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APPARATUS FOR BALANCING ABRASIVE WHEELS DURING FABRICATION

Original Filed July 29, 1936 2 Sheets-Sheet 1

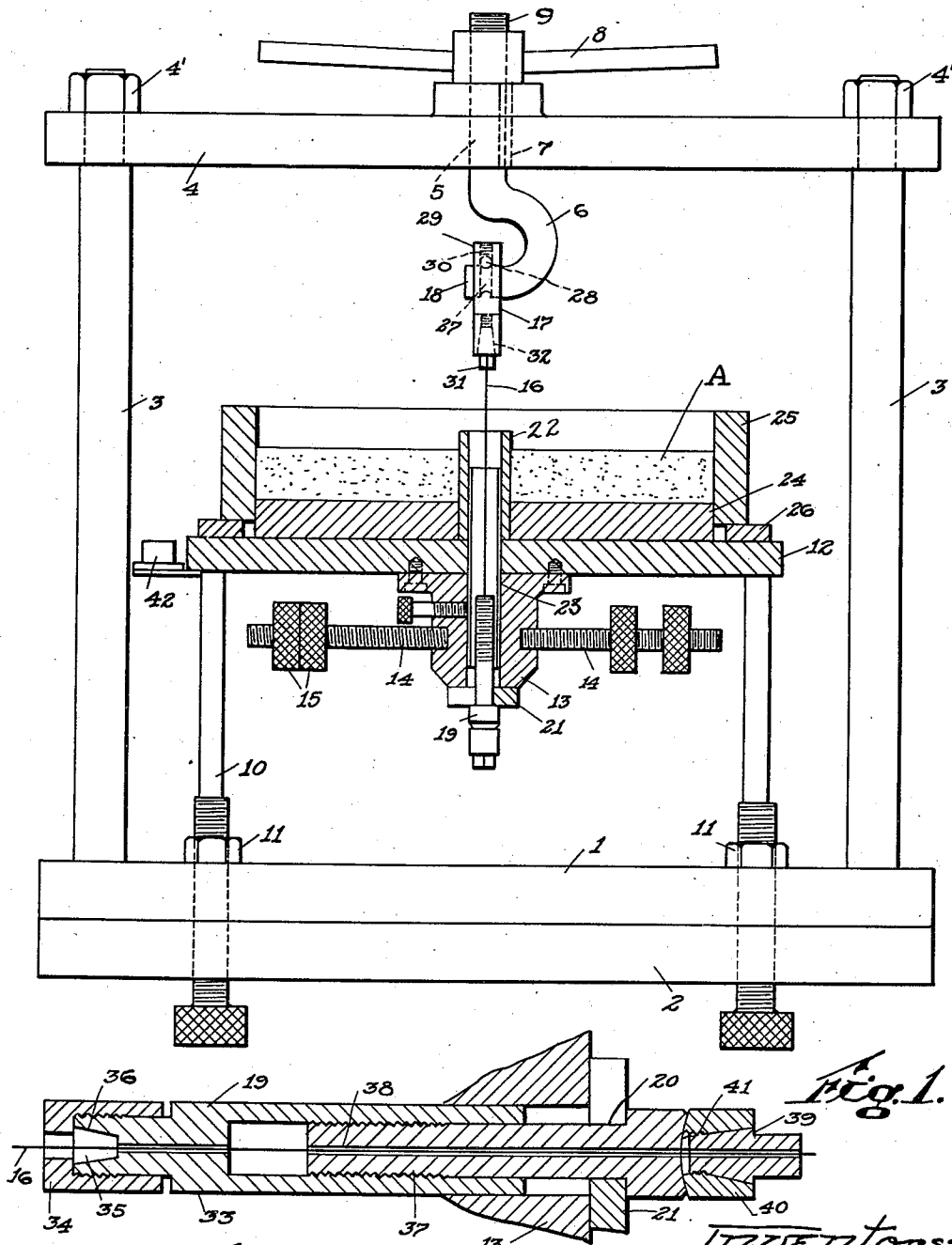


Fig. 3.

Fig. 1.

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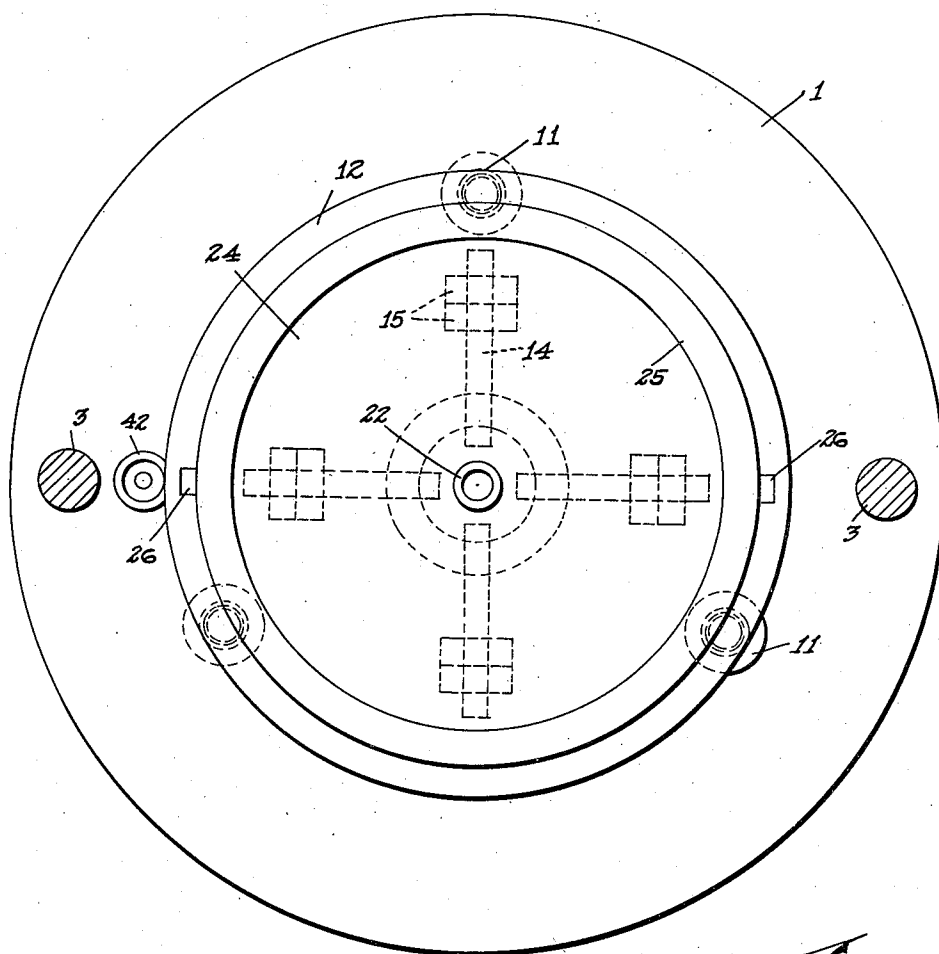


Fig. 2.

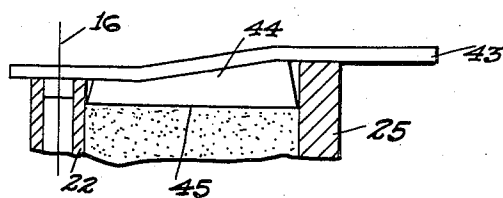


Fig. 4.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR BALANCING ABRASIVE
WHEELS DURING FABRICATION

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Original application July 29, 1936, Serial No. 93,250. Divided and this application April 26, 1937, Serial No. 138,874

8 Claims. (Cl. 73—51)

The present invention relates to an apparatus for making abrasive wheels and is particularly directed to a device for forming an abrasive wheel which, when finished, will be in perfect balance. This application is a division of Serial No. 93,250, filed July 29, 1936, for Method for making abrasive wheels.

Abrasive wheels are commonly made by compressing granular abrasive material, as for example, silicon carbide or crystalline alumina, mixed with a suitable bonding material into the desired wheel shape, preferably in a mold, and subsequently curing the bond by the application of heat to harden the wheel. It is essential that abrasive wheels, which are to be driven at high speeds, be in perfect dynamic and static balance in order that any vibration of the wheels may be eliminated, especially where the abrasive wheel is used for fine grinding or polishing and an out-of-balance wheel would produce unevenness or chatter marks in the work being ground.

In order to obtain wheels which are homogeneous in character and in good balance the material must be evenly distributed throughout the mold and then compressed to a uniform mass before curing the wheel. Several attempts have been made to obtain a uniform distribution of the abrasive material in the mold, but these attempts have not, however, produced an entirely uniform wheel, with the result that the wheel must be balanced after curing. This balancing is generally done by inserting small plugs of lead on the light side of the wheel near the central opening, and the hole which must be made in the wheel to receive the lead frequently weakens the wheel with the result that the wheel may later fly to pieces, in operation, as a result of the centrifugal force developed by the rapid rotation of the wheel. The present invention avoids the necessity for these lead inserts by providing for balancing the wheel before curing.

Although the abrasive material, after being packed in the mold, is greatly compressed under extremely high pressures to obtain a solid wheel, the abrasive material is of such a consistency that it does not flow laterally during the compression and non-uniformity in the distribution of the abrasive material in the mold is thus not corrected during the compression of the abrasive material. One of the principal objects of the present invention is to provide a device for use in the formation of an abrasive wheel which, when finished, will be uniform in character and which will be in static balance without the necessity for

balancing the wheel after the wheel is compressed and cured.

According to the present invention the abrasive material is distributed in the mold in such a manner that the material, before being compressed or cured, is in perfect static balance on a point coinciding with the axis about which the wheel, when finished, will be rotated, and the apparatus provides for balancing of the material. By so balancing the material before curing, the material is easily distributed to obtain perfect balance and the finished wheel will be in perfect static balance. The necessity for subsequent balancing of the wheel is entirely eliminated. Furthermore, in the manufacturing of wheels by this apparatus the number of wheels that must be discarded for being non-uniform is greatly decreased, or entirely eliminated, and the wheels produced are much safer since they are entirely homogeneous.

Other and further objects and advantages of the invention will more fully appear from the following detailed description taken in connection with the accompanying drawings in which—

Fig. 1 is a front elevation of an apparatus by which the method of the present invention may be carried out.

Fig. 2 is a plan view, with parts in section, of the apparatus of Fig. 1.

Fig. 3 is a sectional view on an enlarged scale of the suspending mechanism for the balancing table.

Fig. 4 is an elevation of a leveling plate used in uniformly distributing the abrasive material in the mold.

Like reference characters refer to like parts in the different figures.

With reference first to Fig. 1, the apparatus embodying the invention comprises a base 1 mounted on any suitable support 2, which may be in the form of a table, which will bring the device at the right height for the workman. The base has upwardly extending parallel posts 3 at opposite ends thereof and the upper ends of the posts are connected by a cross bar 4, securely held on the posts 3 as by nuts 4'. Centrally of the cross bar is provided an opening 5 through which a supporting member 6 extends, this member being substantially in the form of a hook. A key 7 holds the member 6 against turning movement in the cross bar and a hand wheel 8 engages the threaded upwardly projecting shank 9 of the supporting member 6 for raising or lowering said member relative to the cross bar.

Projecting upwardly from the base are a plurality of uniformly spaced leveling screws 10

which are threaded into the base, each screw having a clamping nut 11 to provide for locking of said screws against turning, after adjustment of the screws for raising or lowering a balancing plate 12 resting on the upper ends thereof. The plate 12 has secured to the underside thereof a supporting member 13 from which project horizontally a plurality of threaded rods 14 on which are mounted internally threaded weights 15 preferably having their outer surfaces knurled to provide for turning thereof on the rods 14.

The balancing plate 12 is hung from the hook 6 by a wire 16 having a connector 17 at its upper end engaging over the flat portion 18 of the supporting member 6. A connector 19 at the lower end of the wire has an annular groove 20, Fig. 3, engageable by a U-shaped plate 21. The lower end of the member 13 rests on the plate 21 and is supported thereby. Thus, when the hand wheel 8 is turned to raise the balancing plate 12 from the leveling screws 10, the plate is suspended by the wire 16.

On the top of the plate is positioned a sleeve 22 engaging over the connector 19 which extends through a bore 23 centrally of the plate 12 and member 13. The sleeve 22 locates the mold plate 24 centrally of the balancing plate, and an annular shell 25, forming a part of the mold, is positioned around the plate 24. The shell 25 is preferably held slightly above the balancing plate 12 by blocks 26, the purpose of which will hereinafter appear.

To obtain suspension of the balancing plate about a single point, the flat portion of the member 6 has a screw 27 having its upper end cup-shaped to receive a ball 28. The yoke 29 forming a part of the connector 17, and positioned over the portion 18, also has a screw 30, having its lower end cup-shaped to engage the ball 28. The connector 17 also has tapered jaws 31, Fig. 1, threaded to engage in a bore 32 in the yoke 29, and the upper end of the wire 16 is clamped between said jaws. The lower connector 19 for the wire comprises a tube body 33 adapted to fit in the central bore 23 in the member 13. A threaded cap 34 on the upper end of the body 33 holds in place split jaws 35 fitting in a tapered recess 36 in the body. The wire 16 is located centrally of the body and thus centrally of the balancing plate by these jaws which form the pivotal support for the balancing plate and associated parts. The lower end of the body 33 receives a threaded stud 37 having a bore 38 therethrough for the wire 16. Clamping jaws 39 are threaded into a collar 40 and securely clamp the lower end of the wire 16, the collar 40 having an arcuate end 41 engageable with the correspondingly shaped head of the stud 37. The head of the stud also engages the washer 21 to hold the tube body 33 in place.

Adjustment of the stud 37 in the tube body raises or lowers the position of the split jaws 35 relative to the balancing plate and mold parts so that the point where the wire 16 projects from the jaws may be adjusted close to the center of gravity of the mold parts as desired. It will be understood that the sensitiveness of the apparatus is controlled by the position of the pivotal support for the parts being balanced, and the point of support is accordingly adjusted until desired accuracy is obtained.

In use, the hand wheel 8 is turned to raise the balancing plate 12 from its support on the screws 10, and said plate, with the mold parts 22, 24 and 25 and blocks 26 thereon, is brought into perfect

balance by adjustment of the weights 15. When the plate is in balance it is indicated by a circular spirit level 42 of well known construction, mounted on the plate and indicating any out-of-balance condition. The mold parts 22, 24 and 25, and the plate 12 have preferably been previously balanced individually so that there will be, at the most, only a slight out-of-balance to correct.

When the balancing plate 12 with the mold parts thereon is in perfect balance, the abrasive material A is placed in the mold and uniformly distributed therein until the plate and material are again in perfect balance. This uniform distribution may be in part aided by a gage which, as shown in Fig. 4, comprises a cross bar 43, to which is secured a plate 44, having a straight lower edge 45. The cross bar rests on the upper edges of the sleeve 22 and shell 25 and is revolved around the suspending wire to level the abrasive material in the mold. The plate may be made adjustable on the cross bar if desired. It will be apparent that the gage distributes the abrasive material so that the cross section of the annulus of abrasive material is uniform throughout, and when the mold and material are in balance it will indicate a uniform density of abrasive material throughout the mold.

If the abrasive material, when beveled within the mold, is not in perfect balance, a slight amount more of the material is added to the light side of the wheel until the material is in perfect balance. In the making of thick wheels, it is frequently desirable to balance the abrasive material at more than one time, as, for example, when one-half the material is in the mold, and again when all the material is in the mold.

After the abrasive material is reduced to a uniform cross section throughout the mold and is in perfect balance, the mold, with the material therein, is removed from the device, by removing the plate 21 and withdrawing the connector 19 from the sleeve 22. A plate similar to the plate 24 is placed on top of the abrasive material and the entire mold compressed to pack the material. The subsequent steps of curing the material and testing the wheel are performed in the usual manner.

From the foregoing it will be apparent that the invention involves an apparatus for forming a uniform grinding wheel by balancing the abrasive material before curing, at which time it is possible to obtain a uniform distribution of material, by weight, about the axis on which the wheel, when completed, is to be rotated.

We claim:

1. In a device of the class described, a balancing plate, a wire by which said plate is suspended and a connector between the lower end of said wire and the plate having means to provide for the adjustment of the point of balance of said plate, said means comprising an adjustable screw engageable with the plate, and a member secured to the wire in which said screw is adjustable.

2. In apparatus for making abrasive wheels, a balancing plate adapted to support a wheel mold, a pivotal support for said plate, including a wire extending upwardly from the plate substantially at the center thereof, a stationary support for the plate, said pivotal support providing a locating means for centering the wheel mold on the balancing plate, and releasable means on the underside of the plate for disengaging the pivotal support from the plate to provide for removal of the mold from the balancing plate.

3. In apparatus for making abrasive wheels, a balancing plate adapted to support a wheel mold, a pivotal support for said plate, including a flexible connector extending upwardly from said plate, and a releasable connection on the underside of the plate and providing a connection between the connector and plate, and a stationary support for the plate when the pivotal support is inoperative.

4. In apparatus for making abrasive wheels, a balancing plate adapted to support a wheel mold, a pivotal support for said plate, including a flexible connector extending upwardly from said plate, means on the lower end of the connector for adjusting the effective length thereof, and a releasable connection on the underside of the plate and providing a connection between said means and the plate.

5. In apparatus for making abrasive wheels, a balancing plate adapted to support a wheel mold, a pivotal support for said plate, including a flexible connector extending upwardly from said plate, means for adjusting the position of the pivotal connection between the flexible connector and the plate, and a releasable connection on the underside of the plate providing a connection between the flexible connector and the plate.

6. In apparatus of the class described, a balancing plate, a stationary support for said plate, a pivotal support for said plate, and means for rendering said pivotal support operative, the pivotal support comprising a flexible connector

extending upwardly from said plate, a member connected to the lower end of said connector, and an adjustable member connected to said first member and to the plate for adjusting the position of the lower end of the flexible connector relative to the plate.

7. In apparatus of the class described, a balancing plate, a stationary support for said plate, a pivotal support for said plate, and means for rendering said pivotal support operative, the pivotal support comprising a flexible connector extending upwardly from said plate, a member connected to the lower end of said connector, and an adjustable member connected to said first member and to the plate for adjusting the position of the lower end of the flexible connector relative to the plate, said adjustable member being releasably connected to the plate.

8. In apparatus of the class described, a balancing plate having a central opening, and a pivotal support for said plate, said support comprising a flexible connector, means for supporting the upper end of said connector, a member secured to the lower end of said connector, a second member adjustable on said first member, said second member extending through the opening in the plate, and a releasable connection between the plate and said second member on the underside of the plate.

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30