

1,089,894.

4 SHEETS-SHEET 1.

The diagram illustrates a mechanical assembly, possibly a camera or projector, with a top-down view and a side view. The top-down view shows two circular components, A and B, with internal parts L, C, D, and E. The side view shows the device's profile with components G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, and numbers 10, 20, 25, 26, 27. The device is mounted on a base with a central vertical axis.

Julian H. Kendrick,

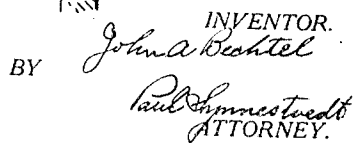
J. C. Bradley

BY

John E. Bechtel
Paul Lynne Strodt
ATTORNEY.

1,089,894.

4 SHEETS--SHEET 2.

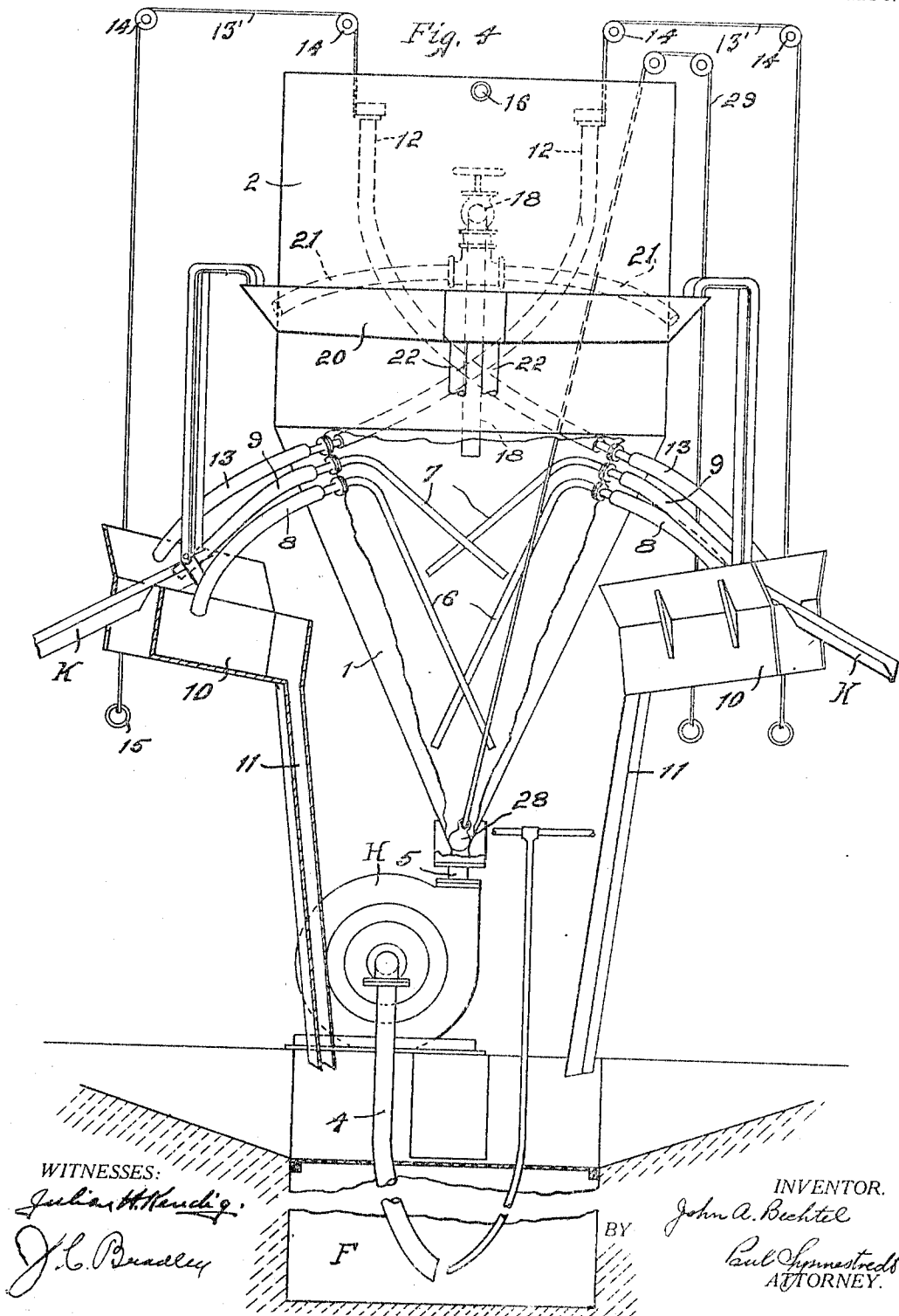


J. A. BECHTEL.
GRINDING APPARATUS.
APPLICATION FILED AUG. 14, 1912.

1,089,894.

Patented Mar. 10, 1914.

4 SHEETS--SHEET 3.



UNITED STATES PATENT OFFICE.

JOHN A. BECHTEL, OF TARENTUM, PENNSYLVANIA, ASSIGNOR TO PITTSBURGH PLATE GLASS COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

GRINDING APPARATUS.

1,089,894.

Specification of Letters Patent.

Patented Mar. 10, 1914.

Application filed August 14, 1912. Serial No. 715,126.

To all whom it may concern:

Be it known that I, JOHN A. BECHTEL, a citizen of the United States, residing at Tarentum, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Grinding Apparatus, of which the following is a specification.

The invention relates to grinding apparatus. It has for its primary objects the provision of a simple apparatus which shall be capable of supplying one or more grinding machines with the exact kind of abrasive required for the operation then in progress while still keeping the other grades of abrasive in such condition as to be ready for immediate application to any one of the grinding machines as the occasion may require, thus enabling the abrasive to be used to the best advantage; the provision of a system of the character specified for the circulation of the abrading material such as will serve to equalize the capacities of the grading apparatus for all of the grades employed; the provision of a system wherein the used and new material in the grades not suitable for the work being done at any particular time is separated and held in readiness for future operations; the provision of an apparatus simple in construction and compact in form wherein the abrasive employed may be used repeatedly and with practically no waste; the provision of an apparatus wherein any desired grade of abrasive may be supplied to a grinding mechanism without interfering with the other grades held ready for use by the apparatus, or being used with other grinding mechanisms, and the provision of an apparatus which may be operated substantially continuously. One embodiment of the invention is shown in the accompanying drawings wherein—

Figure 1 is a plan view showing the general arrangement of the apparatus; Fig. 2 is a side elevation of a portion of the apparatus, with certain of the parts thereof in section; Fig. 3 is a transverse section on the line III—III of Fig. 2; Fig. 4 is a side elevation of the apparatus, with certain of the parts partially broken away to more clearly show the structure; and Fig. 5 is an

end elevation of the apparatus shown in Fig. 4.

Referring first to the general arrangement of parts as shown in Figs. 1 and 2, A, A are grinding tables which may be of any approved type and driven in the usual manner; B, B and C, C are the runners ordinarily employed in the grinding of plate glass, which runners are of the usual construction and supported in the usual way; D, D are the troughs or drainage receptacles lying beneath and encircling the outer edges of the grinding tables and adapted to receive the mixture of sand and water from such tables during the grinding operation; E is the tank for separating the sand employed in grinding, into a plurality of different grades for use in series during the different stages of the grinding process; F is a drainage pit or sump to which the mixture of sand and water from the troughs D, D is conducted through the passages G; H is a rotary pump for carrying the mixture of sand and water in the sump F to the grading tank E; H' is a bin containing fresh sand which is adapted to be supplied from time to time from the bottom of the bin to the sump F through the door I; and K, K are troughs leading from the grading apparatus to the two grinding mechanisms, such troughs communicating at their lower ends with transverse conductors L perforated on their lower sides and extending across the grinding tables so as to supply the mixture of sand and water uniformly over such tables. In the arrangement just described, one grading apparatus is illustrated as taking care of two sets of grinding mechanism, but it will be understood that this arrangement is merely illustrative, and that the grading mechanism may be used with any desired number of grinding mechanisms—depending upon its capacity. In operation the material supplied through the troughs K to the grinding tables after use upon such tables is drained into the troughs D and returns to the pit or sump F from which it is pumped to the grading tank E by means of the pump H, so that the material is used over and over again, the material too fine for use being washed out over the top of the tank as hereinafter described, and

fresh sand being supplied from the bin H' from time to time to take the place of the small quantity of sand which is wasted or which becomes broken up into particles too fine for reuse.

The character of the grading apparatus will be readily understood by reference to Figs. 4 and 5. The lower portion 1 of the grading tank E is conical in form, while the upper portion 2 thereof is cylindrical. The pump H is driven from a motor 3 (Fig. 5), such pump H being provided with an inlet pipe 4 for carrying the material to be graded, from the sump F to the pump, and has an outlet pipe 5 leading into the lower end of the grading tank E. In the form of apparatus illustrated, two sets of pipes 6 and 7 lead from different levels in the conical portion of the tank and have connected to their outer ends which lead through the sides of the tank, the flexible pipes 8 and 9. Either or both of the pipes 8 and 9 may be directed into the troughs K leading to the grinding mechanisms. The other flexible pipe or pipes which do not lead to the troughs K discharge into the boxes 10 provided with pipes 11 leading back into the sump F. Suspended in the cylindrical portion 2 of the tank are a pair of flexible tubes 12, which tubes are open at their upper ends and at their lower ends pass through the side of the tank and carry the flexible tubes 13. These flexible tubes 13 can be made to discharge either into the troughs K or into the boxes 10. The tubes 12 are suspended by means of the cords 13' passing over the pulleys 14, the lower end of each of the cords 13' being provided with a chain 15 which may be made to engage a securing device (not shown) whereby the upper ends of the flexible pipes 12 may be held at any desired elevation. An overflow opening 16 is provided adjacent the upper edge of the tank, from which opening a pipe 17 (Fig. 5) conducts the waste material such as mud and sand too fine for use, to the sewer or some other waste receptacle.

Intermediate the ends of the cylindrical portions 2 of the tank is an outlet pipe 18 extending down into the tank as indicated in dotted lines and governed by the valve 19 and leading to the trough 20 are two branches 21. This trough 20 surrounding the tank is provided with a pair of discharge pipes 22, which discharge pipes, as indicated in Fig. 1, lead to the troughs or ditches D, D underneath the tables and serve a function to be hereinafter described.

As indicated in Fig. 3, the bottom of the sand bin H is formed with converging walls 23, 23, and the joining edges of these sides slope toward the sump F as indicated in Fig. 2. By means of this arrangement, the sand in the bin may be readily conducted to the sump, such passage being controlled

by means of a sliding door I. In order to facilitate the movement of the sand down the inclined bottom of the bin, the pipes 26 are provided along the inclined sides of the bottom as indicated in Fig. 3, and a third pipe 27 extends along the extreme lower edge of the bin. These pipes are supplied with water outlets, and by this means the feeding of the sand out of the bin and to the sump F is greatly facilitated, and all of the sand in the bin may be fed out without difficulty. The small check valve 28 governs the opening at the lower end of the draining tank, such small valve being operated by means of the rope 29 extending over the pulleys shown.

It will be seen that when the pump is operated, the material from the sump F is forced up through the grading tank E, and the sand in the water is graded according to its size, the larger particles occupying a position adjacent the bottom of the tank, and the grades becoming finer and finer as the top of the tank is approached. For the first rough grinding of the plate of glass, the coarse grades of sand are required, and in the operation of the apparatus, when the grinding is first begun, the flexible pipe 8 connected to the pipe 6 is introduced into the trough K, the other pipes 9 and 13 carrying the finer grades of sand and being in position so as to discharge into the box 10. When the grinding has progressed for a given time, and a finer grade of sand is required, the pipe or hose 8 is withdrawn from the trough K and the pipe or hose 9 inserted in such trough. After the grinding with this particular grade has been concluded, the upper end of the pipe or hose 12 is lowered to a position adjacent the lower end of the cylindrical part 2 of the tank or to a level in the tank occupied by the exact grade desired, and the pipe 13 is placed in the trough K, the pipes 8 and 9 at such time discharging into the box 10. As the grinding progresses and finer and finer grades of sand are required, the pipe 12 is raised step by step by means of chain 15 at the end of cord 13' until the finest grade of sand is used, and the grinding operation is concluded. The several links in chain not only serve to secure pipe 12 in the proper position by engaging with the stop not shown, but it also enables the operator to determine the exact position of the free end of the flexible pipe 12 in the grading apparatus so he thereby knows the exact grade of abrasive being delivered to the grinding mechanism at any stage of the operation.

It is desirable during the operation as just described that the upward velocity in the tank may be such that none of the sand suitable for use shall be washed through the outlet 16, and in order to regulate this upward velocity of the water through the

upper portion of the tank and prevent a waste of any of the grinding sand, the outlet pipe 18 controlled by the valve 19 is provided. The opening of this valve 19 reduces the upward velocity of the water in the tank above the lower end of the pipe 18 to such an extent that only the mud and those portions of the sand unsuitable for grinding are washed away through the overflow 17. The mixture thus withdrawn through the outlet 18 passes through the trough 20 and thence through the pipe 22 to the trough or gutter D (see Fig. 1), and thence back to the sump F. The material thus withdrawn is therefore not wasted, but is returned for use, and the returning of the mixture to the gutter D performs a useful function in that it assists in washing out the gutter and keeping it clean, thus reducing or eliminating the amount of clean water which would otherwise have to be furnished to the gutter in order to wash it out. The mixture of fine sand and water, because of its specific gravity, constitutes a better washing medium for the coarse sand in the trough than clear water. The placing of the valve 19 above the inlet to the pipe 18 is advantageous in that the head of water at the valve 19 and its velocity, is reduced, thus reducing the cutting action of the sand on the valve. Similarly the use of the trough 20 is advantageous as the pipes 21 discharge into such trough at relatively low velocity, whereas if such pipes were connected directly with the pipe 22, the suction from such pipe 22, due to the added head, would increase the velocity of flow past the valve 19 and the consequent cutting action of the sand.

It will be seen from the foregoing that the operation of the apparatus is substantially continuous and that the amount of waste is reduced to a minimum. Any desired grade of sand may be withdrawn from the tank at any time, without disturbing the grades above or below the point of withdrawal, and the apparatus is always in condition for use. When the grinding mechanism is not being operated, all of the pipes or hose 8, 9 and 13 discharge into the box 10, and the material is returned to the sump F and again circulated through the apparatus. The pump H may thus be made to operate continuously, regardless of the operation of the grinding mechanism, and as a result, the sand in the water is maintained continuously in suspension, and there is no clogging of the parts due to the settling of the sand.

It will also be readily understood that no matter whether one or more grinders are in operation or whether no grinder at all is in operation, the discharge from the various pipes leading from the grading tank remains constant, thus insuring the same upward

velocities in all of the horizontal planes in the grading tank so that irrespective of the character of the work that is being done, the various grades will always lie at approximately the same position in the grading apparatus, thus insuring a uniformity of operation not easily otherwise obtained.

It will also be apparent that due to the small capacity of the lower part of the conical portion of the cone, the capacity of the grader to hold the larger grades or coarser particles is comparatively small in proportion to that part of the grading apparatus which holds the finer portions of grading material; but, in as much as these coarser grades are continuously discharging from the lower portion of the cones into the sump F, the capacity of the system to hold the lower grades is increased by the capacity of the sump F. This increase of the capacity of the system is very advantageous as it enables the apparatus to be operated under widely varying conditions as regards the amount of coarse sand that is introduced into the system from the bin H'. If it were not for this feature of the apparatus and too great a quantity of sand was introduced into the system, it would all accumulate in the bottom part of the grader E and seriously interfere with its operation. On the other hand the upper portion of the tank above acts as a collector or trap for fine sand, such fine sand accumulating until the desired proportion of sand to water necessary for the best results in grinding is secured. This upper portion of the tank thus constitutes a supplemental grade: superposed upon the lower part of the tank.

Furthermore, the labor of getting the sand into suspension again incident to an intermittent operation is eliminated, and the apparatus is in condition for operation just as soon as the grinding mechanism is in shape to receive the sand. Another advantage incident to the apparatus is due to the fact that a plurality of grinding mechanisms may be fed from the same grading apparatus, and this operation may be carried on whether the stage of grinding is the same in the various grinding mechanisms or not; that is, rough grinding may be carried on in one grinding mechanism while fine grinding is being carried on in another mechanism, such function being incident to the fact that one grade may be withdrawn from the apparatus without interfering with the position of another grade.

As a further function incident to the use of the regulating valve 19, it will be seen that the use of this valve permits any desired upward velocity of fluid in the tank below the lower end of the pipe 18 without increasing the velocity above such lower end or without washing away any of the sand suitable for use through the overflow 16.

This permits the changing of the speed of the pump H to give any desired grade from the pipes 6, 7 or 12, without increasing the overflow and consequent waste. It will be seen that all of the sand in the system is always ready for use, so that the capacity of the system is governed only by the combined capacity of the sump and grading tank.

Another great advantage of the apparatus shown is that no valves are required to regulate the character of the mixture, which, from the various operations in the tank, goes either to the sump or the grinding table, it being extremely difficult to get a valve which will stand the cutting action of the sand and remain tight, and it is extremely important that when the finer grades of sand are being conducted to the grinding table, none of the coarser grades should be allowed to get onto the grinding table as this would greatly impair the quality of the work done.

It will also be readily understood that by use of the swinging conductor 12 which is adapted to be raised and lowered through a wide range in the grading tank, it is possible, at will, to withdraw any of the grades from the grading tank without disturbing any of the other grades or without withdrawing all of any of the grades contained therein so that it is possible by gradually and uniformly raising the end of the flexible conductor 12 while still retaining a large quantity of all of the grades of the abrasive accurately graded in the grading vessel, to withdraw successively a portion of each of these grades ranging from the coarsest to the finest, each grade following the preceding one by imperceptible changes so that the character of the surfaces being ground on the grinder can be readily brought from the state of roughness to the state of extreme fineness desired in the most natural manner and in the shortest possible period of time.

It will be apparent that the invention is capable of embodiment in various forms of structure without departing from the spirit of the invention and its principle of operation. The number of grinding mechanisms fed from a single grading tank may be varied to suit conditions, and the number of withdrawing pipes in the tank may be similarly varied to supply any desired number of grades. The grading tank shown is of conical form and discharges by gravity, but it will be apparent that this is not necessarily the case, as the mixture might be conducted from the tank by means other than the force of gravity, the only requirement insofar as the pipe 12 is concerned being that it should be movable vertically in a tank or receptacle containing graded abrasive in suspension, and that the discharge from such pipe be directed to a grinding mechanism. Similarly as to the feature

of continuously circulating the material through the tank without passing to the grinding machine when such grinding machine is out of operation, such method of operation being just as applicable to a grading tank in which the discharge is secured by means other than gravity, as in apparatus having a gravity discharge. Other means aside from the rotary pump might also obviously be employed to carry the mixture upward from the drainage receptacle without departing from the spirit of the invention.

The apparatus is not limited in its uses to the grinding of the faces of sheets of plate glass, but may be utilized in other grinding or smoothing operations and on other substances besides glass wherein abrasive and water are employed, the drawing being merely illustrative of one of the more important uses of the apparatus. In some cases it may be desirable to use only one grade of abrasive with each grinding or smoothing mechanism and shift the article from a mechanism supplied with one grade of abrasive to another mechanism supplied with a finer grade of abrasive, the number of shifts and the character of the grinding mechanisms being dependent upon the character of the surface being reduced.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent, is the following:

1. The combination with a grinding mechanism employing a mixture of abrasive and water, and a drainage receptacle beneath the grinding mechanism for receiving the said mixture from such grinding mechanism after use therewith, of a grading device adapted to grade the abrasive in the said mixture, means for conducting the mixture of abrasive and water from the receptacle to the grading device, and means whereby the mixture of abrasive and water may be conducted either to the grinding mechanism or to the drainage receptacle whereby it may be circulated continuously through the grading device without passing to the grinding mechanism.

2. The combination with a grinding mechanism employing a mixture of abrasive and water, and a drainage receptacle beneath the grinding mechanism for receiving the said mixture from such grinding mechanism after use therewith, of a grading device adapted to grade the abrasive in the said mixture, means for conducting the mixture of abrasive and water from the receptacle to the grading device, and a movable conductor whereby the mixture of abrasive and water may be circulated continuously through the grading device without passing to the grinding mechanism, or may be directed to the grinding mechanism.

3. The combination with a grinding mechanism employing a mixture of abrasive and water, and a drainage receptacle beneath the grinding mechanism for receiving the said mixture from such grinding mechanism after use therewith, of a grading device adapted to separate the abrasive in the said mixture into a plurality of different grades, means for conducting the mixture of abrasive and water from the receptacle to the grading device, means whereby any one of the grades in the grading device may be conducted from the grading device to the grinding mechanism while maintaining the other grades in suspension in the grading device, and means for returning a portion of such other grades to the drainage receptacle during the application of the one grade to the grinding mechanism.

4. The combination with a grinding mechanism employing a mixture of abrasive and water, and a drainage receptacle beneath the grinding mechanism for receiving the said mixture from such grinding mechanism after use therewith, of a grading device adapted to grade the abrasive in the said mixture, means for conducting the mixture of abrasive and water from the receptacle to the grading device, and a conductor leading to the grinding mechanism and movable vertically in the grading device whereby any one of the grades therein may be withdrawn and delivered to the grinding mechanism without withdrawing the other grades.

5. The combination with a grinding mechanism employing a mixture of abrasive and water, and a drainage receptacle for receiving the said mixture from the grinding mechanism, of a grading tank, means for forcing the mixture from the drainage receptacle upward through the tank, an overflow passage leading from the tank, a conductor for carrying the material graded from the tank to the grinding mechanism, and a regulating passage intermediate the ends of the tank and leading back to the drainage receptacle, whereby the amount of overflow and the upward velocity of the liquid in the tank above the outlet from the tank of such last passage may be regulated.

6. The combination with a grinding mechanism having a table and employing a mixture of abrasive and water, of a drainage trough in position to receive the discharge from the table, a sump for receiving the mixture from the trough, a grading tank, means for forcing the mixture from the sump upward through the grading tank, an overflow passage leading from the tank, a conductor for carrying the material graded from the tank to the grinding mechanism, a passage leading from the tank intermediate its ends to the said trough, and

a regulating means in the said last passage whereby the amount of overflow and the upward velocity of the liquid in the tank above the outlet of such passage may be regulated.

7. The combination with a grinding mechanism employing a mixture of abrasive and water, and a drainage receptacle for receiving the said mixture from the grinding mechanism, of a grading tank, means for forcing the mixture from the drainage receptacle upward through the tank, an overflow passage leading from the tank, a conductor for carrying the material graded from the tank to the grinding mechanism, a passage leading from the tank intermediate its ends to the drainage receptacle, a regulating means in the said last passage whereby the amount of overflow and the upward velocity of the liquid in the tank above the outlet of such passage may be regulated, and means whereby the mixture in the tank above the said outlet of such passage may be withdrawn from the tank.

8. The combination with a grinding mechanism employing a mixture of abrasive and water, and a sump for receiving the drainage from the said grinding mechanism, of a grading device adapted to grade the abrasive in the said mixture, means for conducting the mixture of abrasive and water from the sump to the grading device, and means whereby the mixture of abrasive and water may be conducted from the grading device either to the grinding mechanism or back to the sump and circulated in an uninterrupted cycle without passing to the grinding mechanism.

9. The combination with a grinding mechanism employing a mixture of abrasive and water, and a sump for receiving the drainage from the said grinding mechanism, of a grading device adapted to grade the abrasive in the said mixture, means for conducting the mixture of abrasive and water from the sump to the grading device, means whereby one of the grades in the grading device may be conducted from the grading device to the grinding mechanism without disturbing the other grades, and means whereby such other grades are continuously circulated from the grading device to the sump and back to the grading device again without passing to the grinding mechanism.

10. The combination with a grinding mechanism employing a mixture of abrasive and water, and a drainage receptacle for receiving the said mixture from the grinding mechanism, of a grading tank, means for forcing the mixture from the drainage receptacle upward through the tank, an overflow passage leading from the tank, a conductor for carrying the material graded from the tank to the grinding mechanism, a passage leading from the tank intermediate

its ends, a receiver above the grinding table into which the said passage discharges, and a conductor passage leading from said receiver to the drainage receptacle, the said passage serving to reduce the amount of overflow and the upward velocity of the liquid in the tank above the outlet from the tank of the said passage.

11. The combination with a grinding mechanism employing a mixture of abrasive and water, and a drainage receptacle for receiving the said mixture from the grinding mechanism, of a grading tank, means for forcing the mixture from the drainage receptacle upward through the tank, an overflow passage leading from the tank, a conductor for carrying the material graded from the tank to the grinding mechanism, a passage leading from the tank intermediate its ends, the said passage extending upward and then downward and discharging to the drainage receptacle, and a regulating valve at the upper portion of such last passage for governing the flow therethrough.

12. The combination with a grinding mechanism employing a mixture of abrasive and water, and a sump for receiving the drainage from the said grinding mechanism, of a grading device adapted to grade the abrasive in the said mixture, means for conducting the mixture of abrasive and water from the sump to the grading device, means for conducting the graded mixture to the grinding mechanism, a bin having a hopper bottom adjacent the sump, and pipes with outlets adjacent such bottom for washing the sand in the bin to the sump.

13. The combination with a plurality of grinding mechanisms employing a mixture of abrasive and water and means for collecting the drainage therefrom, of a single grading device adapted to separate the abrasive

in the said mixture into a plurality of different grades, means for continuously conducting the drainage from the said grinding mechanisms to the grading device, means whereby any one of the grades in the grading device may be conducted to any one of the said grinding mechanisms, and means whereby other grades in the grader may be simultaneously conducted either to other of the grinding mechanisms or to the means for collecting the drainage without passing to the grinding mechanisms.

14. The combination with a plurality of grinding mechanisms employing a mixture of abrasive and water and means for collecting the drainage therefrom, of a single grading device adapted to separate the abrasive in the said mixture into a plurality of different grades, means for continuously conducting the drainage from the said grinding mechanisms to the grading device, means whereby one of the grades in the grading device may be conducted to one of the grinding mechanisms without disturbing the other grades in the grading device, and means whereby a different grade may be simultaneously conducted to another grinding mechanism without disturbing the other grades in the grader, a continuous and uninterrupted circulation of the two grades to the grinding mechanisms and back to the grading device being maintained, and the mixture returned to the grader serving to grade the mixture in the grading device.

In testimony whereof I have hereunto signed my name in the presence of the two subscribed witnesses.

JOHN A. BECHTEL.

Witnesses:

LETITIA A. MYERS,
ARCHWORTH MARTIN.