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Rabett

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[54] **TOOLS FOR USE IN PERCUSSIVE MACHINES**

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[51] **Int. Cl.** **E21c 13/00**

[58] **Field of Search** .... 175/414, 320, 325, 408; 173/131, 128, 139, 162; 52/733; 30/168; 125/41; 299/94; 16/116; 181/33 A, 36 A

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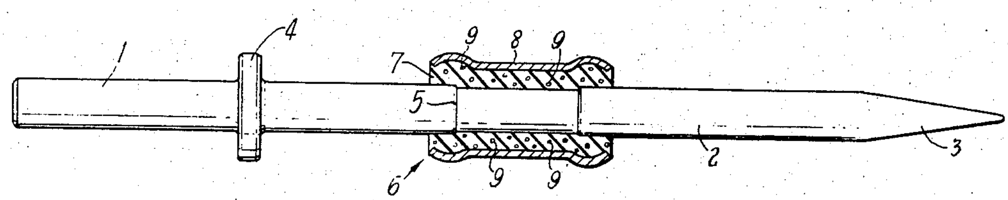
[57] **ABSTRACT**

A percussion tool, typically known as a "steel," having a longitudinally extending stem, a shank portion at one end and a working head at the other end, wherein the stem is sufficiently weighted, at about the mid-point of its length, to inhibit transverse vibration of the tool.

2 Claims, 4 Drawing Figures



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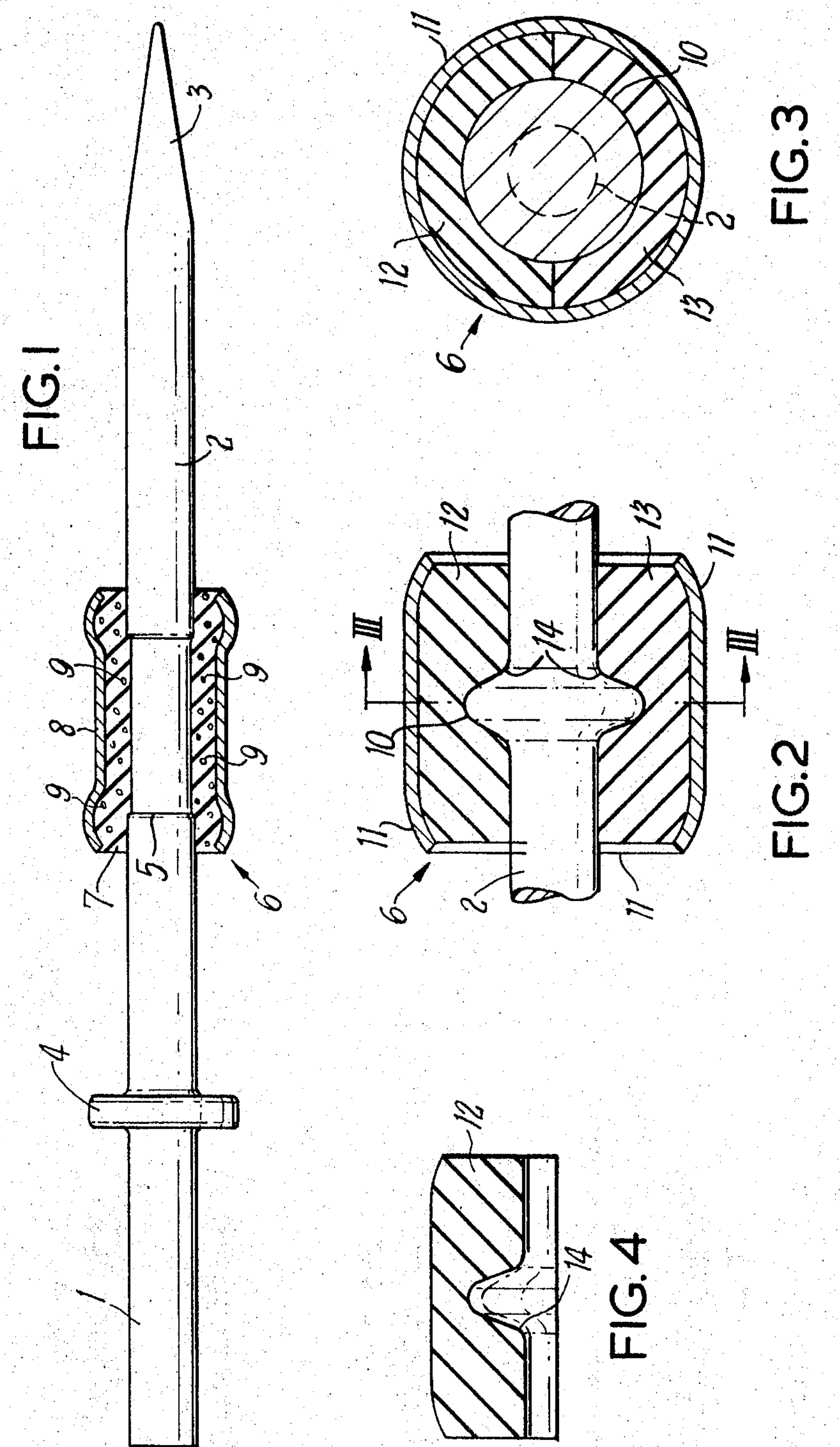

FIG.1

FIG.2

FIG.3

FIG.4

TOOLS FOR USE IN PERCUSSIVE MACHINES

This invention relates to tools for use in percussive machines and is particularly directed towards a tool of the kind known in the art as, and hereinafter referred to as, a "steel" comprising a longitudinally extending stem having a shank at one end thereof by which the steel is adapted to be secured in a percussive machine and a working head at the other end thereof. The working head may comprise a spade, chisel, moil, drill bit or the like. Usually, the steel is forged or otherwise formed from a bar of the material steel which is of circular or polygonal shape in transverse cross-section.

In general, the steel is secured in a percussive machine for the free end of its shank to be repeatedly impacted by a reciprocating hammer device. Such hammer device is usually (but not necessarily) pneumatically driven as, for example, in the well known hand-held pneumatic road drill. A considerable problem encountered with percussive machines is that during their use to drive a steel, a large amount of noise is emitted, the sound level of which frequently approaches the threshold of pain for the human ear. It has hitherto been proposed to reduce the noise level of percussive machines by substantially enclosing or muffling the machine in a bag of sound absorbing material or with a layer of vibration absorbing material as, for example, disclosed in British Pat. No. 1,055,048. Attempts have been made, it is believed unsuccessfully, to similarly muffle the steel over the major part of its exposed length, but it will be apparent that such muffling severely restricts the use of the steel since penetration of the steel to practical depths into concrete or other hard material easily damages the muffling material.

It is an object of the present invention to provide a steel which, when in use with a percussive machine, provides a diminution in the noise emitted by the steel when impacted, that is to say, provides a reduction in the upper sound pressure level emitted by the steel in comparison with conventional steels.

According to the present invention, there is provided a steel of the kind specified in which the steel is sufficiently weighted substantially at its mid-length position to inhibit its primary mode of transverse vibration.

Preferably the mid-length position of the steel is located on the stem and substantially at said position the stem has secured thereto a collar the mass of which is sufficient to inhibit the primary mode of transverse vibration of the steel. The collar may comprise a mass of resilient material secured to the stem which material may be additionally weighted by having high density, preferably particulate, material (such as lead shot) embedded in it. Alternatively, the collar may comprise a sleeve of high density material such as steel resiliently mounted on the stem.

It is of importance to ensure that the collar is secured to the stem so that is does not move longitudinally relative to the stem as a result of vibration during use of the steel. With this in mind the collar can be shaped to conform to the profile of the part length of the steel on which it is to be located and may be adhesively secured or bonded to the stem and/or may be mechanically attached thereto as, for example, by shrinking or swaging techniques. The stem may be provided with a recess or rib with which the collar engages as an interference fit to inhibit its longitudinal movement on the stem. The recess is preferably peripherally formed around the stem and the length of the collar may be partly or wholly located in the recess. The rib is preferably peripherally formed around and integral with the stem, for example during forging of the steel and the collar is preferably formed of substantially complementary shape to the rib to provide an efficient interference fit therewith. The collar can be formed in two or more parts so that it can be assembled around the stem rather than being located as a single unit on the stem by sliding over one end thereof. Such a piece-meal construction of the collar may be necessary when the steel has a broad working head (such as a spade) and a flange is provided on the steel at a position between the stem and shank, or when the collar is to be secured on a rib. the collar parts can be assembled and secured around the stem, for example when the collar comprises a mass of resilient material, by shrinking or swaging a metallic sleeve around the assembled parts to urge them into engagement with the stem (or the recess or rib provided thereon).

It is believed that the upper sound pressure levels emitted by an impacted steel are due largely as a result of transverse vibrations set up in the steel and more particularly that such pressure levels which approach the threshold of pain result from the primary mode of transverse vibration (or the lower frequency mode of transverse vibration having a wavelength approximately equal to twice the length of the steel). By sufficiently weighting the steel at the mid-part of its length the lower frequency modes of transverse vibration may be muted and the primary mode of transverse vibration inhibited. In addition, the weighting of the steel at the mid-part of its length may also, to some extent, mute torsional and longitudinal vibration of the steel which moderates high frequency longitudinal vibrations emitted by the steel which it is believed reduces the noise level emitted by the steel. Further, when a collar is resiliently secured to the stem (or the collar comprises a resilient material secured to the stem) at the mid-length part of the steel, the collar may provide a shielding effect to diminish the efficiency of the radiation of noise from the region of the steel enclosed by the collar, the reason for this being that the collar dissipates energy of vibration of the steel prior to such vibration reaching the external peripheral surface of the collar.

As will be appreciated from the aforegoing, the greater the weighting at the mid-length part of the steel, the more effective is the damping of the transverse vibrations of the steel, however the magnitude of such weighting is restricted due to practical considerations, for example, the collar or weighting should not extend over the length of the steel to unduly restrict its depth of penetration nor should it extend transversely to an extent that it is cumbersome or obscures an operator's view of the working head. In practice a steel of approximately two to three feet in length and weighing approximately nine pounds was found to be considerably improved (insofar as its noise emission during use) by weighting the mid-length part of the steel with a collar weighing approximately 1.0 to 4.0 pounds (454 to 1816 grammes). Conveniently the weighting is in the range of 10 to 40 percent of the weight of the steel.

Two embodiments of the present invention will now be described, by way of example only, with reference to the accompanying illustrative drawings in which:

FIG. 1 shows a conventional steel having secured thereto a collar (shown in longitudinal section) located in a peripheral recess of the stem and of sufficient weight to inhibit the primary mode of transverse vibration of the steel;

FIG. 2 shows the mid-length part of a further steel having secured thereto a two-part collar (shown in longitudinal section) located as an interference fit on a peripheral rib of the stem and of sufficient weight to inhibit the primary mode of transverse vibration of the steel;

FIG. 3 is a transverse section of the steel and collar taken on the line III — III of FIG. 2, and

FIG. 4 is a longitudinal section through one part of the collar applied to the steel as in FIG. 2.

Where possible throughout the following description, the same parts or members in each of the Figures have been accorded the same reference numerals.

The steel comprises a bar (of the material steel) which is of polygonal or circular shape in transverse section and which is forged to provide a shank **1**, a stem **2** and a chisel working head **3**. A transversely extending flange **4** is forged at the junction of the stem and shank. In use, the steel is secured in a percussive machine (not shown) by the shank **1** engaging in a complementary socket of the machine so that the free end of the shank may be impacted by a reciprocating hammer. The steel is generally retained in engagement with the socket by a spring member of the machine engaging over the flange **4** in a known manner.

The stem **2** has a shallow peripheral recess **5** (conventiently formed during the forging of the steel) which is located to extend longitudinally in the mid-length part of the steel. Located around the stem **2** to overlie the recess **5** is a collar **6** comprising an annular block **7** of resilient material (in the present example a molded rubber element) and a rigid sleeve **8** of, for example, steel. the sleeve **8** is swaged to compress the annular block **7** against the stem **2** and deform it into the recess **5**, thereby securing the collar **6** on the stem, particularly against longitudinal movement.

The collar **6** is, as aforementioned, secured at the mid-length part of the steel and has a weight sufficient to inhibit the primary mode of transverse vibration of the steel in accordance with the present invention while the chisel working head **3** and a considerable exposed part length of the stem adjacent the head **3** permit practical penetration depths of the steel without hindrance or damage to the collar **6**.

If required, the resilient block **7** may be artificially loaded to increase the weight of the collar **6** as, for example, by embedding lead shot (shown generally at **9**) in the molded rubber element or by mixing lead dust with the rubber prior to molding.

In the embodiment shown in FIGS. **2** to **4** the stem **2** has a transversely extending peripheral rib **10** which is located at the mid-length position of the steel and is conveniently formed during forging of the steel (in a similar manner to the flange **4**). Located around the stem **2** to overlie the rib **10** and adjacent part lengths of the stem is the collar **6** which comprises a two-part structure of resilient material retained on the stem by a steel sleeve **11**. The two-part structure of the sleeve comprises two molded rubber elements **12** and **13** which are identical in shape and are each molded (as shown in FIG. **4**) so that the profile of their surface **14** which is to be located adjacent the steel conforms to the profile of the mid-length part of the steel which includes the rib. Both elements **12** and **13** are assembled on the stem **2** to encircle the rib **10** (see FIG. **3**) and, being of complementary shape to the rib **10**, provide an efficient interference fit therewith to retain the collar from longitudinal movement over the shank. The elements **12** and **13** are conveniently bonded together and thereafter the steel sleeve **11** is swaged on to the elements to urge them into close contact with the shank.

In a similar manner to the embodiment shown in FIG. **1**, the elements **12** and **13** and sleeve **11** sufficiently weight the steel at its mid-length position to inhibit the primary mode of transverse vibration of the steel.

I claim:

1. A percussion tool assembly comprising:

a longitudinally extending stem,

a shank portion formed integrally with one end of said stem,

a peripheral rib extending radially from said tool between said shank portion and the remainder of said tool, said rib for retaining the shank portion in a percussion apparatus,

a working head at the other end of said stem,

and a collar assembly at the mid-point of the length of said tool, between the working head and the peripheral rib, said collar being fixed to said stem and comprising a mass of elastomeric material bound and compressed against the stem by metal sleeve means, said elastomeric material being additionally weighted with a higher density material embedded therein, said collar assembly for substantially inhibiting transverse vibrations of the tool.

2. The assembly of claim **1** wherein said higher density material is of particulate form.

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