July 9, 1940. C. ZAMBONI 2,207,502

APPARATUS FOR TESTING HARDNESS

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FIG. 1.

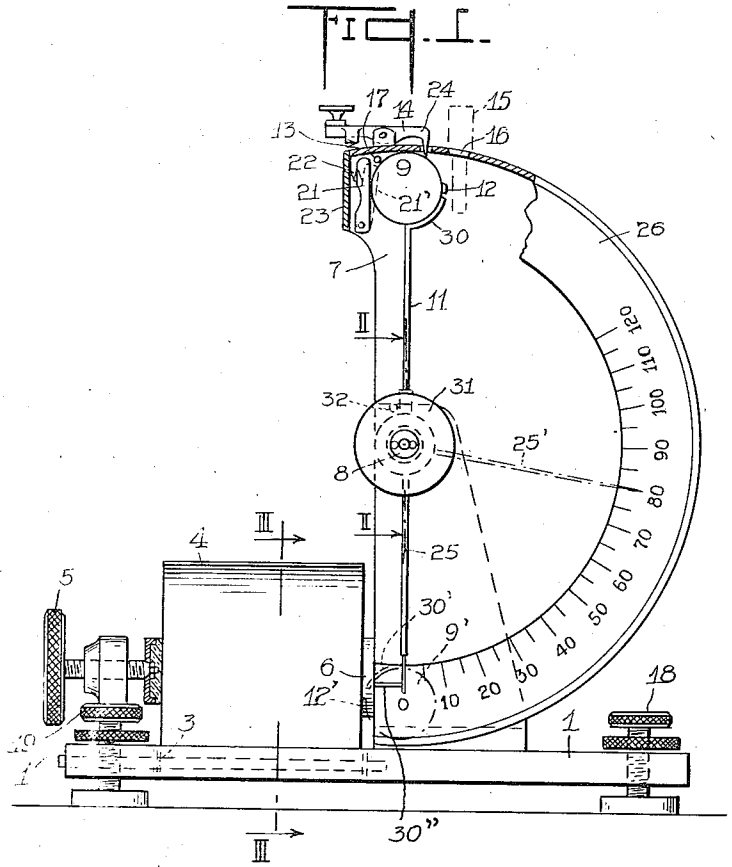
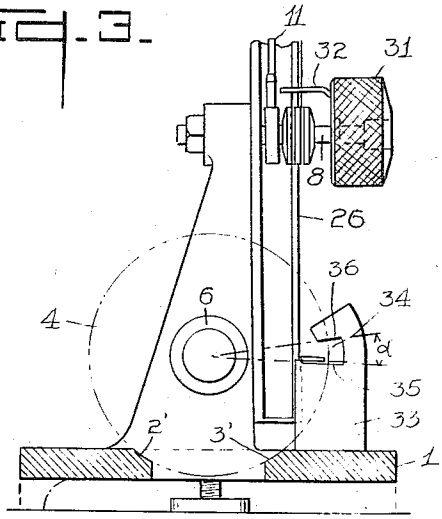


FIG. 3.



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FIG. 2.

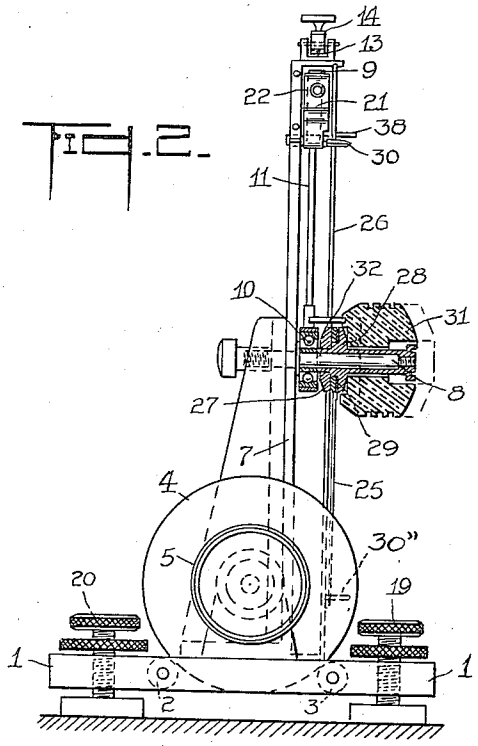


FIG. 4.

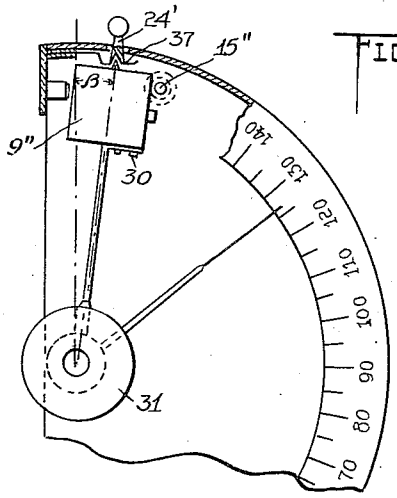
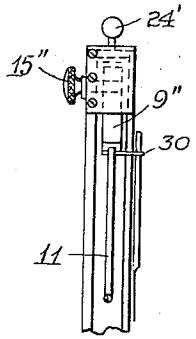


FIG. 5.



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APPARATUS FOR TESTING HARDNESS

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In Italy March 13, 1936

2 Claims. (Cl. 265—13)

The present invention relates to apparatus for testing the hardness of materials, and particularly of hardened cement pastes and conglomerates, by measuring the rebound of a pivotally suspended hammer striking against a test bar of the material to be examined.

One object of the present invention is to produce an apparatus, in which the hammer has a relatively small completely flat impact surface which remains practically constant regardless of wear and tear.

Another object of the invention is to provide for an arrangement in which each individual test bar can be tested successively at a plurality of different points in an easy and effective manner.

A further object of the invention is to produce a device in which a pointer suspended independently of the hammer is entrained by the latter in the direction of rebound only and is retained automatically in the maximum position, whereupon the hammer and the pointer may be reset to their initial positions by means of a hand-operated device.

The invention is illustratively exemplified in the accompanying drawings, in which

Fig. 1 is a front elevational view, partly in section, of one embodiment of the invention.

Fig. 2 is a substantially elevational side view of the device shown in Fig. 1, with one of the outer parts omitted to show the inner arrangement and taken partly in section on line II—II of Fig. 1.

Fig. 3 shows a modification of the lower part of the apparatus in a sectional view taken on a line corresponding to line III—III in Fig. 1.

Figs. 4 and 5 illustrate the upper portion of a modified form of the invention in a partially sectional front view and in side elevation, respectively.

Referring now to Figs. 1 and 2, the apparatus comprises a base 1 provided with two rollers 2 and 3 which support a cylindrical test bar 4 of the material to be examined. The two rollers 2 and 3 allow an easy rotation of the test bar so that different parts of the same flat surface may be exposed successively to the rebound test.

During the test the bar is locked by means of a screw 5. The screw 5 presses the test bar slightly against a lateral projection 6 of an upright 7, which latter supports the pivot pin 8 of a hammer 9.

The hammer 9 is mounted on a ball bearing 10 by means of an arm 11 which is rigid and light at the same time. The mass of the hammer 9 consists preferably of steel and has a suitable weight in proportion to the length of the arm 11, to the striking surface and to the purpose the hammer is intended for.

The hammer 9 is formed as a lens-shaped mass provided at its periphery with a small cylindrical pin 12 having a flat base which forms the striking face of the hammer.

The hammer 9, 11 is mounted free for a rotation of 180° from the upper vertical position down to the bottom position. It is held in the upper position by means of a spring buffer and rocking lever 13, 14. A stop pin 15 may be applied to a hole 16, in order to positively prevent the fall of the hammer 9. The upper rest position of the hammer 9 is determined exactly by a fixed stop 17 when the apparatus has been levelled by means of adjusting screws 18—19 and 20. In this position there lies against the hammer a pawl 21 actuated by the feeble spring 22 bearing against plate 23. The spring actuated pawl 21 serves to lightly displace the hammer 9 by advancing the pawl 21 to the position 21' when the point 24 of the rocking lever 14 is withdrawn from the hammer 9. The fixed stop 17 holds the pawl 21 in the position 21'.

A pointer 25 pivoting on the axle 8 indicates the degrees of rebound (that is the rebound angle) on the dial 26. For this purpose, the hammer 9, 11 is provided with a triangular projection 30 substantially in a plane perpendicular to the hammer rod 11. The projection 30 comprises an inclined cam surface to move the pointer 25 out of its path when the hammer strikes downwardly, and is provided rearwardly with a straight surface, which engages the pointer, when the hammer rebounds, whereby the pointer is entrained by the hammer during the upward stroke of the latter.

If desired the dial 26 may indicate, instead of the degrees of rebound the figures relating to the resistance to pressure per cm.^{2} of the material to be examined, said figures being previously deduced from comparative experiments.

A stop 30'' provided on the dial 26 locates the pointer 25 in its zero position. The pointer 25 is provided with a device by which it is retained in the position corresponding to the maximum rebound point. In the illustrated embodiment, a small laminated spring 29 is inserted between the ring 27 integral with the pointer 25 and the fixed flange 28. The spring 29 causes a slight friction between the flange 28 and ring 27 which does not prevent rotation of the pointer 25 but is sufficient to retain the pointer in the maxi-

mum position 25 assumed after the first rebound of the hammer.

The present apparatus operates as follows.

A cylindrical test bar 4 of the material to be examined, is placed on its seat with the cylindrical surface resting on the rollers 2 and 3. The test bar is fixed by means of the set screw 5, care being taken that the perfectly flat base of the cylinder is presented to the impact of the hammer. Then the hammer is caused to swing down from its upper position to a lowermost position in which the parts 9, 12 and 30 assume the positions 9', 12', and 30' (Fig. 1), and to rebound from the test bar, whereupon the position 25' to which the pointer is carried by the rebounding hammer and in which it is automatically retained thereafter, can be read upon the dial. After releasing the test bar by slackening the screw 5, the bar is rotated on the rollers 2 and 3 and another zone of the same face is presented to the hammer impact. The operation is repeated as often as necessary to obtain the desired approximation.

On the pin 8, there is mounted rotatably and axially displaceably a knob 31 with an eccentric pin 32 fixed thereto. By shifting the knob 31 on the pin 8, the pin 32 may be projected into the path of the hammer arm 11 and may then be rotated in counter-clockwise direction to restore the hammer 9 to its uppermost position. During this movement, the pointer 25 is carried along by the tooth 30 on the hammer 9, but is released from said tooth when it strikes a tapered projection 38 provided on the upper portion of the dial 26 (see Fig. 2). Finally the knob 31 is released and rotated in clockwise direction to restore the pointer 25 to its original position.

Fig. 3 illustrates a section taken substantially on line III—III of Fig. 1 but showing some modifications. The test bar 4 is supported, instead of on rollers, on flat, tangential surfaces 2', 3', which are of a simpler construction. Furthermore a member 33 is fixed to the base 1 and provided with a notch 34 whose bottom face 35 serves for tracing four reference signs on the adjacent base of cylinder 4, while the upper face 36 of said notch 34 may be referred to when the cylinder 4, between two subsequent tests, is subjected to an angular displacement α to avoid the repetition of impacts on the same point.

Figs. 4 and 5 show another modification of the invention. The mass of the hammer 9'' is of parallelepipedon-like form for simplifying the construction and is held in its upper position by means of a stop 24' cooperating with a projection 37 of mass 9''. The centre of gravity of the mass 9'' is declined from the vertical by an angle β, whereby the spring 22 of Fig. 1 can be omitted.

As shown clearly in Fig. 5, the mass 9'' is held in position by a transversally projecting pin 15'' having a knob handle at one end thereof.

The invention is not limited to the example of realization above specified and illustrated; changes may be introduced without modifying the characteristics as resulting from the following claims or trespassing the gist of the invention. For instance the test bar may be of prismatic shape or of another form whatever, in this case the seat serving to fix the test bar will have consequently a form different from the cylindrical one.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. In an apparatus for testing hardness, a frame comprising a support for a cylindrical test bar, and a hammer pivotally suspended on said frame and being provided with a projecting impact pin to strike the base of the cylindrical test bar at a point off center thereof, a lateral projection upon said frame for accurately locating the flat surface of the test bar in relation to the point of pivotal suspension of said hammer, screw threaded means pressing and holding the test bar against said projection, whereby physical displacement of said test bar upon impact of the hammer therewith is prevented, and spaced supports for the test bar whereby, upon the release of said screw threaded means, different portions of the flat surface of the test bar may be brought into the operative relation to the plane of movement of the hammer.

2. In apparatus for testing hardness of materials a frame embodying therein a base having an upright extending therefrom, an arcuate gauge extending from the top of said upright to adjacent said base, a projection upon said upright, a screw threaded clamping member in axial alinement with said projection, spaced supports for a test bar parallel with the axis of said clamp and said projection, whereby a test bar having a flat surface may be firmly mounted in relation to said base with its flat surface accurately positioned in relation to said upright and may be angularly adjusted in relation to said projection, a pendulous hammer mounted in said upright and having an impact pin having a flat impact surface adapted to engage the flat surface of the test bar, a gauge finger co-operating with said gauge, means carried by said hammer adapted to operatively engage and impart movement to said gauge finger in relation to said gauge upon the rebound of the hammer, and means adjacent the top of said upright co-operating with said hammer to predetermine the exact quantity of movement of the hammer in relation to the test bar.

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