ABSTRACT OF THE DISCLOSURE

A detent means and its combination with socket members and coal cutter bits comprising a substantially cylindrical elastomeric member surrounded by a metallic element including a cut-out portion and a key portion, a rigid abutment means extending from said elastomeric member through said cut-out, said abutment means comprising a metallic cylindrical body portion having at least one conical portion extending from said body portion.

This invention relates to coal mining cutter elements and more particularly to a resilient detent for holding coal mining cutter bits in cutter chain or bar sockets.

Coal mining operations such as the undercutting of coal or potash are presently accomplished by employing large high speed machinery such as cutter chains or bars upon which are mounted a multitude of cutter socket members with replaceable bits. The bits used in the cutter socket members are available in a multitude of forms, from the basic integral element consisting of a shank and cutting head to more elaborate structures comprising a bit holder with a removable or replaceable cutting edge. The present invention relates to all coal mining machinery in which the cutter chains or bars are provided with sockets to retain the cutter bit shank elements.

The bits used in the coal mining machinery are dulled rapidly and vibration and shock break a large number of them; therefore, the machine must be stopped frequently to replace the dulled or broken bits. To replace bits, an entire machine must be shut down, the dulled or broken bits removed from their sockets where they are generally held by some form of retainer, and new bits inserted. The efficiency of such machines depends on the ease with which the cutter bits may be replaced. Retaining means such as detent devices must not only permit ease of cutter bit shank removal from the socket member but must resist loosening due to the combined effects of stress and vibration.

A number of detent devices have been developed and are now in use by the industry to allow the changing of bits. One commonly used method is to retain the cutter bit shanks in the socket members with set screws. It has been found, however, that a set screw is slow to release, and with the ever present coal dust and rock chips found in a mining operation, the head of a screw is soon filled to a point where it cannot be driven in or out. The thread channels also become laden with debris and require an excessive force to turn the clogged threads. In hurrying to replace bits, it has been found that it is not uncommon for the threaded apertures in the socket members and respective set screws to become cross threaded and therefore no longer able to hold the bits in the socket members. Since the socket members are usually an integral part of the mining machinery, the machinery must be completely halted to allow the damaged socket member to be replaced.

To overcome the disadvantages of the set screw as a cutter bit retaining means, numerous alternatives have been proposed, one of the most recent of these being a resilient elastomer bearing means backing a metal detent head. These latter retainers are either in the form of plungers operating in bores perpendicular to and abutting the shank of a bit, or as bars which mate with a notch in the shank of a bit and are held in the socket by rubber covered ends which allow movement of the bar away from the bit notch when sufficient pressure is applied as during the cutter bit insertion and removal.

These resilient detent means, although a comparatively successful alternative, are still subject to extreme wear and at times lose their resiliency. The elastomeric portion tends to deteriorate, become brittle and making removal difficult. Additionally, with the designs utilizing metallic bars or fingers, a free portion of the metal abutting element extends into the cutter bit socket and the cutter bit shank notch or cavity, and continued shock on the unsupported free portion of the abutting element may cause untimely failures. The finger type of detent may even be torn loose from its anchorage in the elastomeric backing material and fall into the socket when the contained cutter bit is removed.

One of the principal objects of this invention is the provision of a resilient detent means which does not suffer from the above defects.

Another object of the invention is the provision of a resilient detent means which is easily removed from the socket member regardless of the condition of the elastomeric backing material.

A further object is the provision of a resilient detent means which does not depend for its action on a reciprocating plunger.

A still further object of the invention is the provision of a detent means in which the metallic abutting means is not subject to breakage as in prior art devices.

Yet another object is the provision of a detent means which may be removed from the socket member without the prior removal of the cutter bit and without regard to the condition of the elastomeric material.

Further objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of one type of cutter bit secured in a socket member by the resilient detent of the present invention;

FIG. 2 is a perspective view, partially broken away, of another type of cutter bit secured in a socket member by the resilient detent of the present invention;

FIG. 3 is a side elevational view, partially broken away, illustrating the method of inserting a cutter bit into the socket member;

FIG. 4 is a perspective view of the resilient detent of the present invention;

FIG. 5 is a perspective view of the metallic abutting element forming a part of the resilient detent of the present invention;

FIG. 6 is a longitudinal view taken along the lines 6--6 of FIG. 1;

FIG. 7 is a longitudinal view taken along the lines 7--7 of FIG. 2;

FIG. 8 is a perspective view of the cutter bit shown in FIG. 1 removed from the socket member; and

FIG. 9 is a perspective view of the cutter bit shown in FIG. 2 removed from the socket member.

Referring now to the drawings, and more particularly to FIGURES 1, 3 and 6, there is shown a cutter bit, generally designated 10 which is the resilient member in a rectangular cutter bit holding passageway 12 in the rectangular body portion 14 of a socket member, generally designated 16, and extends outwardly from the upper face 18 thereof. A resilient detent, generally designated 20, which releasably secures the cutter bit 10 in the socket member 16, resides in a circular horizontal passageway 22 in the rectangular body portion 14 intersect-
ing the rectangular cutter bit holding passageway 12 over an arc \( \alpha \) of the passageway 22 of less than 180°, and preferably about 90°. A keyway slot 23 cut in the wall of the retainer passageway 22 opposite the intersection with the cutter bit holding passageway is parallel to the axis of the passageway 22 and extends the length thereof. The rectangular cross section 24 of the cut edge vertically downward from the base of the socket member body portion 14 for connecting the socket member to the chain or bar of a coal cutting machine (not shown) in a manner well known in the art.

The cutter bit 10, as shown best in FIG. 3, has a head portion 26, with a cutting portion 32 formed on one upper edge, and a shank 28, with an integral rectangular flange 30 formed therebetween. The shank portion 28 of the cutter bit 10 is substantially rectangular in cross-section for mating with the passageway 12 of the socket member 16 while the lower face 34 of the flange 30 forms a flat surface for abutting the upper surface 18 of the body portion 14 upon insertion of the cutter bit shank 28 into the cutter bit holding passageway 12 in the socket member 16. The shank 28 has a pair of parallel planer side faces 36, a planer front face 38, and a rear face, generally designated 40. The rear face 40 has a groove 42 formed transversely across the surface thereof to mate with the detent 20, the notch 42 consisting of a curved surface 44 and an upper camming surface 46. The upper camming surface 46 extends downward and outward from the inner end of the curved surface 44 to the plane of the rear face 49 of the shank 28. A lower camming surface 48 extends from the lower end of the upper camming surface 46 downward and inward to the lower face 50 of the shank 28 and forms a apex at the junction with the upper camming surface 46. The lower ends of the side faces 36 have converging lower sections 54 meeting approximately at the lower face 50 to form a wedge shaped profile.

In FIGURES 2 and 7, an alternate cutter bit, generally designated 56, is fixedly mounted in a circular cutter bit holding passageway 57 of socket member 16'.

Socket member 16' includes a base section, not shown for attachment to a cutter chain, the configuration of said base section depending on the coal mining machine being used. Socket member 16' has a circular cutter bit holding passageway 57 in body portion 14' and further includes a circular horizontal passageway 22' with a key 23' to receive resilient detent 20'. The metallic abutting element 72' is to for purposes to be described below. The metallic cover plate 74 has an opening 80 to allow the metallic abutting element 72' to extend therefrom.

The metallic abutting element 72, as shown best in FIG. 5 comprises a cylindrical body portion 82 having truncated conical portions 84 and 86 extending from its ends. The metallic abutting element 72 is molded into cylindrical block 70, the longitudinal axis of the body portion 82 being offset and parallel to the longitudinal axis of the cylinder 70. This will insure retention of metallic abutting element 72 in cylindrical block 70. The truncated conical portions 84 and 86 are crescent cam surfaces to aid in compressing elastomeric member 70 upon insertion of resilient retainer 20 into passageways 22 or 22'. This is necessary since the total diameter of the resilient retainer 20 is slightly larger than passageways 22 or 22'. When retainer 20 is tapped in to passageways 22 or 22' the elastomeric member 70 is slightly compressed thereby applying pressure to hold the retainer 20 in position.

Before a cutter bit 10 or 56 is to be inserted into socket members 16 or 16', respectively, the resilient retainer 20 is placed in retainer passageways 22 or 22', respectively, with the front face 40 and the formed cover plate portion 74 fitting into keyway 23 or 23', respectively, and a portion of the abutting element 72 lying within the intersection of the retainer passageway 22 or 22' with the cutter bit passageway 12 or 57, respectively.

In FIG. 3 an opening 82 in socket member 16 for purposes of illustration, when cutter bit 10 is to be inserted into the socket member 16 (solid lines FIG. 3) the lower camming section 48 drives the abutting element 72 out of the rectangular cutter bit passageway 12 by compressing the cylindrical elastomer block 70. As the cutter bit 10 continues to descend, the abutting elements 72 passes the apex 52 and moves into the notch 42 allowing the elastomer to expand and drive the element 72 back into the intersection of the passageways 12, 22, against the upper camming surface 46 of the shank 28 to urge the cutter bit downward and to hold the bit 10 securely in place (in phantom, FIG. 3). When the cutter bit is driven upward to be removed from the socket member 16, the upper camming section 46 compresses the abutting element 72 until the apex is passed, after which the re-expanding cylindrical block 70 drives against the lower camming section 48 urging the cutter bit 10 upward.

The resilient detent 20 may be easily removed, even when the elastomer has partially decomposed, due to the design of the plate 74 which almost fully covers the elastomeric material allowing enough free, as shown at 78, to contact the walls of the retainer passageway ways as is needed to provide the necessary engagement to prevent accidental axial movement of the resilient retainer 20. Open portion 78 of cylindrical block 70 also permits flexing of cover plate 74 when the retainer 20 is inserted into the retainer passageways. The particular design of the resilient detent 20 permits the use of a comparatively small abutting element, supported along its entire length by the elastomeric cylindrical block to prevent shock or fatigue failures of the element. Moreover, the design of the abutting element 72 with its cylindrical body portion provides a plurality of surfaces to be bonded to the elastomeric material to prevent any possibility of the abutting element being pulled from the resilient detent 20. Furthermore, the design of the abutting element 72 of the retainer 20 permits the retainer 20 to be driven out of the passageway to release the cutter bits 10 or 56 if for some reason proper force cannot be applied to the cutter bits to move the bits past the abutting element 72.

While the forms of apparatus herein described constitute a preferred embodiment of the invention, it is to be understood that the invention is not limited to the
Claim:

1. In combination, a socket member, first and second intersecting passageways each extending through said socket member, a cutter bit, said cutter bit having a head section and a shank section, said shank section being slidably fitted into said first passageway, a detent means in said second passageway for releasably securing said cutter bit in said first passageway, said detent means comprising an elongated substantially cylindrical elastomeric member having a longitudinal axis, a non-yielding abutting means said abutting means having a cylindrical body portion and at least one truncated conical portion extending from said body portion, the longitudinal axis of said body portion being parallel to and offset from the longitudinal axis of said elastomeric member and extending therefrom, said abutment means having a cylindrical body portion and at least one truncated conical portion extending from said body portion, the longitudinal axis of said body portion being parallel to and offset from the longitudinal axis of said elastomeric member, said abutting means being resiliently fixed to said elastomeric member and extending therefrom adjacent the intersecton of said first and second passageways when the detent means is fixed in the second passageway to releasably secure the cutter bit shank in the first passageway.

2. The combination of claim 1 in which there is a means for preventing rotation of said elastomeric member in said second passageway, said means comprising a slot in the wall of said second passageway and extending the length thereof and a slot engaging means on said elastomeric member, said slot engaging means adapted to fit into said slot when said abutting means lies in the intersection of the first and second passageways.

3. The combination of claim 2 in which a non-yielding element extends over a substantial portion of said elastomeric member including said slot engaging means, said non-yielding element being fixed to said elastomeric member.

4. The combination of claim 1 wherein said first intersecting passageway is of rectangular cross-section to receive a rectangular cutter bit shank.

5. The combination of claim 1 wherein said first intersecting passageway is of circular cross-section to receive a circular cutter bit shank.

6. A resilient detent means comprising: a substantially cylindrical elastomeric member having a longitudinal axis, a rigid abutment means, said rigid abutment means being partially contained within said elastomeric member and extending therefrom, said abutment means having a cylindrical body portion and at least one truncated conical portion extending from said body portion, the longitudinal axis of said cylindrical body portion being parallel to and offset from the longitudinal axis of said elastomeric member.

7. The resilient detent means of claim 6 wherein the elastomeric member has an integral flange extending from the surface of said cylinder parallel to the axis thereof.

8. The resilient detent means of claim 7 wherein there is a non-yielding element extending over a substantial portion of said elastomeric member including said integral flange, said non-yielding element being shaped to conform to the surface covered.

9. The resilient detent means of claim 8 wherein said non-yielding element has a cut out portion through which the abutment means projects.

10. A resilient detent means comprising: a substantially cylindrical elastomeric member, a rigid abutment means, and a metallic element, said elastomeric member having an integral key section extending from the surface of said cylinder parallel to the axis of said member, said rigid abutment means comprising a metallic cylindrical body portion having truncated conical portions extending from each end of said body portion, said rigid abutment means being partially contained within said elastomeric member and extending therefrom, said metallic element extending over a substantial portion of said elastomeric member including said key portion, a centrally located cut out portion in said metallic element opposite said key portion through which said rigid abutment means projects, and an open slot portion exhibiting said elastomeric member, said metallic element being formed on said elastomeric member so that the elastomeric member in said slot portion is on the same cylindrical surface as the external surface of said metallic element to provide a friction surface for said detent.

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