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1 H. W. DIETERT

METHOD AND APPARATUS FOR FORMING TEST SPECIMENS

OF MOLDING SAND AND THE LIKE

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2 Sheets-Sheet 1

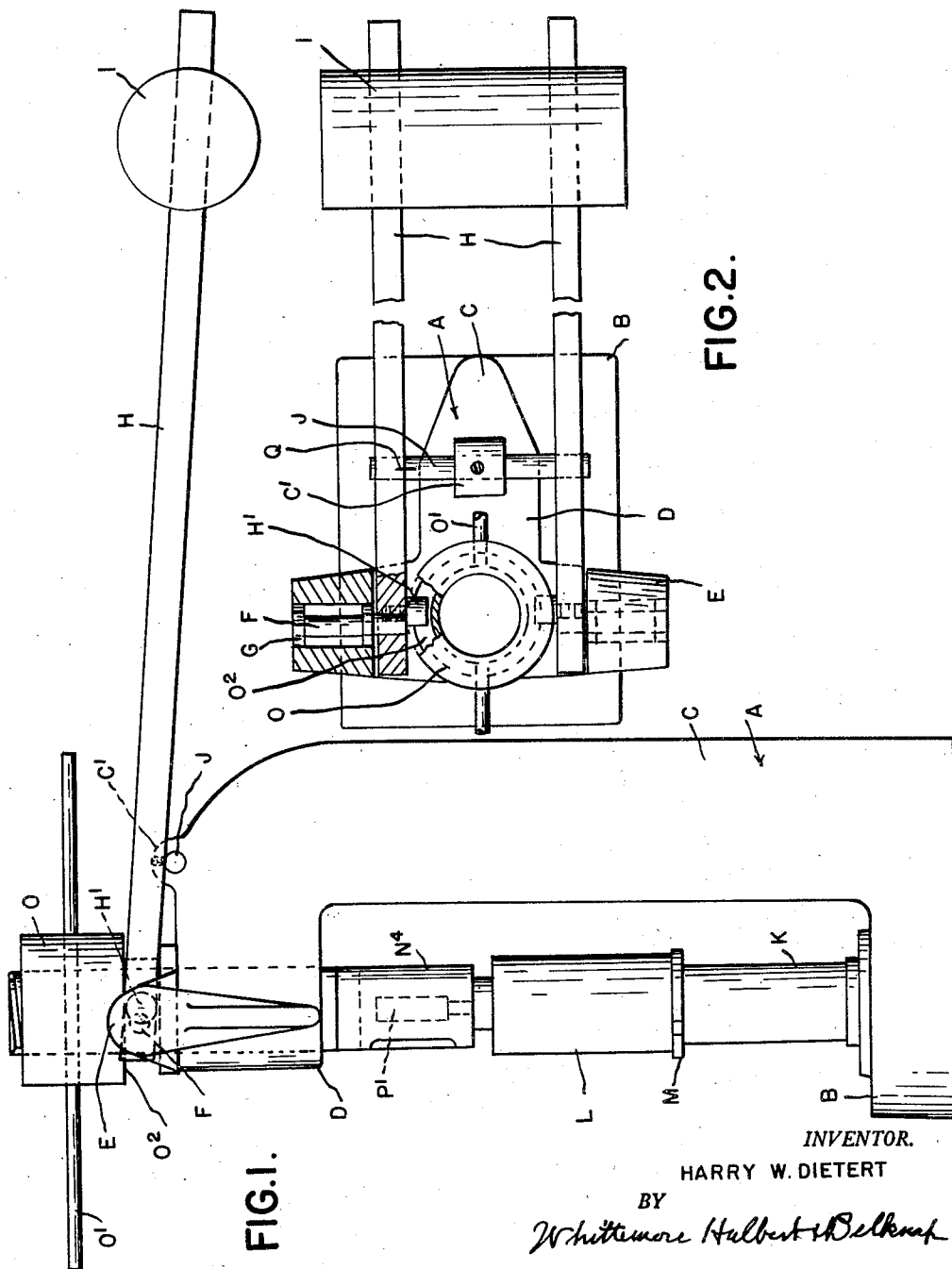


FIG. 2.

FIG. 1.

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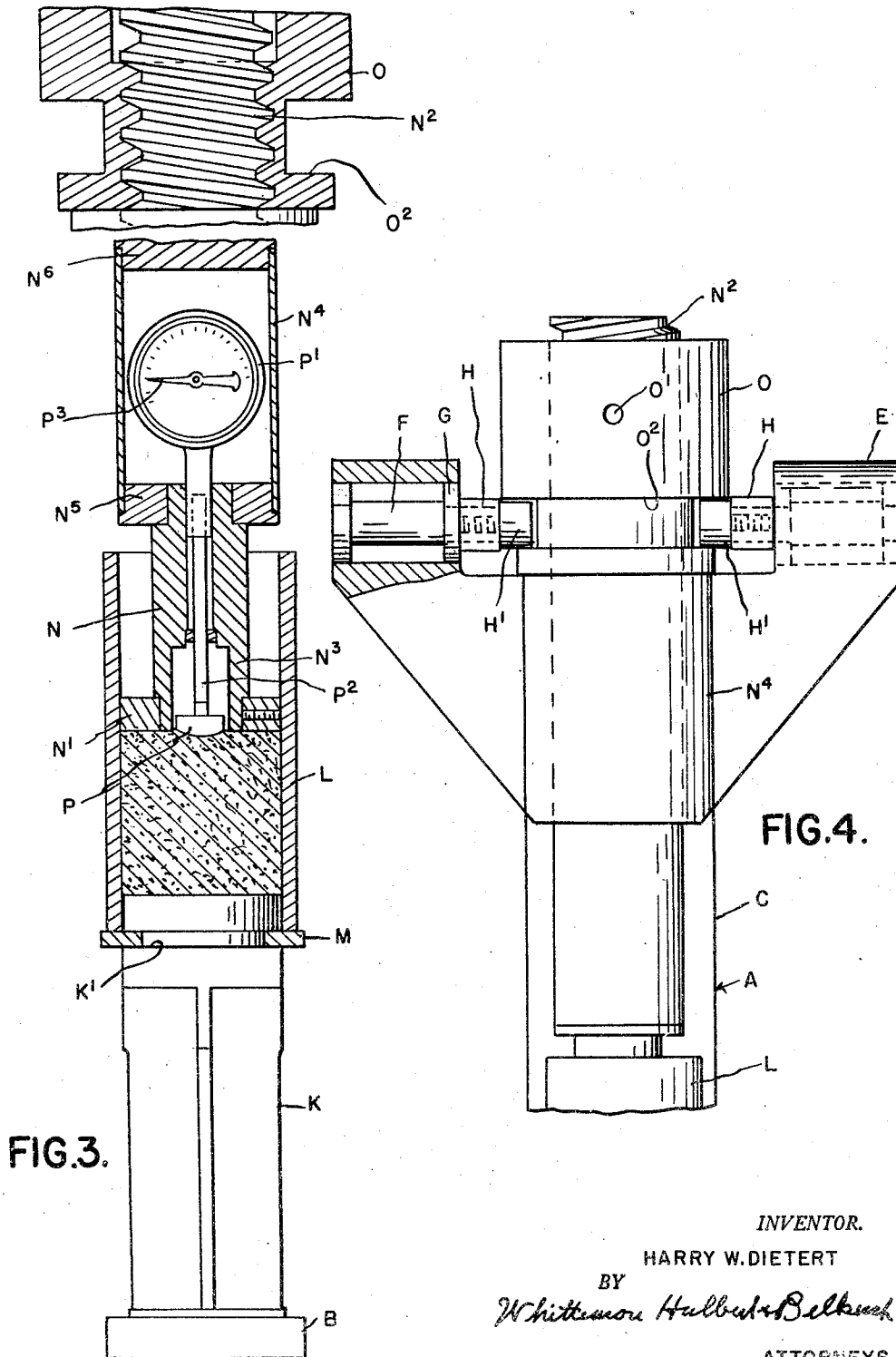


FIG. 4.

FIG. 3.

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METHOD AND APPARATUS FOR FORMING
TEST SPECIMENS OF MOLDING SAND AND
THE LIKE

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The invention relates to the forming of compacted specimens of molding sand or other similar materials to be used for various tests determining characteristics thereof. Among the tests to which such specimens are subjected are green, dry and hot strength, permeability and air-set strength, etc. It has been the practice in the past to form said specimens by ramming the material with a constant impact energy, but this does not produce the same effect in different materials varying in bonding substances and other additives in a particular sand. Good foundry practice requires that molds in the foundry should be rammed to as nearly as practical a specific mold hardness, the optimum or desirable mold hardness being obtained by choosing the one that produces the better castings. However, the various tests performed on the specimens will differ in results with different degrees of hardness of the specimen, and it is therefore important that the hardness of the specimen should correspond to the hardness of the mold which is to be formed of the materials tested.

It is the object of the invention to obtain test specimens which have a predetermined hardness substantially corresponding to the hardness of the mold to be formed of the material tested.

It is a further object of the invention to form specimens of measured hardness which is independent of the impact energy for forming the same.

The invention therefore consists, first, in the method employed for attaining such results and, second, in the apparatus by which said method may be carried out.

In the drawings:

Fig. 1 is a side elevation of the apparatus;

Fig. 2 is a top plan view thereof;

Fig. 3 is a vertical central section partly in elevation of the compacting and indicating means; and

Fig. 4 is an end elevation of a portion of the structure.

As above stated it has been the practice in the past to form specimens by a constant impact energy such, for instance, as is obtained by a plurality of droppings of a ram of predetermined weight. With my improved process the hardness of the specimen is measured during the compacting operation so that the impact may be governed to obtain the particular hardness desired. Molding sand and other flowable materials formed of separate particles behave in

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some respects similar to a hydraulic fluid in that pressure applied in one direction will be transmitted through the materials in other directions also. However, such materials differ from hydraulic fluids in that the transmitted pressures are not the same in all directions per unit of area. It is therefore apparent that the reaction of materials to impact compressive energy is not always the same and that the hardness or resistance to displacement will also vary.

To obtain a predetermined degree of hardness the reaction of the material to the impact energy is measured and indicated, and by progressively increasing this impact energy any desired degree of indicated hardness may be obtained.

My improved method may be carried out in different forms of apparatus, but as illustrated in the drawings, it is of the following construction. A is a frame including a base portion B, a column C rising therefrom and having at its upper end a laterally extending portion D also above the base and terminating in a bifurcated portion E. The furcations of the portion E extend upward above the portion D and are bored in axial alignment with each other to receive shafts F journaled in anti-friction bearings G. The shafts F are respectively secured to a pair of lever arms H which extend substantially horizontally and have adjustably mounted on their outer end portions a weight I of predetermined mass. There is also a stop or rest for these lever arms formed by a shaft J, which projects laterally on opposite sides of a lug C' on the upper end of the column C to extend beneath said arms. Thus the normal position of the lever arms will be inclined slightly in a downward direction towards their outer ends. Supported on the portion of the base B which is beneath the vertical plane of the fulcrum is a post or column K which is exchangeable and which may be either round, square or any other shape in cross sectional contour. L is a tube or casing for holding the material of which the specimen is formed, said tube being of a shape to telescope over the post K. Initially this tube L is supported on the post by clips M beneath the lower end of the tube and engaging a peripheral groove K' in the post. However, after the material is compacted within the tube L, the clips M may be removed and the tube telescoped over the post to remove it from the compacted specimen. The compacting means is a plunger N having at its lower end a head N' fitting within the tube L, and at its upper end engaging means

for pressing it downward. As specifically illustrated downward pressure is produced by a threaded nut O having radially extending actuating arms O' and engaging a correspondingly threaded upper end portion N² of the plunger N, said nut reacting against bearings on the lever arms H. More in detail the lever arms H have mounted thereon rollers H' having their axes in alignment with each other and offset from the axis of the fulcrum shafts F. These rollers project inward from the lever arms and are adapted to engage an annular groove O' in the nut O. Thus if the nut is turned in a direction to move the plunger downward it will react against the rollers H', which will initially be held stationary by the weight I, forcing said arms to rest upon the stop shaft J. This stationary position will be maintained until the reactive force against the lever arms exceeds the downward thrust thereon produced by the weight I, but if a higher pressure is developed the arms H will be lifted. Thus the construction is such as to limit the maximum force which can be applied by the plunger against the material to be compacted to that determined by the weight on the lever and which may be varied by shifting the weight to different positions.

To determine the hardness of the material compacted within the tube L by the plunger N, I have provided means for measuring the reaction of the material while subjected to compressive stress, which is indicative of hardness. This means is mounted within the plunger N and has an indicator which is at all times visible to the operator. As shown it comprises a small head P which is within a central recess in the plunger N to form a portion of the surface bearing against the material within the tube L. The plunger N has a lower hollow portion N³ and a tubular portion N⁴ of larger diameter secured to the portion N³ by a head N⁵. The upper threaded portion N² of the plunger is connected by a head N⁶ to the upper end of the tubular portion N⁴. Within the tubular portion N⁴ is a gauge P' of any suitable construction, which is operated from the head P through the medium of a plunger rod P². The gauge is visible through a window in the tube and is calibrated in units of hardness.

Consequently, when downward pressure is applied by the head N' to the material within the tube L, the portion of said material beneath the head P will react to relatively raise said head and, through the plunger P² and mechanism operated thereby, will turn the index hand P³ to indicate the hardness. If the specimen being compacted is to be used for determining qualities of the molding material when used in a mold of predetermined hardness, then the compression of such material may be continued until the gauge indicates the same degree of hardness. However, when this is once determined then the apparatus may be adjusted to automatically limit the pressure that can be applied through the plunger N to a corresponding amount. This is effected by adjusting the weight I on the lever arms H so that when the desired pressure is attained the reaction of the nut O against the rollers H' will lift the arms H off from the rest J moving them up to a horizontal position at which the resistance is at the maximum. An indicator Q on the shaft J adjacent to one of the arms H will show when said arm is exactly horizontal.

After the specimen has been compacted down-

ward pressure of the plunger N is relieved, after which the tube L may be moved downward telescoping the same over the post K and leaving the specimen free on the top of said post from which it may be removed.

What I claim is my invention is:

1. The method of forming from loose material compressed specimens of predetermined hardness, comprising applying to the material a progressively increasing compressive force and simultaneously measuring the reaction of said material independent of said compressive force which is indicative of the hardness thereof, and continuing the progressive increase of said compressive force until the desired hardness is indicated.

2. The method of forming from loose material compressed specimens of predetermined hardness, comprising applying to the material a progressively increasing compressive force and simultaneously measuring the reaction of said material independent of said compressive force which is indicative of the hardness thereof, continuing the progressive increase of said compressive force until the desired hardness is indicated, and limiting the compressive force to that amount.

3. Apparatus for forming test specimens of compacted material, comprising a container for the loose material, a plunger for compacting the material in said container, and means for measuring and indicating the reaction of the material during the compacting thereof independent of said compressive force which is indicative of hardness thereby permitting the continued compression until the desired degree of hardness is attained.

4. Apparatus for forming test specimens of compacted material, comprising a container for the loose material, a plunger fitting within said container for compacting the material therein, said plunger having an aperture therein, a smaller plunger filling said aperture, means for actuating said first plunger, and means mounted on said first mentioned plunger and actuated by said smaller plunger for measuring and indicating the reaction of the material indicative of hardness during the compacting thereof.

5. Apparatus for forming test specimens of compacted material, comprising a container for the loose material, a hollow plunger fitting within said container for compacting the material therein, a smaller plunger within said hollow plunger completing the enclosure of said container, means for actuating said first mentioned plunger, means mounted on said hollow plunger and actuated by said smaller plunger for measuring and indicating the reaction of the material indicative of hardness during the compacting thereof.

6. Apparatus for forming test specimens of compacted material, comprising a container for the loose material, a plunger fitting within said container for compacting the material in said container, means for measuring and indicating the reaction of the material during the compacting thereof indicative of hardness, actuating means for said plunger, and a yielding member for absorbing the reaction of said actuating means limiting the maximum compressive force of said plunger.

7. Apparatus for forming test specimens of compacted material, comprising a container for the loose material, a plunger fitting within said container for compacting the material in said

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container, means for measuring and indicating the reaction of the material during the compacting thereof indicative of hardness, actuating means for said plunger, a yielding member for absorbing the reaction of said actuating means limiting the maximum compressive force of said plunger, and means for adjusting said limit.

8. Apparatus for forming test specimens of compacted material, comprising a container for the loose material, a plunger fitting within said container for compacting the material in said container, means for measuring and indicating the reaction of the material during the compacting thereof indicative of hardness, actuating means for said plunger, a lever for absorbing the reaction of said actuating means and limiting the compressive force of said plunger, and an adjustable weight on said lever for changing the limit.

9. Apparatus for forming test specimens of compacted molding material, comprising a base, a column and an adjacent standard rising from said base, a mold telescopically engaging said column, means for temporarily supporting said mold on said column to extend above the upper end of the latter to receive and hold the loose molding material, a plunger engaging said mold

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above the material therein and having an upwardly extending threaded portion, a nut engaging said threaded portion, a bifurcated lever fulcrumed on said standard and embracing said nut, being adapted to bear downward thereupon at diametrically opposite points adjacent to said fulcrum, a weight adjustable on said lever, means for rotating said nut to move downward said plunger with a force limited by the resistance to upward movement of said weighted lever, and a gauge mounted on said plunger in operative contact with the material being compacted within said mold for indicating the hardness thereof during the compacting operation.

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