

May 11, 1926

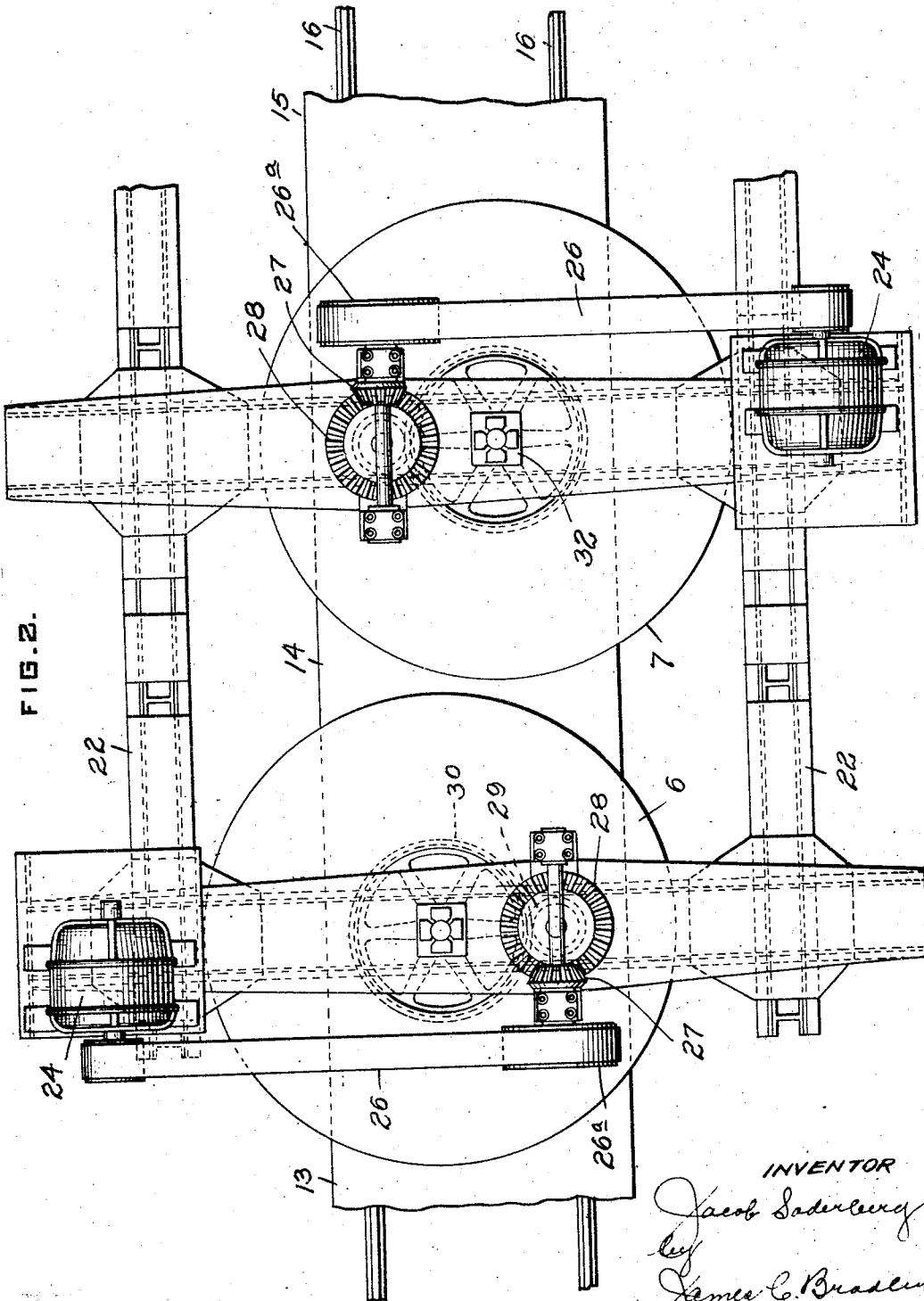
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J. SODERBERG

GRINDING MACHINE

Filed Oct. 11, 1922

4 Sheets-Sheet 2



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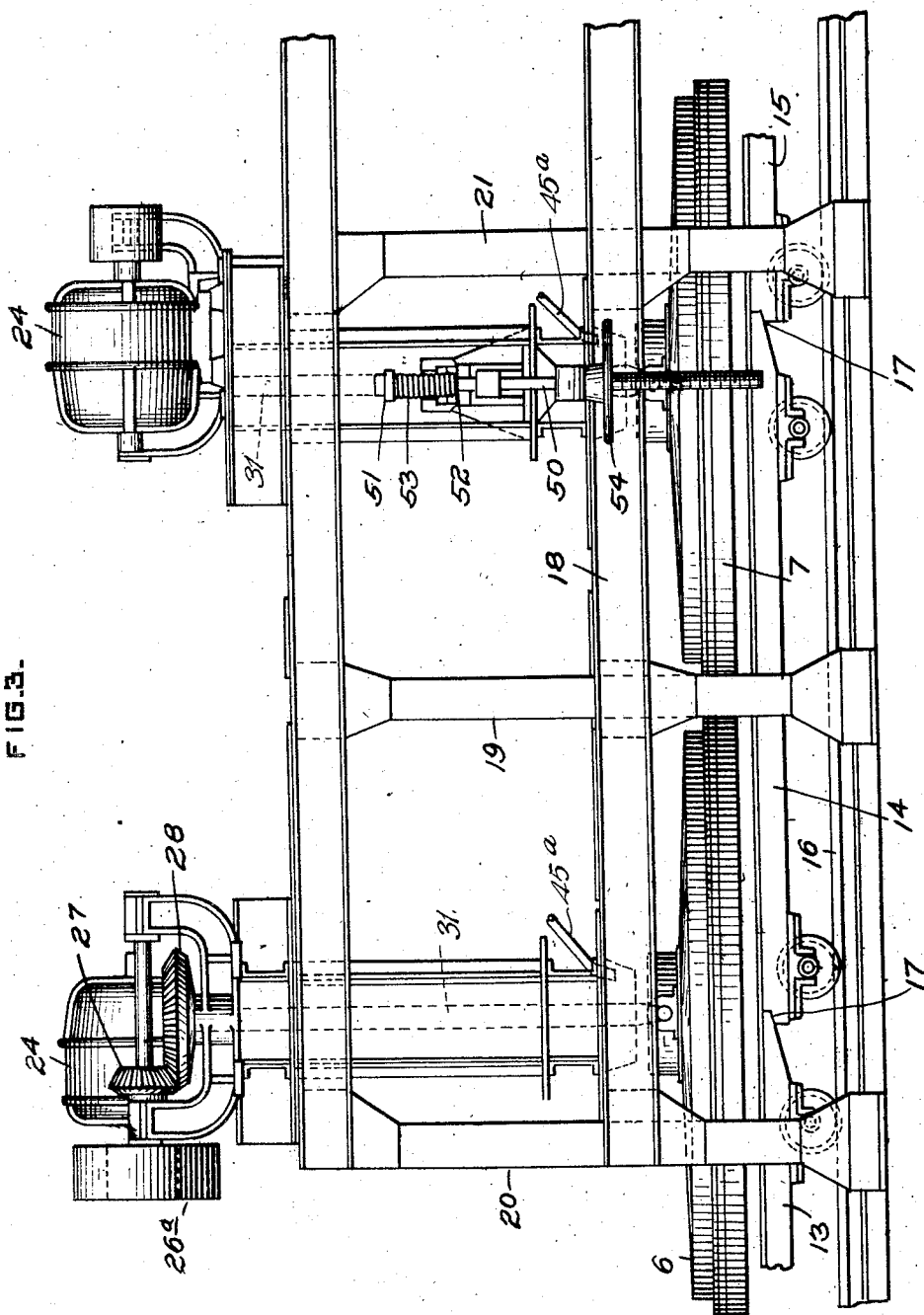
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4 Sheets-Sheet 3

FIG. 3.



INVENTOR

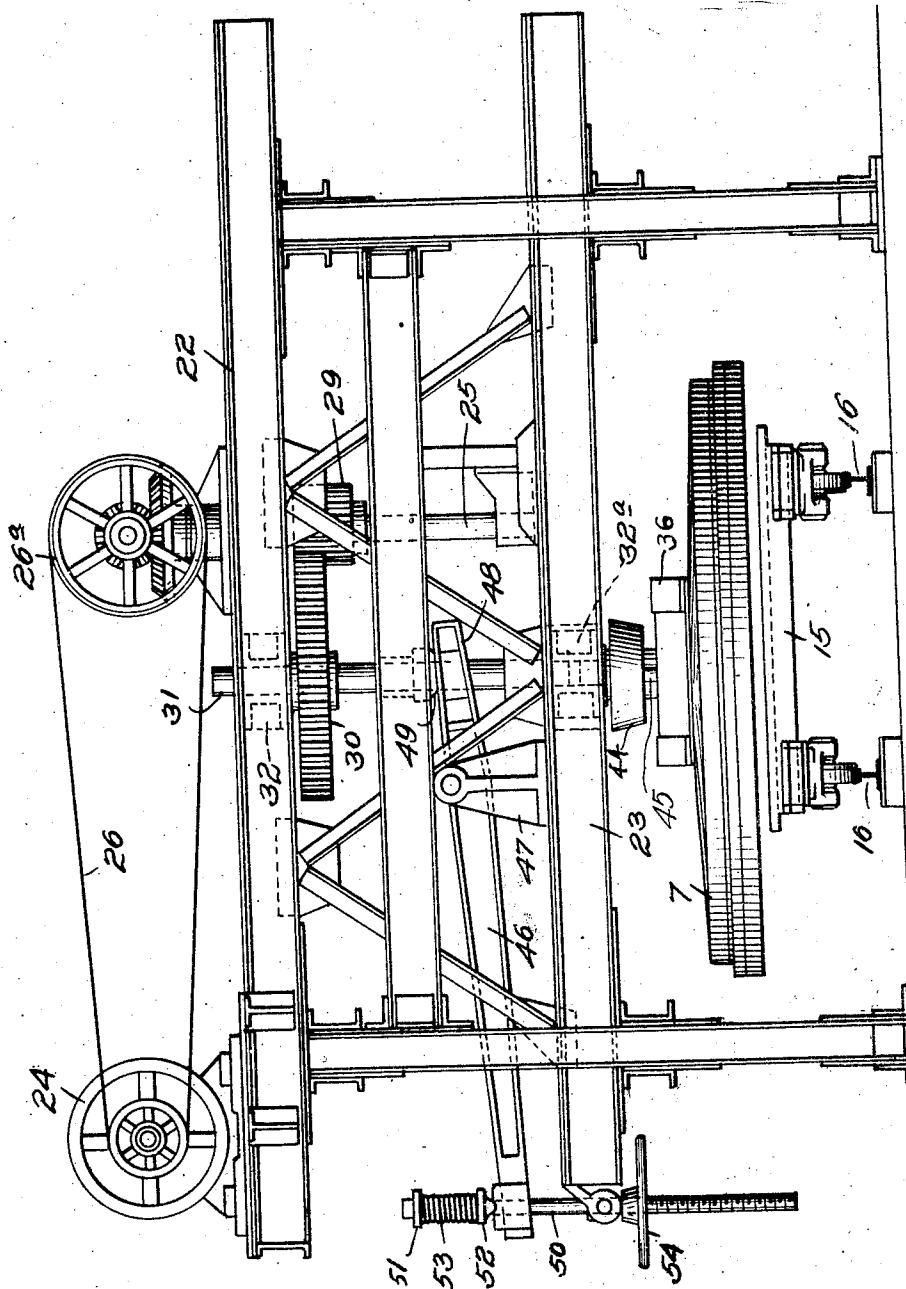
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4 Sheets-Sheet 4



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Patented May 11, 1926.

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UNITED STATES PATENT OFFICE.

JACOB SODERBERG, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO PITTSBURGH PLATE GLASS COMPANY, A CORPORATION OF PENNSYLVANIA.

GRINDING MACHINE.

Application filed October 11, 1922. Serial No. 593,760.

The invention relates to grinding machines of the type in which a continuous sheet or ribbon of glass or a series of sheets are carried beneath a series of grinding or smoothing runners, each of which performs a surfacing function upon the glass, suitable abrasives, such as, sand or emery, being supplied with water as is common in sheet glass grinding operation. In the case of a continuous ribbon of glass, such ribbon must of necessity be carried in a straight line beneath the grinders, but in the case of a series of sheets, the movement may be either in a straight line or on an arc having a relatively large radius of curvature as would be the case in carrying the sheets around a circle beneath the series of grinders. The principal object of the invention is the provision of an arrangement of grinders of such a character, (1) that the grinding or reducing effect upon the glass surface is made as nearly uniform as may be across the width of the sheet, (2) that the grinders themselves will wear uniformly, (3) that the grinders will grind at a more or less uniform speed throughout their grinding areas so that a maximum degree of grinding effect per unit of time (for the weight of grinders and speed or rotation thereof) may be secured. One embodiment of the invention is illustrated in the accompanying drawings wherein:

Figure 1 is a diagrammatic plan view showing the arrangement of the runners with respect to a series of sheets of glass adapted to be carried longitudinally beneath the runners; Fig. 2 is a plan view of a short section of the apparatus; Fig. 3 is a side elevation of the apparatus of Fig. 1; Fig. 4 is an end elevation of such apparatus and Fig. 5 is an enlarged vertical section through the center of one of the runners.

As indicated in Fig. 1, the glass to be ground consists of a series of sheets of glass 1, 2, 3, 4, etc. preferably mounted upon a series of trucks or tables arranged for longitudinal movement beneath a series of runners 5, 6, 7, 8, etc., but it will be understood that the invention is applicable where the glass is in one continuous ribbon instead of a plurality of sections. The number of runners employed will depend upon varying conditions, among which is the

speed of movement of the glass underneath the runners. If the speed of movement of the glass ranges from two to three feet per minute, the number of runners required will range ordinarily from 15 to 25, depending upon the roughness of the glass surface to be smoothed. The glass is ground by the use of abrasive and water, the abrasive preferably used for the coarser grinding being sand and for the final smoothing operation being emery. The grade of sand used with the various runners is progressively finer from the first runner to the last, and similarly several grades of emery are preferably used with the last runners for giving the necessary smoothing effect preliminary to the polishing of the glass which will also preferably be effected by continuing the movement of the glass sheets beneath a series of polishing runners.

The runners have their centers cut out as indicated at 9, 10, 11 and 12 and the centers or axes of rotation of the runners are placed off center with respect to the center line A of the series of sheets of glass, the alternate runners 5, 7, etc. being located with their centers on the line B, while the centers of the other alternate runners 6, 8, etc. are located on the line C. The cutting out of the centers of the runners increases the speed of the surfacing action effected by the runners. The cutting effect of the runners at any point is dependent upon the speed of movement relative to the glass, and this speed of movement decreases from the outside of the runner to the center, so that the cutting action is less at the center, as well as the wear upon the runner. The tendency is, therefore, for the runners to wear away at their outer portions, leaving the center high. The effect is, as the grinding progresses, to wear the outer portions of the runners so that they are out of contact with the glass and, if the glass is moved beneath the runners at a speed which gives the proper grinding effect at the center of the runner, the grinding effect at the sides of the sheet is insufficient. This effect is reduced by cutting out openings of substantial diameter at the centers of the runners and by arranging them so that their peripheries extend out past the side edges of the glass sheet.

The runners are placed off center with respect to the center line A of the series of

sheets in order to give a more uniform grinding effect and to give a more uniform surface upon the glass. The rapidity of the reducing or cutting action of the runner upon the glass at any particular point depends upon the crossing at this point of the lines of cut. The cutting action is much more rapid if the lines of cut crisscross at varying angles than where they are in the same direction. It therefore becomes desirable, that this crisscross cutting effect be extended uniformly over the entire area of the sheet passing beneath the series of runners. The placing of the runners off center in the manner illustrated tends to produce this effect. To illustrate, if the centers of the runners all coincide with the center line of the series of ribbons, the band of glass extending along this line A on each sheet would have lines of cut which extend only at right angles to the line A, so that there would be no crisscross cutting at this point. On the other hand, the glass lying on each side of such line would receive cuts at different angles, for instance, along the line x the glass will receive a plurality of cuts of varying angular direction, as indicated by the arrows y . By placing the centers of the runners off center, the glass along the line A will be given the varying crisscross cuts to which the rest of the surface of the glass is exposed, as indicated by the arrows z . This expedient, therefore, renders the grinding action much more uniform throughout the width of the glass, so that the speed of cutting is increased and the wear upon the runners made more uniform, and the surface or "smooth" secured upon the glass rendered much more uniform, thus facilitating the subsequent polishing operation. This condition of uniform cutting due to the crisscross cuts is adjusted so as to give a satisfactory grinding action by the extent which the runners are made to overhang the glass at its edges and by the distance off center which the runners are placed.

As the abrasive is supplied through the centers of the runners, the tendency is to cut faster near the center due to the fact that the abrasive is coarser and sharper before it works its way to the outer portions of the runners, but on the other hand the cutting effect of the runner is normally greater at its outer portions due to the fact that its speed of movement relative to the glass is greater, so that these two conditions tend to balance each other and give more or less uniform wearing action upon the runner throughout its grinding face. If, however, the runner wears more or less at its outer portion as compared with its inner portion, a definite curvature upon the grinding face will soon be established and remain constant, since the wearing effect also depends upon the pressure between the runner and the glass and, if any portion of the runner is

worn away more rapidly than another portion, the increased pressure is transferred to the surface which is less worn.

The method of mounting and driving the runners and supporting the glass for movement therebeneath will be seen by reference to Figs. 2 to 5 in which a short section of the apparatus containing only the runners 6 and 7 of Fig. 1 is shown. These runners are mounted over a series of tables or trucks 13, 14 and 15 carried by the rails 16, such tables having their ends overlapping as indicated at 17 (Fig. 3) in order to provide a continuous support for the glass. The series of tables may be moved along the track by any drive means desired, such as a cable or gearing or a locomotive (not shown) which pushes or pulls at one end of the series of cars. The glass is held upon the table in any desired manner, either by the use of plaster, as is common in the art, or by suction or by mechanical means at the edges of the sheets for preventing their lateral movement upon the tables.

The runners are supported upon a suitable framework made up of the channels 18, 19, 20 and 21 in connection with the cross channels 22 and 23 (Figs. 3 and 4).

The two runners shown are similarly mounted and driven each by its motor 24, so that a description of one runner and its drive mechanism will be sufficient. The motor drives a countershaft 25 carried by suitable bearings on the framework through the intermediary of the belt 26, the pulley 26^a and the bevel gears 27 and 28. The countershaft 25 is provided with a pinion 29 which drives the spur gear 30 carried by the drive shaft 31 of the runner. This drive shaft is mounted in the bearings 32 and 32^a carried by the framework and is flexibly connected at its lower end with the runner 7 as indicated in detail in Fig. 5, the purpose being to permit the runner to rock with respect to the shaft 31, and so adjust itself to the surface of the glass, thus giving a more uniform cutting action throughout its area and decreasing the danger of breakage incident to localized pressure upon the glass. The runner itself comprises a casting 33 or a plurality of castings bolted together, bearing on its lower face the planking 34 which carries the cast iron runner bars 35, such runner bars being preferably of the ordinary type having their faces divided into the usual diamond or other similar sectional form. Mounted upon the top of the runner is a pair of bearings 36 which receive the bearing ends 37 of the ring member 38. Mounted in the ring member for rocking movement is the collar 39, such collar member being pivoted upon the ring 38 by means of stub shafts 40 which are carried by the ring 38 and project into suitable bosses on the sides

of the collar 39. In order to limit the rocking movement around the stub shafts 40, the stop members 41 are provided in opposition to the shoulders 42 on the ring 38. The shaft 31 is keyed to the collar 39, as indicated at 43. The foregoing arrangement permits the runner to rock in any direction with respect to the shaft 31 and so adjust itself to the surface of the glass.

Mounted upon the top of the collar 39 is a hopper 44 provided with outlet pipes 45 leading downward through the collar 39 and discharging into the space 11 at the center of the runner. This is to provide for the feed of the abrasive through the center of the runner, the hopper being supplied from a pipe 45^a leading from a suitable source of supply.

In order to regulate the pressure of the runner upon the glass, the lever 46 (Fig. 4) is employed, such lever being fulcrumed upon the member 47 carried by the framework and having its end 48 forked and fitting beneath the thrust member 49 secured to the drive shaft 31. At the outer end of the lever is a rod 50 provided with a fixed head 51 and a movable head 52 engaging the upper side of the lever with an interposed coil spring 53. The tension of the spring is regulated by means of the hand wheel 54 which is threaded onto the rod 50 and swiveled at the end of the frame channel 23. By this device the pressure of the runner upon the glass is regulated and the danger of any breakage of the glass on its downward movement after a sudden upward movement is reduced since the spring 53 cushions this downward movement.

The operation of the machine will be apparent from the foregoing description. The glass is placed upon the tables, preferably in a series of sections and the tables carried slowly beneath the series of runners. The coarsest sand is supplied to the first runner, while finer and finer grades are supplied to the succeeding runners until the glass is relatively smooth, at which time the feeding of emery is begun, as many grades of emery or other fine abrasive being used as

is necessary to complete the smoothing action preparatory to polishing. Such polishing action is preferably carried out by continuing the movement of the tables beneath suitable polishing runners.

What I claim is:

1. A grinding machine for sheet glass comprising a bed or table mounted for longitudinal movement and carrying the glass sheet to be surfaced, a plurality of horizontal grinding discs, having their centers open, arranged in two sets or series along the table with their axes of rotation off center with respect to the longitudinal center line of the table and of such diameter that each disc extends out past both of the side edges of the sheet a substantial distance, one set or series of said discs having their axes to one side of such center line, and the other set or series having their axes on the other side of such center line, but all of said axes being located inward from the side edges of the glass sheet, and means for rotating the discs.

2. A grinding machine for sheet glass comprising a bed or table mounted for longitudinal movement and carrying the glass sheet to be surfaced, a plurality of horizontal grinding discs, having their centers open, arranged in two sets or series along the table with their axes of rotation off center with respect to the longitudinal center line of the table and of such diameter that each disc extends out past both of the side edges of the sheet a substantial distance, one set or series of said discs having their axes to one side of such center line, and the other set or series having their axes on the other side of such center line, but all of said axes being located inward from the side edges of the glass sheet, and means for rotating the discs, the two sets or series of discs being interspersed so that the discs of one set alternate with those of the other set or series.

In testimony whereof, I have hereunto subscribed my name this 26th day of Sept., 1922.

JACOB SODERBERG.