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T. LARSSON

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SEGMENTAL GRINDING WHEEL

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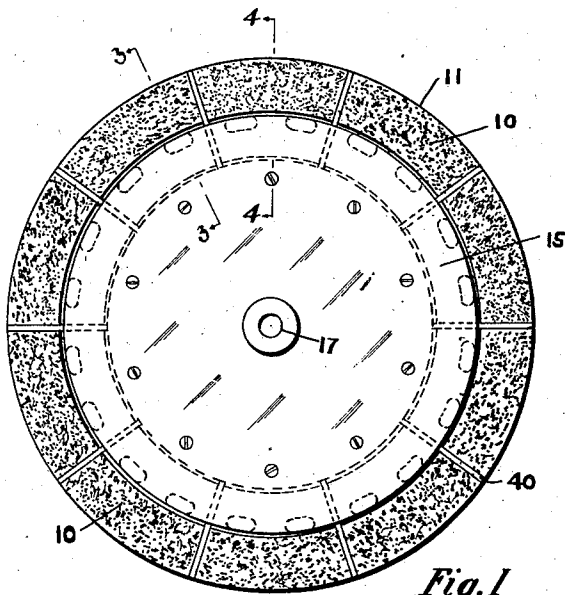


Fig. 1

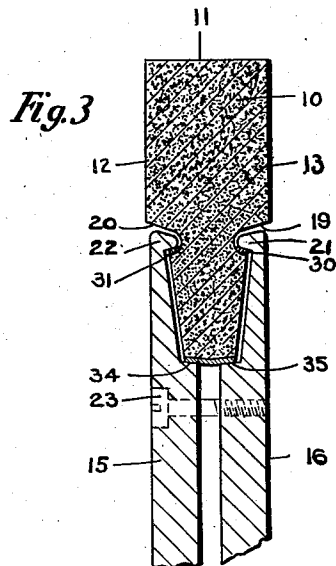


Fig. 3

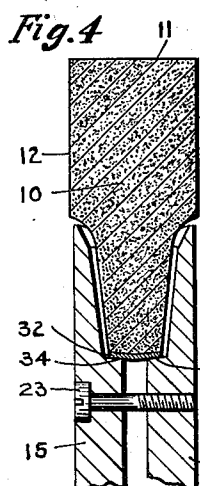


Fig. 4

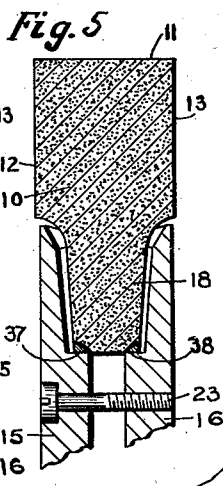


Fig. 5

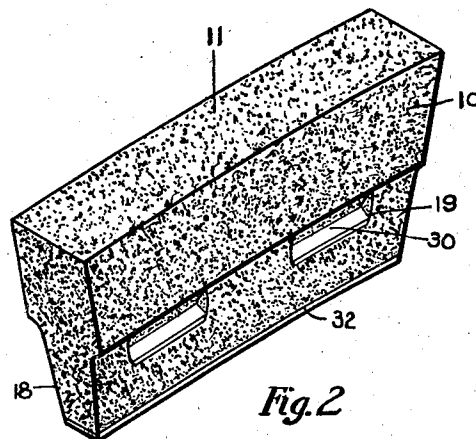


Fig. 2

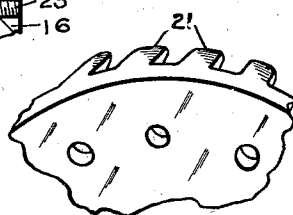


Fig. 6

Witnesses

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SEGMENTAL GRINDING WHEEL

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This invention relates to grinding wheels and more particularly to a grinding wheel made up of segments of bonded abrasive held unitarily in position for grinding.

It is found in modern grinding practice that it is not feasible to rotate at a high speed a solid wheel made of abrasive grains bonded by a vitrified ceramic material. Yet the efficiency of a large wheel rotated rapidly is very high and there is increasing demand for wheels which are so constructed that they may be given a high surface speed of revolution. It has been proposed heretofore to form a grinding wheel of abrasive segments arranged in an annular shape and to hold them in place by clamping devices, but such devices have not been wholly satisfactory, particularly as a design capable of holding the segments properly has been cumbersome in size and has projected beyond the side faces of the wheel so as to interfere with proper use of the wheel in limited spaces.

The main objects of my invention are to provide a segmental grinding wheel in which a number of segments mounted in an annular form may be held in position by clamping devices which do not interfere with the grinding operation or full use of the machine, and in particular to provide a segmental wheel which is simple in design and may be easily manufactured and quickly assembled and which is so constructed and arranged that the abrasive segments may be made in the grinding wheel factory and shipped to the point of use and there mounted readily by unskilled laborers for use as desired.

It is a further object to provide a segmental grinding wheel which is so constructed and arranged that it may be rotated at a high rate of speed and used safely without danger to the operator and which may be of a larger diameter than has been found feasible, from the viewpoint of safety, for a monolithic vitrified wheel.

One embodiment of my invention is shown in the drawings in which:

Figure 1 is an end elevation of a segmental grinding wheel completely assembled and ready for use;

Fig. 2 is a perspective view of an abrasive segment;

Fig. 3 is a cross-sectional view of a portion of a wheel taken on the line 3—3 of Fig. 1 showing the manner of mounting the segments between the clamping plates;

Fig. 4 is a sectional view on the line 4—4 of Fig. 1;

Fig. 5 is a similar view of a modification; and

Fig. 6 is a perspective view of a portion of a clamping plate.

In accordance with my invention, I propose to form a grinding wheel of a number of abrasive segments so shaped and arranged that they may be positioned to form a grinding annulus, and these segments may be held as a rigid wheel structure by means of clamping plates or other suitable means. The segments are preferably cemented together to form a unitary rigid wheel structure so that they may be shipped as a unit and then mounted between the clamping plates on a grinding machine at the place of use. In order to hold the segments against the centrifugal force set up during grinding, they are each provided with shoulders on opposite sides thereof adapted to be engaged by correspondingly shaped surfaces on suitable clamping members. These shoulders are preferably formed by recesses in the outer sides of each segment which are separated by strengthening columns of abrasive material. In order to keep the clamping plates within the planes of the outer faces of the wheel the inner ends of the segments may be reduced in size, and the spaced recesses formed in the side faces of the reduced portion. The clamping shoulders may be provided with shoes of metal or other suitable material adapted to fit snugly against the clamping member and to transmit the clamping pressure over a wide area of the abrasive body.

As shown in the drawings, the segments may be made of bonded abrasive material in the general shape and contour illustrated in Fig. 2, it being intended that in the form illustrated the partial cylindrical surfaces 11 of the segments, when assembled,

form a continuous peripheral grinding surface. The side faces 12 and 13 of the segments are parallel or of suitable shape as is desired to meet the requirements of a particular grinding operation. In order to hold the segments on the grinding wheel spindle, I provide clamping plates 15 and 16 which may be of suitable construction for mounting on the spindle of a grinding machine. They are illustrated as consisting simply of disk-shaped plates provided with central apertures 17 to fit on the spindle.

The segments are each provided with clamping shoulders so arranged that suitably shaped portions on the clamping plates may serve to hold the segments mounted in position. These shoulders are preferably located on reduced inner portions 18 of the segments so that the clamping plates may lie within parallel planes passing through the faces 12 and 13 of the abrasive ring. Since the bonded abrasive material is comparatively weak and any reduction in size of the clamping portions of the segments beyond a certain degree is objectionable, I provide a construction in which such clamping portions are left as large as is feasible. For this purpose, I provide the inner reduced portion 18 of each segment with spaced clamping grooves or recesses 19 and 20 on opposite sides thereof which are separated by strengthening columns of abrasive material. The lower portions of the recesses form shoulders arranged to contact with the corresponding parts on the clamping plates. The plates 15 and 16 have each an inwardly projecting flange cut away to form spaced lugs 21 and 22. These shoulders and lugs are preferably beveled and so shaped that when the plates are drawn together by means of bolts 23 the wedge-shaped lugs 21 and 22 will interfit with the recesses and seat against the shoulders on the lower portions of the grooves 19 and 20 and so tend to draw the segments inwardly and into close relation to one another.

These shoulders are preferably provided with shoes 30 and 31, and the upper surfaces of the shoes are so shaped that they will fit fairly well against the wedge-shaped clamping surfaces of the lugs 21 and 22. These shoes are preferably made of some tough and durable material, such as a Babbitt metal, which may be cast in position and permeate the surface pores of the segments and so make a strong union between the shoe and the abrasive, and which will transmit readily the forces set up when the clamping plates are drawn tightly in position, thereby distributing these forces more uniformly throughout the neck of the abrasive segment. Likewise, each segment is preferably provided with a shoe 32 at the lower end thereof so that it may fit properly against the shoulders 34 and 35 on the plates

or other support provided for the purpose, and the clamping forces there met will be likewise distributed. It will be observed upon inspection of the drawings that the clamping plates are cut away between their heads and their lower thicker base portions so that they will not contact with the sides of the segments, and the clamping forces fall entirely upon the metal shoes. As a simple modification, I may form the shoe as two strips 37 and 38 (see Fig. 5) which are located in grooves in the inner peripheral corners of the assembled segments.

The segments are made in accordance with approved practice of abrasive grains bonded by suitable material, such as a vitrified ceramic bond, and they are then provided with the various shoes as desired, after which the segments are assembled in the correct position for use on the wheel. The segments are spaced apart slightly as will be observed on inspection of Fig. 1 and the crevices 40 between the end faces of these segments may be filled with a suitable cementitious material, such as Babbitt metal or a mixture of sulfur and ground coke, which enters the surface pores of the abrasive body and thereby cements the segments into a rigid unitary structure which may be shipped to the point of use and there suitably mounted between the clamping plates. The plates 15 and 16 are put in position, one on each side of the wheel and the cap screws 23 are then utilized to draw them toward each other and interlock the parts. This serves to force the wedge-shaped lugs 21 and 22 against the beveled shoes on the segments and to clamp the abrasive segments tightly in position and to secure them against the disruptive forces set up during grinding. It will also be observed that the shoe 32 (Fig. 4) may be made with a double bevel and the shoulders 34 and 35 correspondingly sloped so as to provide two further wedge surfaces which will aid in wedging the segments and plates tightly together. It will also be understood that the columns between the spaced recesses 19 and 20 contain a considerable amount of abrasive material which strengthens the wheel, so that if the wheel is thin there is still enough material between the clamping recesses to prevent breakage of the wheel during grinding.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A grinding wheel comprising segments of bonded abrasive grains arranged in the form of an annulus which has a peripheral grinding face, side faces, and a reduced inner portion, and means including plates clamping against the reduced inner portion and located substantially within parallel planes passing through said side faces which hold

the abrasive segments secured in position for grinding.

2. A grinding wheel comprising contiguous segments of bonded abrasive grains forming a peripheral grinding face and having inner reduced portions provided with clamping shoulders on their outer sides, shoes thereon, and clamping plates located within the planes of the side faces of the segments which have clamping members engaging said shoulders and secure the segments in position.

3. A grinding wheel comprising abrasive segments arranged in the form of an annulus having a reduced inner portion, each having a slot in opposite side faces of said portion which is provided with a beveled clamping shoulder, clamping plates provided with beveled lugs engaging said shoulders and means to hold the plates and segments thus assembled, said plates being located within parallel planes passing through the sides of the segments.

4. A grinding wheel comprising abrasive segments arranged in the form of an annulus having a peripheral grinding face and side faces, each segment having an inner reduced portion provided with a beveled clamping shoulder, two clamping members having beveled portions engaging said shoulders and means to fasten the parts together, said clamping members being located wholly within parallel planes passing through the side faces of the abrasive segments.

5. A grinding wheel comprising segments arranged in the shape of an annulus, and having inner reduced portions, each of which has a slot forming a clamping shoulder on each outer side thereof, a shoe integral with each shoulder, clamping members arranged one on each side of the annulus of the assembled segments which have lugs engaging the shoulders, and means to secure the parts together.

6. A grinding wheel comprising a plurality of abrasive segments mounted to form an annulus having a peripheral grinding surface and two side faces, each segment having an inner reduced portion provided with clamping shoulders, a shoe integrally cast on each shoulder which has a beveled face, a clamping plate on each side of the annulus which lies wholly within a plane passing through the outer faces of the segments and has a beveled lug engaging said shoe, and means to fasten the plates together.

7. A grinding wheel comprising a plurality of abrasive segments mounted to form an annulus having a peripheral grinding face and side faces, each segment having a reduced inner portion provided with a clamping shoulder on its opposite outer sides, a shoe on each shoulder and on the inner peripheral face of the segment, a clamping plate on each side of said annulus provided with a

lug engaging and fitting against said shoe and a surface fitting against the inner shoe, and means to secure the plate together.

8. A grinding wheel comprising a series of abrasive segments cemented together to form a unitary annulus of abrasive material provided with a peripheral grinding face and sides, each abrasive segment having a reduced portion provided on its opposite outer sides with a slot having a clamping shoulder, a shoe of metal on each clamping shoulder, and means including clamping plates on opposite sides of the annulus having surfaces fitting against said shoes which are arranged to secure the segments rigidly in place.

9. A grinding wheel comprising segments of bonded abrasive grains united by a cementitious material into a rigid unitary annulus which is independent of a rotatable support, said annulus having side faces and a reduced inner portion, and means on the outer sides of said portion forming clamping shoulders which lie within parallel planes passing through the side faces.

10. A grinding wheel comprising abrasive segments united by a cementitious material into a rigid unitary annulus having a reduced inner portion, means on each outer side of said portion forming a clamping shoulder and a metal shoe on each shoulder.

11. A grinding wheel comprising abrasive segments shaped to form an annulus having a peripheral grinding face, parallel side faces and a reduced inner portion, and a cementitious material therebetween which unites them into a rigid unitary wheel structure, said portion having clamping shoulders on its outer sides which are arranged to be mounted on supporting plates located within the planes passing through the side faces of the annulus.

12. A grinding wheel comprising abrasive segments shaped and arranged to form an annulus having a peripheral grinding surface and an inner reduced portion, the outer sides of the latter being provided with spaced slots, shoes therein forming shoulders adapted to be engaged by clamping members for mounting the wheel on a spindle, and a filler between the segments which unites them into a unitary wheel structure.

13. A grinding wheel comprising a series of abrasive segments cemented together to form a unitary annulus of abrasive material provided with a peripheral grinding face and sides, each abrasive segment having an inner reduced portion provided with slots in opposite faces, metal shoes cast in the slots and forming beveled clamping surfaces and shoes on the inner peripheral portions of the segments for seating on a supporting surface.

14. A grinding wheel comprising abrasive segments held together in the form of an annulus which has a peripheral grinding face

and exposed sides, each segment having recesses in its opposite exposed sides which are separated by a strengthening column of abrasive, and shoes on the faces of the recesses which are arranged to be engaged by clamping members to hold the abrasive annulus on a wheel spindle.

15. An abrasive segment comprising a body of bonded abrasive grains having a partial cylindrical grinding surface which is shaped to be mounted with similar bodies to form an annulus, a side face thereof being provided with recesses separated by a strengthening column, and said recesses having surfaces forming portions of a frustum of a cone which are adapted for engagement with clamping members arranged to hold the segments mounted on a spindle.

16. An abrasive segment comprising a body of bonded abrasive grains having a partial cylindrical grinding surface, converging faces and side faces which is shaped to be mounted with similar bodies to form an annulus having its side faces exposed, the segment having a reduced portion opposite to the cylindrical surface which is provided with recesses in its side faces separated by a strengthening column of bonded abrasive material, said recesses forming clamping shoulders adapted to cooperate with clamping members to hold the segment in position on a wheel spindle.

17. An abrasive segment comprising a body of bonded abrasive grains having a partial cylindrical grinding surface, converging faces and side faces which is shaped to be mounted with similar bodies to form an annulus with its side faces exposed, the segment having a reduced portion opposite to the cylindrical surface which is provided with recesses in its exposed side faces separated by a strengthening column of bonded abrasive material and a metal shoe in each of said recesses which provides a clamping shoulder adapted to be engaged by a clamping member to hold the segment in position on a wheel spindle.

18. A grinding wheel comprising a plurality of abrasive segments arranged as an annulus having a peripheral grinding surface and side faces and a reduced inner portion providing recesses within which clamping plates may be located, said portion having spaced shoulders arranged to cooperate with lugs on the clamping plates, whereby the annulus may be supported thereon.

19. A grinding wheel comprising a plurality of abrasive segments arranged as an annulus having a peripheral grinding face and a reduced inner portion providing recesses in the sides of the wheel, and a clamping member in each recess having lugs thereon, said reduced portion having clamping shoulders engaged by the lugs which are sep-

arated by strengthening columns of abrasive material.

20. A grinding wheel comprising a plurality of abrasive segments arranged as an annulus having a peripheral grinding face and side faces, each side face having spaced recesses in an annular row which form clamping shoulders separated by strengthening columns of abrasive material extending radially therebetween, said shoulders being arranged to coact with spaced clamping lugs on supporting members mounted on each side of the wheel.

Signed at Worcester, Massachusetts, this 26th day of May, 1927.

THURE LARSSON.

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