Feb. 12, 1935. F. H. WILLEY 1,991,238

PENETRATOR

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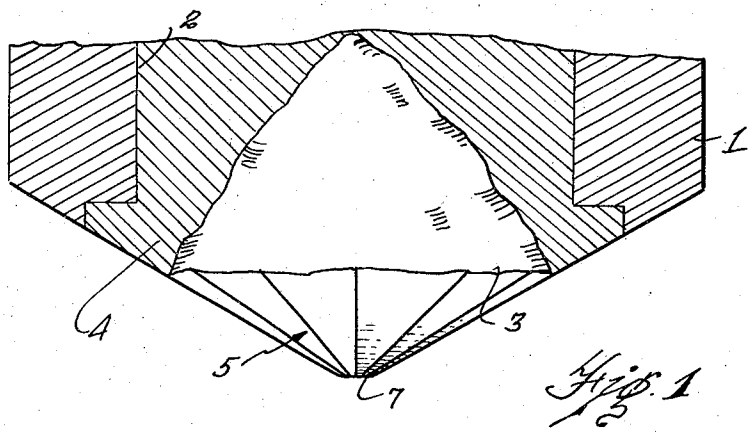


Fig. 1

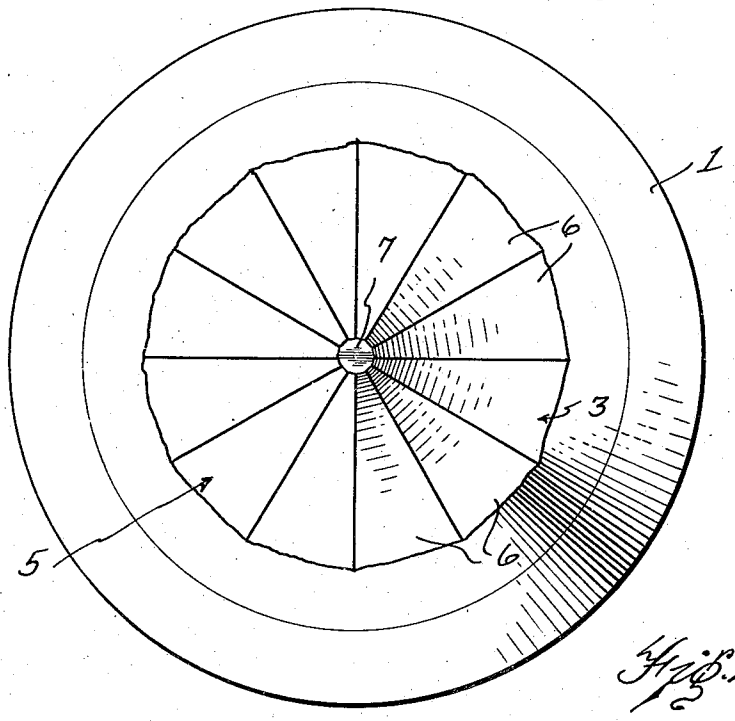


Fig. 2

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PENETRATOR

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7 Claims. (Cl. 265—13)

This invention relates to penetrators for testing penetration hardness of metal such as steel or the like. The penetrator hereinafter described is adapted for use in any of the well known types of machines for testing the hardness of the metal by penetration. In using a testing machine wherein a major and a minor load is applied to the penetrator it is usually customary to place the end of the penetrator against the surface to be tested and then apply a minor load to the penetrator then measure the depth of penetration of the indentation and then apply a heavier load to the penetrator, the difference in depth of the two indentations caused by application of a minor and major load being interpolated whereby the penetration hardness of the material may be determined. This penetrator is equally as well adapted for use in machines not using the major and minor load method of determining hardness. The common type of penetrator in ordinary use is formed with a spherical segmental tip and frustroconical sides. This type of penetrator is more or less inaccurate as it is practically impossible to form a penetrator in which the spherical segmental end has the correct curvature and the sides the correct angle and further in testing the material the rounded point of the penetrator has a tendency to drift out of vertical alignment with the longitudinal axis when a hard or soft spot is encountered during the time of penetration thereby giving an improper reading.

It has further been found that in using a penetrator of this character that the life thereof was extremely short and due to the time and labor involved in producing these penetrators the cost of operation of the testing machine was extremely high.

It is therefore an object of this invention to provide a penetrator which will give an extremely accurate hardness test due to the fact that it is possible to form the sides of the penetrator to the exact required angle and further that since the end of the penetrator is flattened that there is practically no tendency of the penetrator to drift when the major and minor loads are applied thereto.

Another object of the invention resides in the provision of a penetrator of pyramidal shape having a flattened end portion the meeting edges of the sides of the penetrator acting as a cutter whereby the penetrator may be more easily inserted in the metal thereby prolonging the life of the penetrator.

These objects and the several novel features of the invention are hereinafter more fully described and claimed and the preferred form of construction by which these objects are attained is shown in the accompanying drawing in which—

Fig. 1 is a sectional elevational view of my improved penetrator.

Fig. 2 is an end view thereof.

Referring to the drawing, the holder 1 is carried in a testing machine (not shown) and is formed with a recess 2 in which the penetrator 3 is positioned the same being held in place in the recess by pouring the molten metal 4 in the recess and allowing the same to harden whereby the penetrator 3 is held in its correct position when the metal 4 has hardened. This, of course, forms no part of the invention as any desired means may be used for holding the penetrator in the holder. The penetrator 3 is preferably a diamond and is formed with the pyramidal shaped end 5 formed by the flattened sides 6 the included angle between two opposite sides being approximately 121 degrees. The tip of the penetrator 3 is formed with the flattened end 7 which prevents any tendency of the holder 1 to drift from its longitudinal axis in the event the penetrator encounters a hard or soft spot in the metal during the testing operation. It will be further noted that the meeting edges of the flat side 6 will act as cutters during the impression operation and will permit the penetrator to more easily enter the surface of the metal being tested thereby prolonging the life of the penetrator.

From the use of this penetrator in service the conclusion is reached that its ease in penetration and the tendency of the penetrator to "drift" under load is materially decreased due to the fact that, in forming the penetrator with the series of flat faces in pyramidal form, the ridges between the faces which also extend from the point upwardly at an angle one to the other act as cutters as previously stated and as the penetration proceeds continuously extend outwardly into the metal. Thus the metal displaced or extruded by each face is segregated from that extruded by the contiguous faces whereby the pressures about the tool are equalized. With the "cone" type of penetrator previously in use, one side of the cone in penetrating metal of somewhat greater hardness than the opposite side of the cone tends to drift and thus gives an inaccurate depth reading as part of the force of the load is diverted to side pressure. By separating the surface being entered

by means of the ridges between flat surfaces which ridges extend at an equal angle one to another the metal will more easily extrude due to each separate space between the ridges being separated from that extruded by the adjacent faces.

Therefore each flat surface more readily extrudes the metal and does not tend to compact the same as is more nearly the case with the cone type penetrator. This ease of penetration and lessened tendency to compact the material as produced by my construction is of importance for the following reasons:

These penetrators are all tested as to penetration by a test block of known hardness and after repeated tests the surface of the block is removed to below the recesses formed therein by previous trials and with a cone penetrator the resurfaced metal is found to contain many hard spots and therefore does not provide a test block of uniform hardness as was its original condition. This I conceive to be due to the fact that the metal is compacted by the series of tests made thereon. With my improved penetrator the resurfaced block does not appear to in any material degree at least have lost its uniformity in respect to hardness. This I attribute to the fact as above stated, that the metal more readily extrudes and that probably the only real compression of metal forward of the point is only that produced by the metal engaged by the extreme preferably flat point penetrator which should in most cases be not greater than four one-hundredths of a millimeter across opposite sides.

It has been found that it is possible to make a penetrator of this character which is more accurate and which is cheaper to manufacture than the commonly known cone end penetrator. This is due to the fact that it is possible to use an index machine for facing the sides so that absolute precision may be obtained in making a penetrator of this character while in making a penetrator of the cone type it is necessary to rotate the penetrator at an extremely high rate of speed during the forming operation and very often an extremely slight wear in the rotating parts of the machine will form an imperfect penetrator which will not give an accurate reading when used in a testing machine.

From the foregoing description it becomes evident that I have provided a penetrator which will have an extremely long life and in which there is no tendency for the same to drift during the testing operation when the penetrator encounters a hard or soft spot in the metal, further that the device is cheaper and more accurate to manufacture than the ordinary cone type of penetrator.

Having thus fully described my invention, its utility and mode of operation, what I claim and desire to secure by Letters Patent of the United States is—

1. A device of the character described comprising a truncated pyramidal end portion, the tip thereof being a plane surface at a right angle to the longitudinal axis of the pyramidal end portion, the peripheral edge of the plane surface providing a cutting edge.

2. A device of the character described comprising a truncated pyramidal end portion, the included angle between two oppositely disposed sides thereof being substantially 121 degrees and the tip thereof being a plane surface at a right angle to the longitudinal axis of the pyramidal end portion, the peripheral edge of the plane surface providing a cutting edge.

3. A device of the character described comprising a truncated tapered end portion, the said end portion having more than three flat faces, the tip thereof being a plane surface at a right angle to the longitudinal axis of the pyramidal end portion, the peripheral edge of the plane surface providing a cutting edge.

4. A device of the character described comprising a truncated pyramidal end portion having more than three flat faces, the included angle between two oppositely disposed faces thereof being substantially 121 degrees, the tip of the pyramidal end portion being a plane surface at a right angle to the longitudinal axis of the pyramidal end portion, the peripheral edge of the plane surface providing a cutting edge.

5. In a device of the character described having a body and a pyramidal portion providing more than three practically flat faces, the ridges between the flat surfaces terminating short of the extreme tip providing a point of a uniform uninterrupted flat surface occupying a plane at a right angle to the longitudinal axis of the pyramidal portion and of approximately four one-hundredths of a millimeter, a peripheral edge of which is a cutting edge.

6. A penetrator for testing the hardness of material through penetration thereof under measured load comprising a body having a truncated pyramidal end portion having a multiplicity of practically flat faces, the included angle between two oppositely disposed faces being in the neighborhood of 121 degrees and having a flat penetrating tip occupying a plane at a right angle to the longitudinal axis of the said pyramidal end portion, the peripheral edge of the plane surface providing a cutting edge.

7. A penetrator comprising a metal body of the desired form, a tip of extreme hardness mounted in the body and having a plurality of flat side faces forming a pyramid, the hard tip terminating in a plane surface at a right angle to its longitudinal axis, the peripheral edge of said plane surface forming a cutting edge.

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