Aug. 31, 1948. M. A. CHESTER 2,448,486

HARDNESS TESTER

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Fig. 1.

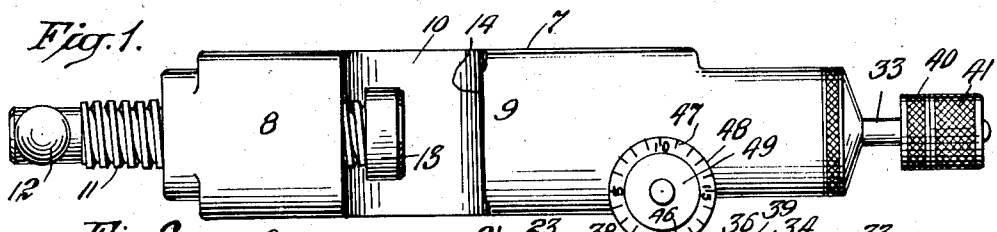


Fig. 2.

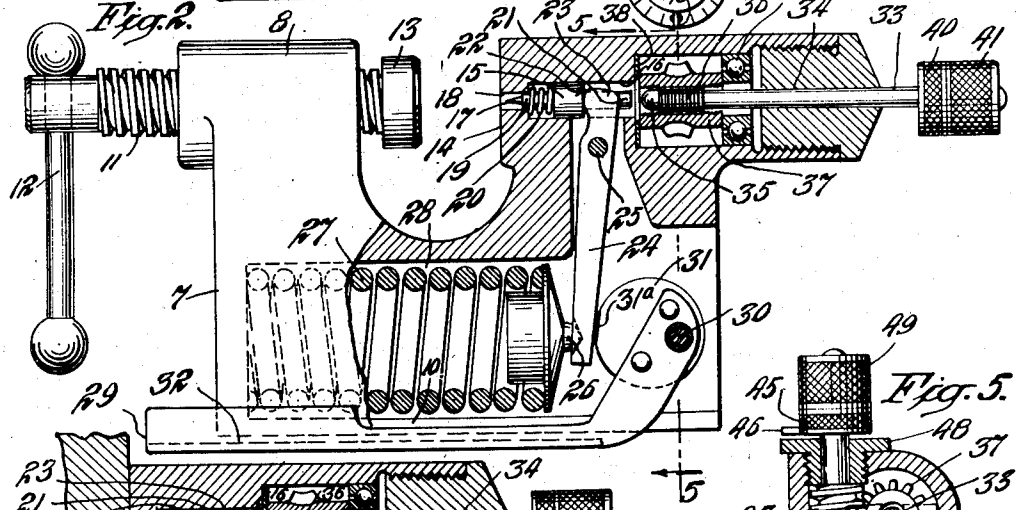


Fig. 3.

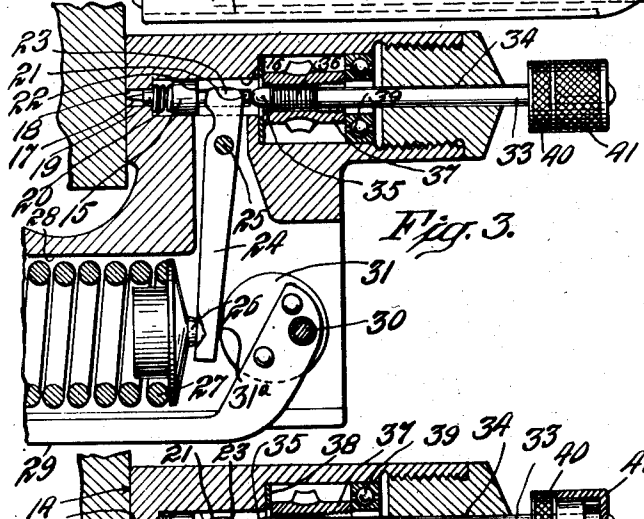


Fig. 4.

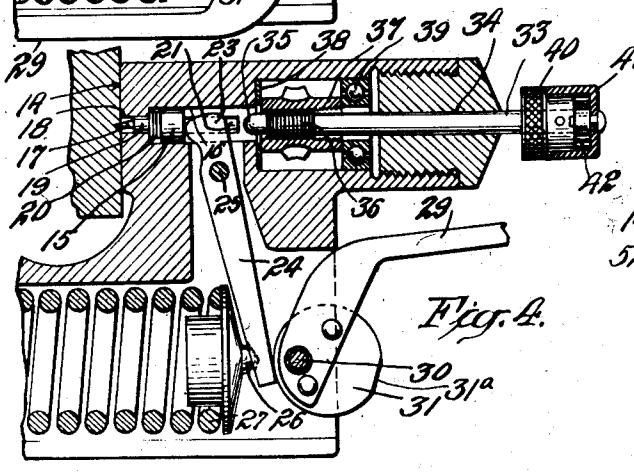


Fig. 5.

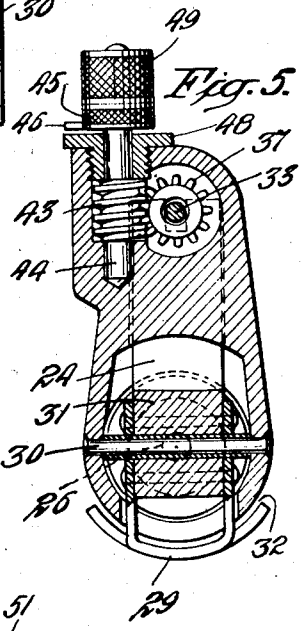
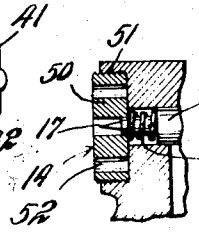


Fig. 6.



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HARDNESS TESTER

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20 Claims. (Cl. 73—81)

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The invention herein disclosed relates to instruments for testing and determining the hardness and strength of various materials.

Special objects of the invention are to provide an instrument of the character indicated, of small size, adapted to be carried in the hand or in the pocket, readily applicable to the pieces or material to be tested and accurate and reliable in its operation.

Additional objects are to provide the instrument in a simple, inexpensive form, quickly and easily understood and used.

Other desirable objects and the novel features of invention by which the above and other purposes are attained, are set forth or will appear in the course of the following specification.

The drawing accompanying and forming part of the specification illustrates a present commercial embodiment of the invention. Structure, however, may be modified and changed as regards the present illustration, all within the true intent and broad scope of the invention as hereinafter defined and claimed.

Fig. 1 in the drawing is a plan view of an embodiment of the invention;

Fig. 2 is a side elevation and broken sectional view with parts shown in the position of first clamping the piece and before setting the penetrator point in contact with the material.

Fig. 3 is a broken sectional detail similar to Fig. 2 but with the follow-up spindle shown turned inward to advance the penetrator into engagement with the piece;

Fig. 4 is a similar view showing the hand lever opened out and the spring load applied to the penetrator;

Fig. 5 is a vertical sectional view as on substantially the plane of line 5—5 of Fig. 2; and

Fig. 6 is a fragmentary sectional view of a structural detail.

The body of the device is shown in the form of a yoke 7 in the nature of a C clamp having the spaced sides or arms 8, 9, connected in such spaced relation by the back portion 10.

A screw shaft 11 is shown operating through one arm, 8, having a handle 12 at the outer end and an anvil or clamp element 13 at the inner end, the latter in opposition to a flat or other desirably shaped fixed clamping face 14.

A penetrator is shown in the form of a plunger 15 operable in a bore 16 and having a penetrating point 17 projectable through an opening 18 in the material engaging and clamping face 14. The plunger is shown as having a reduced front end portion 19 guided in the opening 18. A spring

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20 about this reduced front end portion serves to retract and to normally hold the plunger retracted in the position indicated in Fig. 2.

The opposite end portion of the penetrator plunger is shown reduced at 21, providing an annular shoulder 22 engageable by the forked inner end 23 of a lever 24 fulcrumed at 25 and engaged at its outer end at 26 by a spring 27.

With the leverage provided as indicated, the spring 27 may be relatively short and compact and small enough to be completely housed within a chamber 28 provided in the back or connecting portion of the yoke, to one side of and substantially parallel with the axis of pressure applied by the tool.

The spring load is applied to or removed from the penetrator in the illustration by a hand lever 29 fulcrumed on the body of the tool at 30, substantially in line with the axis of the spring and carrying a cam in the form of an eccentric 31 bearing on the long arm of the lever substantially in line with the point of engagement of the lever with the spring.

The hand lever is shown as hollowed at 32 to fit closely about the back of the yoke, over the spring housing therein, and the closing movement of the lever is indicated as sufficient to carry the eccentric to or beyond dead center position so as to effect holding of the handle in the unloaded position illustrated in Fig. 2.

An initial setting of the penetrator in respect to the material is effected, in the illustration, by means of a follow-up spindle 33 rotatably supported in a bearing 34 in the yoke in line with the penetrator plunger and having a rounded bearing point 35 on its inner end for engagement with the end of the spindle.

In the present illustrated embodiment of the invention, the spindle 33 has a screw engagement in the yoke by which it can be turned into engagement with the penetrator plunger and operated to adjust and set the penetrator into exact contact with the piece under test.

The screw adjustment referred to is provided in the illustration by construction of the spindle with a screw threaded inner end portion 36 engaging in a corresponding screw threaded bore in a worm gear 37. The latter is shown rotatably seated and centered against endwise movement between a thrust washer 38 and the inner rotary element of a ball bearing 39.

Fig. 3 shows how, after the piece under test is clamped in the instrument, the spindle may be screwed through the worm gear to engage the inner end of the plunger and force the latter out-

ward sufficiently to carry the penetrator point into positive engagement with the piece.

The spindle is shown as having a fixed finger hold 40 on the outer end portion of the same, with a slip thimble 41 rotatably engaged partly thereover and frictionally controlled by an enclosed helical spring 42 caught to the spindle at its inner end.

After the preliminary or initial engagement of the penetrator with the piece is effected, as in Fig. 3, the handle 29 may be opened out as shown in Fig. 4 to relieve the lever 24 of control by the cam and permit application of the full spring force to the penetrator point.

In such advancement the penetrator plunger will leave the end of the follower spindle and the extent of such separation is utilized in the illustration as a measure of the penetration. This further or follow-up movement of the spindle is accomplished in the example shown, by worm 43 in engagement with the worm gear 37 and carried by a vertically extending spindle 44 having a handle or knob 45 carrying a pointer 46 registering with micrometer markings 47 on a dial 48. A yieldingly held slip thimble 49 is shown rotatably engaged on the worm spindle 44 similar to that provided at 41 on the outer end of the follow-up spindle.

In addition to or in place of the off-center disposition, the cam or eccentric may have a slightly flattened area 31*a* for releasably retaining the handle in the folded position shown in Figs. 2 and 3. This hand lever permits the load from the spring to be gradually applied and enables an exact control of the operation at all times. Instead of a plain eccentric as shown, the cam may be shaped to automatically provide any desired action.

The retracting spring 20 holds the penetrator point housed and protected when not in use.

The invention provides a compact, pocket size tester, accurate for quantitative determination of hardness, and the worm operated micrometer screw provides easily read fine measurements.

The spring provides a constant load and the hand lever and cam afford a conveniently operable means for applying and disconnecting that load.

The markings on the micrometer scale may be in terms of hardness or other values. The anvil or clamping element 13, instead of being flat as indicated, may be notched, grooved or otherwise shaped to hold circular or other shaped pieces.

To enable ready assembly, removal and replacement of the penetrator and the substitution of different types or forms of penetrators for different kinds of materials, relative hardness, etc., the outer end of the guide passage for the penetrator may be provided by a cover 50, Fig. 6, removably engaged in a screw seat 51 and provided with recesses 52, or the like for engagement by a spanner or other tool. This cover carries the guide opening for the point of the penetrator, serves as the abutment for the retracting spring 20 and has the outer face of the same finished to form the material engaging reference surface 14. This exposed face may be curved, grooved, or otherwise shaped, the ready removability of the cover enabling quick substitution of covers with such different face shapes.

What is claimed is:

1. A hardness tester comprising a base having a reference face engageable with the piece to be tested, a penetrator on said base and movable thereon from a non-protruding to a protruding position, means for adjustably advancing said penetrator with respect to said reference face from a non-protruding position into engagement with the piece, spring means for forcing the penetrator from said adjustably advanced position into the piece, and means for measuring the movement of said penetrator from said adjustably advanced position and for indicating the value of the penetration so effected.

2. A hardness tester comprising a base having a reference face engageable with the piece to be tested, a penetrator movably mounted on said base, spring means for normally holding said penetrator in retracted position in respect to said reference face, means for adjustably advancing the penetrator into engagement with the piece, spring means on the base for forcing the penetrator from said adjustably advanced position into the piece, and means on the base for indicating the value of penetration so effected.

3. A hardness tester comprising a yoke having sides spaced to embrace the piece to be tested, a clamp member adjustable in one side of the yoke to clamp the piece against the other side of the yoke, a penetrator adjustable in said other side of the yoke toward and away from said clamp member, a spring for holding said penetrator in normally retracted position, means for setting said penetrator into contact with the piece under test, spring means on the yoke for forcing the penetrator into the piece, means for indicating value of the penetration so effected, and a hand lever arranged to effect the application and the release of the power of said spring means in respect to said penetrator.

4. A hardness tester comprising a base, a penetrator plunger operable on said base, a spring acting to hold said plunger in retracted position, a screw spindle at the back of said plunger and adjustable to advance the same into engagement with a piece to be tested, spring means for forcefully advancing the penetrator plunger, and indicating means adjustable to advance said spindle into engagement with the plunger in its advanced position.

5. A hardness tester comprising a base, a penetrator plunger operable on said base, a spindle rotatably mounted on the base at the back of said plunger, a worm gear rotatable on the base about said spindle, said spindle having a screw engagement in said worm gear and whereby it may be advanced to engage the plunger and set it into contact with a piece to be tested, spring means for applying a penetrating force to said plunger, and indicator means operable to turn said worm gear to carry the spindle into engagement with the penetrator plunger in the advanced penetrating position of the latter.

6. A hardness tester comprising a base, a penetrator plunger operable in said base, a worm gear rotatably mounted in the base at the back of said plunger, a spindle having a screw engagement in said worm gear and adapted by rotation therein to be advanced into engagement with said penetrator spindle, an indicator worm in engagement with said worm gear, and spring means on the base for applying a penetrating force to said penetrator plunger.

7. A hardness tester comprising a base, a penetrator plunger operating in said base, a lever fulcrumed on said base and engageable with said plunger at one end, a spring operable on the other end of said lever, a hand lever fulcrumed on the base and having a cam portion engaged

with the spring engaged end of said first mentioned lever, and means on said base for indicating values related to the extent of penetration accomplished by said penetrator plunger.

8. A hardness tester comprising a yoke having spaced arms connected by a back portion, said back portion having a spring cavity therein, an expansion spring housed in said cavity, a penetrator plunger operating in one of the arms of said yoke, a lever fulcrumed on said arm and extending from said spring to said plunger, a hand lever fulcrumed in said arm and having an eccentric operating on the end of the lever engaged with the spring, and penetration indicating means associated with said penetrator plunger.

9. A hardness tester comprising a yoke having spaced arms connected by a back portion, said back portion having a spring cavity therein, an expansion spring housed in said cavity, a penetrator plunger operating in one of the arms of said yoke, a lever fulcrumed on said arm and extending from said spring to said plunger, a hand lever fulcrumed in said arm and having an eccentric operating on the end of the lever engaged with the spring, and penetration indicating means associated with said penetrator plunger, said lever having a one-way driving engagement with the penetrator plunger for projecting the same and spring means for effecting retraction of said plunger.

10. A hardness tester comprising a yoke having spaced arms connected by a back portion, said back portion having a spring cavity therein, an expansion spring housed in said cavity, a penetrator plunger operating in one of the arms of said yoke, a lever fulcrumed on said arm and extending from said spring to said plunger, a hand lever fulcrumed in said arm and having an eccentric operating on the end of the lever engaged with the spring, and penetration indicating means associated with said penetrator plunger, a follow-up spindle in back of said plunger for advancing said plunger into engagement with a piece to be tested, and said indicating means including mechanism for advancing said spindle into engagement with the penetrator plunger in its position of advancement by the spring means aforesaid.

11. A hardness tester comprising a base, a penetrator plunger operable in said base and normally supported in a non-projecting position, a lever fulcrumed on the base and engaging said plunger at one end to shift the same in projecting direction, a spring operating on the opposite end of said lever, a hand level fulcrumed on the base, a cam operated by said hand lever in engagement with said spring lever to effect spring loading and unloading of the penertator plunger, and means for indicating results of penertation effected by said penetrator plunger.

12. A hardness tester comprising a C clamp having a movable anvil in one side and a penetrator in the opposite side, a spring housed within the body of said C clamp, a lever operable within the body of the clamp and extending from said spring to said penetrator, and a handle pivoted on the body of said C clamp and having a cam portion engageable with said lever for controlling spring loading and unloading of said penetrator.

13. A hand portable hardness tester comprising a small pocket size C clamp having opposed jaws relatively adjustable for clamping a piece to be tested, a normally non-projecting penetrator operating through the face of one of the jaws,

a lever for projecting said penetrator, a spring housed within the body of the C clamp at one side of the jaw portion of the same and engaging said lever, a hand lever fulcrumed on the body portion of the clamp over the spring housed therein and having an eccentric portion engageable with the spring actuated lever for controlling spring loading and unloading of the penetrator, and indicating means associated with the penetrator.

14. A hand portable hardness tester comprising a small pocket size C clamp having opposed jaws relatively adjustable for clamping a piece to be tested, a normally non-projecting penetrator operating through the face of one of the jaws, a lever for projecting said penetrator, a spring housed within the body of the C clamp at one side of the jaw portion of the same and engaging said lever, a hand lever fulcrumed on the body portion of the clamp over the spring housed therein and having an eccentric portion engageable with the spring actuated lever for controlling spring loading and unloading of the penetrator, and indicating means associated with the penetrator and including a follow-up spindle for effecting initial engagement of the penetrator with the piece to be tested, and mechanism sensible to the extent of adjustment necessary to carry the follow-up spindle from the initial setting of the penetrator to the final position of the same.

15. A hardness tester comprising a C clamp having a reference face at one side and a screw clamp operable in the other side for clamping a piece to be tested, said C clamp having a cavity in the back portion of the same, a spring housed in said cavity, a penetrator operable in the clamp from a non-protruding to a protruding position in respect to said reference face, leverage means extending from said spring to said penetrator and hand operable means on said C clamp for storing and releasing the energy of said spring.

16. A hardness tester comprising a C clamp having a reference face at one side and a screw clamp operable in the other side for clamping a piece to be tested, said C clamp having a cavity in the back portion of the same, a spring housed in said cavity, a penetrator operable in the clamp from a non-protruding to a protruding position in respect to said reference face, leverage means extending from said spring to said penetrator, hand operable means on said C clamp for storing and releasing the energy of said spring and hand adjustable means on said C clamp for effecting projecting movements of said penetrator independently of said spring actuated connections.

17. A hardness tester comprising a base, a penetrator plunger operating in said base, a lever fulcrumed on said base and cooperable with said plunger to thrust it in the penetrating direction, a spring mounted in said base and acting on said lever to apply the penetrating force thereto, a hand lever fulcrumed on the base and having a cam portion operative in the movement of said lever to load said penetrator plunger with and to unload it from the force of said spring and means on said base for indicating values related to the extent of penetration accomplished by said plunger under the loading of said spring.

18. A hardness tester comprising a base, a penetrator plunger operating in said base, a lever fulcrumed on said base and cooperable with said plunger to thrust it in the penetrating direction, a spring mounted in said base and acting on said lever to apply the penetrating force thereto, a

hand lever fulcrumed on the base and having a cam portion operative in the movement of said lever to load said penetrator plunger with and to unload it from the force of said spring and means on said base for effecting a preliminary engagement of said penetrator plunger with a piece to be tested independently of the spring loading and including follow-up indicating mechanism operative after the loading movement to indicate plunger movement accomplished thereby.

19. A hardness tester comprising a base, a penetrator plunger operating in said base, a lever fulcrumed on the base and operable on said plunger to effect advancement of the same in the penetrating direction, a spring operable on said lever to effect movement of the same in the plunger penetrating direction, a cam mounted on the base for applying and removing the effective force of said spring in respect to said penetrator plunger, a hand lever for actuating said cam to effect the reverse functions of the same, a spindle in back of the plunger longitudinally adjustable for advancing the plunger into engagement with a piece to be tested and follow-up mechanism for effecting engagement of said spindle with the plunger after the penetrating impulse applied by the spring and including means for indicating the extent or value of such penetrating movement.

20. A hardness tester comprising a base, a penetrator plunger operating in said base, a lever fulcrumed on the base and operable on said

plunger to effect advancement of the same in the penetrating direction, a spring operable on said lever to effect movement of the same in the plunger penetrating direction, a cam mounted on the base for applying and removing the effective force of said spring in respect to said penetrator plunger, a hand lever for actuating said cam to effect the reverse functions of the same, said cam having a holding portion operable under the force of the spring to yieldingly retain the cam and hand lever in position with the spring force free of the plunger and means on the base for indicating values related to the extent of penetration accomplished by said penetrator plunger under the force of said spring.

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