April 20, 1926. 1,581,839

C. E. DAHLQVIST

APPARATUS FOR TESTING HARDNESS OF FIRM BODIES

Filed Feb. 26, 1923

Fig 1.

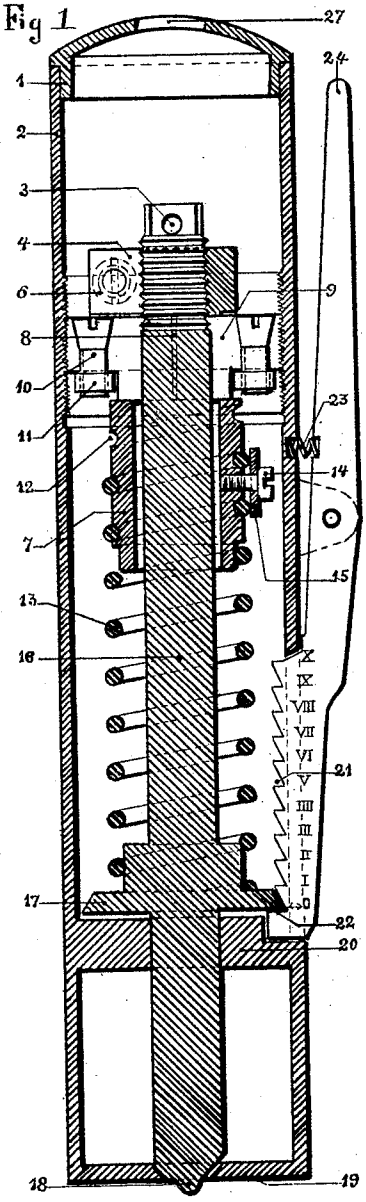


Fig. 2.

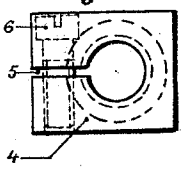


Fig. 3.

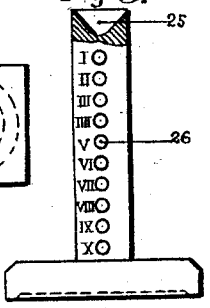


Fig. 4.

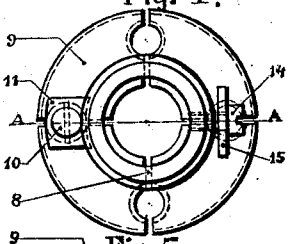


Fig. 5.

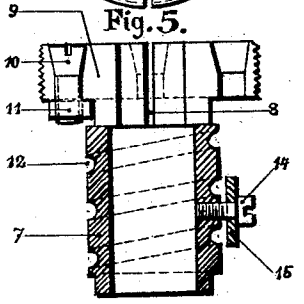
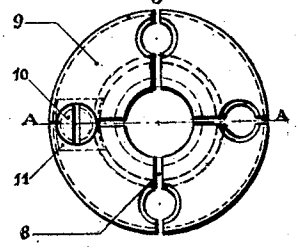


Fig. 6.



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Patented Apr. 20, 1926. 1,581,839

UNITED STATES PATENT OFFICE.

CARL EDVARD DAHLQVIST, OF STOCKHOLM, SWEDEN.

APPARATUS FOR TESTING HARDNESS OF FIRM BODIES.

Application filed February 26, 1923. Serial No. 621,388.

To all whom it may concern:

Be it known that I, CARL EDVARD DAHLQVIST, engineer, a subject of the King of Sweden, and resident of Stockholm, in the county of Stockholm, Sweden, have invented certain new and useful Improvements in Apparatus for Testing Hardness of Firm Bodies, of which the following is a specification.

The present invention relates to implements for testing the degree of hardness or resistance of solid materials, such as metals, etc.; and it embodies certain improvements whereby the spring which operates the impact element may be cocked or set without pressing the implement against the object to be tested, and whereby glancing or ineffective strokes of the impact element may be avoided, all as hereinafter fully described.

One form of the invention is illustrated, by way of example, in the accompanying drawing, wherein:—

Figure 1 is a longitudinal section of the complete implement;

Fig. 2 is a plan view of a lock-nut which is used on the impact element;

Fig. 3 is a part-sectional side elevation of a device for cocking the operating spring;

Fig. 4 is a bottom plan view of an attachment for guiding and holding the impact element;

Fig. 5 is a longitudinal section thereof on line A—A, Fig. 4; and

Fig. 6 is a top plan view of said attachment.

Referring more particularly to the drawing, 2 indicates the tubular shell or case of the implement, and 1 a cap or cover removably threaded into the upper end of the case and provided with a central opening 27. The lower end wall 19 of the case is made with a perfectly flat or plane outer face, for a purpose subsequently explained, and likewise has an opening at its center.

Within the case 2, there is slidably arranged an impact element 16 in the form of a rod or plunger having its upper portion threaded, as shown, and provided immediately above such threaded portion with a transverse opening 3; the lower end of the rod terminating in a rounded or pointed member 18 which is disposed exactly in line with the opening in the bottom wall 19 of the case. A lock-nut 4 is mounted on the threaded upper portion of the rod and is split radially at 5 (Fig. 2); the two legs produced by the split being provided with threaded screw-holes to receive a clamping screw or bolt 6 which, when tightened, will serve to lock the nut in adjusted position upon the rod, as will be understood.

The impact rod is adapted to slide longitudinally within its case, and is guided during such movement by upper and lower bearings 7 and 20, the latter of which consists merely of a transverse partition having a central opening. The upper bearing 7 is in the form of a sleeve, the bore of which is of larger diameter than the rod to enable said rod to slide freely therethrough. The upper portion of the sleeve is enlarged to form a head, and this head is split by two diametrically-intersecting cuts 8 which thus divide it into four equal sectors 9 (Figs. 5 and 6); the confronting side walls of the sectors being formed conjointly with tapering screw-holes for the reception of tapered expanding screws 10 carrying nuts 11 at their lower ends to hold them against displacement.

The peripheral wall of the sleeve head is threaded for engagement with an internally-threaded portion of the wall of the case located a suitable distance below the upper end thereof, so that it is thus possible to attach the sleeve to the case wall at any desired point within the range of the aforesaid threaded portion. The screws 10 can then be tightened to expand the head, whereupon the sleeve will be firmly locked in place. So positioned, the impact rod 16 can move freely in opposite directions through the sleeve, its downward movement being limited by the contact of nut 4 with the upper face of the sleeve.

The portion of the bore of the sleeve which extends through the sleeve head, however, is made slightly smaller than the bore of the sleeve proper (see Fig. 5), and this portion of the bore is enlarged, of course, when the expanding screws 10 are tightened, so that the rod can then pass freely through it. But when said screws are loosened, then the sectors 9 forming the head will tend to come together, thus contracting the aforesaid bore portion, with the result that the sleeve is firmly clamped to the rod. Hence, in assembling the parts, the sleeve head is first expanded to enable it to be fitted on the rod, and then contracted to lock the two parts together, after which the rod and sleeve are inserted into the case and the head thereafter locked in adjusted engagement with

the threaded portion of the case wall, thus releasing the rod from the sleeve head and leaving it free to move axially in either direction.

The working stroke of the rod is effected by means of an operating spring 13, here shown as coiled around the central portion of the rod. One end of this spring bears upon an annular shoulder or collar 17 formed upon or otherwise rigidly secured to the rod and provided with a beveled edge, while the other or upper end fits in a spiral groove 12 (Fig. 5) formed in the outer surface of the sleeve and is fastened in place therein by means of a set-screw 14 and washer 15; the locking of said sleeve to the rod preventing the upper end of the spring from turning or twisting on the sleeve when the latter is being screwed into the threaded part of the case.

As the sleeve is normally locked to the case, and as the spring 13 is of the expansible type, the tendency of said spring is to move the rod downward or outward. To provide the force necessary for the working stroke of the rod, the spring is cocked or compressed to an extent depending upon the character and thickness of the material to be tested. A preferred form of device for effecting this cocking or contracting action is shown in Fig. 3 and comprises a stem or bar provided along one side with a longitudinal series of stops 26, marked I to X, and of such a size and shape that it can pass freely through the opening in the bottom wall 19 of the case. An enlargement or base is provided on the lower end of this member, and its upper end has a seat or depression 25 formed therein to receive the terminal 18 of the impact rod, so that after the said parts 18 and 25 have been engaged, the stem or bar can be forced inward through the aforesaid opening into the interior of the case, thereby moving the rod backward and contracting the spring until the desired stop 26 reaches the case opening. One way of doing this, is to rest the device upon a suitable support by means of its base, then position the implement directly thereabove, with the parts 18 and 25 engaged, and then press downwardly upon the case until the stem of the device has moved inward to the required extent.

To retain the parts in cocked position, a detent lever 24 is utilized which also serves to uncock or release them. This lever is disposed longitudinally and exteriorly of the case, and is fulcrumed intermediate its ends in a bracket on said case, as represented in Fig. 1. The lower arm of the lever is formed along its inner edge with a series of ratchet teeth 21, marked I to X to agree with the marking of the stops 26; and immediately below the lowest tooth, which is marked I, there is a lateral projection or lug 22 serving to indicate the normal position of the impact rod and marked 0. The portion of the case immediately opposite the toothed portion of the lever is formed with a longitudinal slot or opening, through which the said portion of the lever projects, due to the action of a spring 23 interposed between the case and the upper arm of the lever and, hence, situated above the fulcrum of the latter. Both the teeth 21 and the lug 22 are designed to coact with the collar or shoulder 17 on the rod; and in the normal or zero position of the rod, which is illustrated in Fig. 1, the lug engages the under surface of said collar, and said surface is disposed almost, but not quite, in contact with the upper face of the partition 20. The teeth 21 slant upward, as shown, so as to offer no interference to the inward or upward movement of the rod, the lever vibrating backward and forward in its slot during such movement and engaging under the collar 17 as the latter passes each tooth, so that the rod will thus be automatically locked against return movement. Inward movement of the upper arm of the lever, however, will immediately release the lever from the rod collar, and the rod will thereupon be instantly moved outward or downward by the expansion of the operating spring 13.

In order to initially balance the spring 13, one end of a beam (not shown) may be inserted through the hole 27 in the top of the case and hooked into the opening 3 in the upper end of the rod, and the required number of weights are suspended from the other end of the beam, whereupon the compression of the spring is measured.

The operation of the implement is believed to be apparent from the foregoing and, hence, to require no special explanation. It will be observed, however, that the operating spring is cocked without requiring the implement to be pressed against the material to be tested, but that, instead, this action is effected by means of the stem device illustrated in Fig. 3. Consequently, it is possible to adjust the tension of the spring and to set the impact rod with a great deal of nicety, as well as to position the flat end face 19 of the case squarely against the surface of the material. This disposition of the aforesaid end face 19 places the axis of the rod truly perpendicular to the said surface, and the rod is accordingly compelled to strike a direct blow thereagainst, all danger of a glancing or misdirected blow thus being avoided. Furthermore, it is to be noted that the operating spring acts directly on the impact rod, and that the latter itself strikes directly against the material, so that there is no waste effort such as is necessarily present when the operating or impact element and the element which strikes the work are structurally separate

and independent,—particularly if an intermediate part be positioned between those two elements. In the case just mentioned, the force of the blow is necessarily somewhat weakened, so that the depression formed in the work will not afford precise information as to the resistance of the work, whereas with my improved implement, the measurements of the depression made will give an accurate indication of the resistance.

It may finally be pointed out that the combined locking and releasing lever 24 not only performs the fuction specified, but also serves to give notice when, by reason of wear on or displacement of any of the parts within the case, a readjustment of the impact rod is necessary. As has been explained, the rod is normally held in zero position, represented in Fig. 1, in which the lug 22 on the lever catches under the collar or shoulder 17. This position it assumes automatically immediately following its working stroke, due of course to the recoiling of the operating spring after its sudden expansion. If, now, for the reasons stated, such automatic engagement does not take place that fact is at once indicated and the need for further adjustment is apparent.

I claim as my invention:—

1. A resistance-testing implement, comprising a case having one end adapted to be positioned directly against the surface of the material being tested; an impact element housed within the case and movable axially outward through said end to strike against said material; an operating spring for said element; and releasable means for holding said element in any selected one of a series of different, definite retracted positions in said case with its operating spring cocked.

2. A resistance-testing implement, comprising a case having one end adapted to be positioned directly against the surface of the material being tested; an impact rod housed within the case and movable axially outward through said end to strike against said material; an operating spring for the impact rod, said rod being movable inward of said case, against the action of said spring, to different predetermined extents; and means, operable at will, for holding and subsequently releasing said rod in and from any selected retracted position.

3. A resistance-testing implement, according to claim 1, in which the releasable holding means comprise a member having a set of ratchet teeth for selective engagement with the impact element.

4. A resistance-testing implement, according to claim 1, in which the releasable holding means comprise a member having a set of ratchet teeth for selective engagement with a shoulder on the impact element, the ratchet teeth and the edge of the shoulder being inclined or beveled in a direction to enable the free inward movement of said element.

5. A resistance-testing implement, according to claim 1, in which the releasable holding means comprise a lever pivoted intermediate its ends to the case and provided along the inner edge of one arm with a series of ratchet teeth for selective engagement with a shoulder on the impact element; and in which a spring is provided to maintain such engagement and to hold the other arm of the lever in position to effect the releasing operation.

6. A resistance-testing implement, comprising a tubular case having a bottom end wall provided with a central opening; an axially-movable impact element housed within said case; an operating spring for moving said element outward through said opening to strike against the material being tested; and releasable means for retaining said element in retracted position in said case, said end wall having a flat outer face which is adapted to rest squarely against the surface of said material and to which the axis of the impact element is perpendicular.

7. A resistance-testing implement, comprising a tubular case; an axially-movable impact element therein; fixed and movable guides in said case through which said element passes, the movable guide having means for releasably locking it to the case and to the impact element; a spring for effecting the working stroke of said element; and releasable means for holding said element in retracted position with its operating spring cocked.

8. A resistance-testing implement, comprising a tubular case; an axially-movable impact element therein; fixed and movable guides in said case through which said element passes, the movable guide having means for locking it alternatively to the case or to the impact element and simultaneously unlocking it from said element or from said case; a spring for effecting the working stroke of said element; and releasable means for holding said element in retracted position with its operating spring cocked.

9. A resistance-testing implement, according to claim 7, in which the releasable locking means comprise a sleeve having a head which is formed with a plurality of intersecting diametral cuts and which is provided with a bore of less diameter than that of the remainder of the sleeve; and in which expanding devices are adjustably inserted in said cuts to separate the cut portions of the head and thereby expand the diameter of the head bore.

10. The combination, with a resistance-testing implement comprising a case hav-

ing a bottom end member formed with a central opening, an impact element movable outward through said opening, an operating spring for said element, and releasable means for locking said element in retracted position; of a member engageable with the outer end of the impact element and adapted to be forced inward through said opening to retract said element and tension its operating spring.

11. The combination, with a resistance-testing implement comprising a case having a bottom end member formed with a central opening, an impact element movable outward through said opening, an operating spring for said element, and releasable means for locking said element in retracted position; of a member engageable with the outer end of the impact element and adapted to be forced inward through said opening to retract said element and tension its operating spring, said member being provided along one side with a series of indicating devices which correspond to different predetermined tensions of said spring and which are adapted to coact with the edge of said opening.

12. A resistance-testing implement, comprising a case; an axially-movable impact element housed therein; an operating spring for said element; and releasable means for locking said element selectively in any one of a plurality of different definite positions, said locking means and impact element constituting companion parts, one of which is provided with a set of ratchet teeth for interchangeable engagement with a projection on the other part.

13. A resistance-testing implement, comprising a case; an axially-movable impact element housed therein; an operating spring for said element; and a lever for releasably locking said element in any selected one of a plurality of different predetermined positions, said lever having a series of ratchet teeth for interchangeable engagement with a projection on said element and also having a lug at the foot of the series of teeth to normally engage said projection.

14. The combination, with a resistance-testing implement comprising a case having a bottom end member formed with a central opening, an impact element movable outward through said opening, an operating spring for said element, and a lever having a set of ratchet teeth for interchangeable engagement with a projection on said element to releasably lock the latter in any selected one of a plurality of different retracted positions; of a member engageable with the outer end of the impact element and adapted to be forced inward through said opening to retract said element, said member being provided along one side with a longitudinal series of indicating devices for coaction with the edge of the opening, said devices corresponding with said ratchet teeth in number and spacing.

In testimony whereof I have hereunto set my name this ninth day of January 1923.

CARL EDVARD DAHLQVIST.