

Oct. 27, 1959

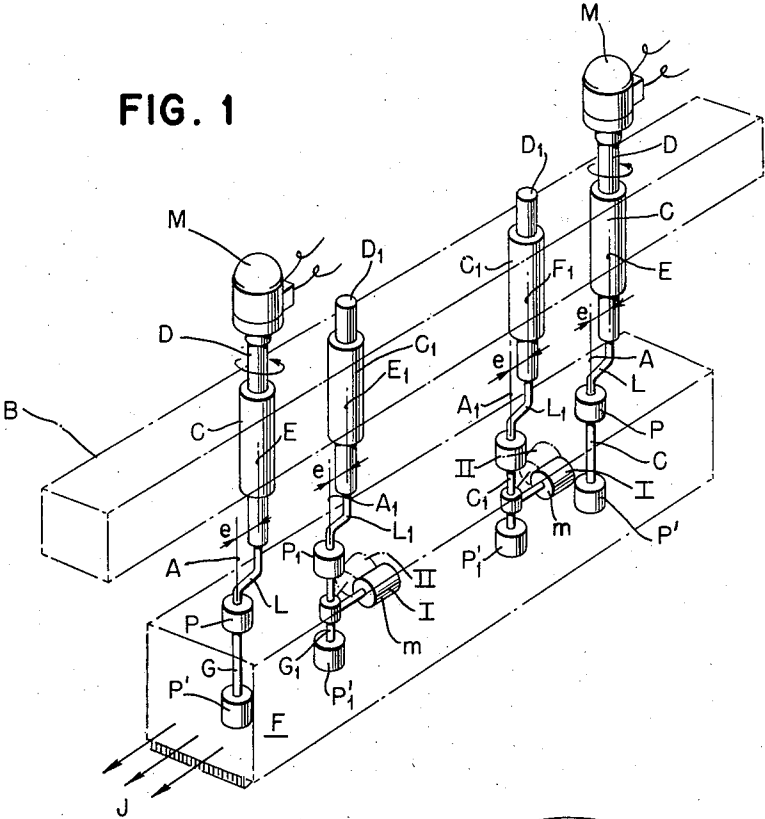
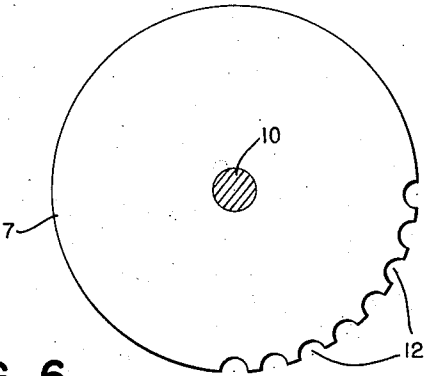
P. R. HEYMES ET AL

2,909,871

APPARATUS FOR POLISHING GLASS AND THE LIKE

Filed Sept. 5, 1956

3 Sheets-Sheet 1



INVENTORS
PIERRE RENE HEYMES
RENE PERGENT
BY
Bauer and Seymour
ATTORNEYS

Oct. 27, 1959

P. R. HEYMES ET AL

2,909,871

APPARATUS FOR POLISHING GLASS AND THE LIKE

Filed Sept. 5, 1956

3 Sheets-Sheet 3

FIG. 5

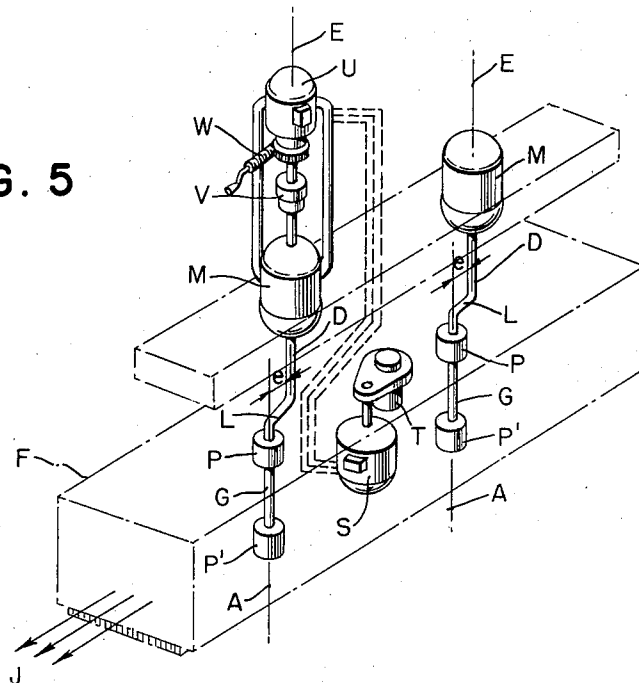
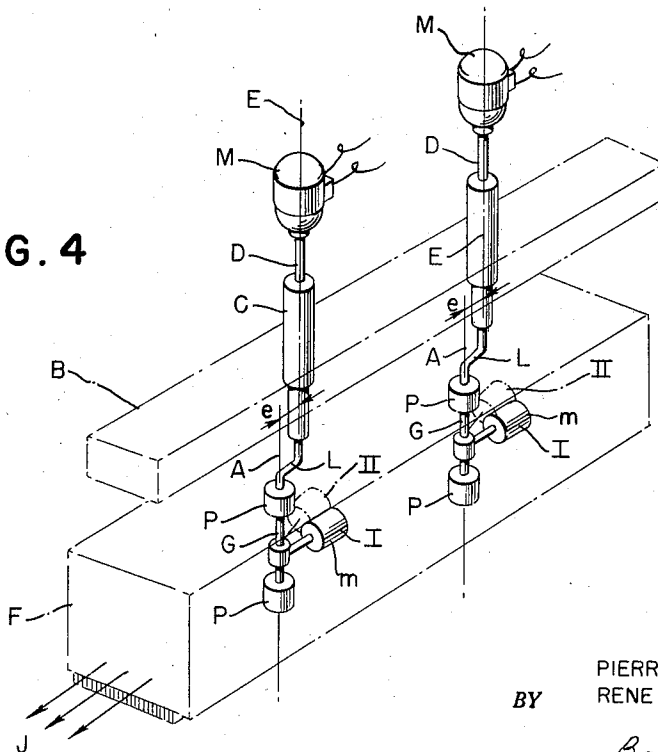


FIG. 4



INVENTORS
PIERRE RENE HEYMES
RENE PERGENT

BY

Bauer and Seymour
ATTORNEYS

1

2,909,871

APPARATUS FOR POLISHING GLASS AND THE LIKE

Pierre René Heymes and René Charles Pergent, Paris, France, assignors to Societe Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey, Paris, France

Application September 5, 1956, Serial No. 608,045

Claims priority, application France September 8, 1955

19 Claims. (Cl. 51—119)

This invention relates to an improved apparatus for grinding or polishing glass and the like, and more particularly relates to a polishing apparatus wherein a polishing member is presented to the glass and is driven so as to have a circular translatory movement with respect thereto.

This application is a continuation-in-part of application Ser. No. 528,098, filed August 12, 1955.

The invention has among its objects the provision of an improved apparatus having a working member driven with a circular translatory movement, wherein unwanted vibratory movements which would otherwise be transmitted from the working member to its driving means are largely counteracted.

A further object of the invention lies in the provision of an improved apparatus for grinding or polishing glass and the like of the type indicated, wherein undesirable vibratory movements transmitted by the grinding or polishing member when in working engagement with the glass, to the supporting frame therefor are at least largely counteracted and preferably are substantially nullified.

The invention has as yet another object the provision of an improved apparatus for grinding or polishing glass and the like by a working member having a circular translatory movement, said apparatus including means for subjecting the working member to centrifugal forces of such magnitude and phase with respect to the working motion of the member as at least substantially to nullify the undesired reactions which would otherwise be transmitted from the working member to its driving mechanism and the supporting frame therefor.

The above and further objects of the invention will more readily appear upon consideration of the following specification and of the drawing forming a part thereof. In such drawings which show illustrative embodiments of the apparatus of the invention:

Fig. 1 is a schematic view in perspective showing a first embodiment of the apparatus of the invention.

Fig. 2 is a view in vertical section through an eccentric balancing means which may be employed in the apparatus shown generally in Fig. 1.

Fig. 3 is a horizontal section through the apparatus of Fig. 2, the section being taken along the line X—X of Fig. 2.

Fig. 4 is a schematic view in perspective of a second embodiment of the apparatus of the invention.

Fig. 5 is a schematic view in perspective of a third embodiment of the apparatus of the invention.

Fig. 6 is a fragmentary horizontal section through the device of Fig. 2, the section being taken along line 6—6 of Fig. 2.

The present invention is shown in the illustrative embodiments herein as applied to apparatus for the polishing of glass and the like generally of the type disclosed in the application of Heymes, Ser. No. 528,098. In such apparatus there is employed at least one working member which is presented to the surface of a moving sheet of glass, the working member being, for example, in the

2

form of a rectangle having its larger dimension positioned transverse to the direction of movement of the glass. Such working member is driven with a circular translatory movement by two parallel cranks or eccentrics, the cranks or eccentrics having the same throw, turning at the same speed, and positioned in phase.

Such movement of the working member, which has considerable weight, gives rise to appreciable forces of inertia. In addition, during operation of the device and with the working member in engagement with the glass, the working member is subjected to additional "rubbing" forces, the directions of which are offset or displaced with respect to the direction of the forces of inertia. As a consequence, the working member is subjected to the action of two systems of rotating forces, which combine into a resultant rotating force being offset by an angle with respect to the force of inertia. The resultant rotating force gives rise to vibrational phenomena which are very harmful, both to the driving and supporting mechanism for the member and to the working member itself and also for the polishing operation, especially when the working member is driven rapidly.

The present invention consists in subjecting the working member to centrifugal force or forces generated by at least one mass which is rotated in synchronism with the movement of the working member, the mass being rotated around an axis perpendicular or normal to the plane of movement of the working member and eccentric to the center of gravity of the mass. In accordance with the invention, the characteristics of such eccentric mass, including the weight of the mass, the distance between the center of gravity of the mass and its axis of rotation, the angle of offset or displacement of the plane perpendicular to the plane of rubbing passing through the axis of rotation of the mass and through its center of gravity, with respect to a plane of reference perpendicular to the rubbing plane and passing through the center of gravity of the working member are so chosen that the centrifugal forces thus created balance, completely or in part, the reactions of the working member on the mechanism which drive the working member with said circular translatory movement.

As will be clear upon consideration of the illustrative embodiments of the apparatus, such balancing centrifugal forces may be generated in a variety of manners. The balancing masses may be so mounted that their angular position with respect to the working member may be adjusted. The balancing weights may be rotatably mounted on axes parallel to the shafts which drive the working member, or may be mounted on such shafts themselves.

According to the invention it is possible to act, during operation of the apparatus, on the above mentioned characteristics of the masses, particularly on their position with respect to the working member.

In Fig. 1 there is schematically shown a polishing apparatus having a working member F generally in the form of elongated rectangular prism. Such working member is driven with a horizontal circular translatory movement parallel to its larger dimension in the following manner:

A frame shown generally at B carries two bearings C spaced longitudinally of the frame. Bearings C mount two vertical shafts D for synchronized rotation about their respective axes E. Each of shafts D is rotated by a motor M mounted upon frame B, motors M being synchronized with their shafts in the proper phase. The vertical plane containing the axes E of shafts D is parallel to the longitudinal plane of symmetry of the working member F. To the lower end of each shaft D there is attached a crankshaft G, each crank being rotatably mounted in the respective pairs of bearings P—P' which are affixed to the working member. The vertical axes A of each pair of bearings P—P' lie in the longitudinal

3

plane of symmetry of the working member. The arms of the cranks L are located a distance e from the axes of the shafts E. The throws of the two cranks L are parallel, the cranks being driven in synchronism by the above mentioned synchronous motors M. When the cranks are thus driven, working member F is given the described circular translatory motion. Although for ease of illustration cranks L have been shown in the apparatus of Fig. 1 for driving the working member F, in practice it is desirable to replace the cranks by accen-

trics, as will more fully appear upon consideration of the apparatus of Figs. 2, 3, and 6. The frame B also carries two bearings C_1 which rotatably mount the vertical shafts D_1 . The axes E_1 of the respective shafts D_1 are located in the same vertical plane as that containing the axes E. The shafts D_1 are provided with cranks L_1 having the same length of throw as the cranks L, the arms of cranks L_1 being parallel to the arms of cranks L. The lower ends of cranks L_1 rotate freely in bearings P_1 — P'_1 which are attached to the working member F. The axes A_1 of vertical shafts G_1 are located in the same plane as the axes A of shafts G.

In accordance with the invention, each of shafts G_1 has an eccentric weight m rigidly attached thereto. If the working member were subjected only to inertia forces J, balancing of the inertia forces by centrifugal forces could be attained by positioning the masses m in a direction displaced 180° with respect to the movement of the working member, as is shown in the solid line position I in Fig. 1.

Actually, as we have seen above, the working member is subjected during its polishing operation to two sets of forces: inertia forces and rubbing forces, which combine into a resultant displaced at an angle with respect to the inertia forces. In accordance with the invention it is possible to balance such resultant force by displacing the masses m , through predetermined angles with respect to their position I to positions II as shown in Fig. 1.

Referring to Figs. 2, 3 and 6, there is shown an embodiment of the apparatus of the invention generally similar to that of Fig. 1 but with the cranks L and L_1 of Fig. 1 replaced by eccentrics. Figs. 2, 3, and 6 show a portion of the apparatus corresponding to the idle shafts D_1 , the bearings C_1 , the cranks L and L_1 , etc., of the embodiment of Fig. 1.

In Figs. 2 and 3 the framework is generally designated by the reference character 1. Non-rotatably mounted upon framework 1 is a vertical shaft 2 which generally corresponds to the shaft D_1 in Fig. 1. The working member F in this embodiment is driven with a circular translatory motion as in Fig. 1 by eccentric means (not shown) generally corresponding to the cranks L of Fig. 1.

The balancing weight is made up of elements 7 and 8, the latter carrying on a portion of its periphery an adjustable weight 9 made up, for example, of a variable number of weights of lead, cast iron, or any other desirable heavy material. In some instances it may be desirable to use a heavy liquid such as mercury, whereby the balancing weight may be changed during operation of the apparatus.

The axis A_1 of element 8 is offset a distance e from the axis E_1 of the shaft 2. Element 7 is rotatably mounted on shaft 2 by means of a roller bearing 4 having a bearing race 3 affixed to element 7. Element 8 is rotatably mounted on the working member F by means of roller bearings 5 and 6. To allow the working member to be vertically adjusted, elements 3 and 7 are connected by longitudinal extending splines 14.

During operation of the apparatus the balancing mass made up of elements 7 and 8 is rotated around the axis A_1 with the same period as the circular translatory movement of the working member. The elements 7 and 8 are adjustable with respect to each other by rotation about the connecting pin 10 which lies on the axis A_1 .

4

Elements 7 and 8 can be locked together, in a predetermined angular position, by means of a set screw 11 which is threadably received at one fixed location in the wall of the element 8, the inner end of the pin extending into a desired one of the depressions 12 on the periphery of the base of element 7, as shown in Fig. 6. By reason of such adjustment, it is possible to give the mass 9 an angular disposition so related to the movement of the working member as to counterbalance the forces of inertia and the polishing or grinding forces acting upon the working member.

Fig. 4 shows another embodiment of apparatus in accordance with the invention. In such embodiment the balancing masses are directly mounted upon the shafts G of the cranks which drive the working or polishing member F.

In Fig. 5 there is shown yet another embodiment of apparatus in accordance with the invention. In this embodiment one or more synchronous electric motors S are affixed to the working member F. Each motor S has an eccentric weight T fixedly connected to its shaft, whereby rotation of the motor S subjects the member F to a centrifugal force. The one or more motors S are electrically synchronized with the motors M, which are, as we have seen, synchronized with each other. The synchronization of motors S and M may be effected by driving motor S by a synchronous generator or pilot motor U which is directly connected to a motor M by coupling V.

The angular displacement of the centrifugal force generated by motor S and weight T with respect to the direction of movement of member F may be varied by angular adjustment of the stator of generator U with respect to the framework of the apparatus on which the generator is fixedly mounted, and thus varying its relationship, and that of the shaft of motor S, with respect to working member F. In Fig. 5 a worm W journaled in the framework of the apparatus is shown engaging a worm gear affixed to the stator of generator U to effect the described angular adjustment of the counterbalancing centrifugal force.

Although only a limited number of embodiments of the invention are illustrated in the drawing and described in the foregoing specification, it is to be expressly understood that the invention is not limited thereto. For a definition of the limits of the invention, reference is had primarily to the appended claims.

What is claimed is:

1. In surfacing apparatus for glass sheets and the like having a work engaging rubbing member driven to move in a circular translatory path on the work, means for driving the member, mechanism for counterbalancing at least in part the forces of inertia of the rubbing member and the forces exerted on the rubbing member by its rubbing of the workpiece, said mechanism comprising a mass mounted on the member for rotation about an axis eccentric to the mass and fixed with respect to the member, the plane passing through the axis of rotation of the mass and containing its center of gravity being inclined according to a predetermined angle with respect to the plane containing the axis of rotation of the mass and the fixed axis about which this axis of rotation of the mass rotates during the circular translatory motion of the rubbing member, and means for rotating the mass in synchronism with the movement of the member.

2. Apparatus as defined by claim 1 wherein the rubbing member moves in a plane, the axis of rotation of the mass lies perpendicular to the plane, and the mass has such weight and is so oriented with respect to the rubbing member that the centrifugal force created by the rotating mass has a direction opposite from that of the resultant of the inertia forces and the rubbing forces to which the rubbing member is subjected.

3. Apparatus as defined by claim 2, comprising a fixed frame supporting the driving means for the rubbing mem-

ber, means rotatably supporting the mass in a fixed position on the rubbing member, a shaft normal to the plane of movement of the rubbing member fixed on the frame, and an eccentric driving means having the same throw as the driving means for the rubbing member connecting the mass and the shaft.

4. Apparatus as defined by claim 3, wherein the mass is formed by two elements of which one is located eccentrically of the other, and means for adjusting the position of the two elements with respect to each other.

5. An apparatus for the grinding or polishing of a workpiece of glass and the like, comprising a workpiece-engaging rubbing member driven to move in a circular translatory path on the workpiece, rotary shafts having main portions with parallel, first axes, said main portions being journaled to rotate in bearings rigidly fixed to a support, said shafts having similar eccentric portions having parallel second axes, the eccentric portions being in phase and journaled in bearings rigidly fixed to the rubbing member, the shafts being driven in synchronism, and means for counterbalancing at least in part the forces of inertia of the member and the rubbing forces exerted on the rubbing member by its rubbing of the workpiece, said last named means comprising a mass which is driven to rotate in synchronism with the movement of the rubbing member about the said second axis of an eccentric portion of one of said shafts, the mass being disposed eccentrically of said one shaft, the mass being disposed in such manner that a first plane containing said second axis of the eccentric portion of said one shaft and the center of gravity of the mass is inclined at a predetermined angle with respect to a second plane containing said second axis of the eccentric portion of said one shaft and the first axis of the main portion of said one shaft.

6. An apparatus as defined in claim 5, wherein the counterbalancing mass is so located that the force generated thereby has a direction opposite from the resultant of the forces of inertia and the rubbing forces to which the rubbing member is subjected.

7. An apparatus as defined in claim 6, wherein the counterbalancing mass is so constructed and arranged as to be variable in its counterbalancing effect.

8. An apparatus as defined in claim 7, comprising means to adjust the distance between the center of gravity of the counterbalancing mass and its axis of rotation.

9. An apparatus as defined in claim 7, comprising means to adjust the counterbalancing effect of the counterbalancing mass during operation of the apparatus.

10. An apparatus as defined in claim 5, wherein the counterbalancing mass is fixed to the eccentric portion of said one shaft and rotates about said second axis of such shaft.

11. An apparatus as defined in claim 5, comprising means to drive said first shafts in synchronism and in phase, and a counterbalancing mass affixed to the eccentric portion of each shaft, each counterbalancing mass rotating about the second axis of the eccentric portion of its respective shaft.

12. An apparatus as defined in claim 11, wherein the shafts also drive the rubbing member, and the driving means is connected to said shafts.

13. An apparatus as defined in claim 11, wherein the driving means for the rubbing member and the first recited shafts comprises a set of second shafts spaced longitudinally of the rubbing member and having main portions parallel to the main portions of the first recited shafts and fixedly journaled in the support, each second shaft having an eccentric portion fixedly journaled in the rubbing member, the eccentric portions of the second shafts being parallel to each other, mutually in phase, parallel and in phase with, and having the same length of throw as, the eccentric portions of the first recited shafts,

and means for drivingly rotating the second shafts in synchronism.

14. In surfacing apparatus for glass sheets and the like having a work engaging rubbing member driven to move in a circular translatory path on the work, means for driving the member comprising at least one first electric motor, mechanism for counterbalancing to at least a substantial extent the reactions of the member on the driving means therefor, said mechanism comprising a second electric motor fixed to the working member, said second electric motor carrying an eccentric weight, and electrical means for synchronizing the second motor with the first motor.

15. Apparatus as defined by claim 14, comprising a fixed mounted synchronous generator for driving the second motor, means for driving the generator from said first electric motor, and means for displacing the stator of the generator whereby to vary the angular position of the mass with respect to the working member.

16. In a surfacing apparatus for glass sheets and the like, having a work engaging surfacing member, means for imparting to said surfacing member a circular translatory motion comprising four parallel first shafts having main portions rotating in bearings rigidly fixed to a support and provided with eccentric portions having parallel crank pins journaled to rotate in bearings fixed to the surfacing member, means for imparting synchronized rotations to two of the first shafts and two balancing masses rotatable synchronously with the movement of the surfacing member about the crank pins of the two other second axes not extending through the centers of gravity of the balancing masses, these balancing masses being so disposed that the planes passing through these second axes about which they rotate and their centers of gravity are inclined at a predetermined angle with respect to the planes passing through these second axes about which the balancing masses rotate and through the first fixed axes about which the second axes rotate.

17. In a surfacing apparatus for glass sheets and the like, having a work engaging surfacing member, means for imparting to said surfacing member a circular translatory motion comprising two parallel first axes rotating in bearings rigidly fixed to a support and provided with eccentric portions having parallel second axes journaled to rotate in bearings fixed to the surfacing member, means for imparting synchronized rotations to these first axes, and one balancing mass rotatable synchronously with the movement of the surfacing member about each second axis not extending through the center of gravity of the balancing mass, these balancing masses being so disposed that the planes passing through these second axes about which they rotate and their centers of gravity are inclined at a predetermined angle with respect to the planes passing through these second axes about which the balancing masses rotate and through the first fixed axes about which the second axes rotate.

18. In an apparatus according to claim 17 each balancing mass is supported in an eccentric rotatable about each first axis which is perpendicular to the rubbing plane of the surfacing member.

19. In an apparatus according to claim 18, the eccentric comprises two members capable of being orientated relative to each other about an axis and of being secured together in a selected relationship.

References Cited in the file of this patent

UNITED STATES PATENTS

233,067	Buzzell	Oct. 12, 1880
2,545,942	Crosby et al.	Mar. 20, 1951
2,669,812	Champayne	Feb. 23, 1954
2,683,336	Scace	July 13, 1954