APPARATUS FOR TREATING PAPER STOCKS
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5 Claims. (Cl. 241—277)

This invention relates to apparatus for processing paper stock by flowing the water borne stock over, against and between spaced, granular surfaced elements. Apparatus of the type to which this invention pertains includes rotor members which comprise hard irregular granules bonded together to form a porous granular surfaced body, the working faces of which have been contoured to direct and manipulate the stock, and which are driven at high speeds under heavy load. Apparatus of this type is exemplified in Patents Nos. 2,912,174; 2,936,172 and my copending application Serial No. 25,527, filed May 3, 1960, now Patent No. 3,058,678; and Serial No. 78,072, filed December 23, 1960, now abandoned.

More particularly the invention relates to means for reinforcing and securing rotor bodies of the above character to their driving supports.

Rotors of the above type are subject, in operation, to thermal shock, and internal stresses resulting from centrifugal forces imposed by high speeds, heavy loading and impact, which tend to cause fracture of the rotor bodies. These working stresses are intensified and set up in complicated and varying patterns in the body of the rotors, particularly in deeply contoured rotors.

It is the principal object of this invention to provide ways and means of securing such rotor bodies to their driving supports to form a unit in which the working and driving stresses are more uniformly distributed through the rotor body and absorbed or transmitted to the driving support, whether the rotor body is one-piece or comprises a plurality of superposed members.

A further object is to provide such a unit in which, if breakage or fracture of the rotor body does occur the fractured portions are held in place, preventing disintegration of the rotor with resulting damage to other parts of the equipment.

Other and further objects and advantages of the invention will be made apparent in the following specification and claims.

In the accompanying drawings,

FIG. 1 is a top plan view, with parts broken away, of a rotor and reinforcing support unit embodying the invention;

FIG. 2 is a bottom plan view of the rotor and reinforcing support unit of FIG. 1;

FIG. 3 is a sectional view, on a larger scale, substantially on line 3—3 of FIG. 1, as viewed in a common plane;

FIG. 4 is a transverse sectional view showing the method of forming the rotor and reinforcing support combination shown in FIGS. 1, 2 and 3;

FIG. 5 is a sectional view similar to FIG. 3, showing the rotor and reinforcing support combination mounted on a driven shaft and driving wheel;

FIG. 6 is a fragmentary bottom plan view of a granular rotor body showing an alternative form of rotor;

FIG. 7 is a diametrical sectional view of the form of FIG. 6;

FIG. 8 is a diametrical sectional view of a reinforcing and supporting element for combination with the rotor of FIGS. 6 and 7;

FIG. 9 is an elevation view with parts in section, showing the rotor and reinforcing support unit, employing the elements of FIGS. 7 and 8, mounted on a drive shaft;

FIG. 10 is a fragmentary plan view of the combination of FIG. 9;

FIG. 11 is a plan view, parts being broken away showing a two part rotor and reinforcing support unit embodying the invention;

FIG. 12 is a transverse sectional view of the unit of FIG. 11 mounted on a driving shaft and indicating its operative relation with a granular stator; and

FIG. 13 is a fragmentary sectional view, on a smaller scale, showing a modification of the structure of FIG. 12.

Referring to FIGS. 1 to 5, an annular granular rotor body is generally indicated at 1. The rotor body 1 may be prepared in accordance with the general procedure disclosed in the above identified copending application Serial No. 78,072, filed December 23, 1960, now abandoned, its upper working face being made with desired working contours such as, by way of example and not limitation, ridges 2 alternating with valleys 3 and its peripheral surface being provided with working contours, as exemplified by shallow grooves 4. In accordance with the present invention the underside of the rotor is also provided with a plurality of radially spaced recesses 5 and 6 and with a tapered central opening 7 which are preferably surfaced in the manner described in the last-mentioned copending application.

Following completion of the rotor body by firing or otherwise setting the bonding material, which bonds the granules, the rotor is placed upside down, as shown in FIG. 4, between suitable mold members such as sand mold members 8 and 9. The mold members form with suitable gates and vents may be prepared in accordance with the usual sand mold practice, and provide, with the addition of a cylindrical core 10 and an annulus 11, a mold cavity which, when filled through gates 12 and 13 with a suitable metal in molten condition, such as navy bronze, provides the rotor body with a supporting disc 14, hold down rim 15, reinforcing lugs 16, a hold down shaft receiving bushing 17, and an annular rib 18, all formed as an integral casting locked to the rotor body by the penetration of the metal into the interstices of the rough rotor surface and by the inclined or other locking conformation of the lugs 16 and bushing 17.

It will be understood that the shape and position of the lugs 16 will be varied from that shown as may be required to meet the needs of the particular surface contours of a given type of rotor, and the work to be done by the rotor; the form, number and position of the lugs being conformed to the stress components which have been found destructive of the rotor.

The rotor 1 and its support 14 may be secured to the drive shaft 19 in any suitable manner. As shown the rotor is clamped to the free end of the drive shaft 19 by a flanged cap member 20 secured to the shaft by a machine bolt 21. The rib 18 is also shown provided with dowel pins 22 which engage in corresponding recesses in a flywheel, not shown, fixed to the drive shaft.

An alternative reinforcing arrangement embodying the invention is shown in FIGS. 6 to 10 inclusive. Referring to the latter figures a granular rotor body of the structural character above described is generally indicated at 25, the rotor having a generally cylindrical form, provided on its working surfaces with relatively shallow grooves as 26, as distinguished from the deep contouring exemplified by the contours 2 and 3 of FIG. 1.

In the formation of the rotor body it is provided with a plurality of elongated generally cylindrical recesses 27 which open to the under surface of the rotor body, and with a central bore 28, enlarged, as at 29, adjacent the upper surface to provide an annular shoulder 30. The underside of the rotor body is also formed with a land 31 providing an annular shoulder 32.

A metallic supporting plate, shown at 33 and formed...
with a rim rib 34, is provided with a plurality of upwardly extending reinforcing rods 35 which, as shown, are threaded throughout their length, as indicated at 36, and are tightly engaged at their lower ends in tapped recesses 37 formed in the base plate 33. The plate 33 is also provided with a central hold-down bushing member 38 which, as shown, takes the form of a cylinder welded or otherwise secured to the base plate. The bushing member 38 is provided with a keyway 39 for splineing the base plate to the upper portion of the drive shaft 40.

The rods 35 are slightly smaller than the recesses 37 and are positioned to substantially centrally engage in the recesses 37 when the rotor member is assembled on the base plate as shown in FIG. 9.

The rotor member is cemented to the base plate 33, including the rods 35 and bushing member 38 by any suitable material making a good adhesive bond with metal surfaces. Cements of this character are available on the market under various trade names—"Devcon" marketed by Chemical Development Corp., Danvers, Massachusetts, has been found suitable. The rotor body is additionally secured to the base member 41 which extends over the free end of bushing 38 and shoulder 30 and is secured to the end of shaft 40 by a machine screw 42. An annular, granular surfaced disc 43 of the same composition as the rotor body is cemented to cap 44 and contoured to suitably complete the upper working surface of the rotor.

The engagement of the edge face 32 of land 31 with the inner face of rib 34 directly opposes outward radial stresses in the bottom portion of the rotor body. The rods 35 are so spaced and arranged in the rotor body as to distribute and absorb the stresses set up in the rotor body from the driving torque, work loads and thermal shock sustained by the rotor in the operation of apparatus—-as well as providing assurance against disintegration of the rotor in the event that fracture of the rotor occurs.

The threading of the rods 35 over their entire length is a convenient method of providing the rods with a surface texture enhancing the strength of the adhesive bond but it will be understood that the surface of the rods may be surfaced in any manner found desirable or advantageous for enhancing the strength of the adhesive bond.

In FIGS. 11 and 12 a modified rotor reinforcing and driving system is exemplified, which is particularly adapted to the reinforcement of rotors having shallow upper surface contouring, and employed in the apparatus disclosed and claimed in my copending application Serial No. 26,527, filed May 3, 1960, now Patent No. 3,058,673.

In the arrangement shown in FIGS. 11, 12 and 13 the rotor body, generally indicated at 50, is formed in two superposed sections 51 and 52. The adjacent faces of the sections 51 and 52 are each recessed as at 53 to receive and enclose a reinforcing plate 54.

The section 52 is supported on a driving base plate 55 similar in form to base plate 33, previously described and carrying a plurality of reinforcing and driving rods 56, similar to rods 35. The rods 56 extend through openings 57 in the rotor body section 52, freely through openings 58 in plate 54 and into recesses 59 formed in the under surface of rotor section 51.

The plate 54 is provided with a plurality of spaced reinforcing and driving lugs 60 threaded into tapped openings in plate 54, or otherwise secured thereto or formed integral therewith. Rotor body section 51 is provided with recesses 61 to receive the lugs 60. Plate 54 is also provided with a plurality of openings 62 through which the bonding cement 63 which secures the sections 51 and 52 together may flow, to enhance the bonding of the sections 51 and 52 and plate 54 into a unitary rotor body.

To facilitate the bonding procedure the plate 55 and its bushing 65, and the rods 56 and the upper surface of section 52 may be coated with bonding cement and the plate 54 properly embedded by temporarily applying nuts on the free threaded ends of the rods 56 and to the cap screw 66 with the granular covered hold-down washer 67 in place. The nuts are then removed, the under surface of section 51 properly coated with cement and secured in place into recesses 80 in the bottom face of the driving support 55. This latter arrangement has the advantage that the sections 51 and 52 are mechanically held together.

What is claimed is:

1. A rotor member for use in the processing of water borne paper stock which comprises a rotor body formed of granules of hard material permanently bonded together to provide the body with coarse granular stock processing surfaces, said body being formed on its underside with a plurality of spaced generally cylindrical recesses, and with a central, cylindrical opening, a driving support, a plurality of metal rods extending from said driving support and positioned in said recesses, a shaft receiving bushing extending from said driving support and positioned in said central opening, and means bonding said rods and said bushing to the rotor body within said recesses and said central opening respectively.

2. A rotor member for use in the processing of water borne paper stock which comprises a rotor body formed of granules of hard material permanently bonded together to provide the body with coarse granular stock processing surfaces, said body including two superposed sections, a metal reinforcing member positioned between said sections, a driving support positioned at the underside of the lower section, a plurality of spaced rods extending from the driving support through said lower section and said reinforcing member and into the upper section, and means bonding said rods and the driving support to the rotor body.

3. A rotor member for use in the processing of water borne paper stock which comprises a rotor body formed of granules of hard material permanently bonded together to provide the body with coarse granular stock processing surfaces, said body including two superposed sections, a metal reinforcing member embedded in said body between the sections, a driving support positioned at the underside of the lower section, a plurality of rods extending from the driving support through the lower section, and the metal reinforcing member and into the upper section.

4. A rotor member for use in the processing of water borne paper stock which comprises a rotor body formed of granules of hard material permanently bonded together to provide the body with coarse granular stock processing surfaces, said body including two superposed sections, a metal reinforcing member aligned between the sections, the lower section and the reinforcing member being formed with a plurality of aligned openings and the upper section being formed with a plurality of recesses aligned with the aligned openings of the lower section and the reinforcing member, the lower section being also provided with a central opening, a metal driving support, a plurality of metal rods extending from said driving sup-
port and positioned in said aligned openings and recesses, a shaft receiving bushing extending from the driving support and positioned in said central opening, and means bonding said rods, reinforcing member and driving support to the adjacent surfaces of said sections.

5. A rotor member for use in the processing of water borne paper stock which comprises a rotor body formed of granules of hard material permanently bonded together to provide the body with coarse granular stock processing surfaces, said body including two superposed sections, the underside of the upper section being provided with an undercut recess filled with cast metal, the lower section being formed with a plurality of openings, a driving support formed with openings aligned with the said openings in the lower section, said sections and the driving support being secured together by bolts extending through the said aligned opening and threaded into the metal filling the said recess in the upper section.

References Cited by the Examiner

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent No.</th>
<th>Date</th>
<th>Inventor</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>452,958</td>
<td>5/91</td>
<td>Sturtevant</td>
<td>241—298</td>
</tr>
<tr>
<td>483,179</td>
<td>9/92</td>
<td>Sturtevant</td>
<td>22—202</td>
</tr>
<tr>
<td>902,732</td>
<td>11/08</td>
<td>Horn</td>
<td>241—298</td>
</tr>
<tr>
<td>1,057,069</td>
<td>3/13</td>
<td>Macdonald</td>
<td>22—202</td>
</tr>
<tr>
<td>1,111,043</td>
<td>9/14</td>
<td>Sturtevant</td>
<td>241—298</td>
</tr>
<tr>
<td>2,108,630</td>
<td>2/38</td>
<td>Walker</td>
<td>51—209</td>
</tr>
<tr>
<td>2,156,321</td>
<td>5/39</td>
<td>Sutherland</td>
<td>241—298</td>
</tr>
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