Oct. 29, 1929. G. N. JEPPSON 1,734,012

SEGMENTAL ABRASIVE WHEEL

Filed May 17, 1927

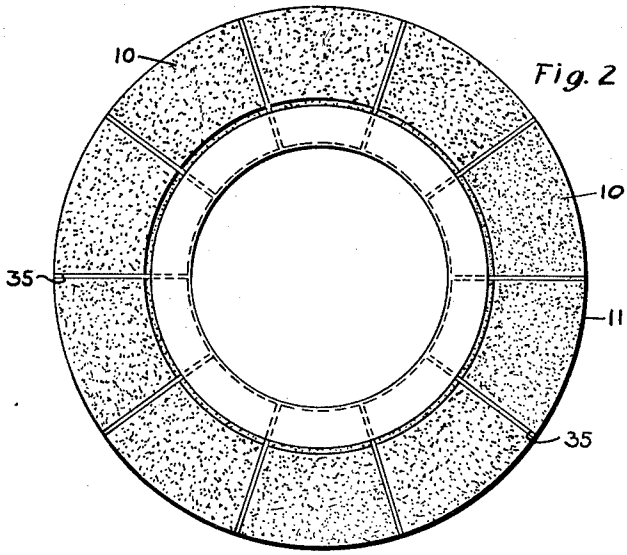

Fig. 2

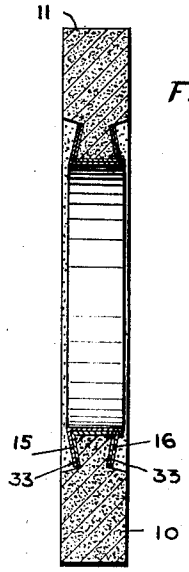

Fig. 1

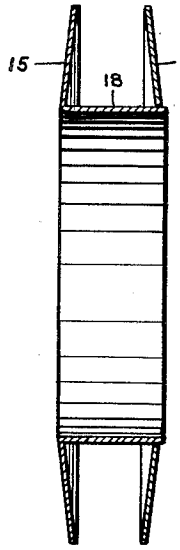

Fig. 3

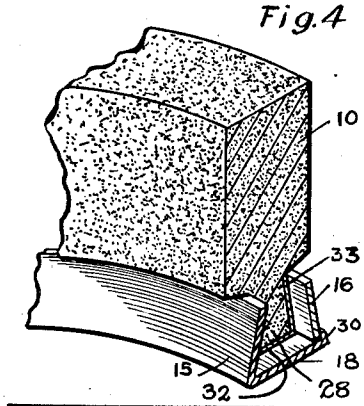

Fig. 4

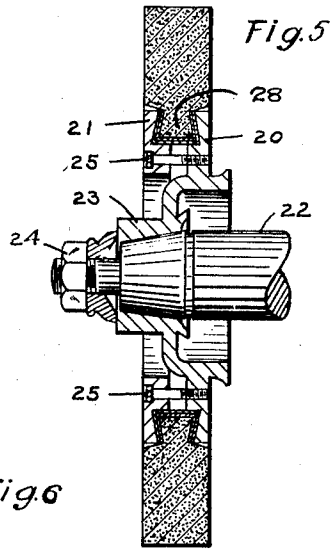

Fig. 5

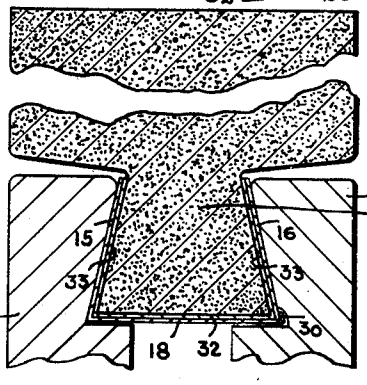

Fig. 6

Witnesses

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Patented Oct. 29, 1929 1,734,012

UNITED STATES PATENT OFFICE

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SEGMENTAL ABRASIVE WHEEL

Application filed May 17, 1927. Serial No. 191,965.

This invention relates to abrasive wheels and particularly to a wheel made up of segments which are assembled in an operative relationship and there held securely in place for the grinding operation.

Grinding wheels are commonly made of abrasive grains bonded by a vitrified ceramic material. This bond is of the nature of porcelain or glass, hence the wheel is brittle and is structurally weak. It is often desirable that the wheel be rotated at a very high speed, thus producing enormous centrifugal forces which are likely to disrupt the bond. It is not always practicable to make the larger sizes of such wheels as a unitary integral structure owing, particularly, to the dangers of the wheel cracking during the firing operation as caused by uneven heat expansion and of breakage of such a large brittle body during the many handling operations which are required. Under the circumstances, it is better to crack the wheel initially, as it were, and then to mount the small portions rigidly in position for use as a grinding wheel. It has been proposed to make a segmental wheel of blocks of ceramic bonded abrasive grains mounted in position on a drum and there held in place by suitable clamping devices. Such a wheel is expensive to manufacture owing particularly to the difficulties involved in assembling the segments properly for grinding use. Owing to the weak structure of the segments, it is necessary that these segments be mounted rigidly in position and that they be not permitted to move during the grinding operation. Moreover, if the segments are shipped to points of use and must there be assembled as a wheel structure, it may be necessary to have someone skilled particularly in this operation to assemble the parts, thus involving a further addition to manufacturing costs. It is desirable that the wheel be made initially in the grinding wheel manufacturing plant and be shipped to the point of use all ready for mounting in the grinding machine.

It is accordingly the main object of my invention to provide an abrasive wheel of segments initially formed separately and then secured rigidly together in a unitary wheel structure for shipment and use.

It is a further object of my invention to provide a very simple grinding wheel structure which may be easily and cheaply manufactured in any desired size, and particularly to make such a wheel of abrasive segments which are mounted upon a form capable of holding them properly assembled in a grinding position for use as desired.

With these and other objects in view as will be apparent to one skilled in the art, my invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

In accordance with my invention I provide a unitary integral wheel structure which may be shipped as one piece and mounted without change on an ordinary wheel spindle and used the same as a regular grinding wheel, but which has been made of abrasive segments fashioned separately and then subsequently assembled and fixed integrally in place. As one manner of carrying out this invention, I propose to mount a number of abrasive segments, shaped to form an annulus, on a support which is so constructed and arranged that the segments may be held rigidly and permanently in place therein, so that the unit may be mounted on a grinding machine wheel spindle the same as an ordinary grinding wheel. The preferred form of support is shaped like a spool or bushing and is preferably made of sheet metal, and the parts are so constructed that the segments may be secured on this metal support irremovably. To insure rigidity of structure, the segments are preferably cemented to each other and to the sides of the support by means of a suitable cementitious material, such as sulfur or Babbitt metal.

In the drawings which illustrate one embodiment of this invention and in which like reference numerals indicate like parts:

Figure 1 is a sectional view of the assembled wheel when ready for use;

Fig. 2 is an elevation of the same;

Fig. 3 is a perspective view of the support for the segments;

Fig. 4 is a detail illustrating the manner of mounting the segments on the support;

Fig. 5 is a sectional view of the wheel

mounted between flanges on a spindle; and

Fig. 6 is an enlarged fragmentary sectional view showing the mounting of the segments.

As illustrated, the grinding wheel may be made up of a plurality of segments 10 which are so shaped that when fitted together they form an annulus having a cylindrical grinding surface 11. These segments may be made of abrasive material suitably bonded, as by a vitrified ceramic material. In order to hold the segments correctly and rigidly in place and make it possible to ship such a wheel completely assembled and ready for use, I make use of a metal support which will not only support the segments but will serve as a retaining member against which the spindle flanges or clamping plates may clamp to hold the grinding wheel properly mounted. The type of metal support shown in the drawings comprises a spool having two disk-shaped sides or flanges 15 and 16 mounted or fastened on a hollow cylindrical hub 18 which is arranged to support the segments and hold them properly positioned and prevent their removal. The outer surface of the hub 18 is of the proper size to fit the inner peripheral surface of the assembled segments and the flanges 15 and 16 are intended to clamp against the sides of the segments and hold them in position. This support is intended primarily to hold the segments in assembled relation for shipment and storage so that the abrasive body will be always ready for mounting on a grinding wheel spindle. In my preferred construction the metal spool or support for the segments is made of light material, such as stamped sheet iron, which need not have sufficient strength and rigidity to support the segments during the grinding operation, and in that case I employ clamping flanges adapted to engage the sides of the assembled segments and thereby hold them securely in position under the centrifugal force and various strains set up during the grinding operation. For this purpose I propose to use clamping flanges or plates arranged to contact one with each side of the annular abrasive body. The abrasive segments are each provided with an undercut and dove-tailed portion which has a beveled clamping surface against which the plates may clamp. In order to fit properly against the abrasive ring, the clamping plates are provided with correspondingly shaped parts. When assembled the beveled faces of the dovetailed portion will aid in preventing removal of the segments from their mounting and the plates will apply a force tending to draw the segments inwardly against the centrifugal forces set up during the grinding operation.

For this purpose I may employ clamping plates of suitable construction, such as illustrated in Fig. 5, in which the wheel center or supporting plate 20 and the clamping plate 21 are shown as suitably mounted on the grinding wheel spindle 22. In the form shown the plate 20 has a hub portion 23 fitted on the tapered end of the spindle and held there by the nut 24 and the other plate 21 is arranged to be secured to the center 20 by means of the bolts 25. The outer ends of these clamping plates are beveled as illustrated so as to fit against the sides of the dovetailed portions 28 of the segments. This dovetailed portion is of the shape clearly illustrated in the drawings and thereby provides two undercut shoulders which slope in such a direction that when the clamping plates 20 and 21 are drawn together the tendency is for the latter to crowd the adhesive segments of the annular ring towards the center.

The segments are individually fashioned to fit on the hub 18 of the metal spool and the flanges 15 and 16 are so shaped as to fit snugly against the clamping faces of the segments, whereby the segments may be held securely in their assembled relation. The metal spool may be made in various ways but as simply illustrated in Fig. 3 the flange 15 is integral with the hub 18 against the flange 15, and thereafter the flange 16 is put in place and the outer edge of the hub 18 is turned up to form a lip 30 which secures the flange 16 in position. Owing to the shape of these flanges which is that of a frustrum of a cone, they will not readily bend and so will be held rigidly in place against the sides of the segments. It will therefore be seen that by means of this simple construction, I have provided a mounting and a supporting container for the segments which holds them in proper grinding relation so that when it is desired to use the wheel it is merely necessary to mount the assembled body on the wheel flanges without removal of any of the parts or addition thereto.

If it is desired, the segments may be provided with inner facings or shoes 32 of suitable material, such as Babbitt metal, which form a bushing adapted to fit smoothly against the member 18. These shoes may, if desired, be extended to form clamping faces 33 against which the metal plates 20 and 21 may clamp. The shoes may be formed on the segments, as by casting, either before or after they have been assembled in their ring formation.

As a further expedient to insure rigidity of wheel structure and to prevent the segments from becoming loosened or not properly fitting in position I may fill the spaces between the radial faces of the segments with a suitable filling material which will hold the parts integrally together. A suitable filler for this purpose is a cement, such as sulfur and graphite, which may be melted and poured into place, or a low melting metal such as a Babbitt metal, may be utilized. This filler is particularly useful if the metal shoes are not cast on the segments, in which

case the filler is placed also between the segments and the parts of the metal spool after the parts have been assembled.

This filler or cement serves various purposes and in particular it has the function of forming the segments into an integral unitary rigid abrasive annulus. The filler enters the surface pores of the abrasive segments and fills all spaces which are left between the segments and the metal spool. The segments are supported peripherally by the filler which enters the crevices 35 therebetween so that any tangential thrust upon the segments during the grinding operation will be transmitted across the fillers to the various segments around the wheel. The filling material between the segments and the sides 15 and 16 not only serves to hold the segments rigidly in position but fills this space completely, so that the pressure of the wheel flanges intended to hold the wheel on its spindle will be distributed uniformly to the abrasive segments throughout a large area and thus prevent the flanges from breaking the segments.

It will therefore be understood that I have provided an integral, unitary wheel structure made of segments of bonded abrasive grains, which are so arranged as to form a proper grinding surface. These segments are held integrally in place by a thin sheet metal support so that they are ready for mounting on a spindle between clamping flanges or plates. It is not necessary that the metal spool be strong enough to hold the segments in place under the conditions of grinding since the clamping plates 20 and 21 serve this purpose. Hence, such a wheel in actual use comprises not only the spool and segments but the clamping plates as well. If desired the clamping plates may be assembled with the spool and segments to form a more rigid structure which may be stored or shipped in that condition without danger of breakage, and thereafter mounted on a wheel spindle when desired. It may also be noted that the filler or the metal shoes are particularly useful in the larger sizes of wheel where extreme rigidity and strength are required. In such a case the filler will aid, particularly if it is a metal flowed in place after the segments have been assembled on the ring support, in making a rigid unitary body of the abrasive segments. Such a wheel after it has been assembled may be shipped to any desired point and there mounted on a grinding wheel spindle in the ordinary manner without removing the support from the segments. The supporting spool, being made of a thin sheet metal, is inexpensive and is not in the way and does not interfere with mounting the wheel on its supporting spindle. In fact, this support serves the additional purpose of directly taking the clamping pressure and thrust of the wheel flanges and thus makes it unnecessary to use a blotting paper pad against the sides of the abrasive body as is ordinarily required in mounting a grinding wheel. The cost of manufacturing and assembling the small segments is low as compared with that of making a large wheel as a single ceramic body, and no serious problems are involved in mounting the wheel in the factory where it is to be used. Various other advantages will be apparent to one skilled in the art.

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

1. A grinding wheel unit comprising individual abrasive segments assembled in the shape of an annulus and a supporting member which is rigidly and irremovably united with the annulus to hold the segments in position, the assembled unit forming an independently transportable structure and presenting opposed clamping surfaces engageable by supporting and clamping members.

2. A grinding wheel comprising a single row of segments of bonded abrasive grains assembled to form a cylindrical grinding surface, a supporting container for the inner ends of the segments holding them irremovably in assembled relation, and a filler flowed in position between the adjacent faces of the segments to form an integral, rigid wheel structure, said wheel having opposed beveled faces for mounting between clamping members.

3. A grinding wheel comprising segments of bonded abrasive grains which have been individually fashioned to form an annulus when assembled in a grinding position, a supporting container therefor having a hollow hub on which the abrasive segments are mounted, and flanges fitting against the sides of the abrasive segments and holding them rigidly in position, and clamping members engaging the hub and the outer faces of the flanges and thereby supporting said container and assembled segments.

4. A grinding wheel unit comprising a plurality of separately fashioned segments of bonded abrasive grains shaped to form a grinding annulus which has clamping shoulders on opposite sides thereof, a metal container having a hub adapted to support the inner peripheral surfaces of the assembled segments, and flanges on the ends of the hub which fit against the clamping shoulders of the assembled segments and prevent removal of the segments radially from the container, said flanges forming clamping shoulders for engagement by relatively adjustable clamping plates.

5. A grinding wheel comprising a metal container having a cylindrical hub adapted to be mounted on a grinding wheel spindle and immovable sides forming an annular groove, a plurality of separately fashioned

abrasive segments mounted in said groove between the side walls of the container and forming a grinding annulus and a filler cast in position to support the segments rigidly in said groove and hold them integrally united with each other and the container, said wheel being independent of a support and arranged for removable mounting between clamping and supporting members.

6. A grinding wheel unit comprising a series of ceramic bonded abrasive segments fashioned separately and shaped to form an annulus having a peripheral grinding surface and an inner supporting surface, a metal spool having a hollow hub which is so shaped that the inner peripheral surface of the assembled segments may contact therewith and a flange fixed on each end of the hub which engages an outer side of each segment, and a filler between the adjacent surfaces of the segments and between the flanges and the segments which forms a rigid unitary wheel structure, said segments and flanges being so shaped that the outer faces of the flanges form a dove-tailed structure capable of being mounted between two clamping plates.

7. A grinding wheel comprising a series of segments of bonded abrasive grains which have been separately fashioned and are shaped to form an annulus having a peripheral grinding surface, a cementitious material between the segments forming them into a rigid, unitary ring, and a metal container having a hub which supports the inner peripheral surface of the assembled segments, said container having flanges permanently and immovably fixed thereon which engage the sides of the segments and hold them in their assembled relation for shipment and for subsequent use on a grinding machine.

8. An abrasive wheel comprising segments which have been separately fashioned and are shaped to form an abrasive annulus having tapering sides, a metal container having a cylindrical surface supporting the inner peripheral ends of the segments and sides which are substantially parallel with and are located closely adjacent to the tapering sides of the segments, said sides providing outer beveled faces for engagement by supporting plates, and a filler of metal cast in place between the segments themselves and between the segments and the container sides, thereby forming a rigid, integral wheel structure capable of being mounted as a unit on a grinding wheel spindle.

9. An abrasive wheel comprising segments shaped to form an annulus having beveled clamping shoulders, a grooved metal support for the segments which has flanges pressing against said shoulders and holds the parts in assembled relation and plates clamping against the flanges of the support and arranged to support the wheel on a spindle for grinding.

10. A grinding wheel comprising a row of abrasive segments arranged to form an annulus having a peripheral grinding surface and an inner dove-tailed portion, a metal container having beveled sides engaging said portion and holding the segments in assembled relationship, a cementitious filler between and uniting the segments, and a support, including two members clamping against the beveled sides of the container, on which the abrasive annulus is rotatably mounted.

Signed at Worcester, Massachusetts, this 14th day of May, 1927.

GEORGE N. JEPPSON.