A flange mounting and driving structure for massive grinding stones such as pulpstones adapted to engage the stone to center it on the drive shaft and engage the ends of the stone with extremely high pressure to transmit the driving force from the shaft to the stone, the flange means being constructed in several separable parts which when assembled serve as a unitary flange element but which may be readily disassembled in a manner to easily break the tight engagement of the flange against the ends of the pulpstone when it is necessary to change stones.

In the paper industry large pulpstones are used for grinding logs into pulp which stones are operated continuously for years on end. The pulpstones are mounted on suitable driving shafts and flanges are disposed along the shaft to center and provide driving engagement between the shaft and the pulpstone. Such flanges are normally mounted on threads integral with the shaft, right and left hand threads being provided so that the flanges may be driven home and adjusted longitudinally of the shaft to center the pulpstone in a proper position.

The stone is driven in a direction relative to the threads on the drive shaft such that the flanges are driven inwardly to tighten against the sides of the stone continuously during the life of the pulpstone. This tightening action together with the corrosive action of the normal chemicals present in wood and water, causes the flanges to become tightly and relatively permanently engaged on the drive shaft. This tendency of these two elements to weld together is promoted in present day flange construction because of the use of a threaded bronze bushing disposed between the shaft and the flange structure itself. This bronze bushing deforms somewhat under the continuous tightening action resulting from driving the wheel against the threads and further the grinding fluids contain chemicals which produce an electrolytic action between the bronze and the metal of the shaft and flange. Such corrosion between the two different materials accomplishes further bonding of the several parts of the assembly together.

When the pulpstone must be changed, it has been found that the flanges have become so firmly engaged as between the shaft and the pulpstone that great difficulties are encountered in unwinding the flange on the threads so that the stone may be removed from the shaft. Due to the increasing power used for driving the stones, the tightening action has become so great on many of the current pulp grinding machines, that the flanges must be destroyed to permit removal of the pulpstone from the shaft. It has even been found necessary to use an acetylene torch to cut through the flange structure to effect its removal from its engaged position between the shaft and the pulpstone.

The present invention has been made to provide an improved flange construction by which the flange may be removed without the necessity of destroying the flange elements and furthermore by minimizing the force required to unwind the flange to effect its separation from the shaft. This is accomplished by making a rigid flange structure which may be utilized for mounting a pulpstone on its driving shaft but which may be disassembled after the pulpstone has been worn out. The assembly provides rigid support and driving engagement between the pulpstone and the shaft during normal use but is constructed so that it may be easily taken apart to minimize the frictional engagement between the flange and the side wall of the pulpstone whereby the frictional engagement of the stone and flange is eliminated prior to removal of the flange so that the remaining portion of the flange structure may be more easily threaded off of the shaft to permit removal of the pulpstone.

For a more detailed description of the invention reference is made to the drawings and description below.

FIGURE 1 is a front elevation of a pulpstone drive shaft and mounting assembly partly broken away showing my improved flange construction. FIG. 2 is an end elevation of the improved flange construction shown in FIG. 1.

Pulpstones used in modern machinery may be as large as 90" in diameter and 104" wide. The largest of these stones now weighs as much as 15 tons and one of the largest machines now in the design stage will be driven by a 14,000 horsepower motor or engine. The bulk of the pulpstones used, however, are somewhat smaller and usually weigh within the range from 7 to 11 tons. Such stones may range in diameter from 54" to 80" and are in the order of up to 67" long. Such pulpstones are driven with engines which develop from 4,000 to 7,200 horsepower. No matter what the size of the pulpstone the current industrial practice is to drive the stones so that they have a speed of from 5,000 to 6,500 surface feet per minute although some experimental activity in pilot plant production currently makes use of wheels driven at a speed of 10,000 surface feet per minute.

Wheels such as have been described above have been used continuously in industry in machines operating on a twenty-four hour a day basis for periods up to nine years. The average life of a pulpstone, however, is on the order of five years. Such stones are sharpened from time to time while the grinding operation proceeds and normally the machines are maintained in continuous operation.

Referring to FIG. 1, the pulpstone 10 is provided with an abrasive section 11 surrounding its periphery. Usually the abrasive section 11 is formed by a composite structure made up of a number of segments interfitted to produce a usually continuous abrasive surface around the periphery of the wheel. The manner of fabrication the abrasive surface is unimportant insofar as my invention is concerned.

The body of the pulpstone is usually formed of a mass 12 of reinforced concrete. Such constructions are well-known and is not shown in detail in this disclosure. The body 12 is formed to have a central passageway 13 therethrough and normally has a conical side wall 14 at each end, the conical surface of which slopes inwardly from its outer diameter to the inner diameter which intersects a seat 15. A seat 15 is disposed to center the stone or to mount it concentrically at each end of passageway 13, the seat 15 being formed to have diameter somewhat larger than the diameter of passageway 13. The seat 15 extends lengthwise along the pulpstone structure for some distance in a direction parallel to the axis above which the wheel rotates.

The pulpstone is adapted to be drivenly supported on a drive shaft 16 which is provided with two threaded zones 17 and 18. The threads 17 are produced in the drive shaft to have a right hand pitch and threads 18 have a left hand pitch. The drive shaft 16 is adapted to extend beyond the ends of the pulpstone to be carried in suitable bearings as is well-known in the art and the shaft may be connected in a conventional manner with a drive means as is also well-known.
3

The oppositely directed threaded portions 17 and 18 of the drive shaft are adapted to receive cooperating flange elements 20 and 21. The flanges are suitably threaded to be driven onto the drive shaft for engagement with the pulstone to hold the stone centered relative to the axis of the shaft. In the assembly of the drive shaft to the pulstone, the flanges are adapted to engage tightly against the conical side walls 14 of the pulstone body to provide a driving engagement between the shaft and the stone. Referring to Fig. 1, it will be seen that the flange 21 has a bearing seat 22 formed concentric with the threaded aperture 23 in the flange element 24 of the pulstone body 12. The flanges 20 and 21 are adapted to co-operate with the threads 17 so that the seat 22 is disposed in a concentric relation about the longitudinal axis of the drive shaft. The seat 22 cooperates with seat 15 in the body portion of the wheel whereby the wheel is centered on the drive shaft. The flanges 20 and 21 are adapted to be thus mounted on the threaded portions 17 and 18 of the drive shaft to center the wheel on the shaft and the flanges are then adjusted on their respective threaded mount with respect to the shaft 16 to center the wheel along the drive shaft in the desired position for mounting the grinding machine. When the longitudinal position of the wheel along the shaft has been established, the flanges 20 and 21 are driven home against the conical side walls of the wheel. The flanges are provided with drilled apertures 30 which extend partially into the main element of the flange 21 for engaging a arculate piece 33 which are temporarily positioned therein and when the wheel 10 is rotated slowly with a pin in position in aperture 30 the pin engages against a fixed stop (not shown) whereby to tighten to flange 21 on threads 17 to drive the flange tightly against the conical side of the body 12 of the wheel. Each flange 20 and 21 may thus be driven home to effect driving engagement between the wheel and the drive shaft mounted on the shaft by means of the flanges. It is thus seen that a very tight, frictional, rigid engagement is established between the drive shaft and the flange structures 20 and 21 to accomplish the supporting and driving of the pulstone. In normal use the wheel is driven in a direction of rotation relative to the pitch of threaded portions 17 and 18 of the drive shaft so that as the wheel is driven forwardly the flanges 20 and 21 tend to tighten against the end wall portions 14 of the supporting body 12. As this tightening action continues the engagement of the flange against the side wall 14 through the gasket 26 always tends to increase and thus tremendous frictional engagement is built up between the internal face of the flange against the grinding wheel. It will be noted that the gasket 26 or in some instances a grout formed of cement or a sulphur layer provides intimate contact between all of the irregularities in the surface of the face 14 and the opposite face of the flange which engages the gasket.

As the size of the wheels has increased in modern practice and as the power delivered through the drive shaft has built up, the tendency to tighten the flanges more and more against the sides of the wheels has increased. When it becomes necessary to remove the flange the reversal of the procedure making use of pins inserted in apertures 30 adapted to be driven against a fixed stop in an attempt to unscrew the flange from the wheel as has been the practice in the past has been found to be wholly inadequate to accomplish removal of the flange. As stated above it has been frequently necessary to destroy the flange to permit removal of the pulstone from the drive shaft. It is obvious that as the wheels are made larger the flanges must be likewise made of larger sizes and thus the expensive replacement is increased.

Referring to Fig. 1, in following my teaching the flange 21 is made as a composite structure having a main element 24 which is preferably provided with a seat 31 which is arranged generally concentrically with respect to threaded aperture 23 and a generally conical disposed wall portion 32 which is adapted to be situated in a generally parallel relationship with respect to wall 14 of the pulstone when the flange is assembled on the drive shaft. The space provided by seat 31 and wall 32 is adapted to be filled by a number of flat accurately shaped peripheral pieces 33 which are adapted to be rigidly assembled on the main element of the flange 21. When assembled on the main element the multipiece flange structure comprises a rigid body having the threaded aperture 23 for engaging on the drive shaft, the seat 22 for centering the grinding wheel on the drive shaft, and a composite face on its inner radial wall for engaging the male element of the pulstone. This composite face of the flange 21 is made up of an annular surface 35 integral with the main element 24 of the flange and a flate arcuate face 36 on the inside of the arcuate pieces 33 mounted on the main element of the flange.

As will be seen by reference to Fig. 1 the arcuate pieces 33 are also provided with threaded holes 39 for bolts 40 which extend from the outside of the periphery of the flange, through the pieces 33 to engage against the seat 31. When the bolts 40 are driven inwardly the inner ends of the bolts engage against the seat and the arcuate pieces 33 are moved outwardly from the seat by the continuous driving action of the bolts 40.

In making use of this structure it is apparent that after the pulstone has been worn out it must be removed from the drive shaft, that the bolts 40 are removed to free the arcuate pieces 33 from rigid assembly with respect to the main element of the flange. After the bolts 40 are removed, the several bolts 40 are then activated to tighten them against the seat 31. Continuous driving of the bolts 40 by means of the threads on the bolts breaks the initial frictional engagement between the surface 36 of the arcuate pieces and the gasket and wall 14 so that the substantial area of the flange in driving engagement with the grinding wheel is broken. Once the initial frictional engagement has been destroyed, the flange 21 may be removed quite easily by inserting a pin in an aperture 30 so that the pin may be driven against a fixed stop as is conventional so that the main element 24 of the flange may be unscrewed from threaded engagement with portion 17 on the drive shaft. In instances where the flange may be very tightly engaged, it may be necessary to remove the arcuate elements 33 entirely from their seated engagement between the main element 24 of the flange and wall 14 of the pulstone. Such removal of the arcuate pieces will eliminate entirely all of the frictional engagement between the wall 14 and flange 21 whereby to render removal of the main element 24 much less difficult.

It is obvious that any number of arcuate elements 33 may be utilized to form the periphery of the multi-piece flange structure. In general the smaller the arc the less effort required to break the initial frictional engagement to remove it from its seated position between the body of the pulstone and the main element of the flange.

It is apparent that if necessary the wall 32 on the main element of the flange could be made to diverge very slightly from the parallel relationship with respect to seat 14 on the pulstone so that upon the first initial movement of the arcuate element more space would be provided between the inner face 36 of the arcuate piece so that the arcuate piece 33 could be much more easily lifted from seat 31.

While two flanges constructed like that shown in Fig. 1 have been shown in the drawings, it is apparent that only one such flange need be provided in any pulstone assembly. Once the flange at one end of the stone has been removed from its tight driving engagement with the stone, the frictional engagement with the other flange is automatically relieved.

While the above description covers the preferred form of my invention it is apparent that many modifications thereof may occur to those skilled in the art and which will fall within the scope of the following claims.
I claim:

1. A mounting means for a pulp grinding wheel for use in the paper industry and the like said wheel having a peripheral abrasive zone and a supporting body with a central passageway therethrough, said mounting means including an elongated drive shaft disposed in said passageway and a pair of flange means for carrying the wheel on the shaft and for providing a driving engagement between the shaft and wheel, said pair of flange means including at least one flange comprising a multi-piece structure; said multi-piece structure having a main element adapted to be adjustably fixed at a selected longitudinal position lengthwise along said elongated shaft whereby the supporting body of said wheel may be drivingly engaged between said pair of flange means; said at least one flange structure having a plurality of generally flat arcuate-shaped separable peripheral pieces removably affixed to its main flange element; said separable pieces when assembled on said main element, constituting a rigid flange structure; said separable pieces each having an appreciable area in a driving contact with the supporting body of said wheel; and each of said arcuate pieces being constructed and arranged to co-operate with means for forcibly separating said arcuate piece from its affixed position on the main element of the structure and from its driving contact with said supporting body.

2. The structure of claim 1 wherein each of said arcuate shaped pieces has walls disposed in parallel relationship on its arcuate sides, one of said walls being the area of said piece that is in driving contact with the supporting body of the wheel, and the other of said walls having an appreciable area in driving contact with said main element.

3. The structure of claim 1 wherein said main element is generally circular in cross-section in a plane disposed at right angles to said longitudinal shaft and is formed with a pair of substantially concentrically arranged seats thereon, one of said seats engaging said passageway through the supporting body of the wheel, and the other of said seats being adapted to receive said separable arcuate pieces.

4. The structure according to claim 1 wherein said arcuate shaped pieces are removably bolted onto said main element to provide said at least one rigid multi-piece flange assembly, and said pieces have additional threaded means associated therewith operable to drive said separable pieces out of their engaged positions with said main element and driving said driving contact with the supporting body.

References Cited

UNITED STATES PATENTS

813,320 2/1906 Neumann 241—293
2,918,867 12/1956 Killary et al. 29—129 X
2,929,568 3/1960 Vawter 241—293
3,042,996 7/1962 Nelson.

WILLIAM W. DYER, Jr., Primary Examiner.
W. D. BRAY, Assistant Examiner.