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PULPSTONE

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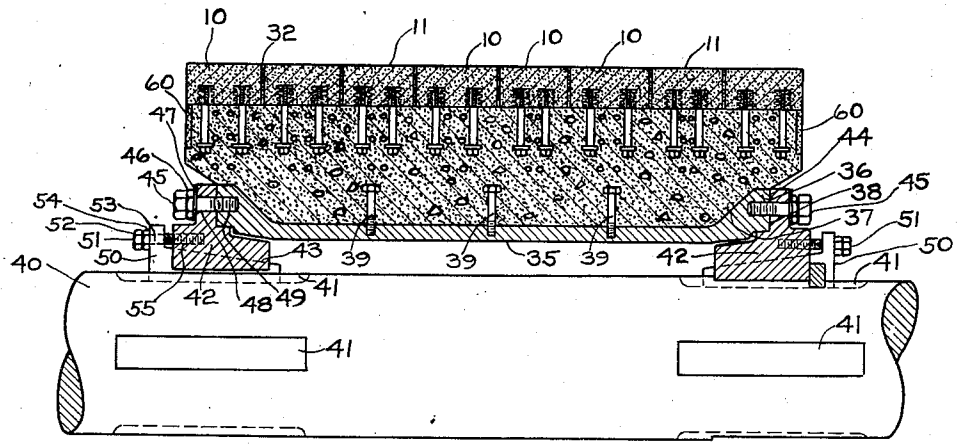


Fig. 1

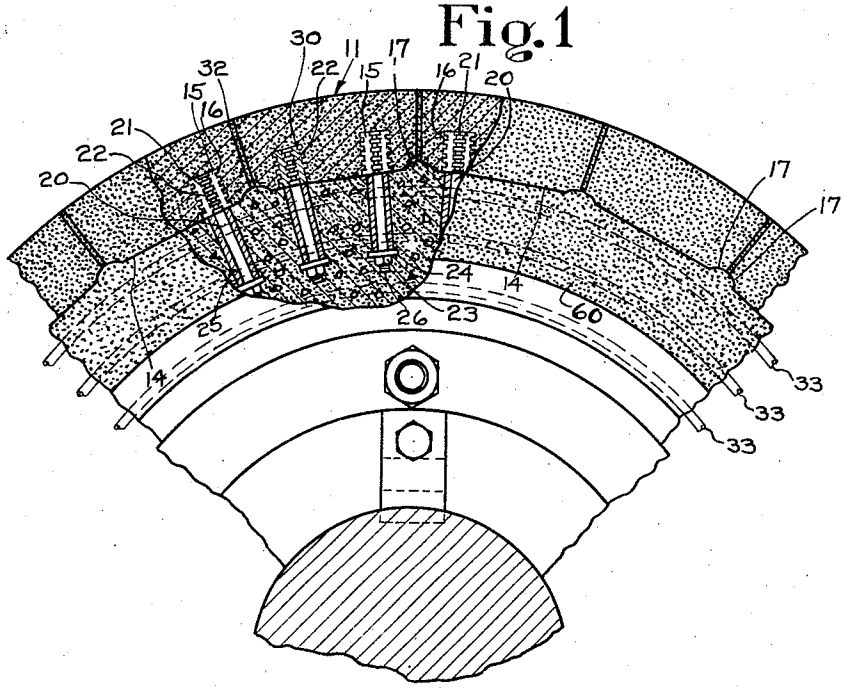


Fig. 2

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PULPSTONE

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The invention relates to pulpstones, and with regard to its more specific features to pulpstones for grinding long logs.

One object of the invention is to provide a long pulpstone, for example of the order of eight feet in length (length here meaning the axial dimension). Another object is to provide a strong pulpstone of considerable length. Another object is to provide a pulpstone and mount of the size and weight necessary to grind long logs, of simple and practical construction and which is capable of long continued and dependable operation. Another object of the invention is to provide a construction for a long pulpstone which is economical to manufacture. Another object is to provide driving means for a pulpstone which is capable of absorbing a greater amount of horse power than conventional driving means.

Another object of the invention is to provide a long pulpstone capable of being used in high production grinding without developing excessive stresses and pressures at the flanges and upon the concrete center. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangements of parts, as will be exemplified in the structure to be hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is shown one of the various possible embodiments of the mechanical features of this invention,

Figure 1 is an axial sectional view of one half of a pulpstone constructed in accordance with the invention, together with the driving flange and the driving shaft.

Figure 2 is an end elevation of a portion of the pulpstone, with part thereof shown in cross section, all on a larger scale than Figure 1.

As conducive to a clearer understanding of the present invention it is noted that pulpstones are customarily driven by flanges on right and left hand threads on the driving shaft, such construction compressing the flanges against the ends of the pulpstone thus providing pressure for frictional driving. The pressure is a function of the power factor as will be readily understood. Pulpstones now used are commonly no more than five feet in axial dimension, usually less. In such stones the power factor is not great enough to set up pressures which could crush the stones.

According to the present invention, however, it is contemplated that stones eight and even nine feet long will be constructed. If the flange friction were used to do the driving very large pressures would be created. The situation is aggravated, moreover, by the differential expansion of the stone and the steel shaft which in the case of a long stone and shaft assumes serious proportions.

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As described in U. S. Patent No. 2,141,608 I provide a number of segmental blocks 10 of bonded abrasive material. Each block of bonded abrasive material is composed of any desired type of abrasive such as silicon carbide or fused alumina, the latter being preferred, bonded together with a suitable bonding material, vitrified ceramic bond being preferred. Each block 10 is, therefore, formed of a mixture of clay or frit with abrasive, suitably plasticized as by the provision of a suitable amount of plastic clay and the addition of water, then molded in a suitable mold and pressed under high pressure to cause the block to have sufficient "green" strength for handling. After each block 10 comes from the mold, it has an outer cylindrical surface 11 and an under surface 14 which may be a plane surface. While the block 10 is in a "green" state, I bore four holes 15 therein, each hole 15 having numerous grooves 16 in its side walls. I then form reentrant grooves 17 at the ends of the surfaces 14. Each groove 17 is adjacent to a corresponding groove 17 in the adjacent block.

The blocks 10 are then fired in a kiln and the shape thus becomes permanent and the material is thereby converted to vitrified bonded abrasive material. I provide a quantity of bolts 20 having heads 21 with grooves 22. I further provide an equal quantity of nuts 23, washers 24 and sleeves 25. I place the sleeves 25 on the bolts 20 abutting the heads 21. I then place the washers 24 against the ends of the sleeves 25, place the nuts upon the outer threaded ends 26 of the bolts 20 and tighten the nuts 23. Thereby the bolts 20 are placed under initial tension.

I then place in each hole 15 a head 21 of a bolt 20 and fill the space with a suitable self setting cement 30 such as a mixture of Portland cement and iron filings. This has excellent holding power. Each block 10 thus has four bolts 20 projecting therefrom, each bolt being encased by a sleeve 25 and having attached to it a washer 24. Each bolt 20 is under initial tension such that a considerable force is needed to move the head 21 away from the washer 24 by even a very slight distance. Each bolt 20 is securely locked to its segment 10 by reason of the fact that the cement 30 interlocks with the grooves 16 in the block and also interlocks with the grooves 22 in the head 21.

I now arrange the blocks 10 in rows to form a hollow cylinder of outside diameter equal to that of the finished pulpstone. Between the blocks I place suitable filler material 32 such as that described in U. S. Patent No. 2,054,771. The blocks are clamped together and the whole assembly is placed in an oven to bake the material 32. Inside this hollow cylinder after it is removed from the oven I place cages formed of hoops of steel 33 spaced apart axially by metal clips, not shown. Preferably there are a plurality of cages made of hoops, for example three as shown, the hoops of one cage being of a different diameter from the hoops of another cage. The cages serve to reinforce the stone against centrifugal and other radial forces.

According to this invention I provide a hollow cylindrical metal drum 35 having enlarged end portions 36 bounded by conical surfaces 37 on the inside, and radial plane annular faces 38. Screwed into the drum 35 are a plurality of bolts 39 which project radially outward. I place the drum 35 inside the cages of hoops 33 and coaxial with the hollow cylinder of blocks 10 and the cages. The drum 35 rests upon a mold bottom plate, not shown, which does not form part of the final pulpstone. A mixture of concrete forming material such as Portland cement, sand and trap rock is now poured inside the cylinder of blocks 10 and allowed to set. The surface of the upper end is shaped to be the same as that of the lower end before the concrete has set. The clamp and the mold bottom plate are then removed and the stone is trued, dressed and sided. The pulpstone per se is now finished.

The pulpstone will usually be mounted upon a drive shaft 40 which has large keyways 41. I provide large flanges 42 which are bored to fit over the shaft 40 and have large internal keyways 43 to fit opposite the keyways 41 upon the shaft 40. The flanges 42 are identical. They have radial plane annular faces 44 to fit against the radial plane annular faces 38 of the drum 35. Bolts 45 with locknuts 46 and washers 47 extend through holes 48 in the flanges 42 and into tapped holes 49 in the faces 38 of the drum 35 thus holding the pulpstone upon the shaft 40. Heavy wedge keys 50 fit into the keyways 41 upon the shaft 40 and the keyways 43 in the flanges 42 and securely lock the pulpstone to the shaft 40 so that it may be driven. Bolts 51 having lock nuts 52 extend through holes 53 in extensions 54 in the heads of the keys 50 and into tapped holes 55 in the flanges 42 to hold the keys 50 wedged securely in place.

In order to assemble the pulpstone with the flanges 42 and keys 50 on the shaft 40, the shaft is dismounted from its journal at one end, the flange 42 farthest from that end is placed over its keyways 41, the pulpstone is placed upon the shaft and the other flange 42 is placed over its keyways 41. The bolts 45 are inserted, screwed in and tightened with their locknuts 46, on both ends of the pulpstone locking the stone to its flanges 42. Then the keys 50 are inserted and driven into their keyways 41 and 43 to lock the pulpstone and flanges 42 to the shaft 40. The bolts 51 are inserted and tightened to hold the keys 50 securely in place. Then the journal can be replaced and the stone is ready to operate upon its shaft 40.

In conventional stones which are usually not more than four or five feet in length, the screw thread drive is used whereby the end flanges are screwed against the stone by right and left hand screw threads upon the shaft. The stone is driven through the friction created by the flanges against its ends as they are compressed against it caused by their tending to be driven together along the opposite screw threads as the shaft drives them. This sets up compressional and tensional stresses in the concrete at the flanges, which however are not too great in a stone of short axial length, and the expansion differential between the concrete and the steel shaft is not a serious problem in the short stone. However, in a stone of long axial length such as eight or nine feet as embodied in the present invention, the proportionally greater horsepower absorption by the stone through its driving means precludes the frictional drive method by flanges which are driven upon the shaft by opposite screw threads. The concrete could not withstand the greater compressional and tensional forces caused by the compressive thrust of the flanges driven against it by the greater power through a screw thread drive and the expansion differential between the steel shaft and the concrete in a long stone would create a serious problem.

Furthermore in former construction the flanges would frequently get so tight they would freeze to the shaft, whereas by this method the keys will get no tighter than they are originally set, and dismounting of a stone for repairs does not become a problem in spite of greater power absorption necessary to drive the longer stone. Also the ratcheting action due to slippage of the flanges where the drive is frictional is eliminated by the positive drive provided by the invention. Power is absorbed by the drum 35 throughout the entire length of the stone, and this eliminates pressures which could crush the stone as well as acute stresses at the ends of the stone.

In the preferred embodiment of a stone constructed according to this invention, I provide abrasive end plates 60 of the same material as the blocks 10 which lie on the ends of the concrete abutting the blocks 10 in a radial plane. These abrasive plates 60 protect the concrete from excessive wear caused by the presence of grinding water with abrasive particles therein and from wood splinters carrying abrasive which become lodged between the end of the stone and the frame of the pulp grinder. The plates 60 on one end are placed upon the bottom mold plate before the concrete is poured and they are set into the concrete on the top end before it sets. The foregoing plates 60 are described in greater detail in U. S. Patent No. 2,205,296 to Carl L. Leafe.

It will thus be seen that there has been provided by this invention a pulpstone in which the various objects hereinbefore set forth together with many thoroughly practical advantages are successfully achieved. As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment set forth it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a pulpstone, a plurality of blocks of bonded abrasive material, said blocks being arranged to form a hollow body of revolution, a hollow concrete core inside of said body of revolution, bolts embedded in said blocks and in said core attaching said blocks to said hollow concrete core, a hollow metal drum inside of said hollow concrete core having enlarged end por-

tions, the outer enlarged end portions of said hollow metal drum being bored and tapped for the reception of driving bolts.

2. In a pulpstone as claimed in claim 1, a combination with the parts and features therein specified, of a plurality of metal members attached to said drum and extending radially into said hollow concrete core to drive said core from said drum.

3. A pulpstone assembly comprising a driving shaft having keyways, a pair of annular metal flanges fitting said shaft and having internal keyways matching the keyways on the driving shaft, a hollow cylindrical metal drum having enlarged end portions fitted to the flanges, bolts securing the flanges to the end portions of the metal drum, keys in the keyways of the shaft and in the internal keyways locking the flanges to the shaft, a concrete core cast around the metal drum, a plurality of blocks of bonded abrasive material outside of and in contact with said

concrete core said blocks being arranged to form a hollow body of revolution, and bolts embedded in said blocks and in said concrete core holding said blocks to said core.

4. In a pulpstone assembly as claimed in claim 3 the combination with the parts and features therein specified, of bolts attaching the keys to the flanges.

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