This invention is concerned with improvements in percussive tools, particularly manually portable tools commonly known as pavement breakers or demolition tools.

Such tools include a hammer piston which is pneumatically reciprocated to repeatedly pound an anvil against a work steel, the work steel having a tapered work end or peg point used for breaking up the work. At times, the work steel becomes so tightly embedded in the work as to make it extremely difficult for the operator to withdraw it. It is common practice when this occurs for the operator to pull the entire tool slightly backward relative to the work steel, and then to operate the tool so as to jar the stuck steel loose. Often the result of such action in tools of conventional structure is damage of the tool, such as a cracked front head or breakage of associated parts. This is because the powerful impact force of the piston that would ordinarily be transmitted through the anvil to the work steel is instead transmitted to the casing of the front head. At other times, the work steel will run out, as when it suddenly breaks through the work into soft earth or into a vacant area. Continued operation of the tool following such action is also likely to result in damage to the front head and associated parts, since in this case the impacting force of the piston will also be transmitted to the casing of the front head instead of to the work steel.

An object of this invention is to improve such tools so as to avoid the likelihood of damage occurring to the tool when the tool is operated to loosen stuck steel, or when the steel has run through the work.

A further object of this invention is to provide in such tools means for checking or attenuating the impacting force of the piston relative to the anvil when the usual support provided by the work steel is removed from the anvil.

A still further object of this invention is to improve these tools in such manner that when the support of the work steel is removed from the anvil, the impacting force of the piston against the anvil will be so attenuated as to eliminate the likelihood of the tool being damaged, but sufficient residual force will nevertheless be transmitted to the casing of the front head to jar a stuck steel loose when the tool is operated for the latter purpose.

The invention further lies in the particular construction and arrangement of its component parts, and also in their particular cooperative association with one another to effect the objects intended herein.

The foregoing and other objects and advantages of this invention will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying drawings, wherein an embodiment of the invention is illustrated. It is to be expressly understood, however, that the drawings are for purposes of illustration and description; and they are not to be construed as defining the limits of the invention.

In the drawings:

FIG. 1 is a longitudinal section through a manually portable percussive tool embodying the invention; and it shows the tool in its normal operating condition with the peg point of the work steel pressed against the solid work or pavement.

FIG. 2 is a plan view of the elastic unit;

FIG. 3 is a longitudinal section through the elastic unit;

FIG. 4 is a view to that of FIG. 1, but shows the work steel stuck fast in the pavement, and further shows the anvil and work steel in their low positions relative to the casing;

FIG. 5 is a fragmentary view of the tool showing the work steel as having run through the pavement; and

FIG. 6 is a sectional view showing what takes place when the piston is reciprocated relative to the anvil in the condition of the tool shown in FIG. 4, or FIG. 5.

There is illustrated in the drawings various views of a pneumatically powered manually portable percussive tool in which the invention is embodied. The tool is of a conventional type commonly known as a pavement breaker or demolition tool. The tool includes a housing or casing having a front head section which is secured by the usual tie-bolts, not shown, to a piston cylinder. The usual back-head is associated with the upper end of the piston cylinder, and includes a handle for guiding the tool during its operation, or for lifting or carrying it.

A hammer piston is pneumatically reciprocable in the cylinder to pound an anvil relative to the work steel. During normal operation of the tool, as will be later described, the piston is enabled, without interference, to impart its full driving force against the anvil. During other times, as will also be later described, attenuating means is caused to materially check the movement of the piston on its work stroke before it is permitted to strike the anvil.

The attenuating means comprises a sleeve or slide member and an elastic unit or elastomer. The slide member has axial movement between a horizontal upper shoulder and a coned lower shoulder of the casing. The sleeve is supported by the elastic unit so that an upper flat shoulder of the sleeve normally limits against the corresponding shoulder of the casing (as in FIG. 4). The elastic unit comprises a pair of cylindrical metal tubes and of different diameters, arranged one within the other in parallel spaced relation and bonded to each other by means of a strong elastic material filling the space between them. The elastic material is a strong plastic, commonly known as neoprene. The outer tube is seated in an annular recess of the casing; and it is restrained against relative axial movement by means of a pair of opposed annular shoulders of the casing. The inner tube sleeves about the central area of the sleeve, and its upper end abuts an overhanging shoulder of the sleeve. The sleeve has an upper coned central surface which is adapted to be stuck at certain times by a complementary coned undersurface of the piston as the latter reciprocates. When this occurs, the sleeve is forced or slid downward against the yielding resistance of the elastic unit to engage a coned bottom end thereof against the annular shoulder of the casing, as appears in FIG. 6. As the sleeve moves downward, it carries the inner tube of the elastic unit with it, causing the elastic element to elastically deform downward. Such action of the piston against the sleeve will materially check or absorb the downward driving force of the piston. When the sleeve is relieved of the stress or impacting force of the piston, as when the piston moves upwardly or away on its return stroke, the sleeve is returned to normal position (FIG. 4). As the elastic element is naturally restored, the strength of the elastic element is so computed that it will have absorbed about half the energy imparted by the piston to the sleeve when the latter is stopped by the shoulder.

The anvil has limited axial movement relative to the sleeve member. The anvil is guided in this movement by means of an enlarged lower body portion of the elastic unit and a collar fixed to the sleeve member. When the tool is in the operating position, the anvil is in the low position relative to the casing; when the tool is in the unoperating position, the anvil is in the high position relative to the casing.

The anvil is shown in FIG. 1, FIG. 4, and FIG. 5. FIG. 1 shows the anvil in normal operating position relative to the casing. FIG. 4 shows the anvil in unoperating position relative to the casing. FIG. 5 shows the anvil in intermediate position relative to the casing.

The sleeve member is shown in FIG. 1, FIG. 2, FIG. 3, FIG. 4, and FIG. 5. FIG. 1 shows the sleeve member in normal operating position relative to the casing. FIG. 2 shows the sleeve member in unoperating position relative to the casing. FIG. 3 shows the sleeve member in intermediate position relative to the casing. FIG. 4 shows the sleeve member in intermediate position relative to the casing. FIG. 5 shows the sleeve member in normal operating position relative to the casing.

The elastic unit is shown in FIG. 3, FIG. 4, and FIG. 5. FIG. 3 shows the elastic unit in normal operating position relative to the casing. FIG. 4 shows the elastic unit in unoperating position relative to the casing. FIG. 5 shows the elastic unit in intermediate position relative to the casing.

The fastener is shown in FIG. 1, FIG. 2, FIG. 3, FIG. 4, and FIG. 5. FIG. 1 shows the fastener in normal operating position relative to the casing. FIG. 2 shows the fastener in unoperating position relative to the casing. FIG. 3 shows the fastener in intermediate position relative to the casing. FIG. 4 shows the fastener in intermediate position relative to the casing. FIG. 5 shows the fastener in normal operating position relative to the casing.

The driving force of the tool is applied to the anvil 19. The anvil is fixed to the sleeve member 21. The sleeve is mounted on the piston 22. The piston is mounted on the cylinder 23. The cylinder is fixed to the housing 24. The housing is fixed to the base 25.
which bears against the adjacent wall of the sleeve; and it is further guided by means of a reduced upper elongated stem portion 35 which bears against a reduced inner annular surface 36 of the sleeve. The anvil has an elevated central operable position, as FIG. 1, and in a coned shoulder 37 thereof limits against a complementary shoulder 38 of the sleeve, and in which the stem 35 projects in part out of and above the sleeve into the piston cylinder 15. The anvil has a low or relaxed position (FIG. 4) in which a coned undersurface 39 thereof seats upon the flange edge 41 of the casing; and in which a flat top end 42 of the stem 35 is positioned a short distance below the lowest part edge 43 of the coned upper surface 31 of the sleeve. The low position of the anvil relative to the sleeve 18 is such that the sleeve must first be moved downwardly a little by the impacting action of the piston, as appears in FIG. 6, before the flat bottom end 44 of the piston can strike the opposed end 42 of the anvil.

The work steel 16 has limited axial movement in the front head 12 relative to the anvil; and the raised and low positions of the work steel determine the corresponding positions of the anvil relative to the sleeve 18.

The work steel includes an elongated forward portion 45 which projects in part out of an open bottom end 46 of the casing, and which is terminated by a peg point 47 adapted to engage the work. The work is here illustrated as a concrete pavement 48. A tail portion 49 of the work steel is axially slidable in a stationary bushing 51 of the casing. A flange portion 52 of the work steel has limited movement below the bushing in an enlarged area 53 of the casing. A lug or stop 54, carried by the casing and projecting radially into the path of movement of the flange 52, not only prevents endwise escape of the work steel from the front head of the tool, but also cooperates with the flange to determine the lowest position of the work steel relative to the casing.

The work steel has an elevated position, as indicated in FIG. 1, during normal operation of the tool. In this situation, the peg point 47 presses against the solid pavement 48, so that the tail portion 49 of the work steel is elevated in the bushing 51 relative to the casing. In its elevated position, the rear portion of the work steel projects axially out of the bushing beyond the annular shoulder 41 of the casing; and the flat top end 55 of the work steel presses upwardly against the base of the anvil to hold the anvil raised in its elevated position. Thus, the top end 42 of the elevated anvil projects into the piston cylinder, and the coned undersurface 39 of the anvil is clear of the casing shoulder 41. Accordingly, the piston 14 reciprocates, its full impacting force is imparted to the anvil 15 and transmitted through the latter to the work steel. As the work steel digs into the pavement, the front head 12 of the tool has equal downward relative movement, thus enabling the work steel to continuously hold the anvil in its elevated position during normal operation of the tool.

At times, the work steel will become so embedded in the work, as appears in FIG. 4, that the operator is unable to withdraw it. When this occurs, the operator pulls back on the handle 8 so as to slide or draw the entire tool by means of the bushing 51 rearwardly relative to the stanchion 11 until the flange 52 of the latter abuts against the stop lug 54. When the operator does this, the tail end 55 of the work steel will have a position in the bushing 51 as in FIG. 4, below the shoulder 41 of the casing and clear of the bottom end 56 of the anvil. The anvil, which gravitationally follows the downward relative movement of the work steel as the casing is pulled back, will seat upon the shoulder 41 of the casing. The piston is then reciprocated or operated while the tool is thus held by the operator. As the piston reciprocates, its impacting force will be largely checked by the attenuating means in the manner earlier described. In this operation of the tool a jarring action will be imparted to the casing as the sleeve impinges on the shoulder 22 and as the anvil receives the residual impacting force of the piston. This jarring action is insufficient to crack or otherwise damage the casing of the tool, its front head 12, or any other parts, as FIG. 1, in which the operator recoils and transmits through the stop lug 54 and flange 52 to the work steel a sufficient and necessary rearwardly acting force to jar the latter loose from its stuck condition in the pavement 48.

At other times, the work steel will suddenly be pulled through the casing when the operator inadvertently releases the safety latch 20 below the impact receiving face of the anvil, as FIG. 5. When this occurs, the entire tool by its own weight and under the pressing force being exerted by the operator upon the handle follows the sudden dropping action of the work steel until the bottom end 46 of the casing abuts the hard pavement. When this occurs, the anvil 15 and the work steel 16 will have dropped to their low positions, which will be the same as shown in FIG. 4. No advantage is to be gained by operating the tool in this situation. But, the operator is not always able to immediately stop the action of the reciprocating piston under these circumstances so that the piston may continue to reciprocate for another cycle or so before he does stop it. However, the driving force of the piston will be largely attenuated by the attenuating means, as earlier described, and no damage will occur to the casing or the associated parts of the tool should such further cycling of the piston occur.

That is, it is to be understood that each of the two situations mentioned, namely, when the work steel is stuck in the work, and when the work steel runs through the work; if the full force of the piston were directed to the anvil while the latter is unsupported by the work steel and while the anvil rests upon the shoulder 41 of the casing, the latter and its associated parts would very likely be cracked or otherwise damaged.

While an embodiment of the invention has been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes might possibly be made in the design and arrangement of the parts without departing from the spirit and scope of the invention. It is intended, therefore, to claim the invention not only as shown and described, but also in all such forms and modifications thereof as may reasonably be constructed to fall within the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In a percussive tool including a casing, a piston cylinder having a piston reciprocating therein, an annular shoulder in the casing below the piston cylinder, an anvil axially slidable in the casing seated upon the shoulder, having an impact receiving face extending into the piston cylinder for receiving impacts of the piston, an axially slidable member seating the anvil including an annular impact receiving surface extending into the piston cylinder in the path of movement of the piston, an annular spring unit having an outer component stationary with the casing and having an axially yieldable inner component seating the slidable member, an offset shoulder about the slidable member resting atop the said yieldable inner component, the yieldable inner component supporting the slidable member relative to the anvil wherein the impact receiving face is normally slightly elevated relative to the striking face of the anvil while the anvil is seated upon said annular shoulder, and the casing having a second annular internal shoulder coaxial with and located radially beyond and upwardly of the first mentioned annular shoulder, with which second annular shoulder the axially slidable member is engageable against the resistance of the yieldable component under impact of the piston on a downward stroke of the latter, and upon such engagement the impact receiving surface of the slidable member assuming a temporary position slightly below the impact receiving face of the anvil enabling the piston upon further movement on its downward stroke to then
pound the anvil against the first annular shoulder with a residual force.

2. In a percussive tool as in claim 1, wherein a work steel axially slidable in the lower end of the casing has an elevated position supporting the anvil above the first mentioned annular shoulder so that the striking face of the anvil is disposed in the piston cylinder above the impact-receiving surface of the slidable member, and wherein the casing has an internal abutment and the work steel has a peripheral collar arrested by the abutment in a low position of the work steel in which low position the anvil is seated upon the first internal shoulder of the casing and is clear of the work steel.

3. In a percussive tool of the character described including a casing having an internal shoulder and a hammer piston reciprocating in the casing, means for transmitting an attenuated driving force of the piston to the internal shoulder so as to provide a controlled vibratory action to the casing without danger of cracking the casing, comprising an outer metal sleeve restrained in the wall of the casing against axial movement, an inner sleeve of reduced diameter arranged within and in parallel spaced relation to the outer sleeve and the wall of the casing, elastic material filling the space between the sleeves and bonding them to one another, an annular floating slide member sleeved about its central area by the said inner sleeve and having an upper peripheral shoulder resting atop the inner sleeve, the slide member presenting an impact receiving face in the path of the piston, and the slide member under impact of the piston being movable into impacting engagement with the internal shoulder against the yielding resistance of the elastic material so as to translate the driving force of the piston against the slide member into a reduced force against the internal shoulder of the casing.

4. A percussive pavement breaking tool including a casing, an anvil, a reciprocating piston, and a work steel therein, the work steel therein subject to being axially and directly pounded by the anvil within the casing wherein the anvil is subject to the pounding of the piston, the work steel having a slidable relation to the casing and adapted under some conditions during operation of the tool to be substantially slidable relative to the casing, shoulder means integral with the casing for disabling the anvil under such conditions from directly pounding the work steel and for receiving the pounding of the anvil; and means in said casing in sliding relationship with said anvil to attenuate the pounding of the piston against the anvil and as a consequence against the casing during the time that the anvil is disabled from directly pounding the work steel.

5. A percussive pavement breaking tool as in claim 4, including stop means carried by the casing below the shoulder means having cooperation with the work steel for limiting the extent of such displacement and translating subsequent pounding of the anvil against the shoulder means into a recoil force of the operator against the work steel.

6. In a percussive tool of the character described including a drill steel having a flange thereon and subject to becoming stuck at times in the work, a casing having an internal shoulder and a stop lug below the internal shoulder, the casing being axially slidable by manual force relative to the drill steel in an upward direction when the latter is thus stuck so as to carry the stop lug on the casing against the underside of the flange of the drill steel and so as to carry the internal shoulder of the casing to an upward position upwardly from the drill steel; an anvil axially slidable in the casing above the internal shoulder normally functioning to pound the drill steel at a point above the internal shoulder but having a position seated upon the internal shoulder when the casing is slid upwardly as above mentioned; a hammer piston reciprocable in the casing normally functioning during reciprocable movement to pound the anvil against the work steel when the anvil is not in seated position; means in said casing in sliding relationship with said anvil disabling the hammer piston in its reciprocating movement from pounding the anvil with its full force while the anvil is in said seated condition so as to avoid cracking the casing but allowing the piston to pound the anvil with an attenuated force insufficient to crack the casing.

7. In a percussive tool according to claim 6, wherein the disabling means comprises a metal sleeve surrounding the anvil and yieldable means coaxial with the sleeve supporting the latter in a normal condition wherein an impact receiving face at the upper end of the sleeve subject to being struck by the hammer piston is below the plane of the impact receiving end of the anvil whereby the hammer piston is blocked from striking the sleeve when the anvil is in its position normally functioning to pound the drill steel, but wherein the said impact receiving end of the sleeve is above the plane of the impact receiving end of the anvil and subject to being struck by the hammer piston when the anvil is in its said seated position.

8. In a percussive tool according to claim 7, wherein the casing has a second internal shoulder of larger internal diameter than the first and above the latter, the lower end of the sleeve is normally above and clear of the said second internal shoulder, but is subject to engaging the latter against the resistance of the yieldable means when struck by the hammer piston.

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