

March 6, 1951

N. F. HOLTER ET AL
REPAIR OF PULPSTONES

2,544,632

Filed Feb. 16, 1948

2 Sheets-Sheet 1

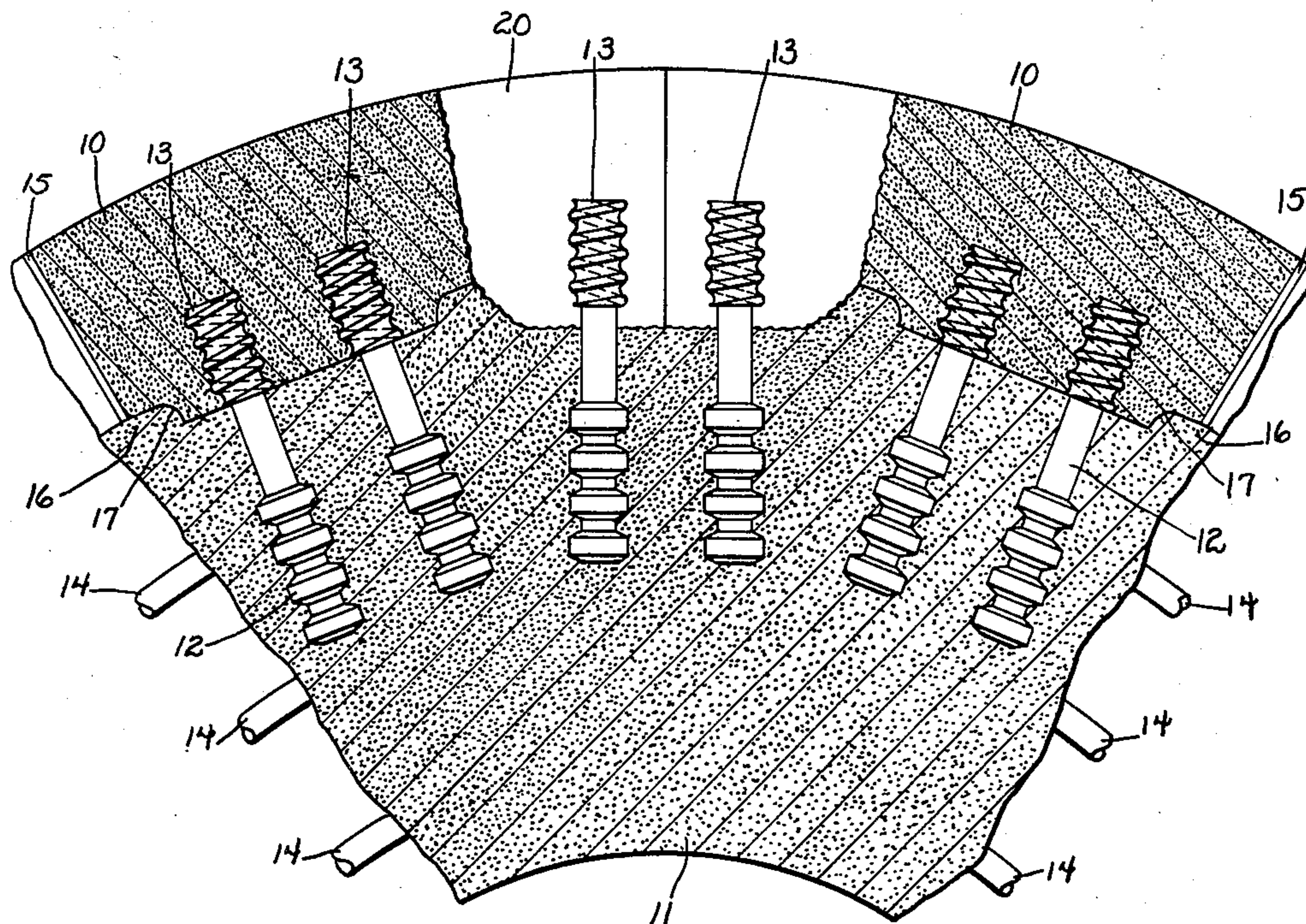


Fig. 1

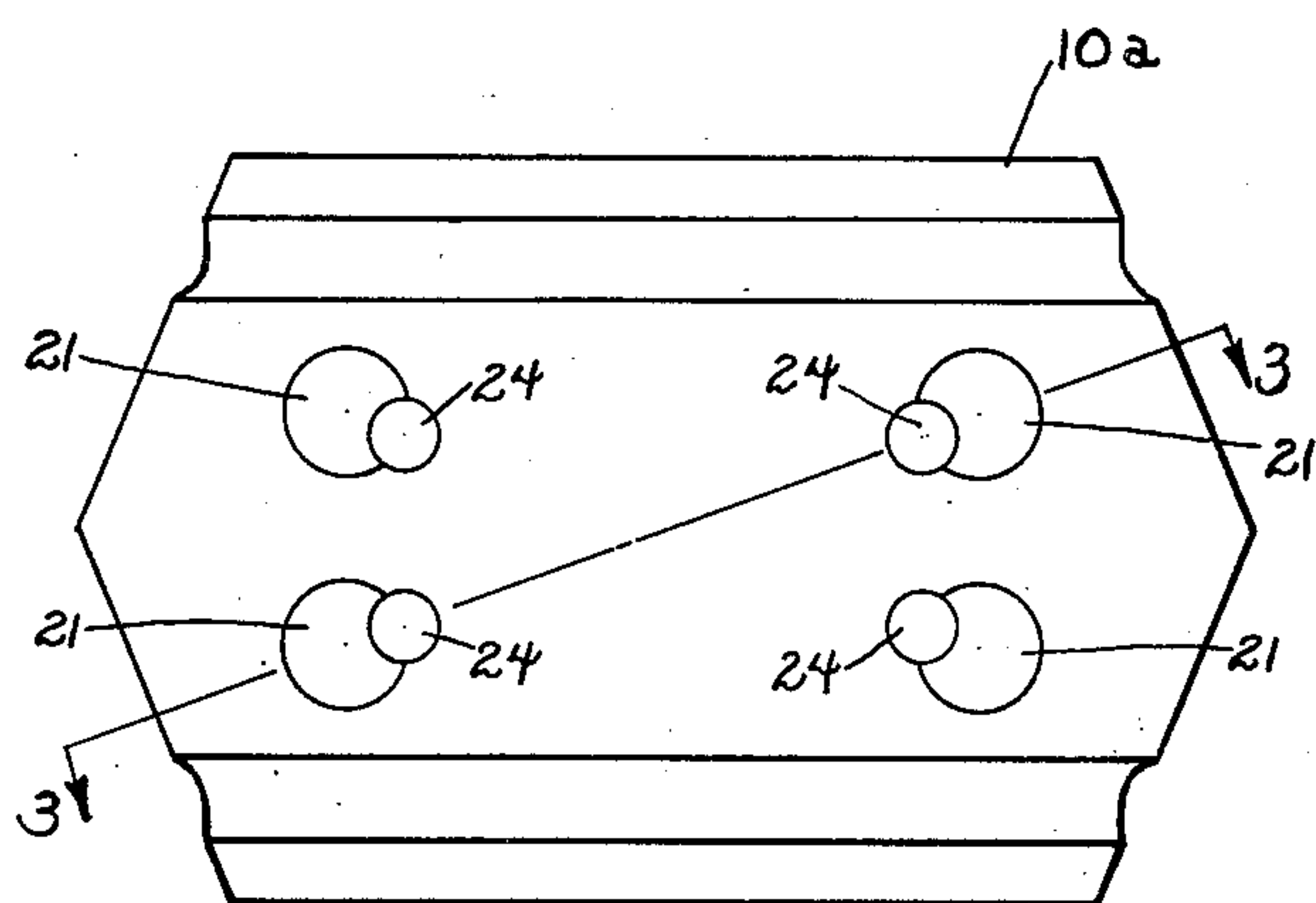


Fig. 2

Inventors
NORMAN F. HOLTER
WALTER BETH

By *George C. Compton*
Attorney

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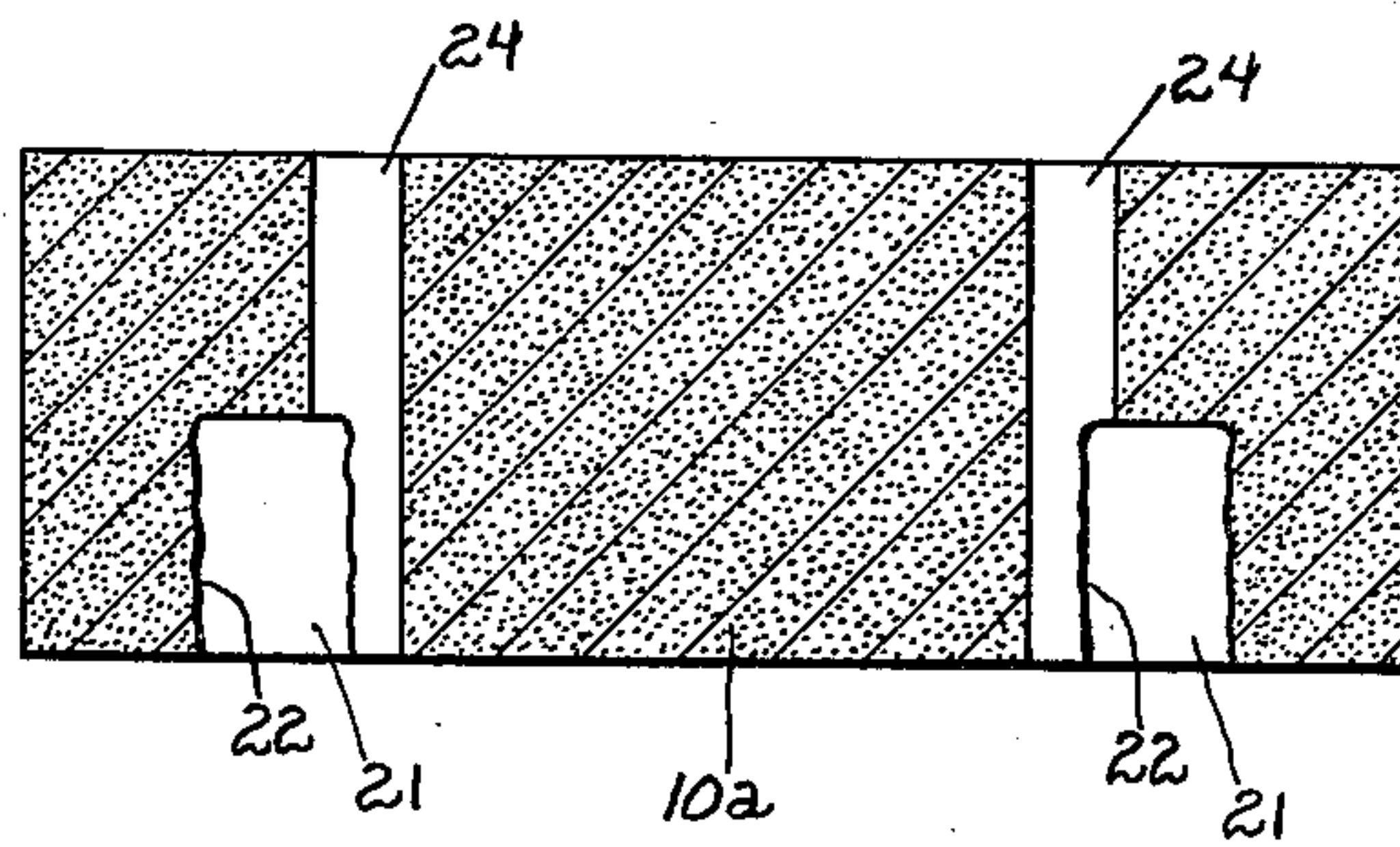


Fig. 3

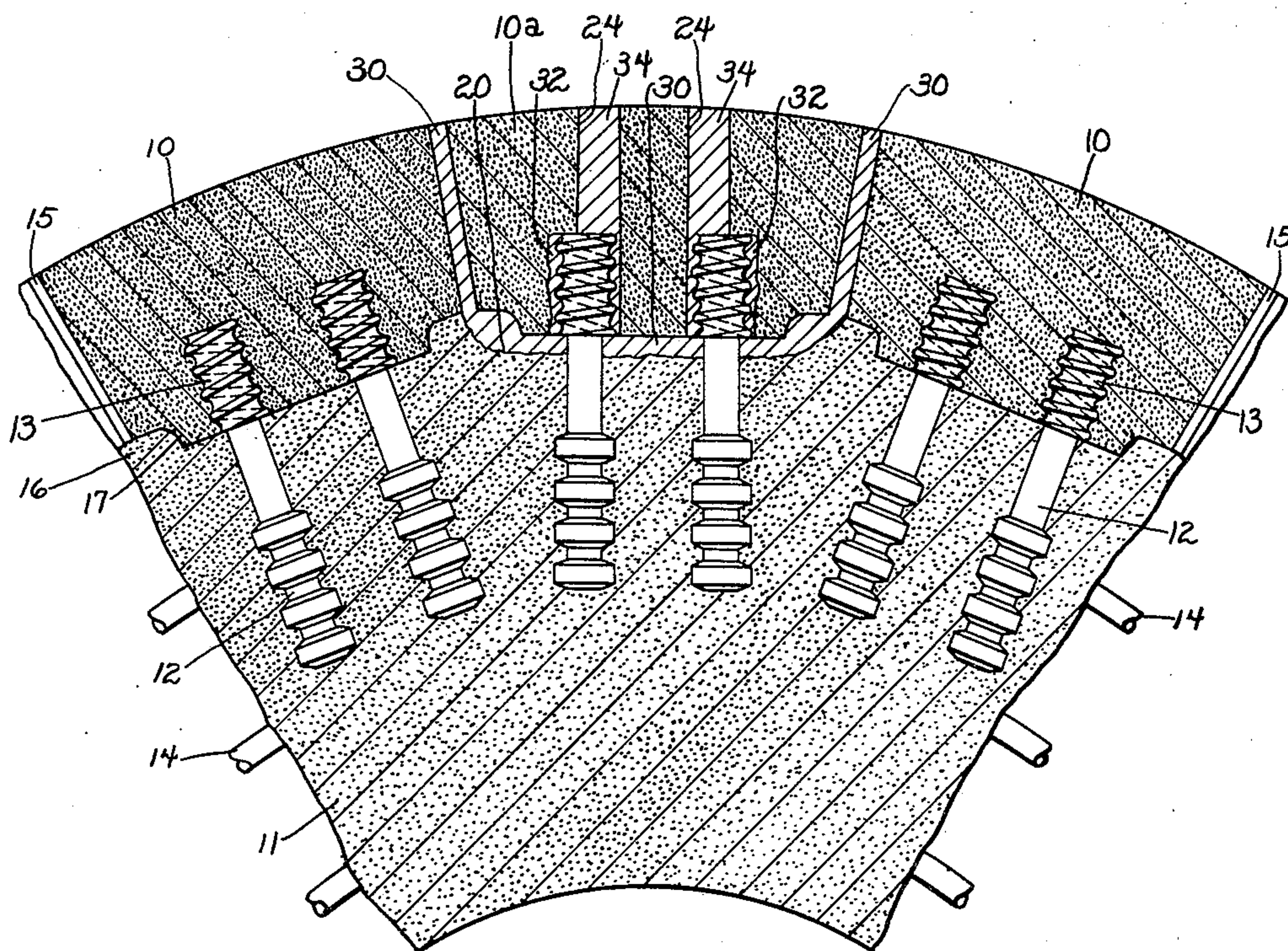


Fig. 4

Inventors
NORMAN F. HOLTER
WALTER BETH

By

George C. Gump

Attorney

UNITED STATES PATENT OFFICE

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REPAIR OF PULPSTONES

Norman F. Holter and Walter F. Beth, Worcester,
Mass., assignors to Norton Company, Worcester,
Mass., a corporation of Massachusetts

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2 Claims. (Cl. 51—206.4)

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The invention relates to pulpstones and the repair thereof.

One object of the invention is to repair a pulpstone one or more blocks of which have broken or come out. Another object of the invention is to provide a repaired pulpstone, that is to produce a satisfactory pulpstone from one in which one or more blocks are broken or missing. Another object is to provide a method and repaired structure for a pulpstone of the type disclosed in U. S. Letters Patent No. 2,421,885 to Wallace L. Howe and Lorenzo S. Washburn, patented June 10, 1947.

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, arrangements of parts, and in the several steps and relation and order of each of said steps to one or more of the others thereof, all as will be illustratively described herein and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings illustrating one of many possible embodiments of the mechanical features of this invention,

Figure 1 is a fragmentary cross sectional view of a pulpstone with one block missing, the rubber filler or joint material having been scraped off and the concrete of the center having been chipped away to a depth of one half inch, more or less,

Figure 2 is a bottom plan view of a replacement block,

Figure 3 is a fragmentary sectional view of the block of Figure 2 taken on the line 3—3 thereof,

Figure 4 is a view similar to Figure 1 showing the replacement block in place.

Pulpstones constructed in accordance with the aforesaid patent to Howe and Washburn have proved superior in practical use to any other pulpstones heretofore known and breakage thereof in normal use has been practically nonexistent. That is to say, we understand that in no case has a block or segment broken or come loose from a Howe and Washburn pulpstone attributable to weakness of or defect in the pulpstone itself or the block or segment. But, in the paper mills, the pulp grinders still occasionally malfunction, usually by way of failure of the water supply. In such cases differential thermal conditions can be created which no large stone could withstand. In such cases one or more blocks or segments cracks,

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breaks or comes loose thus making the stone useless for the time being.

Each pulpstone represents a large investment and it is therefore highly desirable to repair a pulpstone which has lost one or a few blocks. In fact, it is always desirable to repair pulpstones when feasible. In accordance with this invention we provide a method for the repair of a Howe and Washburn pulpstone which may also be applicable to other pulpstones and we provide pulpstones so repaired.

Referring now to Figure 1, the pulpstone of the Howe and Washburn patent comprises blocks 10 secured to a concrete center 11 by bolts 12 embedded in the concrete 11 which bolts 12 have screw heads 13 which are screwed into threaded holes in the blocks 10. The threads of the screw heads 13 are massive with a large pitch as shown. The concrete center 11 may be reinforced with steel hoops 14.

The blocks 10 are made of bonded abrasive material composed of any desired type of abrasive such as quartz, silicon carbide or fused alumina, the latter two being preferred, bonded together with suitable bonding material, vitrified ceramic bond being preferred. Each block is preferably formed from a mixture of clay or frit with abrasive, suitably plasticized as by the provision of a suitable 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 this, the block is vitrified in a kiln.

Between the blocks 10 and on all faces of each block 10 excepting the marginal faces which form the side faces of the pulpstone, are sheets 15 of filler or joint material such as described in U. S. Letters Patent No. 2,054,771 to Thure Larsson. These sheets 15 may comprise hard rubber containing cork granules vulcanized to the blocks 10, but other material might be used. The pulpstone according to the Howe and Washburn patent has integral key ridges 16 of concrete fitting in reentrant grooves 17 formed in the blocks 10 so that the pulpstone will not be torn apart by the stresses resulting from the high power input. The manner of making a pulpstone such as above described is fully set forth in the aforesaid patent to Howe and Washburn and hence will not be repeated herein.

Assuming now that a block 10 of such pulpstone has cracked or broken, the first step is to remove the cracked or broken block if it or any part of it still remains in the cavity 20. The next step is thoroughly to clean away all

joint or filler material 15 on blocks surrounding the cavity 20 and also to remove the phenolic resin or other adhesive upon the screw heads 13 of the bolts 12. (In the Howe and Washburn patent it is explained that phenol-formaldehyde "A" stage resin plasticized to the consistency of a heavy cream by means of liquid furfural is brushed onto the screw heads 13. It is further explained that after assembly of the blocks 10 and insertion of the bolts 12, the entire assembly is heated to cure the sheets 15 and the resin on the screw heads 13.) Thus, the first step is to make a thoroughly clean cavity 20, removing organic material and leaving only the stone-like blocks 10 with clean faces and the stony concrete 11 at the bottom of the cavity and clean iron or steel screw heads 13 (usually four of them) upstanding in the cavity 20.

The next step is to chip away the concrete of the center 11 at the bottom of the cavity 20 to a depth of the order of half an inch. This includes chipping away some of the integral key ridges 16. At some time the sides of the blocks 10 around the cavity should preferably be grooved or roughened. This will materially aid in cementing the new block in place.

A replacement block 10a is shown in Figure 2. This should preferably be, as to abrasive and bond, grade and structure, size and shape and temperature at which matured, the same as other blocks 10 of the pulpstone but differences in any specifications other than size and shape and strength will make little difference in the grinding qualities of the repaired stone. There are, however, some specific features to the block 10a not shared by the other blocks 10. Instead of having threaded holes to receive the screw heads 13 as do the blocks 10, the blocks 10a have oversized holes 21 with roughened or grooved walls 22 as shown in Figure 3. The holes 21 do not go completely through the blocks 10a any more than do the corresponding holes in the blocks 10, but bores 24 are formed through the blocks 10a parallel to the axis of the holes 21 and, as clearly shown in Figures 2 and 3, overlapping the holes 21, that is to say the circles of the bores 24 are partly outside and partly inside of the holes 21. Preferably as shown in Figures 2 and 3 the bores 24 have smaller diameters than the holes 21.

Just before setting the replacement block 10a, it should be soaked in water. A minute is usually sufficient time for soaking and the block 10a should be clean prior to soaking. The cavity 20 should likewise be thoroughly wetted prior to setting the replacement block 10a.

Sometime prior to setting a replacement block 10a, a grouting mixture is prepared from quick-setting Portland cement and iron chips or filings. We have found that eight pounds of Portland cement mixed with eight and one-half pounds of so-called iron hardener which is around No. 46 to No. 60 grit size cast iron makes a good grouting mixture. Sufficient water should be added to give the mixture about the consistency of a heavy paste. This grouting mixture should be made up just prior to use since it is cold-setting.

With a trowel or similar tool a quantity of the grouting mixture is placed in the cavity 20 to fill the cavity to a level about $\frac{1}{4}$ " higher than the concrete of the center 11 which was chipped away. In so trowelling the grouting mixture,

the bottom of the cavity 20 is brought to a shape very close to that which it originally had.

Now the surface of each screw head 13 and the inside of each hole 21 are coated with sufficient grouting approximately to fill the hole 21 then the block is placed in position. This should be done quickly after trowelling the grouting onto the bottom of the cavity 20 and coating the inside of the hole 21 and the surface of the screw heads 13. The replacement block 10a should be well bedded on the grouting at the bottom of the cavity 20 which can be done by tapping the block 10a with a mallet. In setting the block 10a, the holes 21 fit onto the screw heads 13 being oversize with respect to such screw heads. This approximately positions the block 10a; it should then be carefully adjusted to leave joint spaces all around the block of approximately equal size. These joint spaces will then be found to be about $\frac{1}{8}$ " to $\frac{3}{16}$ " wide.

Now grouting is forced down through the bores 24 using a rod which loosely fits the bores and then a plunger which closely fits the bores, tapping the latter slightly to insure complete filling of the holes 21 around the screw heads 13. Grouting should be forced into the bores 24 until the bores 24 are full of grouting to the level of the outer surface of the block 10a.

Now more grouting is used to fill the joints between the replacement block 10a and the original blocks 10 around the cavity 20. Thin metal strips or like tools can be used to force the grouting into position. These joint spaces are filled to the level of the cylindrical periphery of the pulpstone.

Now the replacement block 10a and the area right around it are covered with damp bags which are allowed to stay in place for about forty-eight hours. At the end of this time the bags are removed and the grouting is allowed to cure in air for twenty-four hours more before use. At any time after removing the damp bags, the replacement block 10a is chipped to bring its outer cylindrical surface even with the remainder of the stone. It will be understood that the pulpstone has presumably been in use for some time and therefore its diameter is probably a little less than when it was originally made. If the replacement block is the same size as the original blocks and the original blocks have worn down some, the replacement block 10a will stand up above the level of the other blocks, wherefor it is chipped to make it level. Chipping should be done from the outside edges to the center of the block 10a to avoid breakage. The surface of the replacement block 10a can be finished by rubbing it with an abrasive block, for example, one of the same kind as itself.

Figure 4 shows the repaired pulpstone. It is the same pulpstone as is shown in Figure 1 except that the block 10a is in place in the cavity 20. The cavity 20 around the block 10a is lined with grouting 30 which strongly adheres to the concrete center 11 and to the sides of the adjacent blocks 10. In the holes 21, grouting 32 is in contact with the roughened or grooved walls 22 and also with the threads of the screw heads 13 thus locking these screw heads to the block 10a. The bores 24 are likewise full of grouting 34 thus to make the surface of the repaired pulpstone continuous.

Should several blocks of a pulpstone not contiguous to each other become broken, each one can be replaced as herein described. Should a number of contiguous blocks of a pulpstone be-

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come broken, the entire number can be replaced as herein described up to at least four contiguous or adjacent blocks and probably more.

The sheets 15 of filler or joint material are compressible and absorb considerable expansion of the blocks due to overheating. In the repaired pulpstone the compressible joint material 15 is replaced by substantially rigid grouting 30 around the replacement block. However it is found that the compressibility of the joint material 15 beyond the blocks 10 adjacent to the block 10a is sufficient to provide for expansion under any normal conditions. At all events, pulpstones according to the Howe and Washburn patent have had blocks replaced according to this invention with entirely satisfactory results in that no further breakage has occurred.

It will thus be seen that there has been provided by this invention a method of repairing a pulpstone and a pulpstone so repaired in which the various objects hereinabove 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 above 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.

We claim:

1. Method of repairing a pulpstone of the type having a concrete center, a plurality of holding bolts embedded in said concrete center, abrasive blocks held to said concrete center by said holding bolts, and sheets of filler material between said blocks, said pulpstone having at least one block missing or broken, comprising forming a cavity by removing any broken parts of the broken block, removing the sheets of filler material around said cavity, chipping concrete from the bottom of said cavity to increase the depth of

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the cavity, providing a replacement block with oversize holes fitting over the upper ends of said holding bolts and with offset holes extending from the oversize holes to the outer surface of said replacement block, placing cementitious grouting material at the bottom of said cavity, placing the block in the cavity over said upper ends, ramming cementitious grouting material in said offset holes and from them into said oversize holes, and ramming cementitious grouting material around said replacement block.

2. Method of repairing a pulpstone of the type having a concrete center, a plurality of holding bolts embedded in said concrete center, abrasive blocks held to said concrete center by said holding bolts, and sheets of filler material between said blocks, said pulpstone having at least one block missing or broken, comprising forming a cavity by removing the filler material and the parts of the broken block, if any, providing a replacement block with oversized holes fitting over the upper ends of said holding bolts and with offset holes extending from the oversized holes to the outer surface of said replacement block, placing the block in the cavity over said upper ends, ramming cementitious grouting material in said offset holes and from them into said oversized holes, and ramming cementitious grouting material around said replacement block.

NORMAN F. HOLTER.
WALTER F. BETH.

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

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