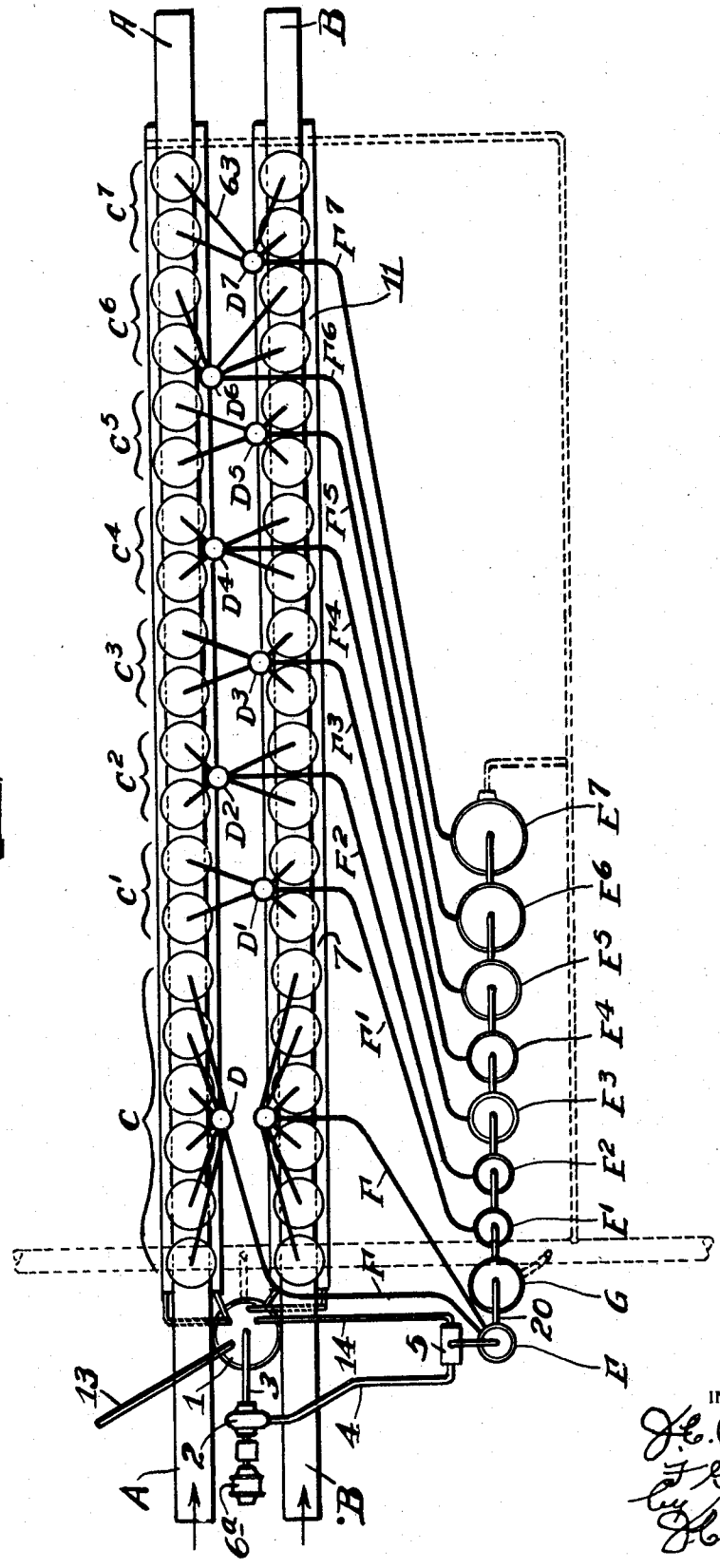
June 13, 1933. J. C. PARKINSON ET AL 1,914,039

PROCESS AND APPARATUS FOR GRADING ABRASIVES

Filed Aug. 19, 1929 4 Sheets-Sheet 1

Fig. 1.



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PROCESS AND APPARATUS FOR GRADING ABRASIVES

Filed Aug. 19, 1929 4 Sheets-Sheet 2

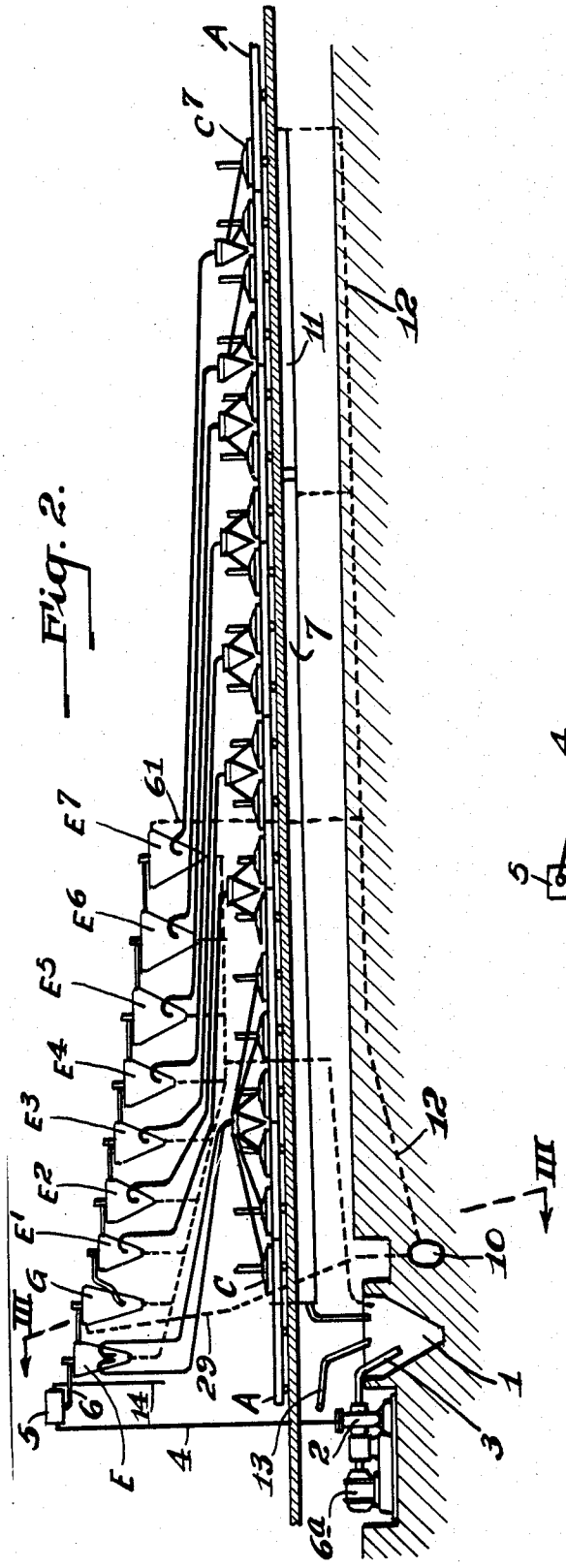


Fig. 2.

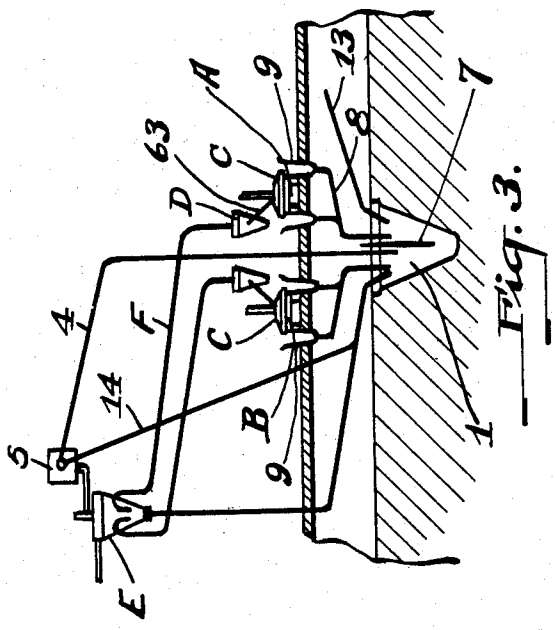


Fig. 3.

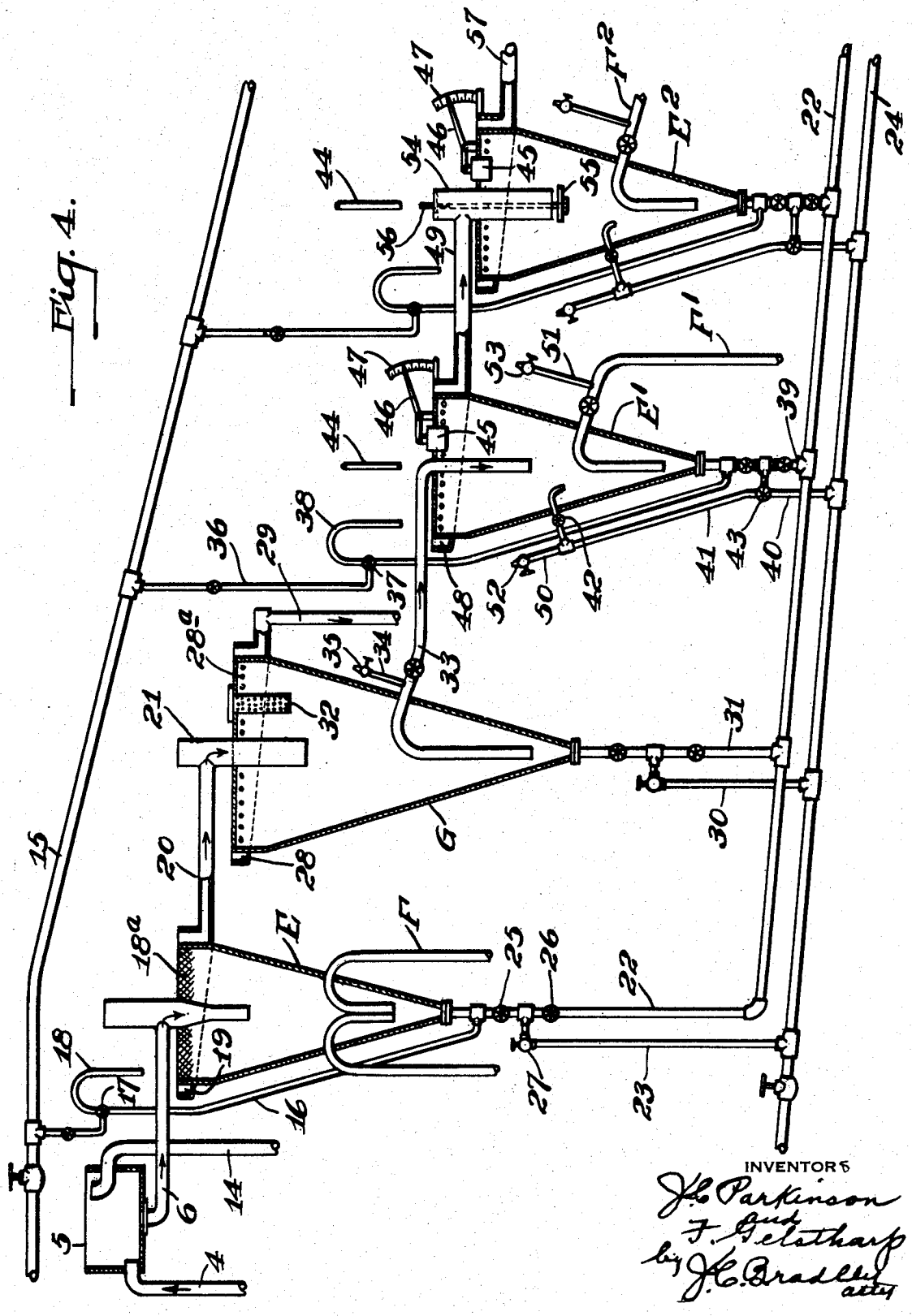
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PROCESS AND APPARATUS FOR GRADING ABRASIVES

Filed Aug. 19, 1929 4 Sheets-Sheet 3

Fig. 4.



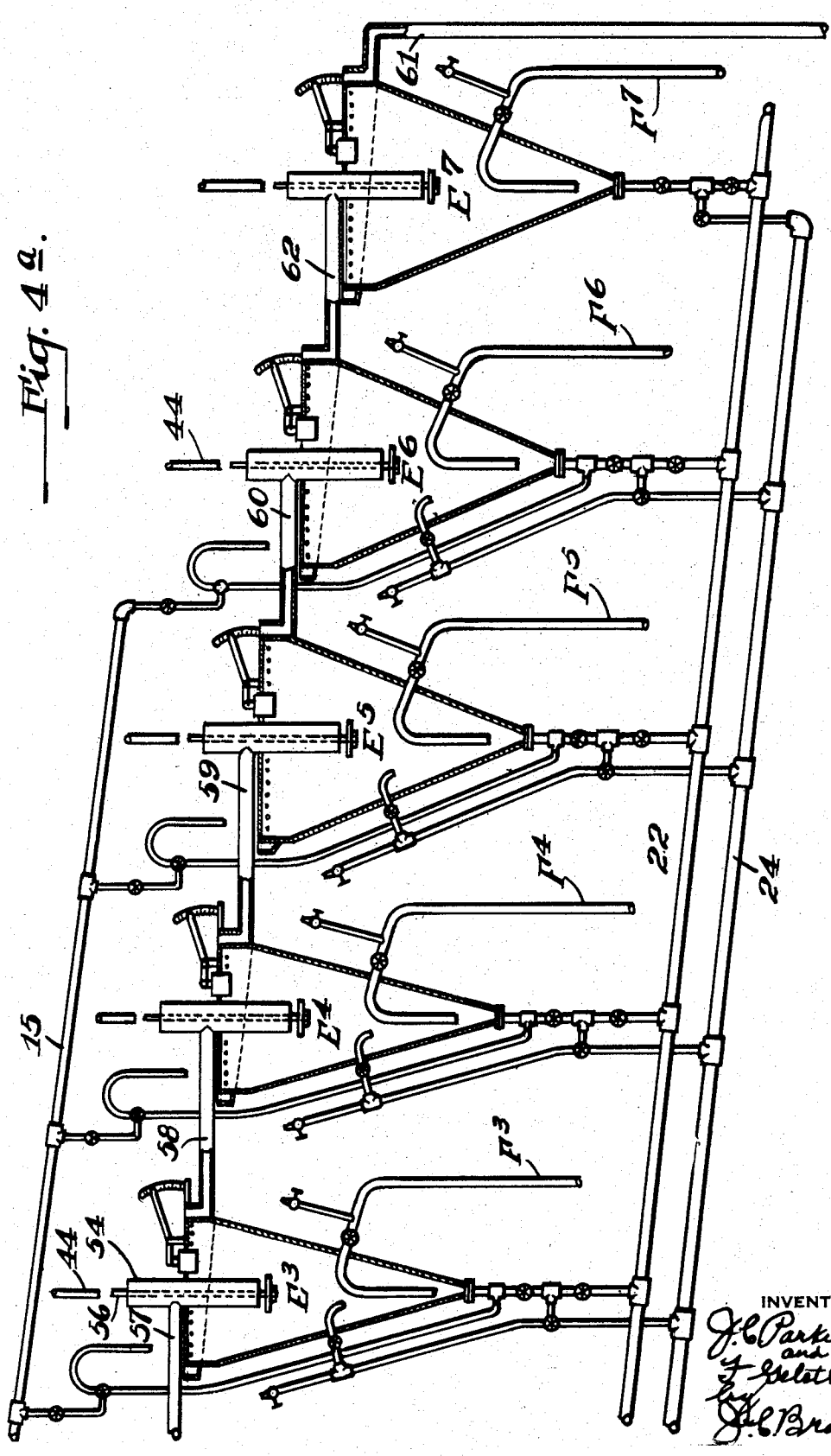
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PROCESS AND APPARATUS FOR GRADING ABRASIVES

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Fig. 4a.



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UNITED STATES PATENT OFFICE

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PROCESS AND APPARATUS FOR GRADING ABRASIVES

Application filed August 19, 1929. Serial No. 387,013.

The invention relates to apparatus for surfacing sheets of material, such as glass, marble, and the like, by subjecting such material to a series of grinding operations with the use of abrasives of successively finer and finer grades. The invention has to do particularly with the means for supplying the grinding machines with the abrasive, ordinarily sand, which is graded while in suspension in a liquid, ordinarily water, and is supplied to the grinding machines mixed with such liquid.

One object of the invention is to provide a system in which a very complete separation of the successive grades of abrasive is secured, it being highly desirable to exclude from each grade any particles which are over size, as such particles produce scratches and thus increase the time required for smoothing. On the other hand, particles of under size do not work when supplied to the glass with the larger particles and in fact interfere to a certain extent with the abrading action of such larger particles. This object is accomplished by providing a grader for each unit of the grinding system, so that only one grade of abrasize is separated from all the other grades in each grader, giving a larger factor of safety against the admixture of different grades than is the case where several grades are separated and withdrawn for use simultaneously from one grader. This further permits of a close regulation of the separation of each grade without any interference with the regulation of the separation of the other grades.

A further object is to provide a system in which the finer grades of the primary abrasive material employed, such as sand, crushed silica or garnet, can be separated to such an extent that the use of a secondary abrading material, such as emery, may be dispensed with. This degree of separation is made possible in part by the use of a grading unit for each surfacing unit as heretofore referred to and in part by the use of a separating agent, which reduces the tendency of the very fine particles to adhere to each other, this separating agent being added to the first of the series of graders in which interference with grading due to the adherence of the particles occurs.

A further object of the invention is to permit the recovery and use of that part of the abrasive which, because of its extreme fineness, has heretofore not been utilized. This grade is of such an extreme degree of fineness that it imparts a "smooth" to the glass or other material under treatment of such character that the period later required to polish the glass is substantially reduced. This same fine grade of abrasive may also be collected without the use of the flocculating agent, if a settling tank of relatively large size is employed and sufficient time for settling is given.

A further object is to provide means whereby the grading in each grader is made uniform so that the character of the grade supplied from each of the graders remains constant. This is accomplished by the use of means for keeping the grading flow and degree of concentration in the grader constant. One embodiment of the invention is shown in the accompanying drawings, wherein:

Figure 1 is a plan view. Fig. 2 is a partial side elevation and partial section. Fig. 3 is a section on the line III—III of Fig. 2. And Figs. 4 and 4*a* together constitute a section through the series of graders.

Referring to the drawings, A and B are two series of tables running on tracks beneath series of grinding runners, preferably of the type shown in the Evans Patent No. 1,577,457 such runners being driven, and the series of tables being moved slowly beneath the runners from left to right (Figs. 1 and 2) as the grinding progresses. The two sets of grinding runners are supplied from a single grading apparatus, the arrangement being the same for both sets so that the description hereinafter will be (for brevity) limited to the one set.

The set of runners as shown comprises twenty runners divided into eight series C, C', C^2, C^3, C^4, C^5, C^6 and C^7, as indicated in Fig. 1, each of which series may be regarded as a grinding unit since the members of each series are supplied with abrasive of the same degree of fineness. The series C constitutes

the facing unit and comprises six runners to which the coarsest abrasive is supplied from the distributing cone D. The next unit C′ comprises two runners supplied with a finer grade of abrasive than that supplied to the series C, such runners C′, being supplied from the distributing cone D′. Similarly the remaining series of runners C^2, C^3, C^4, C^5, C^6, and C^7, each consisting of two runners are supplied respectively from the distributing cones D^2, D^3, D^4, D^5, D^6, and D^7, with each successive series receiving a finer grade of abrasive than the preceding series so that the last series of runners C^7 receives the very finest grade of abrasive. It will be understood, of course, that the total number of grinding runners may be varied to meet requirements and that the number of runners in each unit may also be varied.

The eight distributing cones and the eight grinding series of runners or units are supplied with abrasive from the eight grading or separating cones E, E^1, E^2, E^3, E^4, E^5, E^6, and E^7 through the pipes F, F^1, F^2, F^3, F^4, F^5, F^6, and F^7.

The cone E is supplied with a mixture of abrasive, such as sand and water from a sump 1 by means of a pump 2, having a suction pipe 3 leading into the sump and a delivery pipe 4 discharging into a receiving box 5 located above the cone E and discharging thereto through the pipe 6. The pump is driven from the electric motor 6^a. New sand is supplied to the sump from time to time through the pipe 13 (Fig. 2) and the drainage from a part at least of the grinding units is returned to the sump so that it may be used over again. The drainage of the first five of the grinding units, C, C^1, C^2, C^3 and C^4 is returned to the sump through the ditch 7 (Figs. 2 and 3) to which drain pipe 8 (Fig. 3) leads from the troughs 9 at the sides of the table. The used abrasive from the last three grinding units C^5, C^6 and C^7 is too fine for reuse and is therefore discharged to the sewer 10 (Fig. 2) through the ditch 11 and pipe 12.

In order to maintain a uniform flow from the box 5 to the first grading cone E, an overflow pipe 14 leading back to the sump 1 is provided, so that the head in the box is kept constant. A grading flow upward from the bottom of the cone is provided by water from the pipe 15. Water under pressure from this pipe is supplied through the pipe 16 having a three-way valve 17. By turning this three-way valve so as to shut off the flow to the bottom of the tank, the water is directed through the test pipe 18. The water from this test pipe may be caught and measured, thus giving an accurate indication of the grading flow. The outlet pipe F leading to the grinding unit has its end extended down to a point adjacent the bottom of the cone and the grading flow from the pipe 16 is adjusted so that only the very coarsest abrasive settles to the inlet end of the pipe F, this abrasive being used for facing the glass sheets on the tables. All the rest of the abrasive is carried up through the cone and discharges through the overflow screen 18^a into the trough 19 from which it is carried through the pipe 20 into the vertical pipe 21 leading down into the concentrating or dewatering cone G. Branch pipes 22, and 23 also lead from the bottom of the cone E, the pipe 22 discharging to the sewer and the pipe 23 being connected to a high pressure water supply line 24. Suitable valves 25, 26 and 27 are provided for closing off the pipes 22 and 23 during the normal operation of the apparatus. When it becomes necessary to drain the cone, the valves 25 and 26 are opened, the valve 27 being closed. Water may be forced upward through the cones from the line 23 to wash out the cone and the piping connections by opening the valves 27 and 25, the valve 26 being closed. The pipe 22 may be washed out by opening the valves 27 and 26 and closing the valve 25.

The cone G serves to eliminate the excess water and any mud in the mixture, such water and mud overflowing into the trough 28, through openings $28a$, from which it is carried to the sewer by the pipe 29. No grading flow is supplied to the bottom of this cone, but connections are made to the drain pipe 22 and high pressure line 24 by means of the connections 30 and 31 provided with suitable valves so that the cone may be drained and cleaned out when necessary. This cone as well as all the others are preferably provided with covers and a hydrometer basket or screen 32 carried by the cover extends down into the liquid. A hydrometer is kept in the basket to give a line on the density of the mixture. The abrasive which settles to the bottom of the cone is withdrawn through the pipe 33 having its end extended down to a point adjacent the bottom of the cone. This pipe discharges into the top of the cone E′, being provided with a high pressure water pipe 34 for flushing having a pet cock 35 to facilitate the flushing of the pipe when this becomes necessary.

The grading cone E′ has a connection 36 to its lower end by means of which a grading flow is supplied from the pipe 15, a three-way valve 37 and test pipe 38 being provided corresponding to the valve 17 and test pipe 18 heretofore discussed in connection with the tank E. The tank also has connections 39 and 40 to the pipes 22 and 24. In addition this tank is provided with an outflow connection 41 having a valve 42 and connected to the pipes 39 and 40, with a three-way valve 43. In case the mixture in the tank becomes too thick, the valve 42 is opened, the valve 43 being turned so that the pipe 41 discharges through the pipe 39 to the drain pipe

22 leading to the sewer. At the same time water is admitted through a supply pipe 44 into the top of the tank, the inflow from the pipe 44 just balancing the outflow through the pipe 41 so that there is no variation of head in the cone. This tank is also supplied with a hydrometer and cage (not shown) and with a float 45 carried on a lever 46 whose free end moves over a scale 47, thus providing an overflow and level gauge. The coarsest grade in this tank is withdrawn through the pipe F′ leading to the distributing cone D′ which supplies the second grinding unit C′. The overflow from the tank passes through perforations near the top of the tank into the trough 48 which discharges through the pipe 49 leading to the top of the grading cone E^2. The pipes 41 and F′ are provided with vent pipes 50 and 51 having cocks 52 and 53 to facilitate the draining of the pipes 41 and F′. The cone E′ performs the function of separating the coarsest grade in the mixture and supplying it to its grinding unit, all of the rest of the mixture being passed along to the next cone E^2 of the series.

The cone E^2 is the same as to equipment and function as the cone E′, except that this cone is provided with a baffling arrangement for preventing the incoming mixture from the pipe 49 from carrying air down into the cone and thus interfering somewhat with the grading action. This baffle device comprises a cylinder 54 into which the pipe 49 discharges, and a plate 55 at the lower end of the cylinder carried by a rod 56 threaded through a spider supported upon the top of the cylinder. The position of the plate 55 is regulated so that a head is maintained in the cylinder and little or no air is discharged past the plate. The coarsest grade discharges through the pipe F^2 to the distributing cone D^3 and the grinding unit C^2, while the overflow passes through the pipe 57 to the top of the next grading cone E^3.

The equipment and construction of the cones E^3, E^4, E^5, and E^6 are the same as that of the cone E^2. The overflow pipes 58, 59 and 60 discharge to the next cone of the series in each case and the successively finer grades are withdrawn from the bottoms of the cones and discharged through the pipes F^3, F^4, F^5, and F^6 to the respective distributing cones D^3, D^4, D^5, and D^6 and the respective grinding units C^3, C^4, C^5 and C^6. In each case the coarsest grade remaining in the mixture supplied to the cone is separated and used, while all the remaining grades are passed along to the next cone. This gives very clean, distinct grades, due to the wide separation between the points at which the grade to be used is withdrawn with respect to the point of overflow from the tank. The particles of each grade are relatively uniform as to size and distinctly different in size from the next coarser and finer grades. We have found that the separation of the grades may also be improved by the use of a reagent in the mixture which tends to prevent the particles from adhering. An effective reagent for performing this function with sand crushed silica and the like is soda ash. This is preferably added to the mixture in the tank E^4, the separating effect continuing in the cones E^5 and E^6.

The last cone E^7 of the series differs from the others in that it is a settling tank having no grading upflow from the bottom as in the other cones. The purpose here is to collect all the remaining very fine grades of abrasive and use them in the last stage of grinding. To promote the settling action of the exceedingly fine abrasive in this tank it is desirable to use an agent which will cause the particles to adhere or flocculate, as the large particles thus formed settle much more quickly than the finer particles. We have found several agents which are suitable because of low cost among which may be mentioned chloride or sulphide of lime and aluminum, and iron chloride of calcium and also hydrates of sodium or calcium. If a reagent is used to settle the fine abrasive, a cone of relatively small size may be used, otherwise a very large cone is necessary in order to settle the desired quantity of abrasive. The abrasive thus collected is finer than any which can be collected where a grading flow is employed and may be employed for giving the glass its final smoothing preliminary to polishing. This permits the secondary abrasive, such as emery, which has ordinarily been used, to be dispensed with, thus cheapening the grinding operation to a material extent.

Connections are provided at the bottom of the cone E^7 to the pipes 22 and 24 for drainage and wash out purposes as in the case of the other cones. The overflow from this tank passes through the pipe 61 to the sewer, while the settled material of varying size particles, but all exceedingly fine, is withdrawn through the pipe F^7 and conducted to the last distributing cone D^7 and the last grinding unit C^7. The mixture from the last of the grading cones E^6 is conducted to the settling cone through the overflow pipe 62. The distributing cones D to D^7 are all similar in construction. The discharge to each one is into the top, as indicated in Figs. 2 and 3, and the withdrawal occurs through the pipes 63, 63, etc., which extend through the walls of the cones and have their inner ends extended down toward the bottom of the cones similar to the pipe F in the cone E, as shown in Fig. 4.

In operation the conditions governing the grading action in each cone may be determined at any time by observing the overflow gauge and the hydrometer and by testing the grading flow from time to time by the use of the test pipe. It is thus possible by applying

the regulating means to maintain uniform conditions in each grader, independent of all the others, which insures that each grader will constantly deliver its proper grade of abrasive and a high degree of efficiency and economy. From time to time, the valves 42 controlling the outflow from the grading tanks through the pipes 41 to the sewer are opened, while the corresponding inflow of fresh water through the pipes 44 is permitted, thus preventing the density of the mixture in the tanks from increasing beyond a certain point and thus interfering with the accuracy of the grading operations. This tendency to increasing density of the mixture in the tanks (calling for the above procedure) is due to the fact that only two sets of grades are withdrawn from each tank, viz., the coarsest grade at the bottom, and a mixture of all the other grades at the top, thus leaving in the tank between the two levels of withdrawal, a grade of material which is not used and which gradually collects, thus increasing the density in the tank as the operation continues and calling for withdrawal from time to time, as above set forth. It is this feature of construction and operation which insures the sharply distinct successive grades supplied from the bottoms of the successive graders, as a quantity of abrasive of an intermediate grade between each two successive bottom grades is continually separated and intermittently removed through the pipes 41 to the sewer. The use of the settling tank at the end of the series of graders also means economy in the use of abrasive, as a quantity of abrasive, which would otherwise be wasted, is used to good advantage. Other advantages incident to the process and apparatus, and including that resulting from the sharp separation of the various grades, heretofore referred to, will be readily apparent to those skilled in the art.

What we claim is:

1. In apparatus for grading divided material into distinct grades of varying degrees of fineness, a plurality of grading tanks arranged in series, means for conducting a mixture of said material and water into the first tank, means for supplying water under pressure continuously to the lower end of each tank to provide a grading flow, a concentrating tank into the top of which the first of the grading tanks discharges, an overflow for conducting the excess water from the concentrating tank, an outlet from the lower portion of the concentrating tank leading into the top of the second of the series of grading tanks, means for conducting the overflow from each of the grading tanks beginning with the second of the series into the next one of the series, and means for withdrawing from each grading tank only the coarsest grade of material therein from a level located intermediate the lower end of the tank and the overflow therefrom.

2. A process for grading divided material into distinct grades of varying degrees of fineness which consists in supplying a mixture of water and material to a grading tank, supplying an additional flow of water to the lower end of the tank to provide a grading flow upward therethrough, withdrawing a mixture of the coarsest grade of material and water from the lower portion of the tank, withdrawing the other usable grades from the upper portion of the tank, withdrawing at intervals portions of the mixture from the tank intermediate the points of withdrawal of said coarsest grade and the other usable grades, and supplying another flow of water to the tank at said intervals so as to maintain the level of the tank substantially constant.

In testimony whereof, we have hereunto subscribed our names.

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FREDERICK GELSTHARP.