. Apparatus for finishing the edges of plates, said apparatus including a support for rotatably mounting a plate in a plane normal to the axis of plate rotation, a rotary grinding wheel, means for supporting said wheel in free or unguided yielding engagement with the peripheral edge of said plate, means for rotating said wheel at high speed, means for rotating said support at low speed, means for automatically varying the speed of rotation of said support, and means operating during support rotation for inhibiting vibration of the peripherally engaged plate.

4. Apparatus for finishing the edges of plates, said apparatus including a support for rotatably mounting a plate with its peripheral edge lying in a plane normal to the axis of plate rotation, a grinding wheel yieldingly mounted to bear against said edge of the plate, means for rotating the grinding wheel at high speed, means for rotating the support at low speed, a brake organized with said support for opposing the driving torque of said support-rotating means, whereby vibration of the plate (engaged peripherally by said rotating grinding wheel) is prevented, and means for regulating the speed of the support-rotating means, whereby the speed of rotation of said support is of predetermined variability.

5. Apparatus for finishing the edges of plates, said apparatus including a work support for ro-

tatably mounting a plate with its peripheral edge lying in a plane normal to the axis of plate rotation, means for rotating said support, a grinding wheel including a plurality of circumferential grooves, means for rotating said wheel about its axis, and an arm mounted to swing about an axis parallel to the axis of said wheel for yieldingly supporting said rotating wheel with one of its grooves in engagement with the peripheral edge of said plate, said wheel being adjustable relatively to said work support in a direction parallel to said parallel axes, whereby said wheel may be adjusted with another of its grooves in engagement with the edge of said plate.

6. A machine for finishing the peripheral edges of plates, said machine including a support for rotatably mounting a plate, said support including plate-securing devices, means for moving said devices between release and plate-securing positions, and work-centering means movable in response to the last-mentioned means.

7. Apparatus for finishing the edges of glass plates, said apparatus including a support rotatable on a horizontally extending axis, said support including a plurality of devices for securing a plurality of such plates in common plane normal to said horizontally extending axis, with the outer edge portions of the plates approximating a circle and with the inner edge portions of the plates lying within such approximate circle, and means for maintaining a rotating grinding wheel in yielding engagement with the circle-approximating edges of the plates, said plate-securing devices including clamping means engaging the inner edge portion of each plate in two regions lying one on one side of the axis of support rotation and the other on the opposite side of said axis, and means for operating as a unit the clamping means engaging one plate independently of the clamping means so engaging other plates, whereby individual plates may be removed and introduced during continuous support rotation.

8. Apparatus for finishing the edges of glass plates, said apparatus including a support rotatable on a horizontally extending axis, said support including a plurality of devices for securing a plurality of such plates in common plane normal to said horizontally extending axis, with the outer edge portions of the plates approximating a circle and with the inner edge portions of the plates lying within such approximate circle, means for maintaining a rotating grinding wheel in yielding engagement with the circle-approximating edges of said plates, said plate-securing devices including means engaging each plate on opposite sides of the axis of said support, and means extending laterally of the plane of the assembled plates and being accessible at the side of the apparatus for severally operating said plate-securing devices, whereby individual plates may be readily removed and introduced during continuous support rotation.

9. Apparatus for finishing the edges of glass plates, said apparatus including a support rotatable on a horizontally extending axis, said support including a plurality of devices for securing a plurality of such plates in common plane normal to said horizontally extending axis, with the outer edge portions of the plates approximating a circle and with the inner edge portions of the plates lying within such approximate circle, an arm pivotally mounted to swing in vertical plane, a grinding wheel rotatably mounted on 75

said arm, the length of said arm between its pivotal mounting and the axis of said wheel being relatively great with respect to the diameter of said plate assembly, and means cooperating with said arm for holding such wheel in free or unguided yielding engagement with the outer peripheral edge of the plate assembly.

10. Apparatus for finishing the edges of glass plates, said apparatus including a support rotatable on a horizontally extending axis, said support including a plurality of devices for securing a plurality of such plates in common plane normal to said horizontally extending axis, with the outer edge portions of the plates approximating a circle and with the inner edge portions of the plates lying within such approximate circle, an arm pivotally mounted to swing in vertical plane, a grinding wheel rotatably mounted on said arm, the length of said arm between its pivotal mounting and the axis of said wheel being relatively great with respect to the diameter of said plate assembly, and a counterweight effective upon said arm at a relatively short interval from such pivotal mounting and serving to hold such wheel in yielding engagement with the outer peripheral edge of the plate assembly.

11. Apparatus for finishing the edges of glass plates, said apparatus including a support rotatable on a horizontally extending axis, said support including a plurality of devices for securing a plurality of such plates in common plane normal to said horizontally extending axis, with the outer edge portions of the plates approximating a circle and with the inner edge portions of the plates lying within such approximate circle, an arm pivotally mounted to swing in vertical plane, a grinding wheel rotatably mounted on said arm, the length of said arm between its pivotal mounting and the axis of said wheel being relatively great with respect to the diameter of said plate assembly, means cooperating with said arm for holding such wheel in yielding engagement with the outer peripheral edge of the plate assembly, and means for inhibiting vibration of the plates peripherally engaged by said grinding wheel.

12. Apparatus for finishing the edges of plates, said apparatus including a support for rotatably mounting a plate with its peripheral edge lying in a plane normal to the axis of plate rotation, means for rotating said support, a tool engaging the edge of said plate, and means peripherally engaging said support and cooperating therewith for inhibiting vibration of the engaged plate.

13. In apparatus for grinding the edges of articles of non-circular outline, said apparatus including a rotary shaft carrying a plurality of work-supports in spaced-apart relation, grinding instruments adapted severally to engage the edges of the articles mounted upon said supports, means for rotating the supports, said support-rotating means including an electric motor, speed-reducing gearing, and a speed-varying rheostat, a cam rotatable in synchronism with said rotary shaft, and means cooperating with said cam for automatically adjusting said rheostat, whereby

the common angular velocity of the several articles is varied and accommodation made in the case of each article to variations in the outline of the article from a circumferential line with respect to the center of rotation.

14. A machine for finishing the peripheral edges of plates, said machine including a rotary support, a plurality of pairs of work-securing devices for securing a plurality of plates upon said support, and means for severally operating said devices in pairs between work-securing and release positions.

15. A machine for finishing the peripheral edge of a plate, said machine including a rotary support, a pair of work-securing devices carried by said support and adapted to engage said plate in regions lying substantial intervals from and on opposite sides of the axis of support rotation, and means for moving said devices in common between work-securing and release positions, together with work-centering means movable into operative position when said devices are in release position.

16. A machine for finishing the peripheral edges of plates, said machine including a rotary support, a plurality of pairs of work-securing devices for securing a plurality of plates upon said support, and means for severally operating said devices in pairs between work-securing and release positions, together with work-centering means organized with each pair of work-securing devices, each of said work-centering means being movable into operative position when its associated pair of work-securing devices is in release position.

17. A machine for finishing the peripheral edges of plates, said machine including a rotary support, means carried by said support for securing a plate thereto, said means being movable between plate-securing and release positions, and work-centering means including members adapted to engage the peripheral edge of said plate and being movable with said plate-securing means between alternate positions.

18. Apparatus for finishing the edges of plates, said apparatus including a rotary support for mounting a plate with its peripheral edge lying in a plane normal to the axis of plate rotation, means for rotating said support, a grinding wheel, means for holding said grinding wheel in free or unguided yielding engagement with the peripheral edge of said plate, and means effective during support rotation for inhibiting vibration of the engaged plate.

19. A machine for finishing the peripheral edges of plates, said machine including a rotary support, means carried by said support for securing a plurality of plates in common plane and with outer edge portions of the plates approximating a circle and with inner edge portions of the plates lying within such approximate circle, said means comprising members adapted to engage the inner edge portion of each plate in two regions lying one on one side of the axis of support rotation and the other on the opposite side of such axis.

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