This invention relates to segmental abrasive wheels and particularly to wheels of this type which are used for the manufacture of wood pulp. One object of the invention is to provide a simple rugged construction in which the amount of machining required for metal parts is small.

The cost of a pulp wheel increases enormously with the complexity of the mounting for individual segments. It is therefore desirable to restrict the elements of the segmental mounting as far as possible to strong cylindrical elements which do not require much processing outside of drilling, threading, or slight machining.

The general structure of the type of pulp wheel which is disclosed in the present application is shown in the accompanying drawings in which:

Figure 1 is a partial sectional elevation of a portion of a segmental pulp wheel, the section being taken in an axial plane of the wheel;

Figure 2 is a fragmentary section of the segmental pulp wheel in a plane perpendicular to the axis of rotation, the section being taken on the line II—II of Figure 1;

Figure 3 is a side elevation of the pulp wheel mounted on a driving shaft;

Figure 4 is a plan view of one of the annular clamps used for each ring of segments;

Figure 5 is a section on the line V—V of Figure 4;

Figure 6 is a fragmentary enlarged view taken in an axial plane of the wheel to illustrate the character of one of the joints indicated in Figure 1;

Figure 7 shows a modification of the abrasive wheel illustrated in Figure 1; and

Figure 8 is a fragmentary section taken in the plane indicated by VII—VII of Figure 7.

Referring to the drawings in detail, the segmental pulp wheel is made up of a series of abrasive segments which are provided with dovetailed bases. The segments are arranged in annuln with the aid of ring clamps which are shaped to fit into grooves provided on opposite sides of the base of each segment. The segmental pulp wheel is made up of a plurality of similar abrasive annuli. To form one of the abrasive annuli the segments for that particular annulus can be laid on a horizontal table in correct relative positions and then provided with resilient joint fillers containing vulcanized rubber, or containing a material known in the trade as "Synthane", or containing material of similar characteristics between adjacent segments.

The segments and the radial joint fillers are closely cemented together so that a substantially solid annulus is formed. One of the clamping rings can then be placed with the aid of a suitable temporary support in position above the abrasive annulus, leaving a small gap for seating material which is subsequently introduced between the clamping ring and the individual abrasive segments. Studs or bolts are then dropped into position through corresponding holes in the clamping ring and in the bases of the abrasive segments. The studs are preferably made of approximately 34 to 42 per cent nickel steel which has about the same coefficient of thermal expansion as the abrasive material. If this nickel steel is not used, the studs should be made of a sufficiently elastic material so that dangerous stresses will not be produced in the bases of the segments or in the studs by changes of temperature, while the studs are under tension over the range of temperature to which the wheel is subjected. A seat of lead or babbit, or of cemenitious material, is poured in between the ring and the segments of the abrasive annulus in the positions indicated by the reference character 10 in Figure 1.

After the lead, babbit or cement has hardened, the assembly is turned over and the second clamping ring for the abrasive annulus is put in position in a similar manner, and the material for the seat 10 is poured in place. After the seating material has hardened, the nut 5 is tightened to a predetermined pressure. The upper face of the abrasive annulus can then be trimmed down in a plane which makes a small angle with the opposite side of the annulus, if the latter is to be one of the outside annuli. The object of this procedure is to provide biased joints of the type shown in Figure 3.

A second annulus is formed in a manner similar to that described for the formation of the first annulus. Sheets of resilient material in combination with cement on both sides of each sheet are used to form a joint between adjacent faces or sides of the first and second abrasive annuli. A third annulus may be added in a similar manner, and so on until the desired width of wheel is obtained. Rods or tie bolts are put through registering openings in radially inward portions of the rings to hold the successive abrasive annuli together when nuts 7 are tightened on terminal threaded portions of the tie rods. Before the tie rods are inserted, annular metal reinforcing rings can be placed in the positions indicated in Figure 1. These rings are disposed in planes perpendicular to
the axis of the wheel and embrace all the tie rods. In the core inside the abrasive annulus other metal reinforcements indicated by the reference characters 8 and 11 can be placed as indicated in Figure 1. These can be connected with the annular clamps by means of reinforcing supports 12. A reinforcing system of smaller radial dimensions is shown at 13 and 14 in Figure 1. Inside the last mentioned reinforcing system is positioned the wheel hub 16 and an arbor sleeve 16.

After the reinforcing systems have been placed in position along with the hub and sleeve, the space between the arbor sleeve and the segmental bases is filled with concrete or other suitable material, the necessary forms being used to confine the concrete within the boundaries shown in Figure 1. The reinforcements are made of iron or steel having about the same coefficient of expansion as the concrete.

The tie rods 6 can be made to have about the same coefficient of expansion as the concrete. The inner surfaces of the abrasive segments are lined with a waterproofing material which forms a seat for the segment and prevents the passage of water from the concrete into the abrasive while the concrete is setting, thus preventing radial chipping.

Since the coefficient of expansion of the concrete core is greater than that of the abrasive segments, there is a tendency to distort the rings 3 so that the radially inward portions 17 (see Figure 1) are pushed further apart by a given rise of temperature than the radially outward portions 18, these portions of the ring being disposed in opposite sides of the studs 4. A distortion of the rings 3 in the direction described is in the right direction to maintain the rings in pressure relationship with the reduced portions of abrasive segments as the temperature increases during the operation of the wheel. It has been found by careful tests that heating of the whole wheel above room temperature tends to distort the radially outward portions 18 of the rings 3 toward the abrasive segments 2, thus tending to clamp them even more tightly.

Some of the principal advantages of the pulp wheel construction described will be apparent from the above description.

The metallic parts are of a simple character so that little machining is required in the manufacture of the metal parts. A positive driving means is provided for the abrasive segments.

In the modification illustrated in Figures 7 and 8, the studs 4' do not pass through the bases of the abrasive segments, but pass through the concrete adjacent the bases of the segments. A number of variations may be made in the character of the metal parts and of the joint materials without departing from the invention which is defined within the compass of the following claims.

I claim:

1. An abrasive wheel comprising a plurality of abrasive annuli, each of which contains a plurality of abrasive segments, ring clamps disposed on opposite sides of each abrasive annulus and clamped to the segments by means extending through reduced base portions of the segments, tie rods which extend through the bases of said ring clamps in a direction parallel to the axis of the wheel, and a concrete core in which said tie rods and the bases of said annular clamps are embedded.

2. The abrasive wheel described in claim 1 in which metal reinforcements embedded in the concrete extend around the tie rods in planes perpendicular to the axis of the wheel.

3. A segmental abrasive wheel comprising a plurality of abrasive annuli each of which contains a plurality of abrasive segments, a pair of clamping rings attached to the base of each abrasive annulus, a concrete support for the clamped annuli, and studs extending through corresponding openings in the clamping rings in directions parallel to the axis of the segmental wheel, said studs having a coefficient of expansion substantially equal to that of the abrasive segments.

4. A segmental abrasive wheel comprising a plurality of abrasive annuli each of which contains a plurality of abrasive segments, a pair of clamping rings attached to the base of each abrasive annulus, a concrete support for the clamped annuli, and studs extending through corresponding openings in the clamping rings in directions parallel to the axis of the segmental wheel, said studs being made of an elastic steel having sufficient resilience to compensate for differences of expansion of the abrasive material and its support in an axial direction.

5. An abrasive annulus comprising a plurality of segments which are united by means of radial joints cemented to adjacent sides of the segments, a metal ring disposed on each side of the reduced annular base, a concrete center for the annulus having a coefficient of expansion greater than that of the abrasive segments, said concrete center extending between the radially inward parts of the metal rings to the bases of the segments, and means extending through the radially outward parts of the metal rings and through the reduced bases of the segments for maintaining the rings in engagement with the segmental bases as the temperature increases in the operation of the abrasive annulus.

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