April 3, 1962 B. F. COSKI 3,027,953

PERCUSSION TOOL WITH REPLACEABLE POINT

Filed April 10, 1961

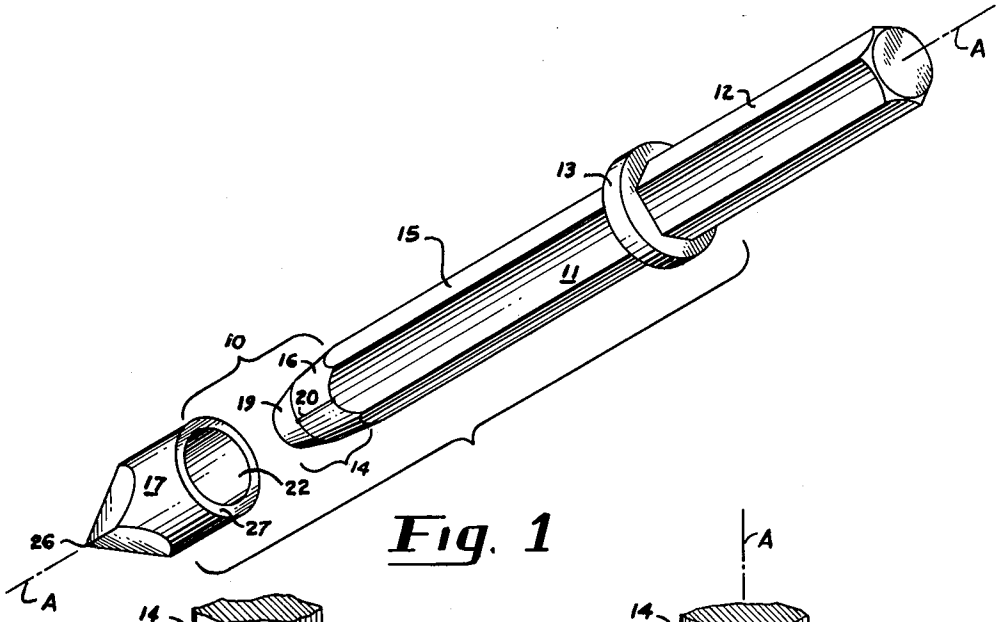


Fig. 1

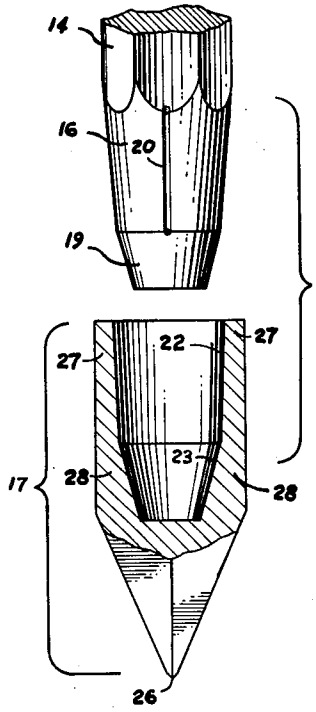


Fig. 2

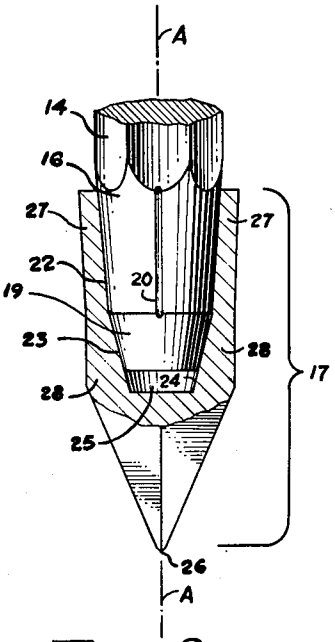


Fig. 3

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United States Patent Office 3,027,953 Patented Apr. 3, 1962

3,027,953

PERCUSSION TOOL WITH REPLACEABLE POINT

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Filed Apr. 10, 1961, Ser. No. 101,904
10 Claims. (Cl. 175—409)

The present invention relates to impact or percussion driven tools such as used with pneumatically powered jack-hammers or the like which impinge the tool against and/or into concrete, brickwork, rock, ore and other like hard materials, and in particular relates to such a tool having a replaceable, frictionally retained tool point.

The tool of the present invention differs in construction from other impact tools having replaceable points in that two sets of variously tapered surfaces are utilized, i.e. both the shank and the replaceable tip of the tool are what may be termed bi-tapered. One set of such tapered surfaces has relatively thin-walled construction and is very slightly tapered to effectively perform most of the gripping action holding the sections together, and the other set of such tapered surfaces has relatively thick-walled construction, is more tapered, and performs most of the percussion impact transmitting function. Characteristically, also, the replaceable point is fabricated from a steel or like material which can be quite hard in the point area and of lesser hardness in thin-walled gripping area, and the shank portion of the tool can be of a suitable hardened high speed drill or chisel grade steel. One of the advantages incident to the invention is that the steel used in the shank portion can be of a better grade than would be economically practical if the tip and shank had to be integrally replaced when the tip becomes worn.

By using the tool of the present invention, the advantages of the overall lower costs customarily associated with multiple sectioned non-percussive tools are fully realized without the disadvantages heretofore encountered with respect to replaceable points on percussive tools when only a single set of tapered surfaces is used. The two sets of tapered surfaces make the initial installation of the cutting point easier and also its later removal much easier and more practical than when installing or removing sections having only one set of tapered interfitting surfaces. With only one set of tapered surfaces, if too much taper is used, a holding fit without unwanted separation is hard to achieve. On the other hand, if a very shallow taper is used the resulting fit is too tight and such attempts to remove the cutting point as by hammering on the side of the point often result in the damaging or breakage of either the point or the tool shank, or both. With single tapering surfaces, sufficient dimensional release of the surrounding wall section is difficult, for the single taper construction requires side walls thick enough to absorb and transmit the pressures of the tool driving forces. In contrast, the tool of this invention has a thinner wall in the vicinity of the gripping tapered surfaces which is reasonably easily and sufficiently dimensionally relieved as by hammering to release the cutting point from the shank. The gripping wall can be made thinner because the second, more tapered surfaces transmit essentially all of the pressure of the tool driving forces.

Other advantages of the invention stem from less severe manufacturing tolerance requirements and from greater ease of both assembly and disassembly of the tool, from the capability of quick replacement of only the cutting point, of freedom from the necessity of on the job tool heating equipment and freedom from the necessity of on the job tool sharpening facilities.

These and other features and advantages of the present invention will be apparent from the following description

of a typical embodiment therein, wherein like numerals refer to like parts, and wherein:

FIGURE 1 is a composite perspective view of a characteristic tool point and shank showing the parts disassembled;

FIG. 2 is a composite fragmentary view of the shank and tool shown in FIG. 1, showing the two tapered interfitting surfaces of the fragmentarily shown shank and the complementary tapered surfaces of the tool point, the latter being shown partly in section; and

FIG. 3 is a composite view similar to FIG. 2 showing the shank and tool point assembled.

In FIG. 1 the cutting tool **10** is shown with its sections separated but aligned for assembly. The longer section **11** called the shank, shaft or body, has its bitter end **12** formed to fit a tool holding means of an air hammer or the like (not shown). End **12**, suitably shown as a hex bar, terminates at an enlarged collar **13** which serves to position the cutting tool in the tool holding means of the air hammer. Between the collar **13** and the cutting point receiving end **14**, there is an extended uniform portion **15**, also suitably shown as a hex bar. This uniform portion terminates as the first tapered surface **16** commences. Throughout its length the shank **11** is preferably fabricated from a relatively hard high speed drill or chisel steel, and cutting point **17** is fabricated from a relatively more hardenable steel. The first tapered surface **16**, mentioned previously, is substantial in area but its taper angle is substantially less than the taper angle of the second continuing tapered surface **19** which on the other hand has relatively less area. A groove **20** extending longitudinally along the first tapered surface **16** provides an air escape passageway during the seating of the cutting point **17** on the shaft **12**.

By way of typical and therefore non-limitive example, the cutting point **17** can be fabricated from SAE 1080 steel, tip hardened to a Rockwell hardness of 62 or 63 from the tip to a depth of about ¾", the remainder having a Rockwell hardness of about 40 or 42 so that the thin-walled gripping area thereof is relatively unembrittled. The shank portion can be suitably fabricated from any good shock tool steel such as the HS or Delsteel steels marketed to the impact tool fabricating trades by Delaware Tool Steel Company, the shank fabrication involving heat treatment throughout, and particularly at the tapered surfaces **16** and **19** so as to prevent galling during use. Suitable Rockwell hardness for the tempered shank portion is 60–62, for example.

For reference purposes, it will be understood that the longitudinal axis of the tool **10** runs concentrically of shank **11** and tip **17**, as indicated at FIGS. 1 and 3 at A—A.

In FIGS. 2 and 3, the tapered portions **16** and **19** of the shaft **11** are shown spaced from the cutting point **17** and in alignment therewith. The cutting point **17** is shown in its entirety except for portions removed to show the interior cross-section of the two tapered surfaces, the surface of lesser taper **22** being of greater area than the surface of greater taper **23**, such surface **23** being substantially longer than complementary surface **19** of the shank, leaving a non-engaged portion **24** forming recess **25**, so that the shank will not bottom in the point before the surfaces **16**, **22** and **19**, **23** seat. The tool point **17** terminates in a sharp apex **26** in a manner conventional per se. As will be observed at FIGS. 2 and 3, tapered surface **22** is relatively thin-walled, as indicated at **27**, and tapered surface **23** is relatively thick-walled, as indicated at **28**.

In FIGURE 3, shank portion **15** and the cutting point **17** are shown assembled, i.e. with the point seated for use. The complementary tapered portions on the respec-

tive shaft 12 and the cutting point 17 are substantially alike with respect to their taper angles or become so upon fitting of the sections together.

The utilization of these two sets of tapered sections 16, 22 and 19, 23 results in the attainment of several practical advantages, as mentioned previously. The more extensive tapered portions having the smaller angle with reference to the major axis of the cutting tool 10 serve very well in establishing the means for setting up radial compressive forces that grippingly hold the shank and tip together, even when the tool is being subjected to pneumatic hammer driving vibration. Even an initially substantially cylindrical surface can be used at 22 in some instances, which is impactively slightly stretched to have a small taper when seated (note FIG. 3 in this respect). It is an important characteristic of engaged surfaces 16 and 22 that their taper angle be small in order to effectively perform their gripping function. The other set of engaged tapered surfaces 19 and 23, with their larger taper angle, serve the primary function of transmitting the impinging forces without assuming any substantial portion of the gripping action. The tapered surfaces 16, 22 on the one hand and 19, 23 on the other hand are thus seen as providing a uniquely effective combination as to both gripping and force transmitting functions, each set of surfaces respectively and primarily performing one but not the other function, with the result that the impact transmitting surface 19 does not become so interwedged in surface 23 as to impede point removal, while the thin-walled surface 22 is of itself sufficiently dimensionally stretchable by lateral impact to permit ready removal of the point from the shank when desired.

Depending to some extent upon the specific alloys used for the shank and point, appropriate tapered surface relationships for a specific tool will occur to those skilled in the art and can be readily evaluated by experimental trial, consistent with the above discussed principles characteristic of the present invention. For practical purposes, with respect to steels of the order of hardness above indicated, it has been found that the smaller taper angle for the assembled surfaces 16, 22 should be less than about 5° and the larger taper angle for the assembled surfaces 19, 23 should range from about 8° to about 20° with respect to the longitudinal axis of the tool, taper angles in this respect being respectively about 3° and about 12°.

What is claimed is:

1. A replaceable point type percussion tool comprising a shank with bi-tapered end surfaces and a point with bi-tapered recess surfaces interfittingly engaging said shank end surfaces.

2. A percussive tool comprising a bi-tapered shank with an end having bi-tapered surfaces, and a cutting point having bi-tapered recess surfaces concentrically and frictionally engaging such shank end surfaces to wedge the point thereon, one engaged set of such tapered surfaces primarily providing percussion impact transmission surfaces, and the other engaged set of such tapered surfaces being relatively thin-walled and primarily providing gripping surfaces retaining said point on said shank.

3. A cutting tool of the character described comprising wedgingly engaged shank and tip sections, each with respectively complementary interfitting portions characterized by two tapering surfaces, one engaged set of wedged surfaces being of small surface area with a comparatively abrupt taper angle with respect to the longitudinal axis of said tool, and the other set of wedged surfaces being of comparatively larger surface area with less abrupt taper angle, such small area wedged surfaces primarily serving to transmit percussion impact from said shank section to said tip section and said large area wedged surfaces primarily serving to frictionally retain said tip section on said shank section.

4. A percussive tool tip having a hardened point area and relatively less hard bi-tapered portion for frictional mounting of the tip on a complementarily bi-tapered tool shank, said tip bi-tapered portion comprising a thick-walled and annularly configured tapered surface disposed at an abrupt angle wtih respect to the axis of the tip concentric of the point area, and also comprising a thin-walled and annularly configured tapered surface disposed at a very shallow angle with respect to said axis, the first said tip surface engaging a surface of like taper on said shank and transmitting most of the percussion impact from the shank to the point and the second said tip surface engaging a surface of like taper on said shank and performing most of the gripping action holding the point on the shank.

5. A percussive tool tip according to claim 4, wherein the said abrupt angle is from about 8° to about 20° with respect to said axis, and said shallow angle is less than about 5° with respect to said axis.

6. A percussive tool tip according to claim 4, wherein said abrupt angle is about 12°, and said shallow angle is about 3° with respect to said axis.

7. A percussion tool having a tool steel shank portion and a replaceable tip portion, the end of said shank portion mating with said tip portion comprising a slightly tapered surface and a more abruptly tapered surface extending beyond such slightly tapered surface, the said point having complementarily arranged tapered surfaces respectively engaging the said slightly tapered and more abruptly tapered shank surfaces.

8. A percussive tool comprising interfitting shank and tip sections, each such section having at least two frusto-conical surfaces of different tapers, one such conical surface on each section having a taper in the range of about 8° to about 20° with respect to the concentric axis of said tip and shank, and the other such frusto-conical surface on each section having a taper less than 5° with respect to said axis, such latter frusto-conical surfaces being in frictional engagement and serving as the primary holding means to keep the sections assembled under impactive use.

9. A tool according to claim 8, wherein said tip section comprises a hardened point area and a less hard thin wall area surrounding the holding surface thereof.

10. A steel tool for use with percussion impact type driving equipment having a replaceable cutting point and a shank which is wedgingly fitted to the replaceable cutting point, the wedged fitting being accomplished by employing at least two interengaged sets of substantially complementary tapered surfaces, each such set of surfaces comprising a surface which is part of the cutting point and a surface which is a part of the shank, the taper angle of one such set of interengaged surfaces being less than about 5° with respect to the longitudinal axis of the shank to primarily provide gripping action between the cutting point and shank, and the taper angle of another such set of interengaged surfaces being at least about 8° with respect to the longitudinal axis of the shank to primarily transmit impact force from the shank to the tip.

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