H. K. HITCHCOCK.

GRINDING APPARATUS.

APPLICATION FILED JULY 19, 1907. RENEWED JULY 12, 1909.

934,442. Patented Sept. 21, 1909.

Fig. 2.

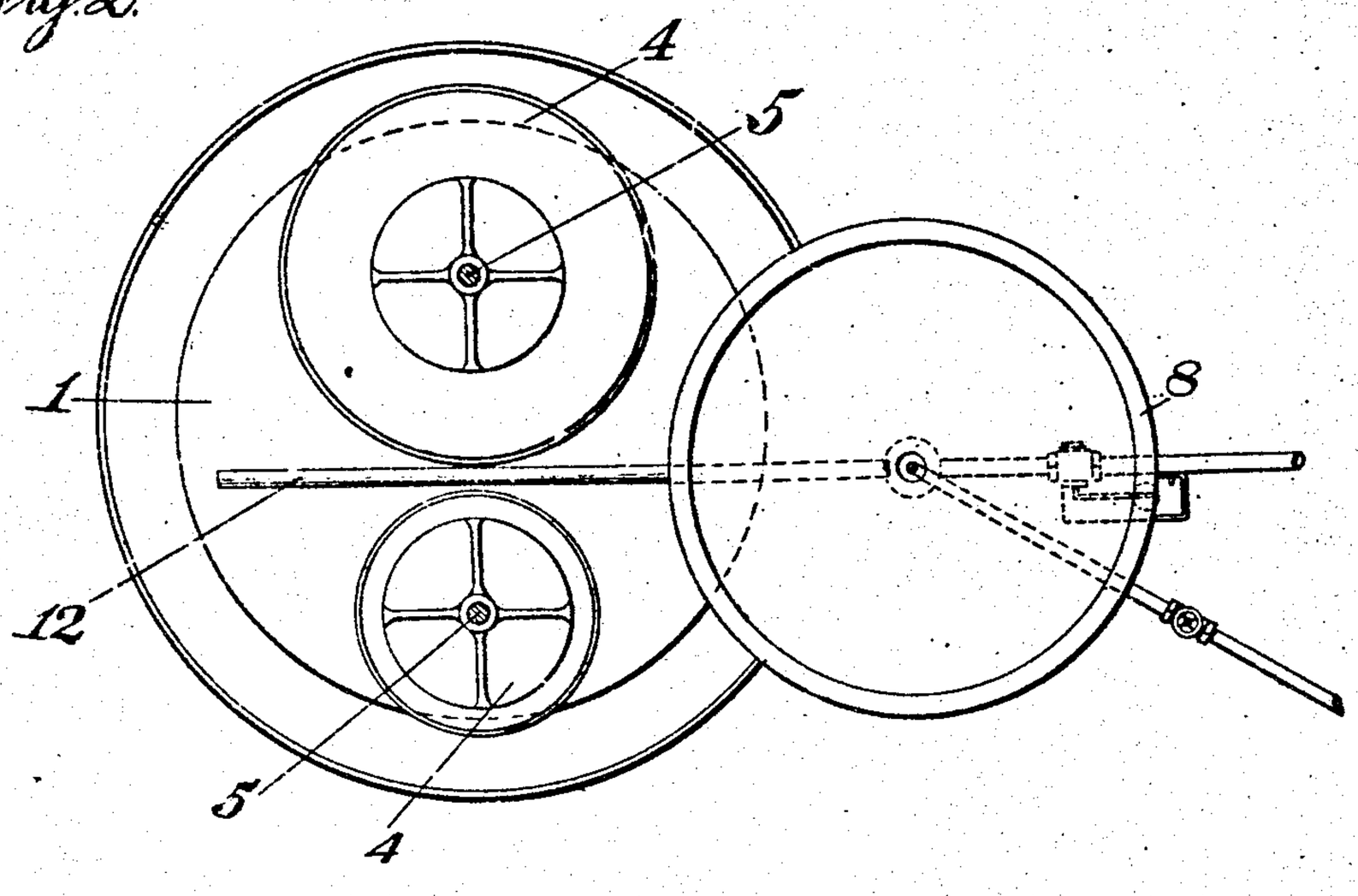
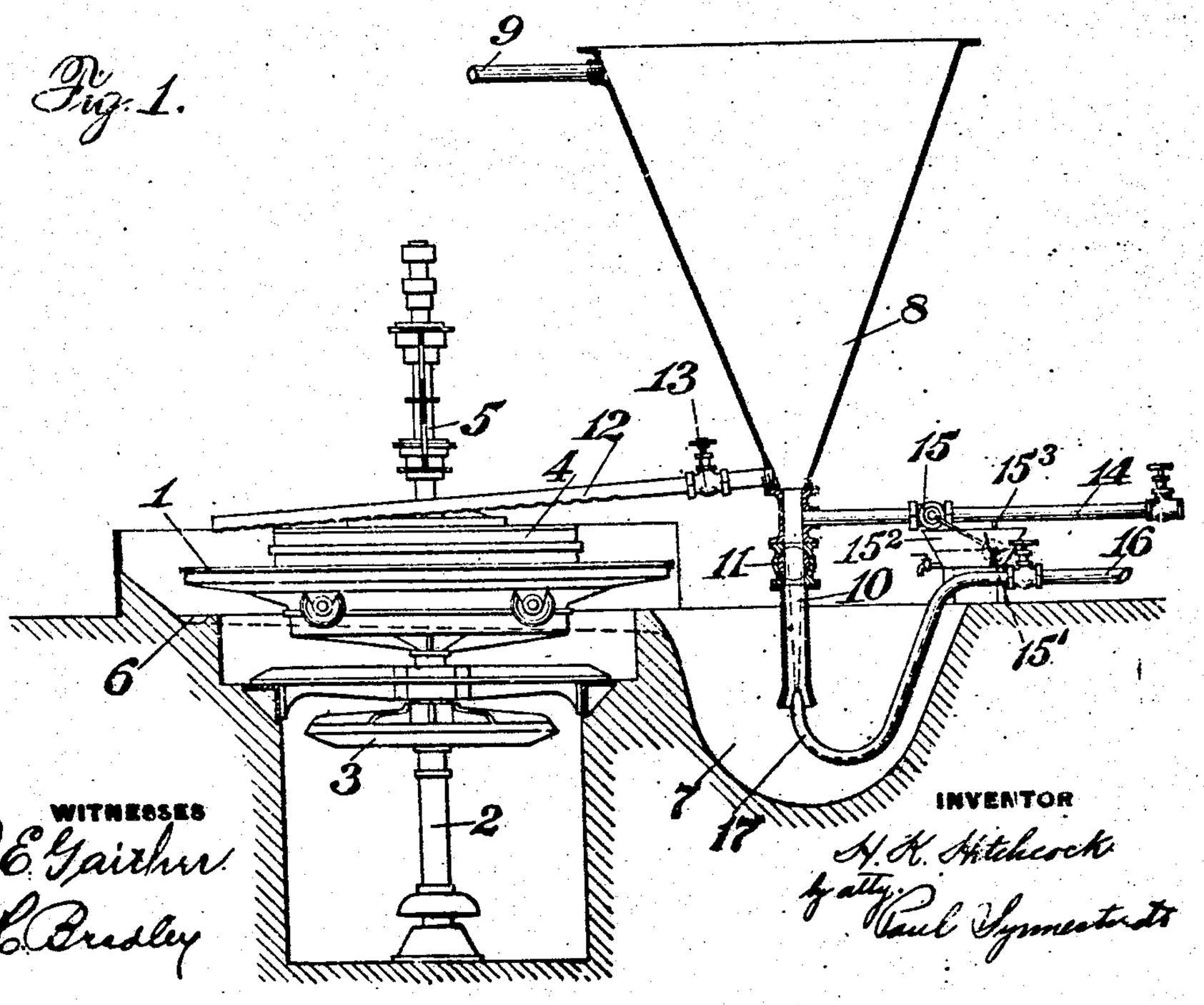


Fig. 1.



WITNESSES

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GRINDING APPARATUS.

934,442. Specification of Letters Patent. Patented Sept. 21, 1909.

Application filed July 19, 1907, Serial No. 384,639. Renewed July 12, 1909. Serial No. 507,259.

To all whom it may concern:

Be it known that I, HALBERT K. HITCHCOCK, 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.

My invention relates to grinding apparatus, and has for its principal objects: to provide an apparatus whereby the rapidity of the reducing operation is accelerated, and without any waste of the abrading material; to provide an apparatus wherein abrading material of a degree of fineness varying to suit the kind of grinding done is automatically supplied in conjunction with the proper amount of water necessary for each particular operation; and finally, to provide an apparatus requiring little attention, wherein the abrading material is accurately graded and supplied in proper quantities directly from the grading means to the grinding mechanism. One embodiment of my invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a side elevation partly in section showing the relative arrangement of the parts, and

Figure 2 is a plan view of the apparatus.

The apparatus illustrated and hereinafter described, is designed for the operations incident to the grinding and smoothing of plate glass, but it will be understood that the broad invention involved is applicable to a wide range of grinding operations. In the apparatus illustrated, the invention relates particularly to the means for supplying abrading material, the grinding mechanism used being substantially the same as that heretofore employed. Heretofore the sand used in glass grinding has been handled as follows. For the rough reduction of the surface of the glass, or facing operation, a mixture of sand containing both coarse and fine material was placed in a long V shaped hopper adjacent the grinding table and washed thereon by a stream of water from a hose. In this operation the finer, lighter material was washed out first leaving the coarser material to be used last. This operation has been found uneconomical, as the use of the coarse sand last leaves the glass with a very rough finish, necessitating a long and tedious subsequent finishing operation. Furthermore, the character of the sand and water cannot be accurately gaged and the sand acts to poor advantage when coarser and finer particles are upon the table at the same time, as the coarser particles keep the runners from touching the finer particles and the finer particles get in the way of the coarser ones and impair their effectiveness. For the finishing operation, the abrading material was then separated into grades of varying fineness either by means of a settling process wherein the water from the facing operation carrying the abrading material in suspension was carried through a series of pits or tanks wherein the various grades settled, or by an additional process wherein water carrying the abrading material in suspension was placed in a tank and agitated, after which the abrading material was allowed to settle for a given period and the mixture above a certain level withdrawn, which operation was followed by a series of additions of water, agitations, withdrawals and settlings of the volumes withdrawn, thus gradually eliminating the lighter parts of the material from the tank and settling them. While the addition of the second method gives better results than the first, both are inconvenient in operation and give grades lacking in uniformity, as the result of the separation varies with the mixture introduced, which mixture is a variable one and cannot be gaged with any certainty, and in any case the separation is incomplete due to the entrapping of quantities of the finer material beneath that which is coarser. It will be seen that the foregoing operations required a great deal of labor in rehandling the abrading material after grading it, conveying it to the grinding mechanism and gaging its application to the grinding mechanism, and the operation was accompanied by a waste of material and an inefficient operation of the grinding mechanism. My improved apparatus is designed to accomplish the desired separation into an infinite number of grades completely and accurately without rehandling, and to supply such material to the grinding mechanism directly, and in quantities adjusted to suit the condition of the surface to be reduced, beginning with the coarsest and following up with successively finer and finer grades. Briefly stated, the apparatus comprises the usual grinding mechanism in conjunction with a grading tank adapted to separate the abrading material into its various grades and so

located as to permit of its discharge to the grinding mechanism. My grading tank is so constructed that a stream of fluid passes upwardly from the tank at a constantly decreasing velocity, thereby counterbalancing the normal downward velocity of the particles of material in the tank and holding them in suspension in predetermined positions, which positions depend upon the upward velocity of the water, the frictional surface of the particles and the weight of the particles. The particles in which the ratio of the weight to the frictional surface is largest take the lowest positions, as the normal downward velocity of a particle through the water depends upon this ratio, which ratio in particles of the same shape and density increases with the size of the particles. The larger and more compact particles thus come to a position of equilibrium in a stratum in the bottom of the tank where the upward velocity is greatest, while the other particles arrange themselves in a series of strata, the ratios of weight to resistance in liquid of the particles composing which strata, decrease as the distance from the bottom of the tank increases. After the material has been graded, the contents of the tank is drawn off from the bottom, thus supplying the coarsest material to the table to do the rough grinding, and as the surface of the glass is reduced, a finer and finer quality of material is supplied until all the material has been withdrawn from the tank and the plate under treatment has been reduced to the required degree of smoothness.

Referring now to the drawing, the apparatus shown at the left of the figures is the ordinary grinding mechanism for reducing the surface of plate glass, while the apparatus shown at the right of the figures is the means for grading and supplying the material to the grinding apparatus wherein my invention particularly resides. The grinding mechanism comprises the usual table 1 on the surface of which the glass is secured, the shaft 2 for turning such table, the gear 3 for driving the shaft 2, the runners or grinding disks 4 supported above the table 1 in position to grind the face of the glass in the usual manner, and the shafts 5 for carrying the runners, which shafts 5 are mounted in a frame-work capable of lateral movement to permit of the removal of the glass. 6 is the usual trough extending about the table in position to receive the abrading material and water as it falls from the table, and 7 is the drainage pit into which the abrading material and water from the trough 6 is collected. The grading apparatus comprises the tank 8 preferably of the conical shape shown, provided with the overflow pipe 9 and the inlet pipe 10, which inlet pipe is provided with a cut-off valve 11. The contents of the tank are conducted to the grinding mechanism by means of the pipe 12 carrying the valve 13, which pipe 12 extends across the table 1 between the runners and is provided on its under side with a series of discharge openings. Water is supplied to the tank from the pressure main when necessary by means of a pipe 14 carrying a valve 15. This valve is provided with automatic closing means comprising an operating rod provided with a float 15′ carried in the receptacle 15², which receptacle is constructed with downwardly converging walls, and is adapted to be filled gradually from the main by means of the cock 15³. A steam pipe 16 is provided with an upwardly directed end 17 adjacent the lower end of the admission pipe 10 which constitutes a means for securing a flow of liquid from the pit 7 up into and through the tank 8.

The operation of the apparatus is as follows. The pit being filled with a mixture of abrading material and water from the facing operation, steam is admitted to the pipe 16 thus sending a stream of liquid upward through the pipe 10 and the tank 8. This flow is continued until a proper density of liquid in the tank 8 is secured, the surplus water together with the particles of material in the mixture, too fine to use, overflowing through the pipe 9 and leaving in the tank the heavier portions designed for use in the grinding operation. A stratification of the particles of material in the tank occurs with the larger and heavier particles at the bottom and the smaller particles arranged thereabove in positions depending upon their size, density and frictional surface, which result is secured because of the difference in the upward velocity of the liquid in the tank at the different levels and because of the fact that the ratio of the weight of the particles to their frictional surface increases with their size and density. The point of greatest velocity of upward flow in the tank 8 is obviously at the bottom for two reasons, first, because of the increased cross-section of the tank as the water progresses upward, rendering such velocity inversely proportional to the area, and, second, because of the fact that the larger particles at the lower levels crowd closer together than do the particles at the upper levels, thus reducing the amount of space between the particles. As the total space between the particles at any level decreases, the inter space velocity of course increases, so that even in a tank which did not have converging walls, the inter space velocity at the bottom would be greater than at the top. After the tank has been filled to the required density, which may be determined by a hydrometer, or by any other desired means, the flow of steam through the pipe 16 is shut off, the valve 11 closed and the valves 13 and 15 and 15³ are opened, thus

permitting the mixture of abrading material and water in the tank 8 to flow to the grinding mechanism, while a stream of water through the pipe 14 is introduced in order to maintain in suspension the particles already in equilibrium in the tank, and to carry to their proper positions the finer material last introduced into the tank. The grinding mechanism is of course started to operate at the time the valve 13 is opened and the valve 13 may be turned to supply precisely the amount of abrading material necessary. It will be seen that the coarser material is supplied first to the grinding mechanism, and, as the surface is reduced, a finer and finer grade of material is supplied, which operation continues until the glass is properly faced and finished. As the tank empties, the valve 15 is gradually closed by reason of the filling of the tank 15^2 from the cock 15^3 and the raising of the float 15'. The reduction of the flow from the pipe 14 permits the finer grades of sand to settle to the bottom of the tank and discharge, and at the same time prevents the proportion of water to abrasive from becoming too great. The valve 15 may be adjusted to supply the mixture of abrasive and water which may be found most efficient for the work to be done.

It will be apparent from the foregoing that by the use of my apparatus no additional handling of the abrading material after grading is necessary, and that after the tank 8 has been filled and the valves 13 and 15 opened, the suppiying of material to the grinding mechanism is entirely automatic. It will also be seen that the material supplied is very accurately graded with all particles having the same physical characteristics arranged together, and that the various grades of material are supplied to the grinding mechanism in proper order and with the proportion of water necessary to effect the best results. The form of tank shown although the preferred one, is not essential to the operation of the apparatus, and if desired, the material might be dumped into the top of the tank 8 instead of drawn from the drainage pit 7, the water from the main 14 being depended upon to secure the proper arrangement of the particles in the tank. The supply of water from the main 14 may of course be controlled manually if desired, and in case the apparatus is used for finishing and the abrasive is very fine, the flow of water from the main may be omitted and the abrasive allowed to grade by settling without the assistance of the upward flow. Various other modifications which will be apparent to those skilled in the art, might be made without departing from my invention as defined by the claims.

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. Apparatus for supplying abrasive to grinding or smoothing mechanism, comprising in combination with a mechanism using an abrasive with water, a grading tank provided with discharge means in the lower end in position to permit of discharge to the said grinding mechanism, and means for securing an upward flow of liquid through the tank, whereby the particles of abrading material are suspended in different strata at positions depending upon the ratio of their resistance in the liquid to their weight.

2. Apparatus for supplying abrasive to grinding or smoothing mechanism, comprising in combination with a mechanism using an abrasive with water, a grading tank provided with downwardly converging walls and having a discharge passage at its lower end above the said mechanism, and means for securing an upward flow of liquid through the tank, whereby the particles of abrading material are suspended in different strata at positions depending upon the ratio of their resistance in the liquid to their weight.

3. Apparatus for supplying abrasive to grinding or smoothing mechanism, comprising in combination with a mechanism using an abrasive with water, a conical grading tank having a discharge passage at its lower end adjacent the said mechanism, and means for securing an upward flow of water through the tank, whereby the particles of abrading material are suspended in different strata at positions depending upon the ratio of their resistance in the liquid to their weight.

4. Apparatus for supplying abrasive to grinding or smoothing mechanism, comprising in combination with a mechanism using an abrasive with water and having a drainage pit, a grading tank provided with downwardly converging walls, a discharge passage leading from the lower portion of the tank to the said mechanism, an admission passage leading from the pit to the bottom of the tank, and means for securing a flow of liquid up through such last passage and the tank.

5. Apparatus for supplying abrasive to grinding and smoothing mechanism, comprising in combination with a mechanism using an abrasive with water and having a drainage pit, a grading tank provided with downwardly converging walls, a discharge passage leading from the lower portion of the tank to the said mechanism, an admission passage leading from the pit to the bottom of the tank, means for securing a flow of liquid up through such last passage and the tank, and a water pipe for securing a flow of water upward through the tank to hold the abrading material in suspension when the flow of liquid from the pit is cut off.

6. Apparatus for supplying abrasive to grinding or smoothing mechanism, comprising in combination with a mechanism using an abrasive with water, a grading tank having downwardly converging walls above the table, a passage leading from the lower end of the tank to the said mechanism and means for securing an upward flow of liquid from the bottom of the tank, whereby the particles of abrading material are suspended in different strata at positions depending upon the ratio of their resistance in the liquid to their weight.

7. Apparatus for supplying abrasive to grinding or smoothing mechanism, comprising in combination with a mechanism using an abrasive in water, a grading tank having a discharge passage at its lower end in position to discharge to the said mechanism, means for securing an upward flow of liquid through the tank and automatic means for gradually cutting off the said upward flow as the tank empties through the said discharge passage.

8. Apparatus for supplying abrasive to grinding or smoothing mechanism comprising in combination with a mechanism using an abrasive with water, a grading tank having a discharge passage at its lower end in position to discharge to the said mechanism, means for securing an upward flow of liquid through the tank and automatic means for cutting off the said upward flow at a decreasing rate as the tank empties through the said discharge passage.

9. Apparatus for supplying abrasive to grinding or smoothing mechanism, comprising in combination with a mechanism using an abrasive with water, a grading tank having a discharge passage at its lower end in position to discharge to the said mechanism, means for securing an upward flow of liquid through the tank, a valve for controlling such flow, a float for operating the valve, a receptacle for the float and means for gradually filling the receptacle as the tank empties through the said discharge passage.

10. Apparatus for supplying abrasive to grinding or smoothing mechanism, comprising in combination with a mechanism using an abrasive with water, a grading tank having a discharge passage at its lower end in position to discharge to the said mechanism, means for securing an upward flow of liquid through the tank, a valve for controlling such flow, a float for operating the valve, a receptacle for the float having downwardly converging walls and means for gradually filling the receptacle as the tank empties through the said discharge passage.

11. Apparatus for supplying abrasive to grinding or smoothing mechanism, comprising in combination with a mechanism using an abrasive with water, a grading tank in position to discharge to the said mechanism, means whereby the abrasive in the tank is separated into a plurality of grades lying at different levels and ranging from coarse to fine, and connections from the tank to the grinding mechanism arranged to automatically discharge the coarsest material to the grinding mechanism first and subsequently the other grades in the order of the size of the particles comprising the grades.

12. Apparatus for supplying abrasive to grinding or smoothing mechanism, comprising in combination with a mechanism using an abrasive with water, a grading tank in position to discharge thereto, means for carrying abrasive in suspension to the tank, and means whereby the abrasive is maintained in suspension in the tank until discharged to the grinding mechanism.

13. Apparatus for supplying abrasive to grinding or smoothing mechanism, comprising in combination with a mechanism using an abrasive with water, a grading tank in position to discharge thereto, means for carrying abrasive in suspension to the tank, means whereby the abrasive is maintained in suspension in the tank until discharged to the said mechanism and means whereby the proportion of abrading material to water may be varied.

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

HALBERT K. HITCHCOCK.

Witnesses:
F. E. GAITHER,
ARCHWORTH MARTIN.