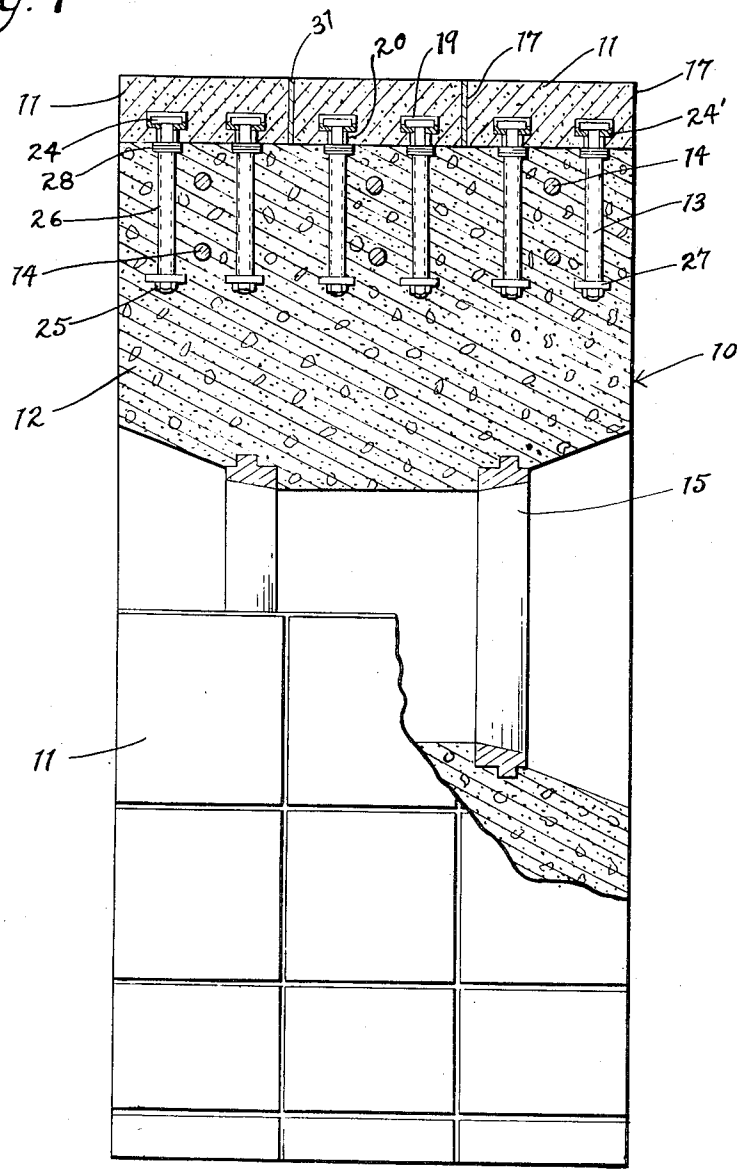
July 25, 1950 A. M. FROST 2,516,693

ABRASIVE WHEEL

Filed Feb. 19, 1949 2 Sheets-Sheet 1

Fig. 1



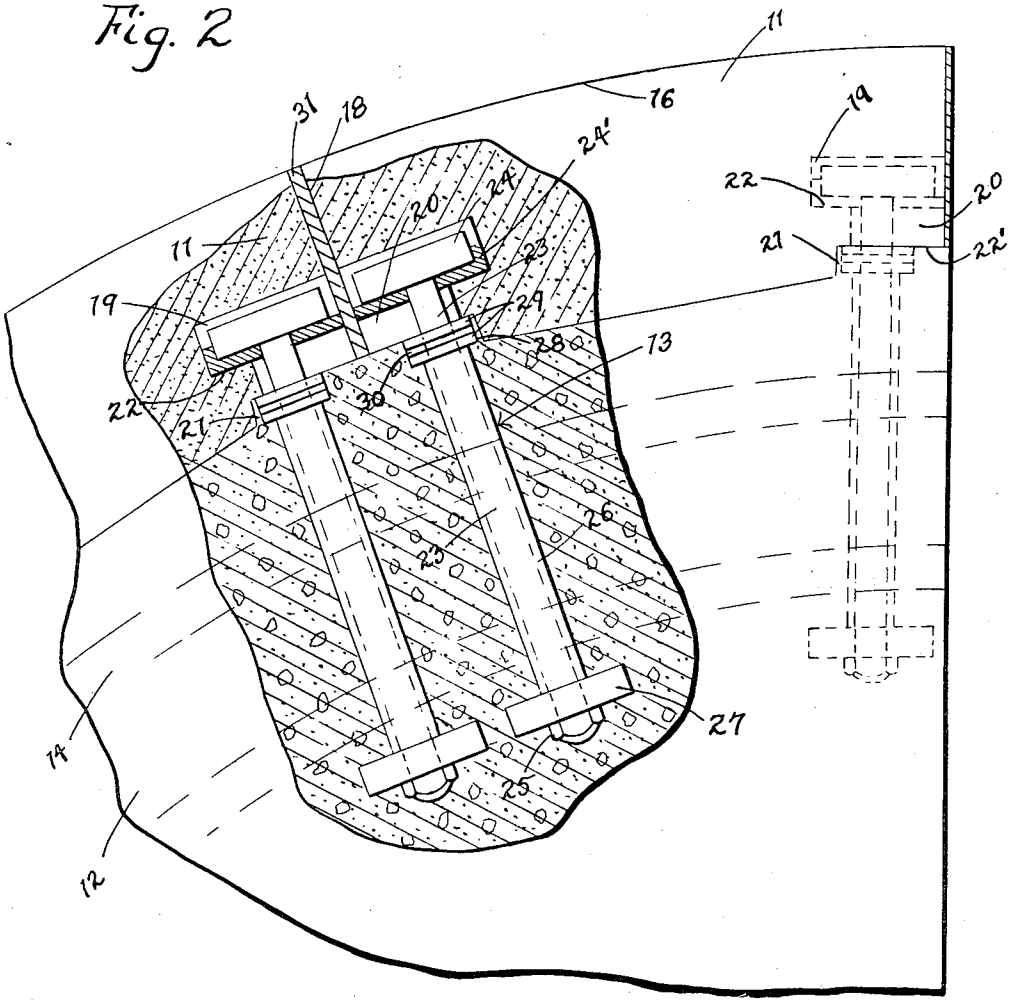
INVENTOR.
AUSTIN M. FROST
BY W. J. Foley

July 25, 1950 A. M. FROST 2,516,693

ABRASIVE WHEEL

Filed Feb. 19, 1949 2 Sheets-Sheet 2

Fig. 2



INVENTOR.
AUSTIN M. FROST
BY W. J. Dolley

Patented July 25, 1950

2,516,693

UNITED STATES PATENT OFFICE

2,516,693

ABRASIVE WHEEL

Austin M. Frost, Nunda, N. Y., assignor to The Carborundum Company, Niagara Falls, N. Y., a corporation of Delaware

Application February 19, 1949, Serial No. 77,383

3 Claims. (Cl. 51—206.4)

1

This invention relates to the manufacture of segmental abrasive wheels and particularly to the manufacture of segmental abrasive wheels of the type used in the reduction of wood to wood pulp.

It is an object of the present invention to provide a segmental abrasive wheel in which the abrasive segments are securely anchored to the core or body of such wheel.

Other objects of the present invention are to provide means whereby abrasive segments are held to the body or core of a segmental abrasive wheel by fastening means which are under tension and which thus tend to pull the segments and the body or core together, and to provide such abrasive wheels which are light in weight, easily assembled and inexpensive to manufacture.

Still further objects of the invention will be perceived from the following description.

In segmental abrasive wheels of the type used in manufacturing ground wood pulp, a type of construction has become common which involves the use of abrasive segments assembled into a cylinder within which concrete is poured to form a core or center. Various means have been provided for holding the segments to the concrete cores. Such means have usually consisted of metal bolts or studs embedded or held in the segments and in the cores. Most of such means have been unsatisfactory since, as the abrasive wheels are operated at elevated temperatures, there are imposed upon such fastening means, stresses resulting from variations and differences in thermal expansion, as well as the centrifugal force tending to pull the segments away from the cores when the wheels are rotating. There is also transmitted to the fastening means the mechanical shock and stress occasioned by the grinding of the logs. All of these forces have tended toward loosening the abrasive segments and such loosening, once begun, speedily results in failure of the wheels by the loss of one or more segments.

According to the present invention, fastening means are provided which securely hold the abrasive segments to the concrete core or center of the abrasive wheel. This is accomplished by causing the abrasive segments to be held under a definite tension tending to draw them to a firm seat against the core or support in contrast to merely providing resistance to displacement of the segments in a radial direction. Consequently the life of the wheel is greatly prolonged as the progressive deterioration which follows from the slight loosening of the segments as a result of differences in thermal expansion, etc. is avoided.

In the accompanying drawings,

2

Fig. 1 is an elevational view, partly in section, of a segmental abrasive wheel according to the present invention; and

Fig. 2 is a fragmentary enlarged side view of a portion of the segments and core, with portions broken away to provide a better view of the fastening means.

Referring to the drawings in detail, 10 is a composite segmental abrasive wheel according to the present invention. The surface of wheel 10 is an annulus composed of a plurality of abrasive segments 11 which are mounted on a concrete core or center 12 and held thereto by fastening means designated generally by the numeral 13. Embedded within concrete core 12 are reinforcing rings 14 and hubs 15.

Abrasive segments 11 are formed from granular abrasive material and bonding material in a manner well known in the art. These segments have a curved outer surface 16, parallel edges 17 and end surfaces 18 normal to the curvature of face 16. In each end of segments 11 there are formed pockets 19 extending from the end surfaces toward the center of the segments and communicating by slots 20 with the recesses 21 formed at the base of each end of the segments. The floor 22 of each pocket 19 and the surface 22' forming the top side of each recess 21 are preferably parallel and in planes normal to the planes of the segment ends 18.

Pockets 19, slots 20 and recesses 21 are designed for the accommodation of fastening means 13. Each of such means comprises an elongated bolt 23 having a head 24 and, screw-threadedly attached to its free end, a nut 25. Loosely fitting on bolt 23 is a sleeve 26 which is retained between washers 27 and 28 which are mounted on bolt 23 on each side of said sleeve.

Bolts 23, nuts 25 and sleeves 26 may be conveniently formed of a low carbon steel as may also washers 27 which, in the accompanying claims, are called permanent washers. Washers 28, which in the claims are described as destructible washers, comprise a material that is initially strong in the condtion in which it is placed in use but which, under proper predetermined conditions, will be deformed or disintegrate, thus losing its effectiveness as a washer. It is preferred to form washer 28 in three sections with outer layers 29 of steel or other suitable metal and interior layer 30 of a less resistant material. Layer 30 may be formed, by way of example, of thermoplastic materials such as cellulose nitrate and cellulose acetate which at room temperatures have high compressive strength, but at moderately

elevated temperatures soften and flow under pressure, materials such as casein which soften by the action of water, or low melting metals such as tin or alloys thereof. Under favorable circumstances one or both of the metal layers 29 may be dispensed with. The purpose of these layers is to distribute over the destructible portion of the washer 28 loads which are applied thereto through sleeve 26 and prevent mechanical damage to the destructible layer 30. Where such protection is unnecessary, layers 29 may be omitted.

In assembling an abrasive wheel according to the present invention, bolt heads 24 are inserted in each of the pockets or cavities 19 of the abrasive segments 11. It is in some cases desirable to provide a smooth, even seat for bolt heads 24 by casting a suitable bearing metal, shown as 24', around said heads in pockets 19. Destructible washers 28 are mounted on the bolts against the walls 22' of recesses 21 and held in that position by sleeves 26 which are retained on bolts 23 by permanent washers 27 and nuts 25. Tightening of nuts 25 while the bolts are in this position will result in the clamping of the abrasive surrounding slots 20 between the bolt heads 24 and washers 28. Although, as stated above, it is preferred to assemble the fastening means with the segments in such manner that bolt heads 24 are contained in pockets 19, it will be understood that, in assembling the fastening means with segments 11, bolts 23 may be reversed so that nuts 25 are so contained and heads 25 extend outwardly from the segments 11.

Nuts 25 are preferably tightened until the shanks of bolts 23 are each under a definite, predetermined tensile stress. The tensile stress applied should be sufficient to insure that the segments will be firmly seated upon the concrete core when destructible washers 28 have had their effectiveness removed. It is preferred to have this stress of the order of 18,000–22,000 p. s. i. although higher tension may be employed within the strength limitations of the steel used for bolts 23. It will be realized that sleeves 26 are, of course, at the same time put under compressive stresses equal to the tension in bolts 23 as are also the portions of abrasive segments 11 surrounding slots 20.

After the necessary number of abrasive segments 11 required to form an abrasive wheel of the desired size have been thus equipped with bolts, sleeves, washers and nuts, the abrasive segments are assembled in the form of an annulus or cylinder. Such assembly may be conveniently carried out by the use of a fixture within which the segments are placed with the free ends of bolts 23 extending inwardly toward the center of the fixture.

The joints between the abrasive segments are, as shown by the drawing, filled with material 31. Such filling material serves to cushion the segments 11 and restrain them against sideways movement. It should be sufficiently resilient to permit expansion of the segments under the influence of heat and to maintain the joints filled when the segments have contracted. It should also be resistant to the action of water to prevent its deterioration and disintegration, which would leave the edges of the segments unsupported and permit spalling and cracking thereof.

A number of materials have been disclosed in the prior art which may be used in providing this resilient joint filler. The type of material used is a matter of choice. If desired or found necessary the sides and ends of the segments may be coated with adhesive to hold the joint filling material in place. The filling material is preferably inserted between the segments as the annulus of abrasive segments is built up in the fixture mentioned above. It is also preferred to coat the bottoms of the abrasive segments with a waterproofing material to minimize the absorption of water from the wet concrete which is poured inside the annulus of segments and thus avoid impairing the quality of the concrete adjacent thereto.

A cylindrical form (not shown) is inserted within the fixture and inside the annulus of segments to provide for the insertion of a shaft and concrete may then be poured between the form and the abrasive segments so as to embed the shanks of bolts 23, the sleeves 26, nuts 25 and washers 27 and 28. Prior to or during the pouring of the concrete, reinforcing rings 14 and hubs 15 are preferably inserted in the fixture between the cylindrical form and the abrasive segments to serve as strengthening means for the concrete core or center and as guides for centering the wheel on a shaft. After the concrete core or center has set the completed wheel may be removed from the fixture.

At this stage the segments are mechanically held to the concrete core by the interlocking of the core with the washers 27 on bolts 23. Bolts 23 are under tension but this force is not transmitted to the concrete since the nuts 25 by which bolts 23 are tensioned are reacting against segments 11 through sleeves 26 and washers 27 and 28. Certain pulp wheels of the prior art have relied upon holding means similar to this to maintain the abrasive segments in position as the tension in the bolts will make it difficult to pull the abrasive segments away from the core. During the setting and drying of a concrete core, however, there is often some tendency toward shrinkage and it may then happen, therefore, that the abrasive segments are not held firmly to the concrete core. Thus, while they may be resistant to outward movement, it is possible, because of their failure to fit tightly against the core, ot impart some sidewise movement to the segments which will, if continued, cause movement of the bolts and eventually result in failure of the segment structure or the holding means.

By the improvement of the present invention these difficulties are overcome since washers 28, being destructible, may be suitably acted upon so as to remove them as an effective operative part of the holding means, thus releasing sleeves 26 from compression and permitting the tension in bolts 23 to positively draw the abrasive segments 11, through the action of the bolt heads 24 against the bottoms of pockets 19, to a firm and positive seat against the core. The concrete of the core between washers 27 and abrasive segments 11 will then be under compression as will also be the abrasive surrounding slots 20.

The destruction or failure of washers 28 need not take place at any specified time. If, for example, a cellulose nitrate composition, such as Celluloid, is used in forming destructible layer 30 they may well be maintained effective as washers until the abrasive wheel is placed in use, if in such use the temperature of the wheel is raised to the point where the Celluloid layers will flow under the pressure to which they are subjected as a result of the tension in bolts 23. In a similar manner pulp wheels having washers 28 formed with layers 30 of casein may be placed in use before the washers 28 are rendered ineffective, as

the hot water which will penetrate through the wheel to the washers will cause softening of the casein and consequent loss of compressive strength. Of course, where suitable washers **28** are used heat treatment of the abrasive wheel can be employed if desired to relieve the compression in fastening means **13** by causing destruction or disintegration of layers **30** prior to placing such abrasive wheels in use.

It will be noted that the construction of segmental abrasive wheels according to the present invention is simple. No expensive alloys are necessary for the bolts by which the segments are held to the core or the other fittings and it is easy to assemble the segments carrying the bolt assemblies into a cylinder for pouring the concrete core or center.

In the drawings the abrasive segments have all been shown the same size and arranged in an even pattern. It will be realized, of course, that this is not necessary but that by having certain of the segments larger than others a pattern of segments can be obtained in which the joints of the segments are not in line. This is desirable in some cases and such arrangements are disclosed in various patents of the prior art. It will also be realized that numerous other modifications and changes may be made in the construction described in this specification and shown in the drawings without departing from the spirit of the present invention. It is therefore desired that the invention shall not be considered limited except by the scope of the appended claims.

I claim:

1. A segmental abrasive wheel having an annular rim comprised of a plurality of abrasive segments, each of such segments being adapted to be engaged by fastening means, a concrete core supporting said abrasive rim and providing means for mounting said abrasive wheel upon a shaft, and a plurality of fastening means comprising bolts, each including a head and a nut at opposite ends thereof and a sleeve surrounding said bolt, one end of each of said bolts being engaged with one of said abrasive segments, the other end thereof and said sleeve being encased in said concrete core, each of said bolts being under tension and having a destructible washer mounted thereon at the end of said sleeve adjacent to said abrasive segment, said destructible washer being held under compression between its associated sleeve and a portion of said segment by pressure exerted thereon through said sleeve by the tension of its associated bolt.

2. A segmental abrasive wheel having an annular rim comprised of a plurality of abrasive segments, each of such segments having a plurality of recesses each adapted to receive fastening means, a concrete core supporting said abrasive rim and providing means for mounting said wheel upon a shaft, and a plurality of fastening means comprising bolts, each including a head and a nut at opposite ends thereof and a sleeve surrounding said bolt, one end of each of said bolts being engaged in one of the recesses in said abrasive segments, a permanent washer mounted on each of said bolts between the other end thereof and said sleeve, and being encased with said other end and said sleeve in said concrete core, each of said bolts being under tension and having a destructible washer mounted thereon at the end of said sleeve opposite from said permanent washer, said destructible washer being held under compression between its associated sleeve and a portion of one of said segments by pressure exerted thereon through said sleeve by the tension of its associated bolt.

3. A segmental abrasive wheel having an annular rim comprised of a plurality of bonded abrasive segments, each of such segments having a plurality of recesses each adapted to receive fastening means, a concrete core supporting said abrasive rim and providing means for mounting said wheel upon a shaft, reinforcing means embedded in said concrete core and a plurality of fastening means comprising bolts, each including a head and a nut at opposite ends thereof and a sleeve surrounding said bolt, one end of each of said bolts being engaged in one of the recesses in said abrasive segments, a permanent washer mounted on each of said bolts between the other end thereof and said sleeve and being encased with said other end and said sleeve in said concrete core, each of said bolts being under tension throughout its length between said head and said nut and having a destructible washer mounted thereon at the end of said sleeve opposite from said permanent washer, said destructible washer being held under compression between its associated sleeve and a portion of one of said segments by pressure exerted thereon through said sleeve by the tension of its associated bolt.

AUSTIN M. FROST.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,141,608	Larsson	Dec. 27, 1938
2,433,814	Holter	Dec. 30, 1947
2,447,943	Jeppson	Aug. 24, 1948