

April 14, 1925.

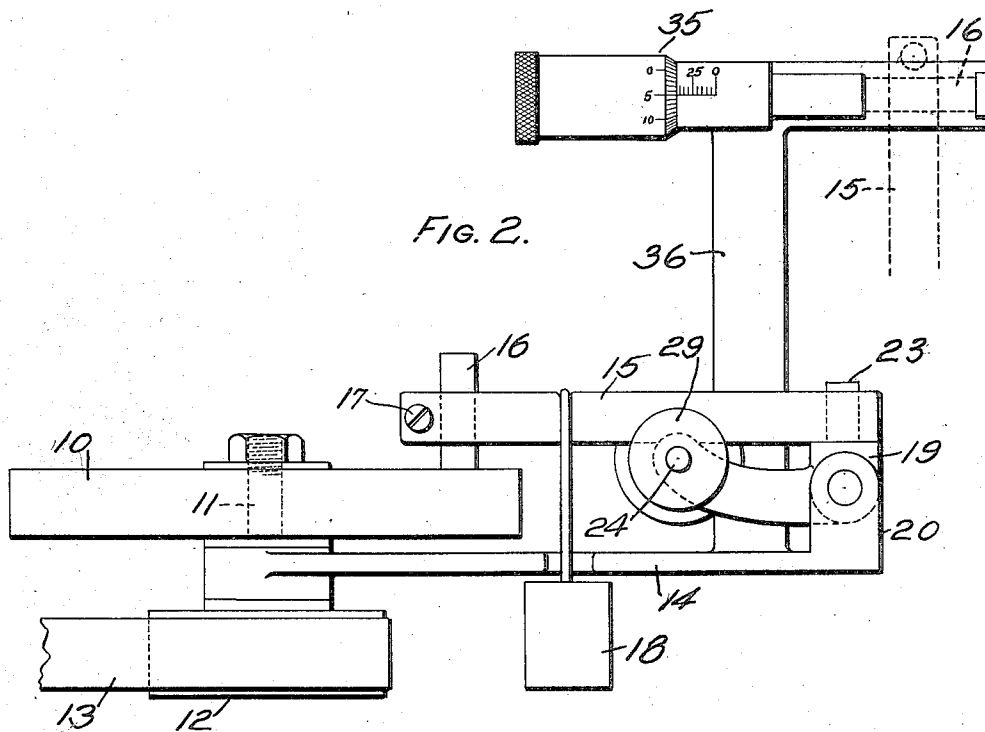
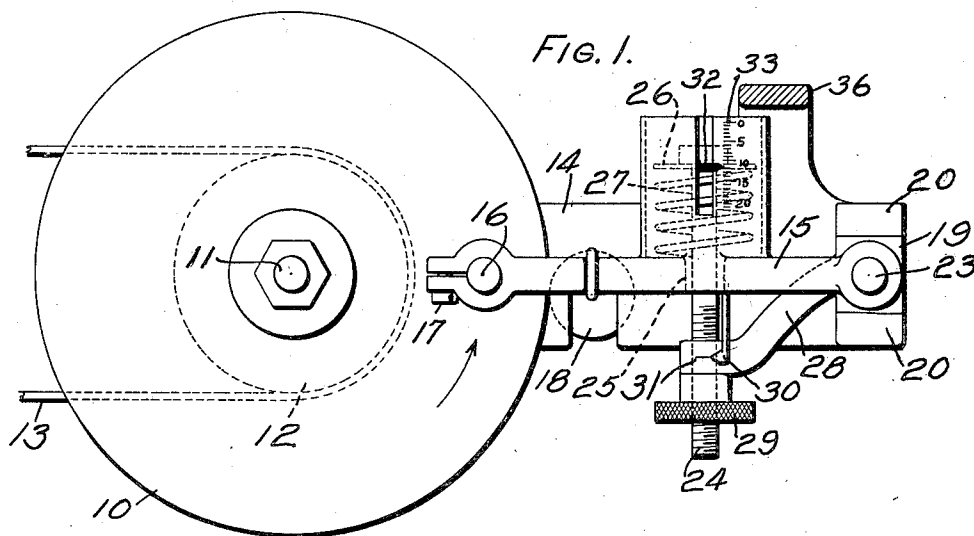
1,534,014

C. E. GILLETT

GRADING MACHINE

Filed Oct. 22, 1919

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 3.

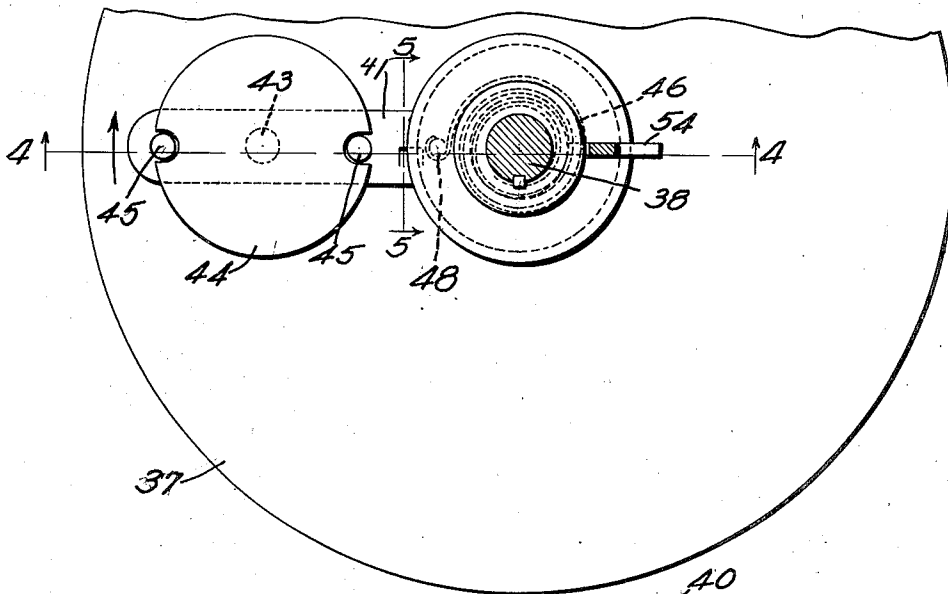


FIG. 4.

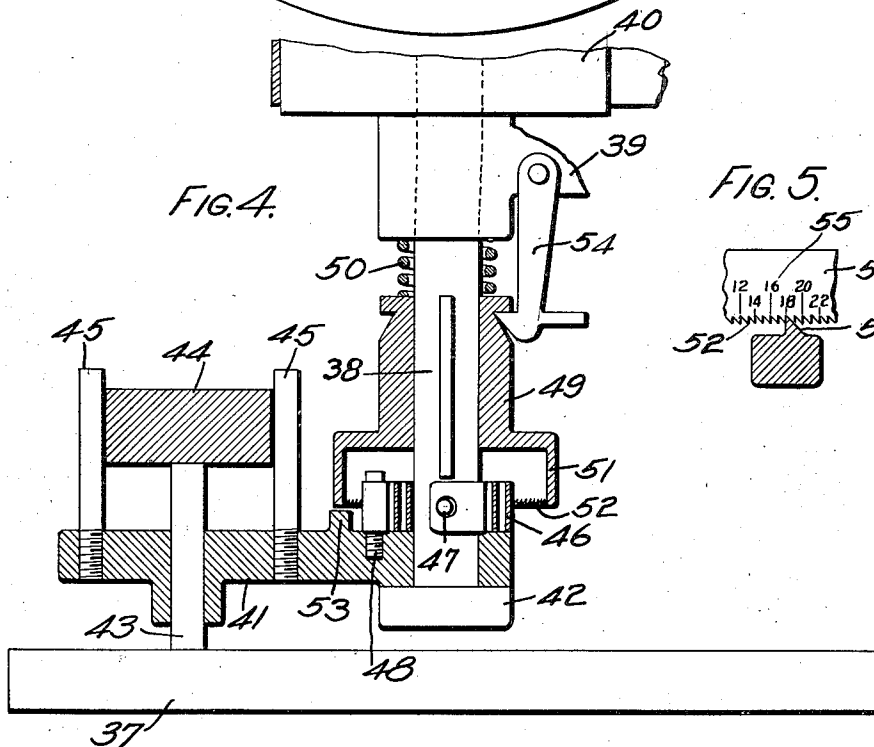
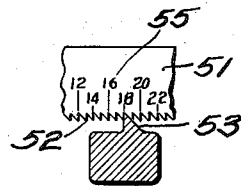


FIG. 5.



WITNESS

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UNITED STATES PATENT OFFICE.

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GRADING MACHINE.

Application filed October 22, 1919. Serial No. 332,518.

To all whom it may concern:

Be it known that I, CHARLES E. GILLETT, a citizen of the United States of America, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Grading Machines, of which the following is a full, clear, and exact specification.

This invention relates to the art of classifying or grading various articles and more particularly to an improved method of grading ceramic ware of bonded granular material and the machine by which the method is carried into effect.

The object of grading such articles as abrasive wheels made, for example, of crystalline alumina or silicon carbide granules bonded by vitrified clay material, is to pre-determine the cutting ability and other grinding characteristics of the wheel when it is used in a grinding machine. This is usually done by testing a wheel which has proven satisfactory for a certain class of work with a grading machine which indicates certain characteristics under duplicate tests and comparing wheels to be graded with this standard. The grade of such wheels has heretofore been determined by a test of the hardness of the clay bond and has not adequately taken the physical characteristics of the abrasive grain into account, since a wheel made of weak, easily fractured abrasive grains will have a different grinding ability from one made of tough abrasive grains, although the clay bonds in the two wheels may be alike.

One object of my invention is to provide a simple and accurate method of classifying abrasive bodies and similar articles and to utilize a machine for this purpose which may be easily used by an unskilled operator to obtain uniform results and a satisfactory classification of the body being graded relative to a standard body.

It is a further object to utilize for classifying such articles the principles involved in relatively moving the tool and the article being graded in frictional engagement along an extensive path and measuring and comparing the frictional forces involved.

To the accomplishment of these objects and such others as may hereinafter appear, as will be readily understood by those skilled in the art, the invention comprises the gen-

eral features and combination of parts hereinafter described and more particularly pointed out in the appended claims.

The preferred embodiment of the machine for carrying my improved method of grading into practical effect is illustrated in the accompanying drawings in which:—

Fig. 1 is a plan view of the machine, certain parts being omitted for the sake of clearness;

Fig. 2 is an elevation of the machine shown in Fig. 1;

Fig. 3 is a plan of a modified form of the machine shown in Figs. 1 and 2;

Fig. 4 is a section on the line 4—4 of Fig. 3; and

Fig. 5 is a section on the line 5—5 of Fig. 3.

In order to compare the cutting characteristics of abrasive wheels, for example, I provide means for determining the abrasive frictional engagement existing between the wheel and a standard tool under uniform conditions as by measuring the drag on the tool caused by the friction of the moving body or by measuring the weight or pressure required on the tool to produce a standard friction or drag. As an additional indication of the characteristics of the wheel, I prefer to measure also the wear on the tool under standard conditions which taken with the measure of friction enable one to duplicate wheels with a high degree of exactness and thus to accurately foretell the working ability of the wheel as is indicated by the grade mark.

In accordance with the illustrated embodiment of my invention I classify such bodies as grinding wheels by determining the variation in the force required to hold either the wheel or tool stationary while the other part is moved relatively thereto along what may be termed an extended path, which force varies in accordance with the frictional characteristic of the wheel, the tool of course being of the same size and material and exerting the same pressure on the wheel for all wheels being compared. In addition to determining the friction exerted by or upon a standard tool I also preferably measure the wear or abrasive action on the tool under standard conditions as a second indication of the cutting action of the wheel when in use.

Referring to Figs. 1 and 2, the wheel 10,

which is to be graded, is mounted on a stud 11 arranged to be rotated at a constant speed by any well-known means, such for example as a pulley 12 and a belt 13. The stud 11 is mounted to turn in a suitable base 14 which also supports a movable tool-carrying arm 15 in which a tool 16 is secured by means of a clamping screw 17.

The arm 15 is weighted if necessary, as by the weight 18 suspended therefrom, to produce the desired pressure between the tool and the wheel and, in order that the tool as it is worn away may move toward the wheel, the arm 15 is mounted on a hinge member 19 pivotally mounted on the base 14 between ears 20. When the wheel is rotating in the direction of the arrow shown in Fig. 1, the tool tends to move with the wheel and I make use of this fact to determine the cutting characteristics of the wheel which have a definite relation to the force required to restrain the tool from movement under the frictional action of the wheel when it is rotated. To this end the arm 15 is pivotally mounted on a vertical pivot 23 formed on the hinge member 19 so that it is capable of movement in a plane parallel to the plane of rotation of the wheel. This movement is restrained by a measuring instrument, such as a dynamometer, which indicates the force acting on the arm tending to cause it to move with the wheel. A convenient form of dynamometer is illustrated in Figs. 1 and 2, which comprises a stud 24 passing through a clearance hole 25 in the arm 15 and provided with a head 26, which engages one end of a helical spring 27 confined between it and the arm.

In order that the angular movement of the arm 15 under the influence of the wheel may not vary the frictional effect, I provide means for moving the arm to a radial position with respect to the wheel in which position it will receive the maximum frictional effect. For this purpose an arm 28 is formed integral with the member 19 and is provided with a clearance hole for the stud 24. A thumb nut 29 is provided on the stud so that the nut can be turned to exert a greater or less pressure on the arm 15 through the spring 27 so as to bring the arm back to a radial position which will be indicated by the position of a pointer 30 with relation to an index mark 31 on the arm 28. By this construction when the nut 29 is turned to bring the arm 15 to a radial position as indicated by the pointer, the force exerted by the rotating wheel on the arm will be indicated by the pointer 32 which moves over a scale 33 provided with any convenient graduation. In order that the starting friction, or the friction of rest, which will be greater than the corresponding force required after the parts have assumed their normal running position, may not be record-

ed, I prefer to observe the point at which the pointer 32 comes to a substantially rest after the wheel has acquired its full or predetermined speed.

In order to observe a further abrading characteristic of the wheel I may utilize a wearable tool and provide means for measuring its wear. For this purpose, I may provide a micrometer device indicated generally at 35, which may be conveniently mounted on an upright 36 formed integral with the base 14, so as to be in position to receive the tool 16 when it is swung into a vertical position about the horizontal axis of the hinge member 19, as indicated in dotted lines in Fig. 2. Since the wear will vary in accordance with the duration of the test, it is essential that the test shall be conducted for a definite period of time or that other means be employed for limiting the abrasive action of the wheel. In using the machine illustrated, the time of treatment or the number of revolutions of the wheel is noted.

In the modification of the invention illustrated in Figs. 3, 4 and 5, a somewhat similar device is shown, the only essential distinction being that the grinding wheel shown in the modification remains stationary while the tool moves, which is a reversal of the relative movement of these parts as shown in Figs. 1 and 2. As illustrated, the wheel 37 is non-rotatably held upon any convenient support, preferably in axial alignment with a vertical shaft 38 which is rotatably supported in the machine frame 39 and driven by the pulley 40. A radial arm 41 revolvably mounted on the lower end of the shaft and held in place by the head 42 is arranged to be turned by the shaft. This arm carries a wheel-engaging tool 43 which is vertically slidable through an aperture in the arm and is held down against the wheel 37 by a weight 44 guided in its vertical movement by two guide rods 45.

In order that the frictional resistance of the wheel acting to retard the movement of the tool may be observed, the tool is driven through a spring which forms, in effect, a dynamometer. One arrangement for this purpose comprises a spring 46 having one end secured to the shaft 38, as by a pin 47, and having the other end secured to the arm 41 by means of a pin 48. The arm 41 is rotatably mounted on the lower end of the shaft 38 so that when the shaft is rotated, as by means of a pulley connected to any suitable source of power, the arm 41 will be moved through the agency of the spring 46, which will wind up more or less in accordance with the resistance to movement offered to the arm by the wheel.

As it would be inconvenient to observe the angular relation of the arm 41 and the shaft 38 during the rotation of the parts, I

provide means for locking the parts in their relative position during the movement of the tool over the work. As it is also found preferable not to observe the starting force or the friction of rest which will be first indicated by the movement of the spring, I also provide means for locking the arm and shaft in their relative positions after the tool has acquired its full speed, so as not to indicate the abnormal force involved in starting the movement. For this purpose, I have provided a locking device comprising a sleeve 49 slidably keyed to the shaft 38 and held downwardly toward the arm 41 by a spring 50. The lower end of the sleeve 49 is provided with an enlarged flange 51 having a series of teeth 52 any one of which is adapted to cooperate with a detent 53 carried by the arm. During the initial movement of the parts the sleeve 49 is held in elevated position with the detent 53 out of operative relation with the teeth 52 by means of a hook 54 mounted on any convenient fixed part of the machine frame 39. After the tool 43 has acquired its full speed the sleeve 49 may be dropped by releasing the engagement of the hook 54 so that the detent 53 will engage one of the teeth 52 and lock the arm 41 with relation to the shaft 38. As illustrated in Fig. 5, the teeth 52 may be provided with any desired index numerals such as indicated at 55, so that the friction or resistance to movement offered to the tool by various wheels may be compared by reference to these numerals.

It will be obvious that the modification of the invention illustrated in Figs. 3 and 4 may be provided with a measuring device similar to that shown in the preferred form of the invention for measuring the wear on the tool 43. As illustrated, however, the tool would be removed from the arm 41 and measured by any convenient instrument such as the usual hand micrometer.

If it is desired to grade abrasive bodies by friction alone without considering tool wear, the tool may be of a relatively non-wearable material, such as a diamond, but if the wear of the tool is to be measured I prefer to use a tool of soft iron or steel not over $\frac{1}{4}$ " in diameter on which the wear is large enough for convenient comparison. My improved method may be carried into practical effect by the machines illustrated, if it is so preferred, by adjusting the pressure on the tool until a standard power is indicated on the dynamometer and then determining this pressure due to the weight acting on the tool. In this case, the weights 18 (Figs. 1 and 2) or 44 (Figs. 3 and 4) are varied until a standard reading is obtained on the scales 33 or 55 respectively and then a comparison of the weights required on any two wheels indicates their relative grades.

By the constructions described in connection with the two illustrated embodiments of the invention, mechanism has been provided for grading abrasive wheels and similar objects by a method including the steps of holding a wearable tool in engagement with the body, giving them a relative motion so that an extended straight or curved path will be generated by any point in the active face of the tool and then measuring the drag or friction between the tool and the body and the amount worn from the tool. Both of these measurements are closely related to the grinding ability of the wheel and by the use of these characteristics the action of the wheel may be predetermined with much greater degree of accuracy than has heretofore been possible. It will of course be understood that the measurement of force may be made in accordance with any suitable standard scale or an arbitrary one which has no significance in engineering practice since the apparatus may be used for comparative as well as absolute measurements; hence the claims are to be interpreted in this light.

What I claim as new and desire to secure by Letters Patent is:—

1. The method of grading an abrasive wheel comprising the steps of rotating the wheel at a fixed rate, causing a tool to bear against the wheel under a definite pressure and move along an extended path thereon and measuring a force which varies with and is produced by the friction between the wheel and the tool during such movement.

2. The method of grading an abrasive wheel comprising the steps of rotating the wheel at a predetermined speed, causing a tool to engage the wheel and thereby generate a circular path on the wheel, maintaining a standard pressure between the tool and the wheel and measuring the force required to overcome friction between the tool and the wheel.

3. The method of grading an abrasive wheel comprising the steps of rotating the wheel at a predetermined speed, causing a tool of standard dimensions and material to bear against the wheel in an extended path, maintaining a constant pressure therebetween, determining the frictional and abrasive resistance between the wheel and the tool and comparing the data thus obtained with measurements similarly made upon standard wheels.

4. The method of grading an abrasive wheel comprising the steps of causing a wearable tool to bear against the wheel, relatively moving the wheel and the tool so that the tool will describe on the wheel an extended path, measuring the force of the frictional drag between the wheel and the tool and measuring the wear on the tool.

5. A machine for grading abrasive wheels

comprising a wheel support, a tool adapted to frictionally engage a wheel on said support, means for relatively moving the wheel and the tool so that the tool will describe on the wheel an extended path, means to apply a definite pressure upon the tool and means to measure the force of the frictional drag between the relatively moving wheel and tool.

6. A machine for grading abrasive wheels comprising means for rotatably supporting the wheel to be graded, a tool adapted to engage the wheel in a circular path during said rotation, means to produce a definite pressure between the tool and the wheel, means to resist movement of the tool under the frictional pressure of the rotating wheel and means to indicate the force necessary to resist such movement.

7. A machine for grading abrasive wheels comprising a rotatably mounted wheel support, a pivotally mounted arm carrying a tool adapted to frictionally engage a wheel on said support, a spring to control the position of the arm, means for adjusting the spring to position the arm on a radius of the wheel and means for measuring the force

required to hold the arm in such position under the frictional drag exerted on the tool by the rotating wheel.

8. A machine for grading abrasive wheels comprising a rotatably mounted wheel support, a pivotally mounted arm carrying a wearable tool bearing on a wheel on said support, means for measuring the friction between the tool and the wheel, means for moving the arm into a second position and means for measuring the tool in the second position.

9. A machine for grading abrasive wheels comprising a rotatably mounted wheel support, an arm mounted to move in two planes, a wearable tool carried by the arm and bearing on a wheel on said support, a spring to control the position of the arm in one plane, means to indicate the force exerted on the spring by friction of the rotating wheel on the tool and means for measuring the wear on the tool when it is swung in the second plane.

Signed at Worcester, Massachusetts, this 20th day of Oct., 1919.

CHARLES E. GILLETT.