United States Patent

Metzger et al.

[15] **3,664,068**

[45] **May 23, 1972**

[54] ROTARY GRINDING WHEEL

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[73] Assignee: **Super-Cut, Inc.,** Chicago, Ill.

[22] Filed: **Apr. 13, 1970**

[21] Appl. No.: **27,565**

Related U.S. Application Data

[62] Division of Ser. No. 731,591, May 23, 1968, Pat. No. 3,550,575.

[52] **U.S. Cl.** **51/209,** 125/3

[51] **Int. Cl.** **B24d 5/00,** B24d 7/00

[58] **Field of Search** 51/209; 125/3; 144/219, 176

[56] **References Cited**

UNITED STATES PATENTS

2,980,098	4/1961	Wayland	51/209 X
135,642	2/1873	Grear	125/3

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[57] **ABSTRACT**

A rotary abrasive grinding head adapted progressively to traverse a pre-grooved refractory surface, embodying impact members which fracture the intervening ribs between the grooves and thus remove the fractured fragments, and also embodying abrasive members which eradicate the residual or remaining portions of the ribs.

3 Claims, 5 Drawing Figures

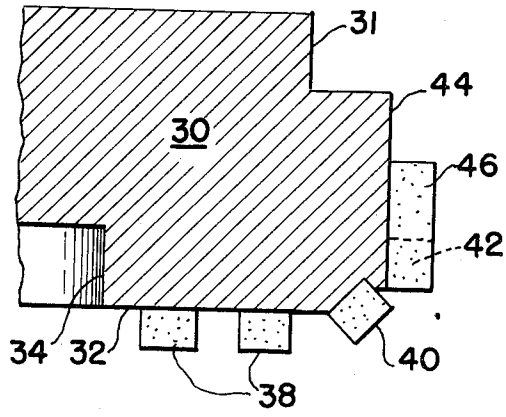


FIG. 1

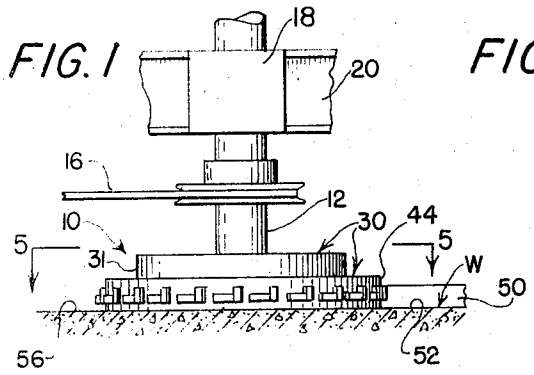


FIG. 2

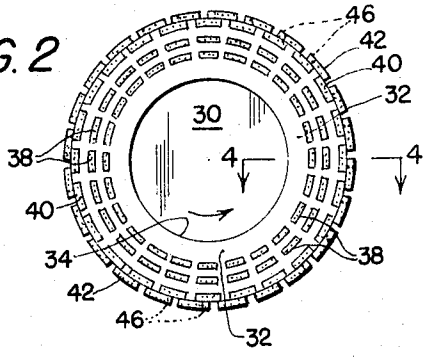


FIG. 3

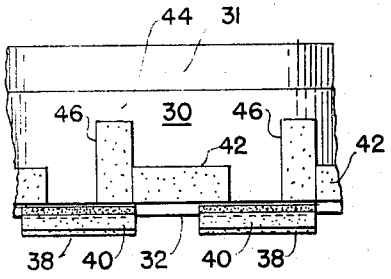


FIG. 4

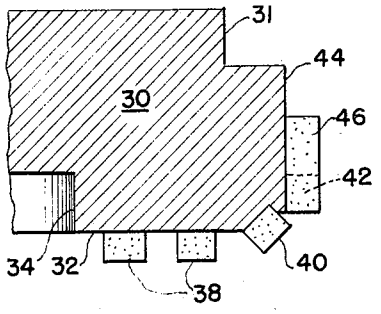
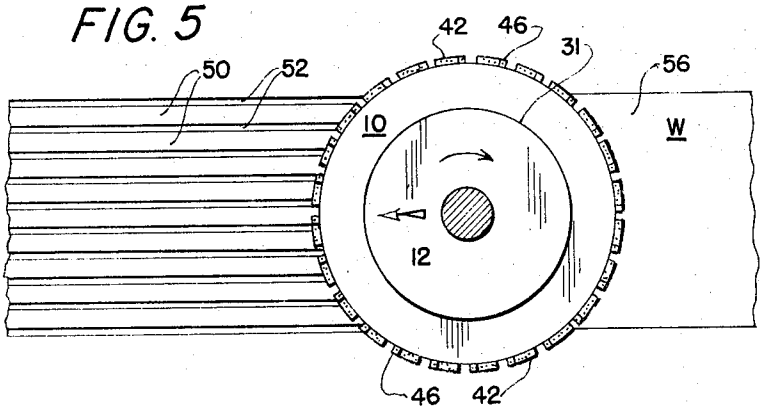


FIG. 5



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ROTARY GRINDING WHEEL

The present application is a division of copending United States patent application Ser. No. 731,591, filed by Leopold H. Metzger and Harold C. Miller on May 23, 1968 and entitled "METHOD OF AND APPARATUS FOR SURFACING REFRACTORY SLABS AND THE LIKE", (now U.S. Pat. No. 3,550,575, granted on Dec. 29, 1970).

The present invention relates to a novel rotary grinding head which is particularly useful in connection with the surfacing of a refractory or similar surface which has been pregrooved in order to provide a multiplicity of closely spaced, parallel intervening ribs between the grooves, such head being operative in connection with use thereof and while traversing the surface in a longitudinal direction to fracture the ribs progressively and at the same time to eradicate the residual or remaining portions of the ribs. The invention is not necessarily limited to such use and a rotary grinding head embodying the principles of the present invention may, if desired, and with or without modification as required, be employed for treating other irregular surfaces, such, for example, as concrete pavement or the like having abrupt high spots or other areas which are capable of being fractured by impact. Irrespective, however, of the particular use to which the improved rotary grinding head may be put, the essential features thereof are at all times preserved.

It is obvious that in surfacing a concrete, marble, granite or similar refractory block or slab for the purpose of reducing the faces thereof to a flat or planar condition, it is necessary by way of grinding to surface the slab on each face thereof to a depth which is no less than the depth of the lowest point thereon. This means that all of the refractory material which lies outside of the plane of such lowest point must be removed. Where grinding operations are resorted to by utilizing a cylindrical or a planar abrasive grinding wheel or head, for each unit volume of material that is removed from the slab, a proportional unit volume of abrasive material on the grinding head is consumed. Considering a slab having a high region of large base area on a face thereof, the amount of refractory material which must be removed to reduce the face to a flat or planar condition is appreciable and, where a diamond type grinding head is utilized for surfacing purposes, the cost of the diamond particles that are expended to eliminate the high region is extremely high.

The present invention is predicated upon the use of a method like that which is disclosed in aforementioned patent No. U.S. Pat. No. 3,550,575 and wherein large amounts of material may be removed from a refractory surface with a minimum amount of grinding, thus materially reducing the expenditure of abrasive material which is employed in connection with a surfacing operation. For a full understanding of such method, reference may be hade to such application, but for purposes of disclosure herein it is deemed sufficient to state that the method comprises sawing a multiplicity of closely spaced, relatively deep parallel kerfs or grooves in the surface of the block or slab underoing surfacing, thus leaving a series of intervening and spaced apart ribs which are by necessity of appreciable height. Thereafter, the ribs are fractured adjacent to their bases and thus broken away, leaving only a modicum of grinding to be performed before the surface is reduced to a flat or planar condition. The present invention is particularly concerned with a novel rotary grinding head by means of which such fracturing and grinding operations are carried out.

In carrying out the invention, there is provided a rotary grinding head having mounted thereon an annular series of impact members which are in the form of solid tungsten carbide blocks and sweep inwardly toward the ribs or other high spots undergoing fracturing from the sides thereof near their bases. Each block-like impact member, in addition to its impacting or hammering function, serves as a protective front for an abrasive grinding segment which lies directly behind or trails it and is disposed at an effective level slightly higher than the effective level of additional abrasive segments which perform the final cleaning up or finishing operation.

In the accompanying single sheet of drawings forming a part of this specification, there is illustrated an exemplary form of grinding head which is capable of performing the aforementioned impacting and grinding functions.

In this drawing:

FIG. **1** is a side elevational view of a grinding head embodying the present invention, such head being in operation on a grooved surface;

FIG. **2** is a bottom plan view of the grinding head proper;

FIG. **3** is an enlarged fragmentary side elevational view of the grinding head;

FIG. **4** is an enlarged vertical sectional view taken on the line **4—4** of FIG. **2**; and

FIG. **5** is a horizontal sectional view taken on the line **5—5** of FIG. **1**.

Referring now to the drawings in detail, and in particular to FIG. **1**, the improved grinding head of the present invention is designated in its entirety by the reference numeral **10** and is shown as being provided with an upstanding drive shaft **12**. The latter has fixedly mounted thereon a pulley **14** which is driven by an endless belt **16**, the drive shaft being rotatably journalled in a bearing member **18**, which is associated with the framework **20** of the grinding machine (not shown) with which the head **10** is associated. The grinding wheel is shown in FIG. **1** as being operatively applied to the upper surface of a grooved slab, a section of a strip of concrete pavement or other workpiece W upon which the head is adapted to operate.

The grinding head **10** is comprised of a cylindrical body **30** having a lower annular end face **32** which is defined by a central recess **34**. The lower peripheral edge **36** of the body **30** is bevelled in order to provide a frusto-conical area. Two annular series of abrasive segments **38** are fixedly mounted on the lower annular end face **32** of the body **30**, such series being arranged concentrically and spaced a comparatively small distance apart in a radial direction. The segments **38** are spaced apart in a circumferential direction. An annular series of similarly spaced apart abrasive segments **40** is fixedly mounted on the bevelled edge **36**. Another annular series of similarly spaced apart abrasive segments **42** is fixedly mounted on the outer cylindrical side surface **44** of the body **30**. The various segments **38**, **40** and **42** are of elongated rectangular design, the segments of each series being disposed in end-to-end but spaced apart relationship. Each of these segments is formed of sintered metal throughout which there are uniformly distributed quantities of crushed or fragmented diamonds.

As best illustrated in FIG. **3**, each of the abrasive segments **42** is preceded by an impact member **46** in the form of an elongated rectangular block of tungsten carbide or other hard material having a high resistance to shattering upon impact. The various blocks **46** extend vertically in parallel side-by-side but spaced apart relationship and the lower region of the trailing side of each block **46** bears against the leading end face of the associated trailing abrasive segment **42** as clearly shown in FIG. **3**. The medial and upper regions of each block-like impact member **46** project above the upper face of its associated abrasive segment **42**.

In the operation of the rotary grinding head **30**, the function of the block-like impact members **46** and their trailing abrasive segments **42** is to cut arcuate swaths through the oncoming high spots in the workpiece W undergoing surfacing. In the illustrated environment for the grinding head **30**, the workpiece W is considered to be a refractory slab which has been pre-grooved as shown in FIGS. **1** and **5**, the grooves **50** establishing intervening ribs **52** therebetween. It will be understood, of course, that during the surfacing operation there will be a relative traversing movement between the workpiece W and the head **10**. In the case of a slab surfacing machine such as is disclosed in aforementioned U.S. Pat. No. 3,550,575, means are provided for causing the slab to traverse the surfacing head, but in the case of a pavement surfacing machine, the head **10** will ordinarily be carried on a vehicular type of framework so that forward movement of the framework will cause the head to traverse the pavement.

Considering each tungsten carbide impact member **46** and its associated abrasive segment **42** as a unit, the function of the annular series of units on the outer cylindrical surface **44** of the cylindrical body **30** is partially a chipping operation and partially an abrasive operation, large segments of the ribs **52** being variously fractured and broken from the ribs and thus forcibly ejected from the vicinity of the working area of the head by the impact force of the tungsten carbide, block-like members **46**. The abrasive segments **42** which trail the impact members initiate a preliminary grinding operation on the portions of the ribs **52** which are not dislodged by said members, while further progressive grinding operations are performed by the abrasive segments **40** on the bevelled edge **36** of the cylindrical body **30** of the head **10**. This is followed by a smoothing operation under the influence of the abrasive segments **38** on the lower annular end face **32** of the body **30**.

The segments **42** are largely abrasive in their function, but they also have a minor impact function of appreciably less proportions than the impact function of the tungsten carbide impact members **40**. This minor impact function of the abrasive segments **42** is related to the removal by impact of any small protuberances which may remain on the fractured portions of the ribs **52** after the tungsten carbide impact members **46** have passed thereover.

The function of the abrasive segments **38** is entirely abrasive, these segments serving to bring to a planar condition, as indicated at **56** in FIGS. **1** and **5**, any trace of rib structure which may remain after the rib regions of the workpiece W have been traversed by the grinding head **10**.

It is to be noted that there is a vertical overlap between the abrasive segments **42** and **40**, as well as between the abrasive segments **40** and **38** in order that continuity of removal of the material of the ribs will be assured.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification as various changes in the details of construction may be resorted to without departing from the spirit or scope of the invention.

Having thus described the invention what we claim as new desire to secure by letters patent is:

1. A rotary abrasive grinding head adapted progressively to traverse a pre-grooved refractory surface in a longitudinal direction with respect to a series of ribs established between the grooves and thereby to remove such ribs and reduce the refractory surface to a planar condition, said grinding head comprising a generally cylindrical body having a circular end face , said end face being bevelled to provide a frusto-conical area, a cylindrical side surface, a series of circumferentially spaced impact members mounted on said side surface and adapted to traverse said ribs crosswise during the forward progressive movement of the head and by impact therewith fracture the same and eject the fragments produced by the fracture, an abrasive segment mounted on said side surface and positioned immediately behind each impact member, each of said abrasive segments having a forward abrasive surface which is substantially coplanar with the forward surface of its associated impact member, an annular series of abrasive segments concentrically mounted on said end face and adapted during such forward progressive movement of the head to eradicate the residual portions of said ribs , and a second annular series of abrasive segments on said frusto-conical area.

2. A rotary abrasive grinding head as set forth in claim **1** and wherein the extent of said impact members in the axial direction of the head is overlapped by the extent of said second annular series of abrasive segments, and the extent of said latter series of abrasive segments is overlapped by the extent of said row of abrasive segments on said end face.

3. A rotary abrasive grinding head as set forth in claim **1** and wherein all of said abrasive segments are in the form of elongated block-like matrices containing fragmented diamonds and the axes of elongation of which extend generally in a circumferential direction.

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