ABSTRACT

A replaceable wear-resistant element assembly is described having a wear-resistant element and a mounting device for releasably securing the element in the recess of a supporting body. The mounting device is constructed of a one-piece goblet shaped unit having a sleeve portion for receiving the element therein and a stem portion for supporting the element. The stem and sleeve portions are interconnected by a shearable web portion which will fracture when an axial force of sufficient magnitude is applied to the sleeve to cause the sleeve to move downward about the stem to release the element.

4 Claims, 7 Drawing Figures
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1

REPLACEABLE WEAR-RESISTANT ELEMENT ASSEMBLY

BACKGROUND OF THE INVENTION

This invention relates to replaceable wear-resistant elements and more particularly to replaceable wear-resistant elements for earth drilling, crushing and engaging equipment.

One of the principal objects of this invention is to provide an improved wear-resistant replaceable assembly to that shown and described in U.S. Patent application, Ser. No. 151,859, filed June 10, 1971, now U.S. Pat. No. 3,717,209, issued Feb. 20, 1973 entitled "Replaceable Wear-Resistant Element Assemblies and Method for Replacing Same" which is assigned to a common assignee.

An additional object of this invention is to provide a replaceable wear-resistant element assembly having a mounting device that is one piece.

A further object of this invention is to provide a replaceable wear-resistant element assembly having a sleeve for receiving a wear-resistant element in which a mechanism is provided for preventing relative movement of a holding sleeve during normal working conditions.

These and other objects and advantages of this invention will become apparent upon the reading of the following detailed description of a preferred and alternate embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred and alternate embodiment of this invention is illustrated in the accompanying drawings, in which;

FIG. 1 is an isometric view of a wear-resistant element assembly embodying the principal features of this invention;

FIG. 2 is an expanded isometric view of an alternate wear-resistant element assembly;

FIG. 3 is a radial cross-sectional view taken of the wear-resistant element assembly illustrated in FIG. 1 in which the assembly is mounted in a recess of a body;

FIG. 4 is a cross-sectional view of the wear-resistant element assembly mounted in a body taken along line 4-4 in FIG. 3 in which a wear-resistant element is held in a sleeve;

FIG. 5 is a cross-sectional view similar to FIG. 4 except showing the sleeve being moved further into the recess to release the wear-resistant element;

FIG. 6 is a cross-sectional view of the wear-resistant element assembly illustrated in FIG. 2 in which the assembly is mounted in the recess of a supporting body; and

FIG. 7 is a cross-sectional view similar to FIG. 6 except showing the sleeve being moved further into the recess to release the wear-resistant element.

DETAILED DESCRIPTION OF PREFERRED AND ALTERNATE EMBODIMENTS

Now, referring in detail to the drawings, there is shown in FIG. 1, as a preferred embodiment, a wear-resistant element assembly 10 that is mountable in a recess 13 of a supporting body 14 such as a drill bit (FIG. 4). The wear-resistant element assembly 10 includes two major components—a wear-resistant element 11 and a mounting device 12 for releasably securing the wear-resistant element 11 in the recess 13.

Frequently a plurality of wear-resistant element assemblies 10 are mounted in a face 21 of a supporting body such as a drill bit to perform a cutting, chipping or grinding action against earth material during the operation of a drilling tool.

Each of the bores or recesses 13 has a side wall 17 and a back or bottom wall 18. The recess has an opening 20 in the face 21 of the supporting body (FIG. 4). In a preferred embodiment the recess 13 is cylindrical in shape forming an annular or cylindrical side wall 17. The back wall 18 may be flat or curved depending upon the particular application. Under certain conditions it may be desirable to have the back wall 18 relatively curved and flowing into the side wall to minimize any stress concentration being formed in the supporting body 14.

The wear-resistant element 11 is generally made of a rather hard wear-resistant material such as tungsten carbide or ceramic material of a hardness considerably greater than the supporting body 14. In the drilling industry, the wear-resistant elements 11 are frequently referred to as cutter inserts or as buttons. Preferably each of the wear-resistant elements 11 has a body 23 with a circular cross-section. The body 23 has an annular peripheral exterior surface 24. The body 23 has a front end 26 for projecting outward from the face 21 of the body 14. Frequently the front end 26 has a semi-spherical surface for best performance, particularly for impact drilling. The body 23 has an opposite base end 30 for extending into the recess.

The mounting device 12 for releasably securing the wear-resistant element 11 in the body, includes a sleeve 32. The sleeve is preferably constructed of a relatively tough, non-brittle hardened alloy steel that is not as hard as the wear-resistant element 11. The sleeve 32 has a central bore 33 formed therein forming an inner surface 34 for receiving the peripheral surface 24 of the wear-resistant element 11. The sleeve 32 has an outer surface 36 that is complementary in shape to the side wall 17. The sleeve 32 has a front end 37 and a rear end 38. Front end 37 has an annular end surface 40 and an adjacent beveled surface 41 that extends to the outer surface 36. When the wear-resistant element assembly 10 is mounted in a recess 13, the front end 37 normally projects slightly outward from the face 21 with the front end 26 of the wear-resistant element 11 extending forward therefrom.

Preferably the sleeve 32 has a longitudinal slit 43 extending the full length thereof for making the sleeve 32 more resilient, to permit a greater degree of circumferential expansion and contraction. Additionally annular spaced longitudinal grooves 45 are formed in the outer surface 36 at angularly spaced locations about the sleeve. As illustrated in FIG. 3 the slit 43 and the longitudinal grooves 45 are equally spaced about the periphery of the outer surface 36.

The mounting device 12 has an anvil, stool, or pedestal means 47 for mounting in the rear portion of the recess 13 against the back wall 18 to longitudinally position the wear-resistant element 11 and sleeve 32 spaced from the back wall 18 in a forward portion of the recess with the wear-resistant surface 26 extending from the face 21 an intended distance. The means 47 includes a base or foot 48 for engaging the back wall 18 of the recess and a projection or stem 50 extending upward from the foot centrally within the recess terminating in a forward end 51 for engaging and supporting the base.
end 50 of the wear-resistant element 11. The stem 50 is spaced from the side wall 17 forming an annular space 52. The diameter of the stem 50 is less than the outside diameter of the wear-resistant element 11 so that the thickness of the annular space 52 is greater than the thickness of the sleeve 32. A central bore 53 is formed in the stem 50. A counterbore 54 is formed in end 51 with threads formed in the bore 53 to enable a threaded tool to be inserted into the bore 53 to remove the pedestal means 47 from the recess.

The main feature of this invention is that the mounting means 12 has a shearable means projecting radially outward from the stem 50 for supporting the sleeve 32 spaced from the back wall 18 during normal operation and for enabling the sleeve 32 to be moved toward the back wall relative to the wear-resistant element 11 to release the wear-resistant element 11 when a force is exerted on the sleeve driving the sleeve further into the recess in which the force is of sufficient magnitude to sever the shearable means.

In a preferred embodiment illustrated in FIGS. 1, 3–5 the shearable means includes a shearable web 58 that interconnects the stem 50 with the sleeve 32 in which the sleeve and pedestal means are formed as an integral part in the shape of a goblet. The web 58 extends radially out from the end 51 interconnecting with the rear end 38 of the sleeves 32. The web 58 is formed with a radius curving outward from the stem 50. The web 58 has a minimum thickness at point 60 which identifies the location where the web will shear when sufficient force is applied to the sleeve driving the sleeve further into the recess and as the annular space 52 as illustrated in FIG. 5.

With the sleeve and pedestal formed as integral components, it is much easier to insert the pedestal means 47 into the recess at any angular inclination of the supporting body. Previously with the device illustrated in U.S. application, Ser. No. 151,859 filed June 10, 1971 entitled “Replaceable Wear-Resistant Element Assemblies and Method for Replacing Same,” it was difficult to mount the pedestal means in a recess unless the recess was oriented upward so that the pedestal means would fall into the recess with the foot engaging the back wall. Considerably better alignment can be obtained with the sleeve and pedestal means formed as an integral part.

Alternatively, the shearable means includes a shearable annular shoulder 64 formed at the end 51 of the stem 50 that extends out radially to engage the rear end 38 of the sleeve as illustrated in FIGS. 2, 6, and 7. The shearable means provides support to the sleeve to prevent the sleeve from working its way into the annular space 52 during normal operation.

When the wear-resistant element 11 is mounted in the sleeve bore 33, the peripheral surface 24 is connected to the inner surface 34 through a resistance connection. When the wear-resistant element 11 and the mounting device 12 are positioned in the recess 13, the outer surface 36 of the sleeve 32 is connected to the side wall 17 through a resistance connection.

In a preferred embodiment, the sleeve bore 33 has a diameter less than the diameter of the peripheral surface 24. Also preferably the outer surface 36 of the sleeve 32 has a diameter slightly less or equal to the inside diameter of the side walls 17. When the wear-resistant element 11 is pressed into the bore 33, an interference fit is formed between the inner surface 34 and the outer surface 24 to provide the resistance connection between the wear-resistant element and the sleeve. The internal pressure of the wear-resistant element 11 on the sleeve 32 causes the sleeve to expand to increase the diameter of the outer surface 36 to a dimension greater than the inside diameter of the side wall 17. When the sleeve is pressed into the recess 13, an interference fit is provided between the outer surface 36 and the side walls 17 to thereby form the resistance connection.

To prevent dirt, shavings and other debris from passing through the longitudinal slit 43 or the longitudinal grooves 45 into the annular space 52, the mounting device 12 is provided with barrier means. The barrier means includes, in a preferred embodiment illustrated in FIGS. 1 and 3–5, a soft filler material 73 mounted in the longitudinal slits 43 and longitudinal grooves 45. In an alternative embodiment illustrated in FIGS. 2 and 6–7, the barrier means includes an annular gasket 75 that is mounted on the shoulder 64 for engaging the side wall 17 to prevent any dirt or debris from passing into the annular space 52.

To replace a worn wear-resistant element 11, a removal tool 80, is placed against the front end 37 of the sleeves 32 (FIG. 5 or 7). An axial force is then applied to the front end 37 of sufficient magnitude to overcome the forces of the resistance connections and in addition to shear the shearable means to cause the sleeve to move axially into the annular space 52 provided about the stem 50 as shown in FIGS. 5 and 7. The pedestal means 47 prevents the wear-resistant element 11 from moving further into the recess 13 and enabling the sleeve to move relative to the wear-resistant element 11 to punch the wear-resistant element out of the sleeve bore 33. As the front end 37 of the sleeve clears the base end 30 of the wear-resistant element, the sleeve is permitted to contract slightly to its undeformed condition with the outer surface 36 of the sleeve disengaging from the interference fit with the side wall 17 as shown in FIGS. 5 and 7. The removal tool 80 is then backed away from the sleeve and the wear-resistant element 11 is removed. To remove the sleeve and the pedestal means 47, the body 14 is inverted to allow them to slide out. Under some conditions, it may be desirable to insert a threaded bolt into the bore 53 to pull the pedestal means and sleeve from the recess.

The degree of interference fit between the wear-resistant element and the sleeve 32 and between the sleeve 32 and the side wall 17 is sufficient to hold the wear-resistant element assembly 10 in the recess under normal operating conditions yet insufficient to cause plastic deformation of the sleeve or the side wall 17. The thickness and configuration of the shearable web 58 or the shearable shoulder 64 may be varied as desired to meet special conditions. The web 58 or the shearable shoulder 64 should be of sufficient dimension to prevent them from shearing under normal working conditions.

The recess 13, the sleeve 32 and the wear-resistant element 11 may have a variety of complementary cross-sections including square, circular, triangular or rectangular. Alternatively the resistance connections may be provided by placing an adhesive between the surfaces to create an adhesive bond.

It should be understood that the above described embodiments are simply illustrative of the principles of this invention and that numerous other embodiments.
may be readily devised without deviating therefrom. Therefore, only the following claims are intended to define this invention.
What is claimed is:
1. A mounting device for releasably securing a wear-resistant element in a recess of a body, in which the recess has a side wall and a back wall, comprising:
   a sleeve mountable in the recess with a bore formed therein to securely receive the wear-resistant element to support the wear-resistant element spaced from the side wall;
   a pedestal mounted in the recess for supporting the wear-resistant element spaced from the back wall; and
   in which the improvement includes the feature of a shearable means projecting radially outward from the pedestal for supporting the sleeve spaced from the back wall during normal operating conditions and for enabling the sleeve to be moved toward the back wall relative to the wear-resistant element to release the wear-resistant element when a force is exerted on the sleeve of sufficient magnitude to sever the shearable means.
2. The mounting device as defined in claim 1 wherein the shearable means includes a shearable web interconnecting the pedestal and sleeve.
3. The mounting device as defined in claim 2 wherein the sleeve, pedestal, and web are integrally formed as one piece having a goblet shape.
4. The mounting device as defined in claim 1 wherein the sleeve has an angularly spaced longitudinal groove formed therein to increase the flexibility of the sleeve.