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HYDRAULIC PAD

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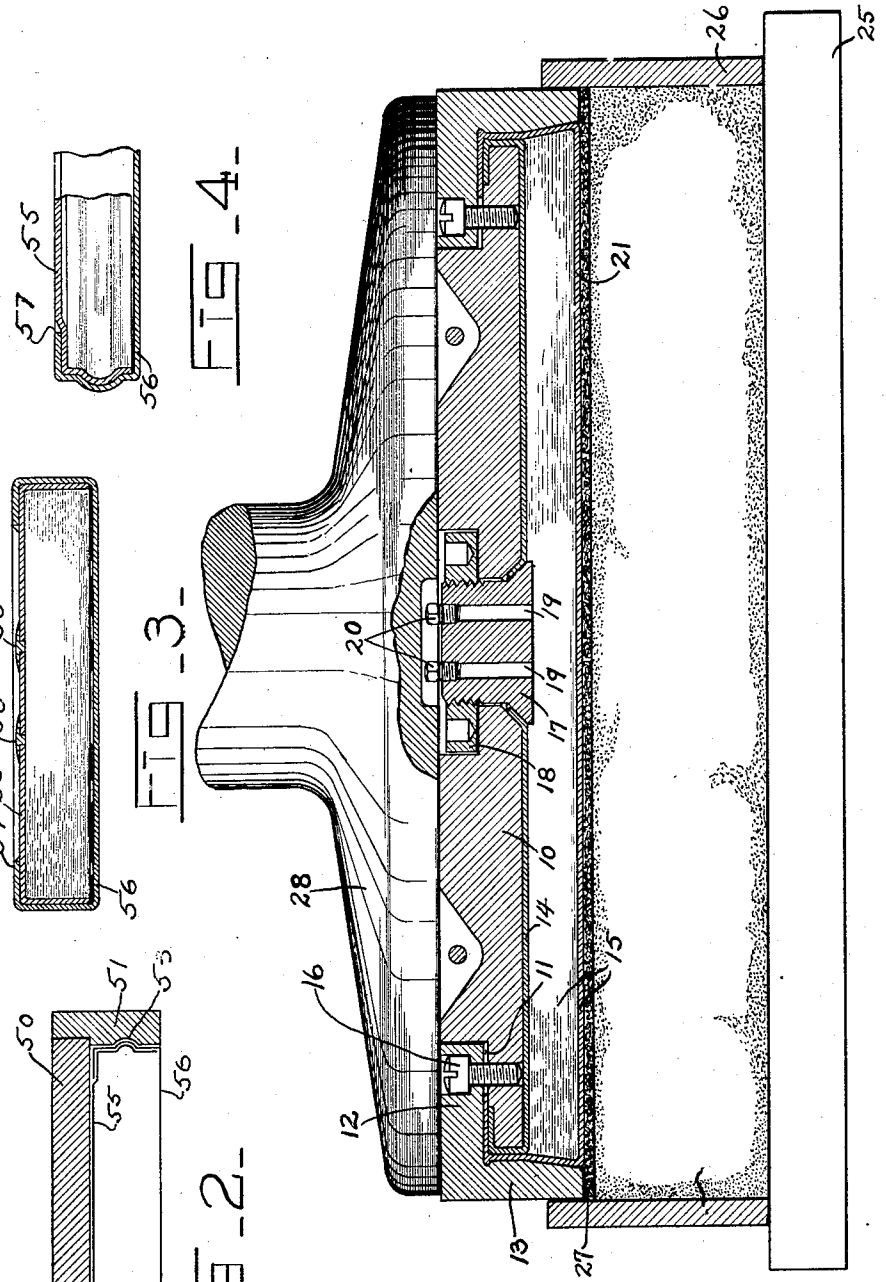

FIG. 1.

FIG. 4.

FIG. 3.

FIG. 2.

Inventor

Edward Anderson,

By F. K. Fassett,

Attorney.

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EDWARD ANDERSON, OF DAYTON, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SIMONDS WORDEN WHITE COMPANY, A CORPORATION OF OHIO

HYDRAULIC PAD

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This invention relates to a new method of and mechanism for compressing and compacting masses of loose material used in the manufacture of abrasive or grinding wheels, and its principal object is to obtain uniformity of density throughout the compressed mass. In making such wheels the granular abrasive material, together with clay and such other ingredients as are to compose the wheel, are put into a mold, usually consisting of a metallic ring lying on a platen or other flat object, having the requisite strength to withstand the pressure to which the mass of material is to be subjected. A circular platen or ram of the required size is then set in the ring and allowed to rest upon the mass of material within. This assemblage is then placed in a hydraulic press where the mass contained in the mold is subjected to very high pressure. Notwithstanding the utmost care upon the part of the operatives it has always been found impossible to distribute the mass of material over the area of the mold so that the finished wheel would have a uniform density throughout.

To overcome this trouble I interpose a hydraulic pad between the upper platen and the mass of material to be compressed. In its broadest aspect this pad consists of a disk-like closed container filled with liquid, preferably water. This container, or at least the wall of the container which lies on the mass of material, is composed of pliable material. In practice I use sheet lead for this purpose. As is well known liquid presses with equal pressure upon all portions of the wall of a container in which the liquid is confined. This property, which is given full freedom by the pliable wall of the container, causes each unit of area of the mass covered by the pad to be subjected to the same pressure to which every other unit of area is subjected. If the quantity of material in any given area happens to be less than in some adjacent area, therefore requiring the portion of the pad covering the latter area to become thicker in order to compress it to the same density as the adjacent areas, the pliable wall of the pad permits this adjustment of the stratum of water by which the pressure is communicated to the mass of material.

In the accompanying drawings, Fig. 1 illustrates one embodiment of my invention, including certain apparatus with which it is associated when in operation;

Fig. 2 illustrates a pad of simplified construction;

Fig. 3 shows a filler for the pad shown in Fig. 2, before the filler has been inserted in the casing of the pad; and

Fig. 4 is a fragmental view of the filler, showing the form which the walls of the filler assume when the pad is put under pressure.

I shall first describe the structure shown in Fig. 1. A circular metal plate or disk 10 is rabbeted at 11 to receive an inwardly extending flange 12 of a ring 13. The side of the disk opposite to the rabbet is covered with a layer of sheet lead 14, the edges of the lead extending around the edges of the disk and into the rabbet. After being thus covered the disk is placed in a sort of pan made of sheet lead, but kept some distance from the bottom 15 of the pan so as to form a closed chamber 15. The upper edges of the pan are turned into the rabbet and made to lie on the inturned edge of the cover 14. These edges are then clamped between the bottom of the rabbet and the flange 12 to form a water tight joint, screws 16 being used to clamp the parts together. At its center the disk 10 is bored and countersunk to receive a plug 17, which is secured with a nut 18. The conical head of the plug clamps the lead covering 14 and makes a water tight seal around the head of the plug. In the plug are two ports 19, each being closed with a screw plug 20. One of these is used as an inlet for water while the other serves as a vent. The chamber 15 is filled with water. For convenience I shall call the bottom of the chamber 15 the diaphragm 21.

This hydraulic pad is used in connection with apparatus which I shall now describe, still referring to Fig. 1. Upon a metal platen 25 I set a metal ring 26. This forms a mold in which the loose material to be molded is deposited. Upon the material I lay a felt pad 27 and upon this pad I set the hydraulic

pad which I have previously described. This assemblage is then placed in a hydraulic press where the hydraulic pad is pressed down on the mass in the mold with great pressure, in some cases as much as 4000 pounds to the square inch. The member 28 on top of the hydraulic pad represents the plunger of the press.

From what has been said the operation of my invention will be obvious. Because of ununiform filling of the mold the top of the mass becomes uneven, some portions projecting up higher than others. The lead diaphragm 21 readily conforms to this unevenness, and since the hydraulic pressure on all portions of the diaphragm are equal it follows that every part of the mass will be compressed to the same density. I use lead for the diaphragm because of the great pliability of this material, but other metals may be used, such as copper or sheet iron. Nonmetallic materials may also be used, leather or rubber for example. It is not necessary to cover the inside of the disk 10 with lead if the disk be made of an impervious material. For various reasons cast iron is a desirable material for this disk, but as cast iron is incapable of holding water at the high pressures used in compressing the wheels I cover the disk in the manner described. The felt pad 27 is not a necessity, its object being merely to protect the lead from grains of abrasive material, which may become embedded in the lead and gradually work their way through, causing a leak.

Instead of the hydraulic pad shown in Fig. 1 that shown in Fig. 2 may be used. This pad comprises a casing formed with a circular plate or disk 50 on which a ring 51 is secured. One way of securing the ring is to "shrink" it on. That is, the ring is put on the plate hot and upon contracting as it cools it hugs the plate tightly. To facilitate assembling the plate and ring the ring is rabbeted to form a shoulder on which the plate is made to rest while the ring is still hot.

Referring now to Fig. 2, a pan 55 is placed in a pan 56 inverted, after which the vertical wall of the outside pan is turned down over the bottom of the inverted pan, as at 57, and this turned down edge is soldered to the bottom of the inverted pan. Thus a closed container is formed. Preferably this container is made of sheet lead. After the two pans are soldered together, water is poured into the container through one of two small holes, the other hole serving as a vent. These holes are then closed with solder, as at 58—58. The container is then placed in the casing (50—51), the whole then being put into the mold as is the pad in Fig. 1. The inside of the ring 51 is provided with a groove 53, into which the minor wall of the container is forced by the pressure of the water the first time the pad is used, after which the casing and container are, for all practical purposes, integral and can be handled as an integer. The bottom of the pan 56 is also forced against the plate 50 by the pressure, so that the container, or filler as it may be called, will assume a form such as is shown in Fig. 3. The advantage of this construction is that when a filler gives out and begins to leak it can be removed and another put in its place in a moment by the workmen who is using it for molding wheels.

While I have described the use of my hydraulic pad in connection with a well known form of mold, it is not to be supposed that other molds cannot be used with equal success. If desired two hydraulic pads may be used, one on each side of the mass of material. That is, for example, the ring 26 might be made deep enough to lay a pad on the platen 25 and still have sufficient room in the ring for the required depth of material, the felt pad and a portion of the upper pad. This is so obvious that it is not necessary to illustrate it. After the wheels are molded they are shaved to the proper thickness and diameter, bored, and otherwise treated in the usual way.

Abrasive wheels made by my novel method are of such uniform density that it is not necessary to balance them. This point can be best described by referring to wheels made by methods now in use. After such a wheel is fired the central bore is fitted with a bushing composed of lead or the like, adapted to fit the arbor on which the wheel will be mounted for use. The wheel is then put on a shaft and the shaft laid on two level rails. Being free to do so the wheel and shaft roll to a position where the heavy side of the wheel, if there be such, is lowermost. Lead is then added to the bushing on the light side of the wheel, sufficient to balance the wheel. This is a delicate operation and usually requires several tests on the rails, all of which is expensive. Furthermore, balancing these wheels is at best a makeshift, as it does not correct variations in tensile strength and erodibility which are the concomitants of variations in density. Nor does the fact that a given wheel made by present methods happens not to need balancing, insure that the wheel is free from variations in density, for the balance may result from an accidental arrangement of areas of different density. In that case unequal wear, resulting from these variations in density, will soon throw the wheel out of balance, making it necessary to often "true it up", shortening the life of the wheel. Thus by my method abrasive wheels may be produced which are not merely better wheels than others, but wheels of a new kind.

It is to be understood that my invention is not limited in its practical aspects to the em-

bodiments here shown, nor is it limited to use in compressing masses of loose material as in the making of abrasive wheels. Having described two embodiments of my invention, and explained their use fully, I claim as my invention:

1. Apparatus for forming solid objects from loose material, comprising a mold, and a ram to compress the material in the mold, the periphery of the pressure face of said ram having a flange perpendicular to the face, and a container filled with liquid interposed between the face of the ram and the material in the mold, lateral expansion of said container being prevented by said flange, the wall of said container contiguous to the material in the mold being flexible.

2. Apparatus for molding grinding wheels, comprising a circular mold, a ram for pressing the material of the wheel into the mold, said ram moving in the mold in the manner of a piston, a hydraulic pad interposed between the ram and material, comprising a flat, circular, closed container filled with liquid, the wall of said container placed contiguous to the material in the mold being composed of pliable material, and a band encircling the annular wall of the container, whereby said wall is relieved of excessive strain due to lateral pressure of the liquid.

3. Apparatus for molding grinding wheels, comprising a circular mold, a ram for pressing the material of the wheel into the mold, said ram moving in the mold in the manner of a piston, a pad interposed between the ram and the material, consisting of a flat, circular closed container made of lead and filled with liquid, and a non-expandible band encircling the annular wall of said container.

4. A hydraulic pad, comprising a disk having a rabbet cut in one side of its perimeter, a ring surrounding said disk and having an inwardly projecting annular flange which lies in said rabbet, said ring being wider than the disk is thick, allowing the edge of the ring remote from the flange to extend beyond the disk to form a shallow annular basin of which the disk is the bottom and the ring the side, said basin being covered with sheet lead to form a closed chamber, which chamber is filled with water.

5. A hydraulic pad, comprising a disk having a rabbet cut in one side of its perimeter, a circular pan into which said disk is placed, with the inner face of the disk a short distance from the bottom of the pan, the edges of the pan being turned into the rabbet; a ring closely surrounding the perimeter of the pan, one edge of the ring being substantially flush with the bottom of the pan, the other edge having an inwardly turned flange which enters said rabbet and lies on the inturned edge of the pan, screws passing through said flange and threaded into the disk, whereby the edge of the pan is clamped between the disk and flange, forming a water tight joint, the space between the disk and bottom of the pan being filled with liquid, the pan being composed of pliable metal.

6. A hydraulic pad, comprising a disk having a rabbet cut in one side of its perimeter, a covering for the unrabbeted side of said disk composed of impervious material, said covering extending over the edge and into the rabbet; a circular pan into which said disk is placed with its covered face inward, but spaced a short distance from the bottom of the pan, the edges of the pan then being turned into the rabbet and made to lie on the inturned edge of said impervious covering; a ring closely surrounding the perimeter of the pan, one edge of the ring being substantially flush with the bottom of the pan, the other edge having an inwardly turned flange which enters said rabbet and lies on said inturned edges of the pan and disk covering, and screws for drawing the flange into the rabbet and clamp said edges together, said pan being composed of pliable metal, the space between the bottom of the pan and said disk being filled with water.

7. A hydraulic pad consisting of a casing comprising a disk having a ring surrounding it of sufficiently greater width than the thickness of the disk to form a shallow annular basin, and a removable filler therefor, comprising two flat major walls, substantially the diameter of said basin, joined by an annular minor wall substantially the height of the depth of said basin, said walls being joined to form a water tight container which is filled with water, said filler then being placed in said basin.

8. Apparatus for molding grinding wheels, comprising a circular mold, a ram for pressing the material of the wheel into the mold, said ram moving in the mold in the manner of a piston, a pad interposed between the ram and the material, consisting of a flat, circular closed container made of malleable, pliable, inelastic metal, filled with liquid, and a non-expandible band encircling the annular wall of said container.

EDWARD ANDERSON.