April 22, 1952 A. J. DOERMANN 2,594,137

GRINDING WHEEL

Filed Sept. 12, 1949 2 SHEETS—SHEET 1

Fig. 1.

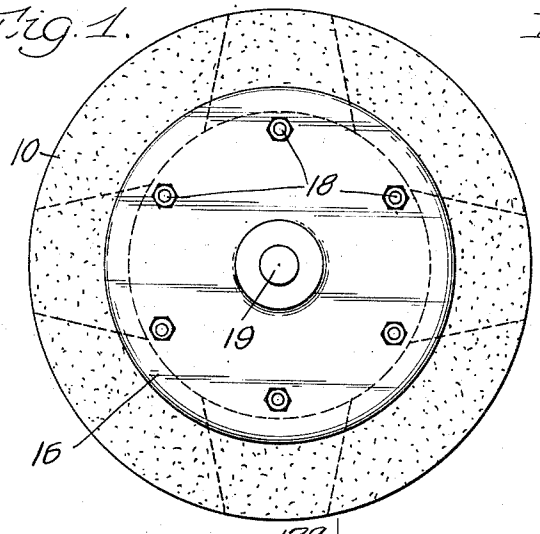


Fig. 2.

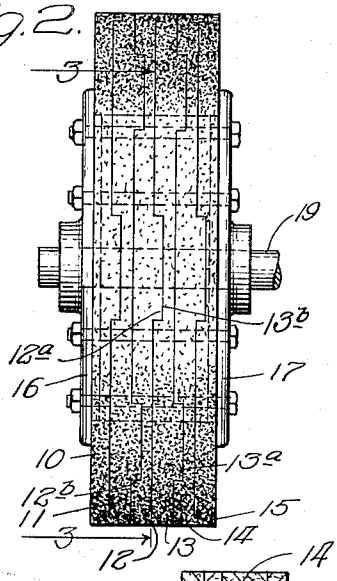


Fig. 3.

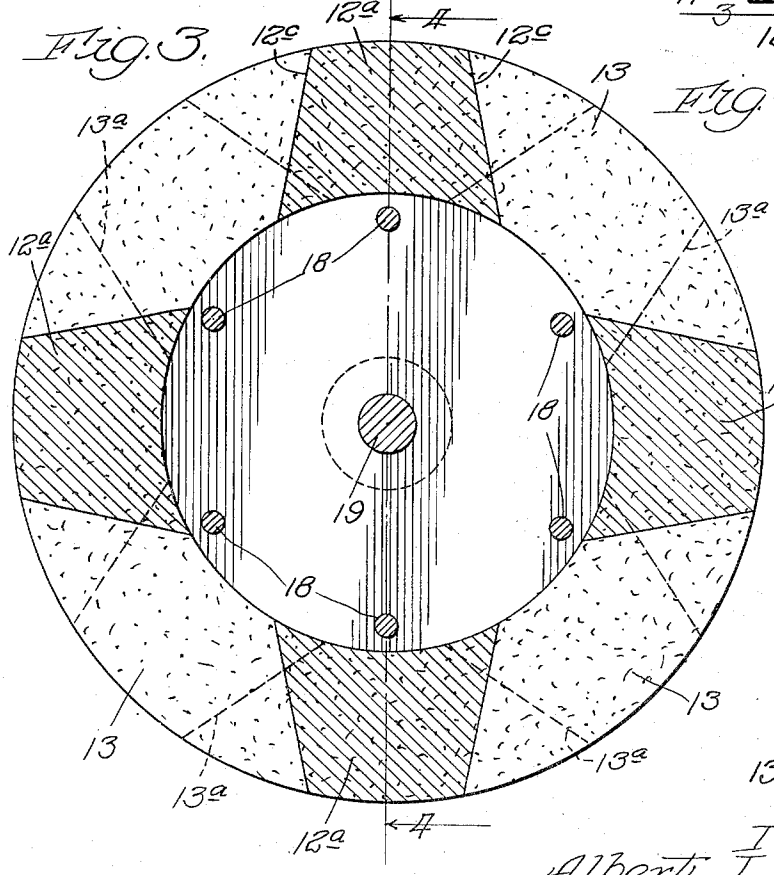
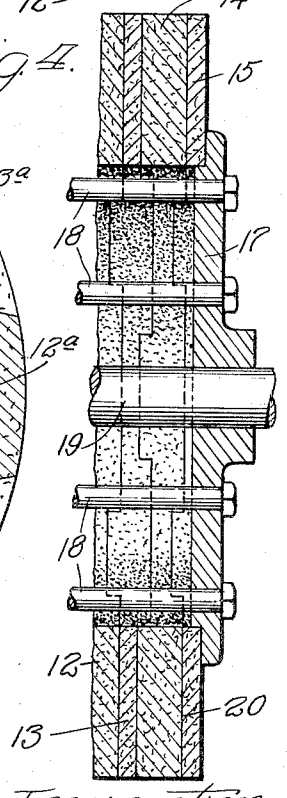


Fig. 4.



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Fig. 5.

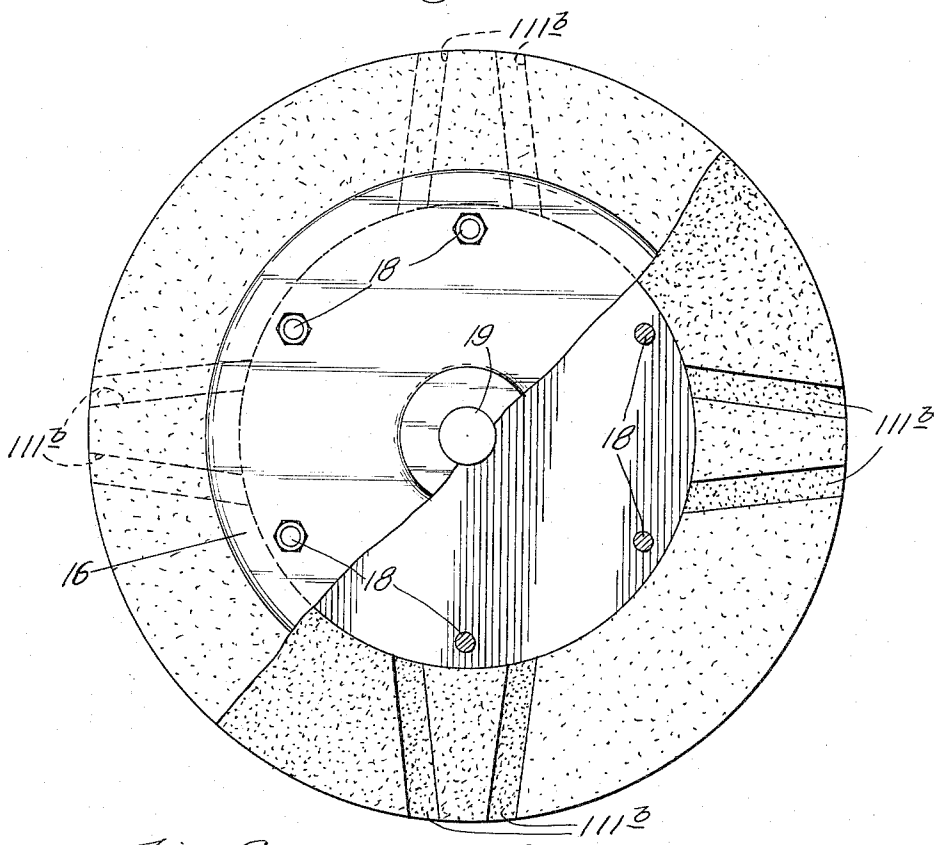
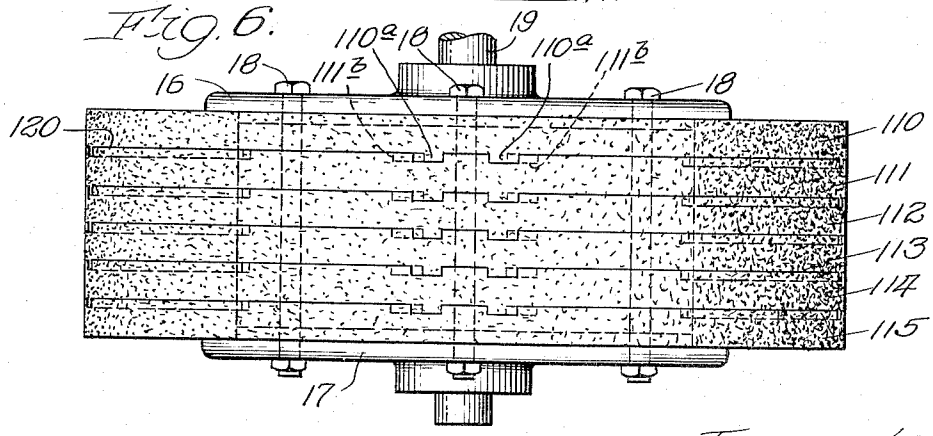


Fig. 6.



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GRINDING WHEEL

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9 Claims. (Cl. 51—207)

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This invention relates to a grinding or abrasive wheel, and relates particularly to such a wheel comprising a plurality of adjacent grinding disc-like elements adapted to be locked together for making the completed wheel.

One of the features of this invention is to provide a rotatable grinding wheel comprising a plurality of adjacent grinding disc-like elements each having a tongue on one side engaging a groove on the adjacent side of the next element with at least one of the cooperating edges of a tongue and groove being at an angle to a radius of the wheel to aid in restraining a broken section from being thrown outwardly by centrifugal force when the wheel is rotated; another feature of the invention is to provide such a wheel wherein both side edges of the tongue and groove are at an angle to each other; a further feature of the invention is to provide such a wheel having a plurality of annular disc-like elements wherein the cooperating opposite sides of the tongue and groove are inclined toward each other from inner portions of the elements to the peripheries thereof; yet another feature of the invention is the provision of a grinding wheel comprising a plurality of adjacent grinding disc-like elements with at least one element having a tongue with substantially parallel sides and located on one side of the element engaging a groove in the adjacent side of the next element wherein the tongue and groove are inclined to a radius of the wheel to aid in restraining a broken section of either element from being thrown outwardly by centrifugal force when the wheel is rotated; another feature of the invention is to provide such a wheel having a pair of adjacent tongues and corresponding grooves with each pair of tongues and grooves being inclined toward each other from the inner ends thereof to the periphery of the wheel; and another feature of the invention is to provide a grinding wheel comprising adjacent disc-like elements with at least one end element being of a grinding character different from that of at least one of the other elements. Other features and advantages of the invention will become apparent in the following descriptions of two embodiments of the invention taken in conjunction with the accompanying drawings. Of the drawings:

Fig. 1 is an end elevation of a grinding wheel embodying the invention.

Fig. 2 is a side elevation of the wheel of Fig. 1.

Fig. 3 is a sectional view taken substantially along line 3—3 of Fig. 2.

Fig. 4 is a fragmentary sectional view taken substantially along line 4—4 of Fig. 3.

Fig. 5 is an end elevation partly in section of a grinding wheel illustrating a second embodiment of the invention.

Fig. 6 is a side elevation of the grinding wheel of Fig. 5.

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The grinding wheel of this invention is particularly designed for grinding where the wheel is positioned adjacent to but spaced from either a second grinding wheel or an idler wheel. The metal elements to be ground are ordinarily of substantially circular cross section and are fed between the grinding wheel and the second grinding wheel or the idler wheel at one end thereof and progress along the face of the wheel during the grinding operation. The ground elements are eventually ejected from the other end of the wheel. The timing is such that the grinding is ordinarily completed by the time these elements are ejected.

The grinding wheels ordinarily comprise a hard binder such as hard rubber, vitreous clays, or a resinoid binder such as a phenolic condensation product with an aldehyde, having incorporated therein particles of a grinding material such as aluminum oxide. As the grinding wheels are ordinarily of relatively great thickness when of one piece construction, it is quite difficult to cure the resinoid binder uniformly throughout the wheel. The abrasive, being a refractory material, also interferes with proper heat transfer to the center of the wheel during the curing steps. As a result the center of an ordinary resinoid wheel often remains at least partially uncured or soft. These disadvantages are avoided in the present grinding wheel as the wheel is made up of relatively thin grinding disc-like elements. These are made separately and are provided with interlocking tongues and grooves so arranged that if a piece of one element breaks, the broken element will be restrained against being thrown outwardly by centrifugal force.

The multi-layer grinding wheel of this invention also permits making the various disc-like elements of different grinding characteristics, if desired. Thus, the end section where the metal elements to be ground, such as automobile valves, are introduced can be made harder as this end disc-like element is subjected to the greatest wear. This end disc-like element can not only be made of a different formula, but may also be compacted to a greater density during the manufacturing operation to provide an extremely hard leading edge for the wheel. The end disc-like element can also be given a different grinding character by providing a different curing time and temperature than those of the other elements. Similarly, if desired, the beginning element or elements may be made very coarse so that rough grinding may be accomplished easily and rapidly and one or more of the succeeding disc-like elements may be made with finer abrasive so that the metal element to be ground may be roughed and finished in a single pass across the face of the grinding wheel. With a standard grinding wheel it is not too difficult to make one end harder than the remainder of

the wheel, but because the entire wheel must be compressed at one time during the manufacturing operation, the grain structure and the density cannot be varied substantially.

In the ordinary grinding wheel constructed according to this invention, it is sometimes desirable to provide a slight clearance between adjacent grinding elements so as to allow the grindings to escape. In the ordinary wheel of this invention the areas at the joints wear away fairly rapidly so as to provide automatically for this clearance. However, when the work being performed is of such a nature that no clearance is desired, a cement or bonding material may be chosen such that layers of extremely hard material may be provided (upon curing of the bond) between adjacent grinding elements, thereby greatly increasing the life of the wheel.

In the present application the term "grinding disc-like element" is used to include both the grinding element and any intermediate layer of hard material which may exist between the grinding elements as a result of the selection of a resinoid bonding material having this characteristic when cured.

In the present invention each of the grinding disc-like elements is provided with a tongue on one side engaging a groove on the adjacent side of the next element with at least one of the cooperating edges of a tongue and groove being at an angle to a radius of a wheel to aid any adhesive present in restraining a broken section of either element from being thrown outwardly by centrifugal force when the wheel is rotated. Such a tongue and groove arrangement may be provided in many different forms or designs. Two arrangements are illustrated in the accompanying drawings.

In the embodiment shown in Figs. 1 to 4, inclusive, the grinding wheel comprises a plurality of adjacent grinding disc-like elements 10, 11, 12, 13, 14 and 15. These elements are of annular shape, as shown in Figs. 3 and 4. While these elements would normally be cemented together before being shipped, primarily as a matter of convenience in handling, they may also be merely mechanically held between substantially circular steel holding plates 16 and 17. As illustrated here, the assembly of grinding disc-like elements is held tightly clamped by spaced studs or bolts 18 extending between the plates and located within the center openings of the disc-like elements at points just within the inner periphery thereof. This may be independent of, or supplemental to, the locking provided by a cement bond, and it is to be understood that when I speak of the disc-like elements as being "locked together" I intend this term to cover either a cement bonding or a mechanical locking, or both. The holding plates 16 and 17 also provide a mounting for fixing the wheel on a rotatable shaft 19.

As can be seen in the drawings, the grinding disc-like elements 11 to 14, inclusive, are substantially the same and only adjacent elements 12 and 13 will be specifically described.

The grinding disc-like element 12 is provided on one side thereof with a plurality of tongues 12*a* substantially equally spaced around the element 12. Each tongue 12*a* engages a corresponding groove 13*b* in the next grinding disc-like element 13. As is shown in Fig. 3, the side edges 12*c* of the tongue 12*a* are inclined inwardly toward each other from the inner to the outer periphery of the element. As will be noted, each of the side edges 12*c* is also inclined at an angle to a radius of the grinding wheel.

The grinding disc-like element 12 is also provided on the side opposite the tongue 12*a* with a groove 12*b* for receiving the tongue of the adjacent element 11. The grinding disc-like element 13 is also provided with a plurality of tongues 13*a* engaging grooves in the next disc-like element 14. As can be seen in Figs. 2 and 3, the succeeding tongues and grooves of the different grinding disc-like elements are preferably out of line with each other so that the wheel will not be unduly weakened in any single section. Thus, as shown in Fig. 2, the tongue and groove 12*a* and 13*b* are spaced circumferentially from the groove 12*b* and the corresponding tongue, and from the tongue 13*a* and the corresponding groove.

The outer side surface of each outer grinding disc-like element 10 and 15 is preferably made planar, as shown in the drawings, so that the grinding wheel will have a cylindrical appearance. Because of this the end elements 10 and 15 are different from the intermediate elements 11 to 14 in that the first end element 10 is provided with tongues on the inner side thereof, while the other element 15 is provided with grooves on the inner side thereof. However, the areas on the end element 10 between the described tongues serve as grooves to aid in locking the element in position, while the spaces on the other end element 15 between the described grooves serve as tongues.

In the embodiment shown in Figs. 5 and 6, the grinding wheel comprises grinding disc-like elements 110, 111, 112, 113, 114 and 115, with the wheel retained between holding plates 16 and 17. Connecting studs or bolts 18 extend between the plates and the wheel assembly is mounted on a rotatable shaft 19. Each grinding disc-like element 110 to 114 is provided with a pair of tongues as shown at 110*a* engaging similar grooves as shown in 111*b*. The tongues 110*a* are arranged in pairs and the tongues of each pair are arranged adjacent each other. The pairs of tongues are substantially equally spaced around the grinding wheel, as shown in Fig. 5. Each tongue 110*a* has substantially parallel side edges and each tongue and groove is inclined with respect to a radius of the grinding wheel. The tongues and grooves of each pair are inclined toward each other from the inner periphery of the disc-like elements to the outer periphery thereof. These tongues and grooves aid in restraining a broken section of either element from being thrown outwardly by centrifugal force when the wheel is rotated.

In both embodiments of the invention the adjacent disc-like elements are preferably cemented together as indicated at 20 in Fig. 4 and 120 in Fig. 6 to make a grinding wheel. The wheel may then be mounted between the holding plates by the user.

One type of commercial wheel made according to the invention would employ disc elements having an exterior diameter of 20 inches, an interior diameter of 12 inches, and would use six disc elements each about one inch thick. The plates 16 and 17 would each be of about 16 inches diameter.

Having described my invention as related to the embodiments shown in the accompanying drawings, it is my intention that the invention be not limited by any of the details of description unless otherwise specified, but rather be con-

strued broadly within its spirit and scope as set out in the accompanying claims.

I claim:

1. A grinding wheel, comprising: a plurality of adjacent grinding disc-like elements each having a plurality of tongues on one side each engaging a groove on the adjacent side of the next element, one of the cooperating side edges of a tongue and groove being inclined toward an adjacent other of said cooperating side edges from a point nearer the center of the wheel toward the periphery thereof to aid in restraining a broken section of either element that includes at least part of at least one of a tongue and a groove from being thrown outwardly by centrifugal force when said wheel is rotated.

2. A grinding wheel, comprising: a plurality of adjacent grinding disc-like elements each having a plurality of tongues on one side each engaging a groove on the adjacent side of the next element, each of a pair of cooperating side edges of a tongue and groove being inclined toward the other from a point nearer the center of the wheel toward the periphery thereof to aid in restraining a broken section of either element that includes at least part of at least one of a tongue and a groove from being thrown outwardly by centrifugal force when said wheel is rotated.

3. A grinding wheel, comprising: a plurality of adjacent grinding disc-like elements with at least one element having a pair of adjacent tongues engaging similar grooves in a next element, the adjacent side edges of one of said pair of tongues and grooves being inclined toward the other from a point nearer the center of the wheel toward the periphery thereof to aid in restraining a broken section of either element that includes at least part of at least one of a tongue and a groove from being thrown outwardly by centrifugal force when said wheel is rotated.

4. A grinding wheel, comprising: a plurality of adjacent annular grinding disc-like elements each having a plurality of tongues on one side each extending from the inner edge of the element to the periphery thereof and each tongue engaging a groove on the adjacent side of the next element, the cooperating side edges of a tongue and groove being inclined toward an adjacent other of said cooperating side edges so that said side edges are inclined toward each other from said inner edge to the periphery thereof to aid in restraining a broken section of either element that includes at least part of at least one of a tongue and a groove from being thrown outwardly by centrifugal force when said wheel is rotated.

5. A grinding wheel, comprising: a plurality of adjacent annular grinding disc-like elements each having a plurality of tongues on one side each extending from the inner edge of the element to the periphery thereof and each tongue engaging a groove on the adjacent side of the next element, each of a pair of cooperating side edges of a tongue or groove being inclined toward the other from said inner edge to the periphery thereof to aid in restraining a broken section of either element that includes at least part of at least one of a tongue and a groove from being thrown outwardly by centrifugal force when said wheel is rotated.

6. A grinding wheel, comprising: a plurality of adjacent annular grinding disc-like elements with at least one element having a pair of adjacent tongues extending from the inner edge of the element to the periphery thereof and engaging similar grooves in a next element, the adjacent side edges of one of said pair of tongues or grooves being inclined toward the other from said inner edge to the periphery thereof to aid in restraining a broken section of either element that includes at least part of at least one of a tongue and a groove from being thrown outwardly by centrifugal force when said wheel is rotated.

7. A grinding wheel, comprising: a plurality of adjacent annular grinding disc-like elements each having a plurality of tongues on one side each extending from the inner edge of the element to the periphery thereof and each tongue engaging a groove on the adjacent side of the next element, the cooperating side edges of a tongue or groove being inclined toward an adjacent other of said cooperating side edges from said inner edge to the periphery thereof to aid in restraining a broken section of either element that includes at least part of at least one of a tongue and a groove from being thrown outwardly by centrifugal force when said wheel is rotated, at least one end element of said wheel having grinding characteristics different from those of at least one other element.

8. A grinding wheel, comprising: a plurality of adjacent annular grinding disc-like elements each having a plurality of tongues on one side each extending from the inner edge of the element to the periphery thereof and each tongue engaging a groove on the adjacent side of the next element, each of a pair of cooperating side edges of a tongue and groove being inclined toward the other from said inner edge to the periphery thereof to aid in restraining a broken section of either element that includes at least part of at least one of a tongue and a groove from being thrown outwardly by centrifugal force when said wheel is rotated, at least one end element of said wheel having grinding characteristics different from those of at least one other element.

9. A grinding wheel, comprising: a plurality of adjacent annular grinding disc-like elements with at least one element having a pair of adjacent tongues extending from the inner edge of the element to the periphery thereof and engaging similar grooves in a next element, the adjacent side edges of one of said pair of tongues or grooves being inclined toward the other from said inner edge to the periphery thereof to aid in restraining a broken section of either element that includes at least part of at least one of a tongue and a groove from being thrown outwardly by centrifugal force when said wheel is rotated, at least one end element of said wheel having grinding characteristics different from those of at least one other element.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
229,513	Allen	July 6, 1880
872,321	Allen et al.	Dec. 3, 1907
1,912,069	Doermann	May 30, 1933

FOREIGN PATENTS

Number	Country	Date
319,200	Great Britain	Sept. 16, 1929