

March 6, 1956

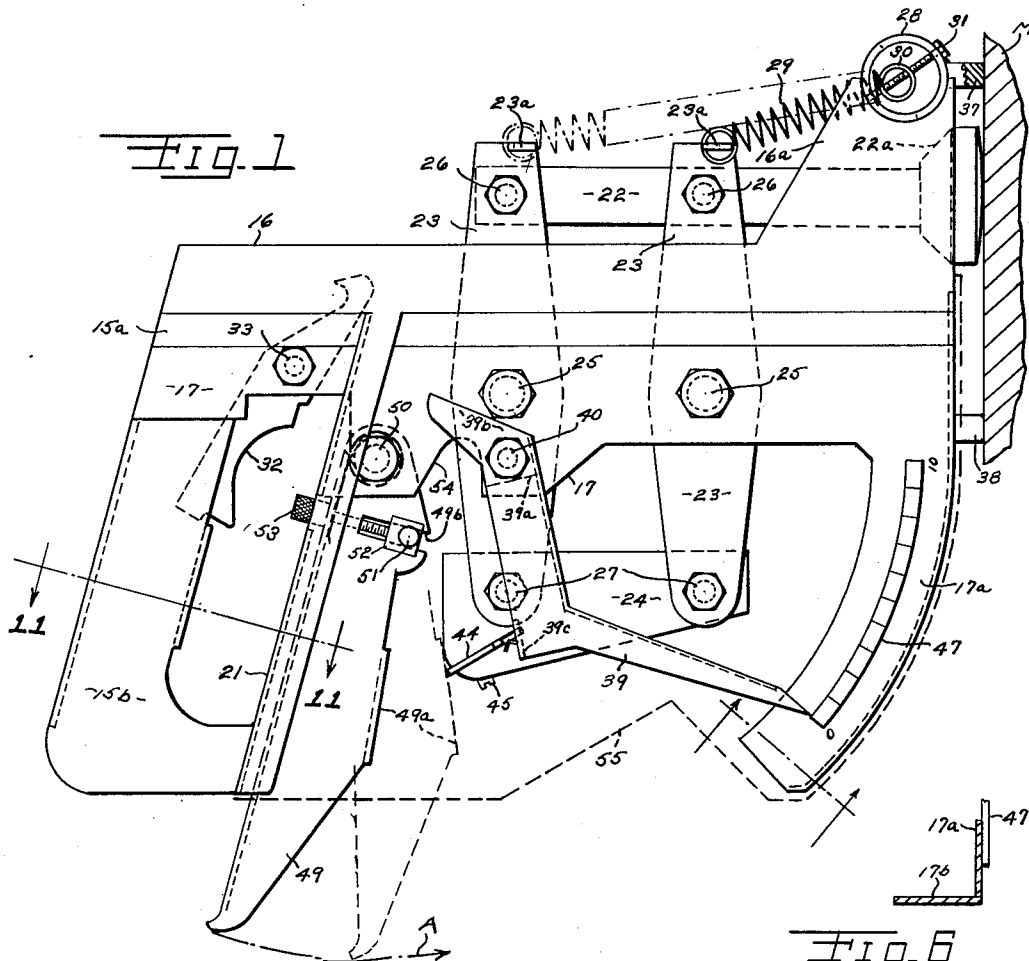
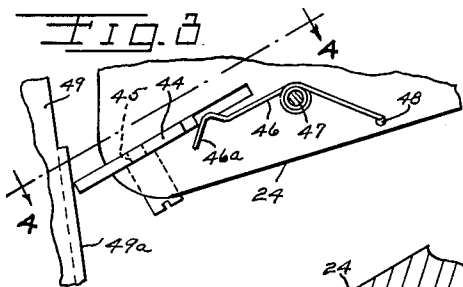
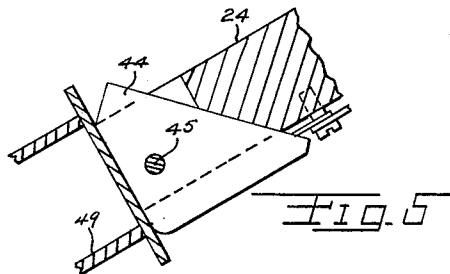
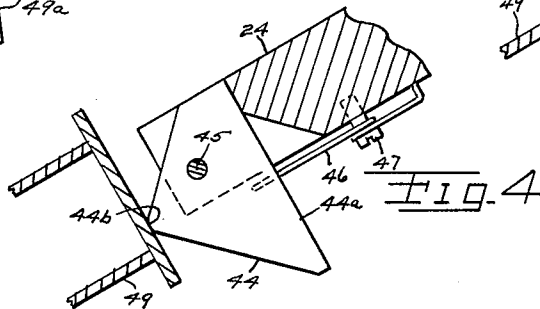
J. W. T. VAN ERP

2,737,048

MATERIALS TESTING DEVICE

Filed Jan. 12, 1953

3 Sheets-Sheet 1



INVENTOR.
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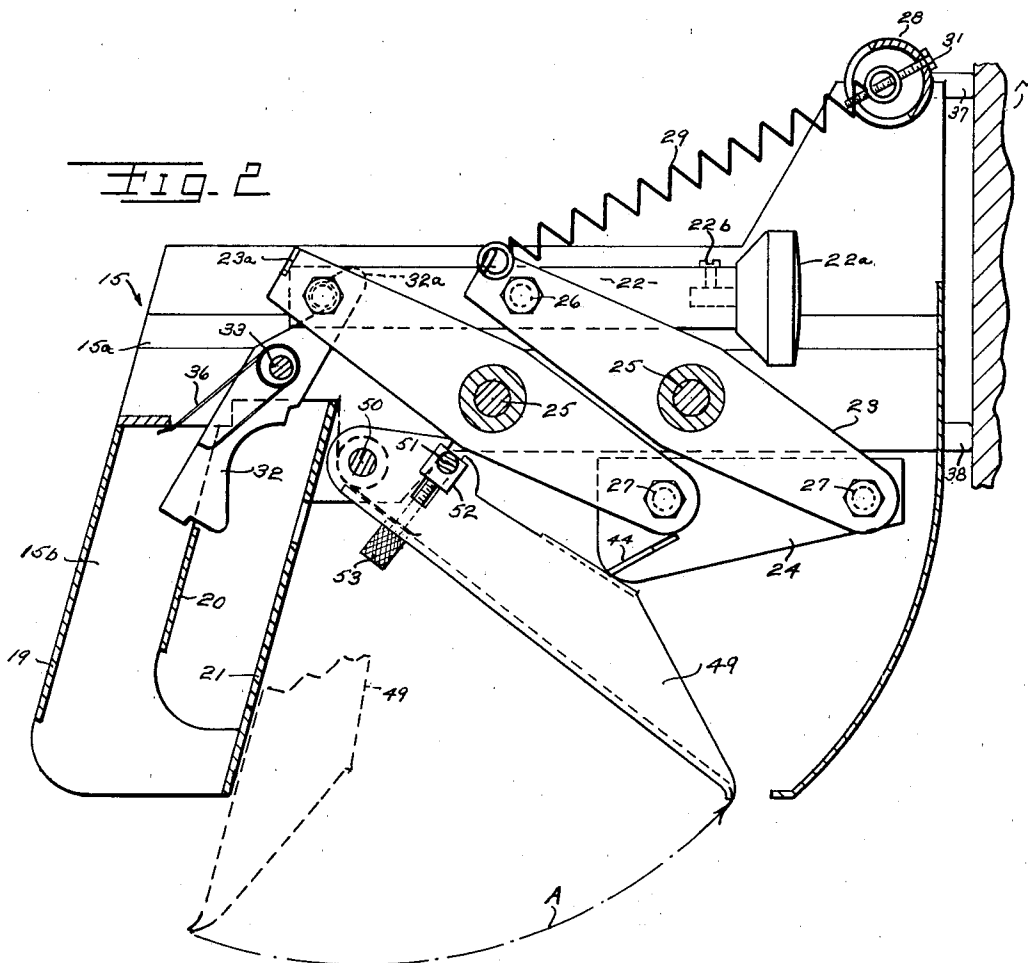
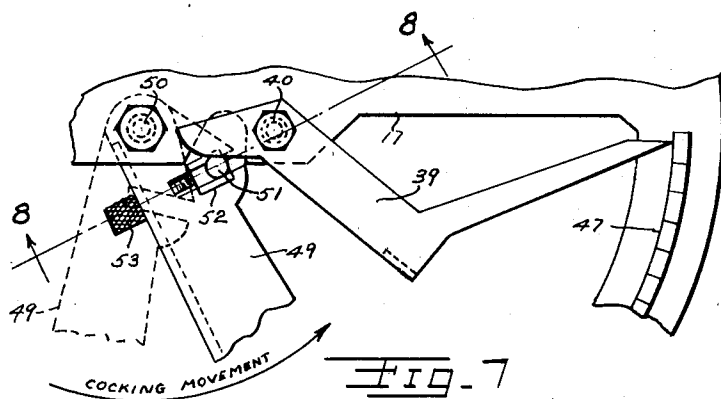
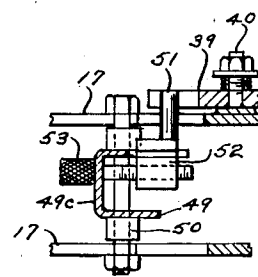
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J. W. T. VAN ERP
MATERIALS TESTING DEVICE

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Filed Jan. 12, 1953

3 Sheets-Sheet 2



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2,737,048

MATERIALS TESTING DEVICE

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Fig. 10

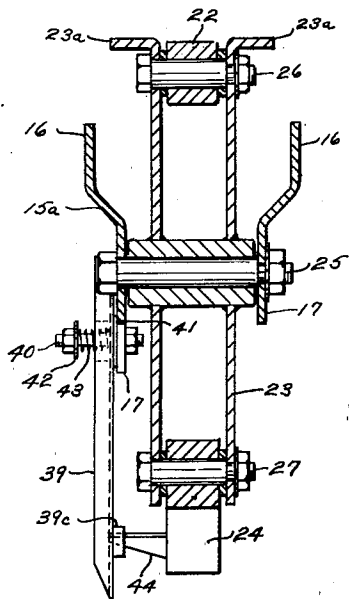


Fig. 11

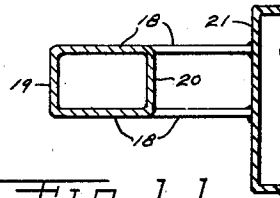


Fig. 12

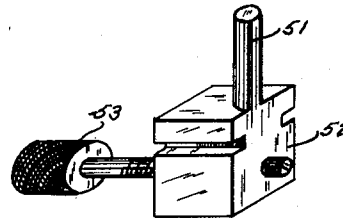
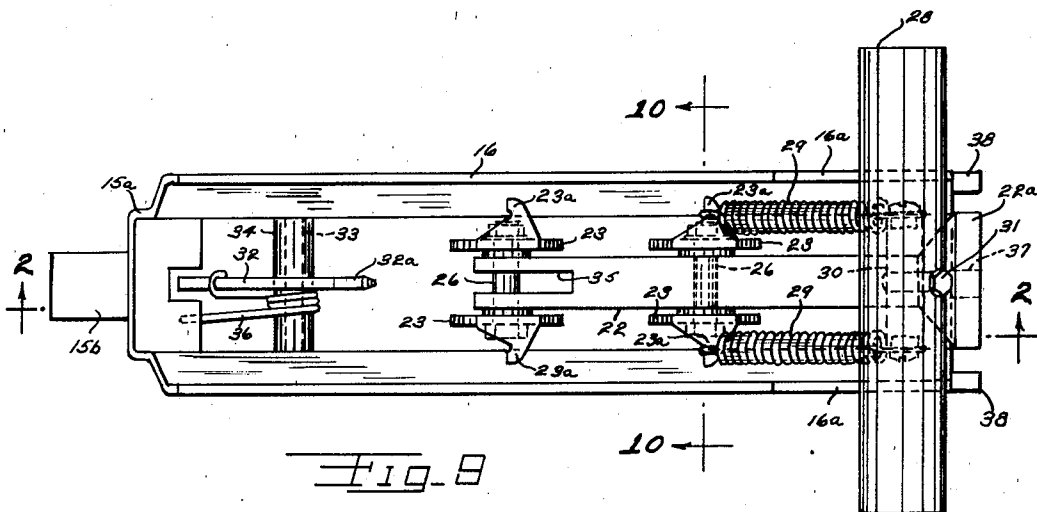


Fig. 9



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2,737,048

MATERIALS TESTING DEVICE

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Application January 12, 1953, Serial No. 330,615

15 Claims. (Cl. 73-79)

This invention relates to improvements in a materials testing device, and more particularly to one in which a hammer is caused to rebound from the material being tested, and the amount of the rebound is indicated by a pointer.

One of the objects of the present invention is the provision of a hammer assembly mounted in a frame, wherein the hammer assembly is completely balanced to eliminate the influence of gravity. This permits the instrument to be used in any position, such as vertical, horizontal, or inclined.

Another object of the present invention is the utilization of strong spring-means for producing the striking action of the hammer against the material to be tested, the arrangement being such that a very strong spring-means can be used, thus insuring the greatest depth of impact influence when the hammer strikes the material being tested, without appreciably exceeding the elastic behavior of the tested material.

A further object of the present invention is to provide stop means including a trigger for uniformly predetermining the amount of stress of the spring-means so that the blow struck by the hammer will always be uniform.

A further object of the present invention is to provide catch means interengaged between the hammer assembly and the pointer or indicator, this connection being operative only upon the rebound movement of the hammer assembly so as to carry the indicator over indicia indicating the amount of rebound of the hammer.

A further object of the present invention is to provide a lever for cocking the spring and engaging the hammer assembly with the releasing trigger, which cocking lever at the same time, during its cocking movement, pushes the pointer engaging catch into its retracted position and returns the pointer toward zero ready for the next reading.

Other objects and advantages of the present invention will be apparent from the accompanying drawings and description, and the essential features thereof will be set forth in the appended claims.

In the drawings,

Fig. 1 is a side elevational view of an instrument embodying my invention.

Fig. 2 is a longitudinally extending section through the same, taken along the line 2-2 of Fig. 9 and with the hammer assembly moved to cocked position.

Fig. 3 is an enlarged fragmental view of the lower central portion of Fig. 1 with the pointer omitted so as to more clearly disclose the pointer engaging catch.

Fig. 4 is a fragmental sectional view taken along the line 4-4 of Fig. 3.

Fig. 5 is a view similar to Fig. 4 illustrating how the cocking lever moves the catch into its retracted position.

Fig. 6 is a fragmental sectional view taken along the line 6-6 of Fig. 1.

Fig. 7 is a fragmental view of the parts found in the central portion of Fig. 1, the parts being shown in a different position in Fig. 7.

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Fig. 8 is a fragmental sectional view taken along the line 8-8 of Fig. 7.

Fig. 9 is a top plan view of the device of Fig. 1.

Fig. 10 is a transverse sectional view taken along line 10-10 of Fig. 9.

Fig. 11 is a transverse sectional view taken along the line 11-11 of Fig. 1.

Fig. 12 is a perspective view of the pointer return pin adjustment device shown in Fig. 8.

My device operates on a principle similar to that found in known hardness testing devices wherein a weight is caused to rebound from the material being tested, and the amount of rebound is measured. These previously known devices are generally usable only in a vertical position where the rebounding weight is dropped vertically downwardly, or they cannot be utilized to test materials which are part of constructions located in the field, or they have a tendency to slightly damage the material during test. My invention overcomes these difficulties in that it can be utilized in any position, it can be carried into the field for testing material in situ, it can reach into various places in constructions hitherto not adapted for testing, and it is not destructive of the material tested.

In the preferred form of my invention as shown in the drawings, I have shown a frame 15 having an upper gun portion 15a and a handle grip portion extending downwardly from the rear end of the gun portion. As most clearly seen in Fig. 10, the gun portion 15a comprises two spaced-apart generally parallel walls having upper portions 16 which are more widely spaced and lower portions 17 which are less widely spaced. The grip portion 15b, as most clearly shown in Fig. 11, comprises two generally parallel walls 18 which are rigidly welded to the gun portion 15. These walls are connected across the rear by a plate 19 and across the front by a shorter plate 20. The lower end of the handle grip portion bends forwardly and is secured to a shallow channel member 21, the upper end of which is welded to the gun portion 15a.

The hammer assembly comprises the hammer 22, a pair of levers 23, and a counter-weight 24. The hammer has a removable head 22a, made of hard steel, which is held in place by a set screw 22b. The levers 23 are pivotally mounted at 25 intermediate their ends between the walls 15a, and more particularly between the portions 17 of those walls. The linear pivots 25, supported by the frame 15, guide the hammer 22 for movement generally in a plane. The upper ends of the levers 23 are pivotally connected at 26 to the hammer 22. The distance between the pivots 25 and 26 on each lever are the same, and the distance between pivots 25 is equal to the distance between pivots 26. This provides the familiar parallel ruler arrangement. At their lower ends, the levers 23 are pivotally connected at 27 to the counterweight 24. The arrangement is such that the hammer assembly is almost perfectly balanced about the pivots 25 so that the same rebound occurs in the hammer 22 regardless of the position in which the apparatus is held when the test is made.

Means is provided for gripping the forward end of the frame when the instrument is presented to a piece of material M to be tested in the position of Fig. 1. I have here shown the portions 16 extended upwardly in ears 16a, and a tubular handle 28 is provided rigidly connected to the ears 16a and preferably extending laterally outwardly at one side or at both sides of the gun portion 15a. Other arrangements of this handle might be made, but I believed the upper forward portion of the frame is the most natural place for one hand to be placed while the other hand holds the grip portion 15b.

The means which urges the hammer toward striking position comprises two tension springs 29, which are in tension between a portion of the frame and a portion of the hammer assembly. At their forward ends, the springs pass over a yoke 30, which is held in the tubular handle 28 by means of a bolt 31. The bolt is threaded through the yoke and this permits adjustment of spring tension within certain limits. The rear ends of the springs 29 are hooked over wings 23a at the upper ends of the levers 23. One position of the springs 29 is shown in full lines in Fig. 1. A second position of these springs is indicated in dot-dash lines, where the springs have been carried to the second lever so as to place them under greater tension.

When the hammer assembly has been moved from the striking position of Fig. 1 to the cocked position of Fig. 2, means is provided for holding the hammer assembly in this cocked position. A trigger 32 is pivotally mounted between the walls 17 on a pivot 33. Spacers 34 hold the trigger in proper position centered in the gun portion 15a. The upper end of the trigger is formed into a hook 32a and the rearmost pivot bolt 26 is adapted to engage behind the hook 32a, as shown in Fig. 2, to hold the hammer assembly in cocked position. Referring to Fig. 9, it will be noted that the hammer 22 is cut away at 35 so that the bolt 26 (or a sleeve thereover) is adapted to engage the hook. A spring 36 biases the trigger counter-clockwise about the pivot 33 as viewed in Fig. 2. To release the hammer assembly, the trigger is moved in a clockwise direction by a hand of the operator holding the handle grip portion 15b. The hammer then moves from the position in Fig. 2 to the position of Fig. 1 and strikes a blow against the material to be tested M. It will be noted in Fig. 1 that the hammer 22 in striking position is at right angles to the central axis through the levers 23. Preferably, positioning members 37 and 38 are arranged to properly position the apparatus against the material to be tested. The stop members 37 are at the ends of and supported on the front of the handle 28. The lower stop member 38 is placed near the lower end of the gun portion 15a. These three stop members 37 and 38 define a plane which is the same plane as that struck by the hammerhead 22a in the striking position previously defined. This insures that the hammerhead 22a hits the surface of the test material M on the moment of impact exactly perpendicular so that there is no lateral movement and resulting friction losses of rebound energy.

An indicator or pointer 39 is pivotally mounted at 40 between the walls 17 so as to indicate the rebound of the hammer from the position of Fig. 1 after it has struck the impact blow against the material to be tested. The pointer 39 is made as light as possible so as to influence the reading as little as possible. It may be made of a thin plate bent in an L shape and it made be made of aluminum to save weight. Referring to Fig. 1, that portion of the pointer 39 below the line 39a is of such thin sheet metal construction. Above the line 39a, a weight 39b is secured to the pointer so that the weights on opposite sides of the pivot axis 40 are equally balanced. The pivot 40, as best seen in Fig. 10, is so constructed as to hold the pointer 39 by friction in any position to which it is moved. The pivot is actually the bolt 40 which passes through the plate 17, there being a brass washer 41 between the pointer and the plate 17. Nuts are provided at opposite ends of the bolt, and on the outside a washer 42 holds a spring 43 between the washer and the pointer 39 so that the pointer is always held by spring pressure against the washer 41.

Means is provided on the hammer assembly for moving the pointer 39 in its rebound indicating movement only upon movement of the hammer assembly away from the material M upon the rebound after the hammerhead 22a has struck a blow against the material. In the present instance, a catch 44 is mounted in a slot in the counterweight 24 at the lower rear end thereof, as clearly shown

in Figs. 1, 3, 4, and 5. The catch is generally triangular in shape and pivots about the point 45. Referring to Fig. 5, the normal retract position of the catch 44 is there shown. In this position, the catch 44 does not engage the pointer 39. When the hammer 22 is moving toward the right, as viewed in Fig. 1, the counterweight 24 is moving toward the left. As the hammerhead 22a strikes the material being tested, the counterweight 24 suddenly comes to a stop. Referring to Fig. 5, it will be noted that the major portion of the weight of the catch 44 is down and toward the right with respect to the pivot point 45. When the counterweight 24 stops suddenly, the inertia of the catch 44 causes it to swing from the position of Fig. 5 to the extended position of Fig. 4. The catch is held in this extended position by means of the spring 46, which is fastened about pin 47 in the counterweight and has its opposite end secured in a hole 48. The bent end 46a of the spring 46 engages against the edge 44a of the catch and holds it in the extended position shown in Figs. 3 and 4. Referring to Fig. 10, when the catch 44 is in its extended position, it engages a lip 39c, which is bent inwardly from the pointer 39. Then when the hammer 22 bounces toward the left, as viewed in Fig. 1, after striking the material M, the counterweight 24 moves toward the right and catch 44 carries the pointer 39 in a counter-clockwise direction from the position shown in Fig. 1. This causes the pointer to travel over the indicia 47 from the zero or starting point toward the indicia 10 at the opposite end. The reading on this scale may then be compared with the chart previously referred to in order to get an indication of the hardness of the material tested. Preferably, the plate 17 on one side of the frame is extended downwardly as indicated at 17a for the purpose of carrying the indicia 47. Preferably, the portion 17a is provided with a stiffening angle-forming member 17b, as shown in Fig. 6 so as to give rigidity to the portion carrying the indicia.

A cocking lever 49 is provided pivotally mounted between the walls 17 at 15. This cocking lever is generally channel form in shape, opening toward the front of the main frame. A short plate 49a ties the flanges of this channel form together at the front side of the lever. As the cocking lever moves in its cocking movement counter-clockwise, as viewed in Figs. 1 and 2, in the direction of the arrow A, the plate 49a engages against the catch 44 as seen in Fig. 4. Since the point 44b of application of force from the lever 49 provides a counter-clockwise turning movement for the catch 44 about its pivot 45, as viewed in Fig. 4, the catch will be automatically returned to its retracted position as shown in Fig. 5 upon further movement of the cocking lever 49 in its cocking direction.

Means is provided on the cocking lever for automatically returning the pointer 39 toward its zero on the scale 47. This construction is clearly shown in Fig. 12 and comprises a pin 51 carried in a block 52, which in turn rides in a notch 49b of one of the flanges of the lever 49. An adjusting screw 53 is threaded through the web 49c of the lever 49 and is also threaded through the block 52. Fig. 8 shows how pin 51 engages the pointer 39 on the left hand side of its pivot 40, as viewed in Figs. 1, 7, and 8 so as to cause counter-clockwise movement of the pointer 39 from the position of Fig. 7 to the position of Fig. 1. The plate 17 is cut away as shown at 54 to permit this pointer adjusting movement of the pin 51. The screw 53 may be adjusted by means of its knurled thumbpiece so that the pointer 39 is returned no further than just a little below the expected test readings on the indicia 47. This reduces the amount of energy used in moving the indicator upon taking the next reading, thereby increasing the accuracy of the instrument.

In use, the cocking lever 39 is moved from the broken-line position of Fig. 2 to the full-line position thereof. During the first portion of this cocking movement, as

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the lever 49 is moved from the full-line position of Fig. 1 to the broken-line position there shown, the catch 44 is moved from the position of Fig. 4 to the retracted position of Fig. 5. Further cocking movement of the lever 49 carries the hammer assembly from the position of Fig. 1 to the cocked position of Fig. 2, where it is held by the trigger 32. The final movement of the cocking lever in cocking direction causes the pin 51 to engage the end 39b of the pointer 39 and return it back toward zero on the indicia 47. The frame is then grasped by the hand grip portion 15b and by the handle 28 and presented to the material M to be tested. The stop members 37 and 38 are placed against this material to be tested. The trigger 32 is then pulled, releasing the hammer assembly to the action of the springs 29, which causes it to move rapidly from the position of Fig. 2 to the position of Fig. 1. Upon striking the material to be tested, the catch 44 is thrown outwardly to its extended position as shown in Fig. 4. Upon rebound of the hammer 22 from the material tested, the counterweight 24 moves in a counterclockwise direction about the pivots 25, as viewed in Fig. 1, and the catch 44, engaging the lip or ear 39c, carries the pointer 39 to a position along the indicia 47, which is a true measure of the rebound of the hammer from the material tested. Due to the construction at the pivot 40, the pointer remains in this position.

At 55 in Fig. 1, I have indicated in long-dash lines the outlines of a protective casing which may be placed over the moving parts. This casing may be entirely transparent or it may have a window over the indicia 47 so that the latter may be easily read.

What I claim is:

1. A materials testing device comprising a frame, a hammer assembly including a rigid hammer and linear pivot means mounting said hammer in said frame for striking movement out of said frame and for rebound movement back into said frame, said means and said frame constraining said hammer for movement generally in a plane, means counterbalancing said hammer about said pivotal connection to said frame, said frame having a face for presentation to material to be tested, means for causing said striking movement of said hammer, and means for indicating the amount of rebound of said hammer following its striking movement.

2. The combination of claim 1 wherein said mounting means is a parallel linkage system.

3. The combination of claim 1 wherein said means for causing said striking movement is spring means urging said hammer out of said frame, and stop means for uniformly predetermining the amount of stress of said spring means.

4. The combination of claim 3 including means for varying the pull of said spring means.

5. The combination of claim 1 wherein said indicating means includes a pointer pivotally mounted on said frame, a catch carried by said hammer assembly and engageable with said pointer only responsive to rebound movement of said hammer, and means for retaining said pointer in any position to which it is moved by said catch.

6. The combination of claim 5 including a cocking lever pivotally mounted in said frame, spring means between said frame and assembly for causing striking movement of said hammer, said cocking lever during cocking movement engaging said assembly and moving the same in spring-means-stressing direction, and a releasable trigger for holding said spring means stressed, and said cocking lever having a portion engaging said pointer during cocking movement of said lever and returning said pointer toward its initial starting point before any indication was made.

7. The combination of claim 6 wherein said pointer engaging portion of said cocking lever is adjustable in a

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direction to vary the amount of return of said pointer toward its initial starting point.

8. A materials testing device operable by striking a hammer against material to be tested and comprising a frame having a gun portion at the top and a handle grip portion extending downwardly from the rear end of the gun portion, said gun portion including two spaced generally parallel walls, two levers pivoted between said walls and extending above and below said walls, a hammer pivoted to the upper ends of said levers in a parallel linkage arrangement, whereby said hammer and levers and counterweight provide a hammer assembly, a counterweight pivoted to the lower ends of said levers, a trigger pivoted between said walls near the upper end of said handle portion, a tension spring connected between the upper end of said hammer assembly and the upper front part of said gun portion, a hook on said trigger in position to engage and hold a part of said hammer assembly when said spring is cocked, a pointer pivoted to one of said walls for movement in a plane parallel to said hammer movement, said pointer and counterweight moving in adjacent parallel paths, a catch on said counterweight normally retracted out of the path of said pointer but movable by its own inertia into extended pointer engaging position upon sudden stoppage of said counterweight upon said hammer striking tested material, indicia carried by said frame near one end of said pointer, and a cocking lever pivotally mounted between said walls in front of the upper end of said handle grip portion, said cocking lever engaging said hammer assembly and carrying said assembly to spring cocking position.

9. The combination of claim 8 wherein said cocking lever engages said catch during cocking movement of said lever and moves said catch into retracted position.

10. The combination of claim 8 wherein said cocking lever engages said pointer during cocking movement of said lever and moves said pointer toward its initial starting position.

11. The combination of claim 8 including a handle at the upper forward part of said gun portion.

12. A materials testing device comprising a frame, a hammer assembly including a hammer and means mounting said hammer in said frame for striking movement out of said frame and for rebound movement back into said frame, said means being pivotally connected to said hammer and to said frame, means counterbalancing said hammer about said pivotal connection to said frame, means for causing said striking movement of said hammer and assembly, means for indicating the amount of rebound of said hammer following its striking movement, said mounting means is a pair of parallel levers, each lever pivoted intermediate its ends in said frame, a pivotal connection between the upper end of each lever and said hammer, the distance between said two pivots on each said lever being the same, said frame having a substantially plane face for presentation to material to be tested, and the axis of said hammer being substantially normal to a line between the two pivots on each lever when the striking face of said hammer lies in said plane.

13. A materials testing device comprising a frame, a hammer assembly including a hammer and means mounting said hammer in said frame for striking movement out of said frame and for rebound movement back into said frame, said means being pivotally connected to said hammer and to said frame, means counterbalancing said hammer about said pivotal connection to said frame, means for causing said striking movement of said hammer and assembly, means for indicating the amount of rebound of said hammer following its striking movement, said mounting means is a pair of parallel levers, each lever pivoted intermediate its ends in said frame, a pivotal connection between the upper end of each lever and said hammer, the distance between said two pivots on each

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lever being the same, a counterweight pivotally connected between the lower ends of said levers, and the parts connected to opposite ends of said levers being approximately exactly balanced about the pivot connections of said levers within said frame.

14. A materials testing device comprising a frame, a hammer assembly including a hammer and means mounting said hammer in said frame for striking movement out of said frame and for rebound movement back into said frame, said means being pivotally connected to said hammer and to said frame, means counterbalancing said hammer about said pivotal connection to said frame, means for causing said striking movement of said hammer and assembly, means for indicating the amount of rebound of said hammer following its striking movement, said mounting means is a pair of parallel levers, each lever pivoted intermediate its ends in said frame, a pivotal connection between the upper end of each lever and said hammer, the distance between said two pivots on each lever being the same, a counterweight pivotally connected between the lower ends of said levers, and the parts connected to opposite ends of said levers being approximately exactly balanced about the pivot connections of said levers within said frame, said indicating means includes a pointer mounted on said frame for movement in a path close alongside said counterweight, a catch pivotally mounted on said counterweight, said catch having the major portion of its weight on that side of its pivot toward said pointer path whereby stoppage of said counterweight suddenly, upon striking impact of said hammer, causes said catch to be thrown from a retracted position to an extended position, and said catch in retracted position lying outside of said pointer path and in extended position lying in the path of movement of said pointer.

15. A materials testing device comprising a frame, a hammer assembly including a hammer and means mounting said hammer in said frame for striking movement out of said frame and for rebound movement back into said frame, said means being pivotally connected to said hammer and to said frame, means counterbalancing said ham-

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mer about said pivotal connection to said frame, means for causing said striking movement of said hammer and assembly, means for indicating the amount of rebound of said hammer following its striking movement, said mounting means is a pair of parallel levers, each lever pivoted intermediate its ends in said frame, a pivotal connection between the upper end of each lever and said hammer, the distance between said two pivots in each lever being the same, a counterweight pivotally connected between the lower ends of said levers, and the parts connected to opposite ends of said levers being approximately exactly balanced about the pivot connections of said levers within said frame, said indicating means includes a pointer mounted on said frame for movement on a path close alongside said counterweight, a catch pivotally mounted on said counterweight, said catch having the major portion of its weight on that side of its pivot toward said pointer path whereby stoppage of said counterweight suddenly, upon striking impact of said hammer, causes said catch to be thrown from a retracted position to an extended position, and said catch in retracted position lying outside of said pointer path and in extended position lying in the path of movement of said pointer, a cocking lever pivotally mounted in said frame, said cocking lever during cocking movement being movable into engagement with said catch in direction to return said catch to retracted position, spring means between said frame and assembly for causing striking movement of said hammer, said cocking lever during cocking movement engaging said assembly and moving the same in spring-means-stressing direction, and a releasable trigger for holding said spring means stressed.

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