COMMONWEALTH OF AUSTRALIA
The Patents Act 1952
APPLICATION FOR A STANDARD PATENT Form 1
OR A STANDARD PATENT OF ADDITION Regulation 9

WE, ROCK DRILL TECHNICAL SERVICES LIMITED, an Irish Company, of, Smithstown, Shannon, Co. Clare, REPUBLIC OF IRELAND, hereby apply for the grant of a standard patent for an invention entitled:

"A METHOD OF SEATING CUTTING INSERTS IN ROCK DRILLING EQUIPMENT"

is described in the accompanying complete specification.

(To be included in the case of a Convention application)
Details of basic application(s)-

Number of basic application 143/90
Name of Convention country in which basic application was filed: ZIMBABWE
Date of basic application September 11 1990

Our address for service is:
KELVIN LORD AND COMPANY, Patent & Trade Mark Attorneys, of 4 Douro Place, West Perth, Western Australia, AUSTRALIA, 6005

Dated this 2ND day of SEPTEMBER 1991.

ROCK DRILL TECHNICAL SERVICES LIMITED
By their Patent Attorneys
KELVIN LORD AND COMPANY

To: THE COMMISSIONER OF PATENTS
(Signature)
Australia Patent Declaration Form

Forms 7 and 8

AUSTRALIA

Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT OR PATENT OF ADDITION

In support of the application made by ROCK DRILL TECHNICAL SERVICES LIMITED

for a patent for an invention entitled "A METHOD OF SEATING CUTTING INSERTS IN ROCK DRILLING EQUIPMENT"

I/We, Patrick Purcell, of 17 Tullyglass Hill, Shannon, Co. Clare, Republic of Ireland, and

do solemnly and sincerely declare as follows:-

1. I am/we are the applicant(s) for the patent, or am/are authorised by the abovementioned applicant to make this declaration on its behalf.

2. The basic application(s) as defined by Section 141 of the Act was/were made in the following country or countries on the following date(s) by the following applicant(s) namely:

   Country, filing date and name of applicant(s) for each basic application

   in Zimbabwe on September 11 1990
   by ROCK DRILL TECHNICAL SERVICES LIMITED

   name(s) and address(es) of each actual inventor

   Patrick Purcell, of 17 Tullyglass Hill, Shannon, Co. Clare, Republic of Ireland, and
   John Elsby, of 7 Thrum Close, Leeming, Western Australia, Australia 6155.

3. The said basic application(s) was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

4. The actual inventor(s) of the said invention is/are

   Patrick Purcell, of 17 Tullyglass Hill, Shannon, Co. Clare, Republic of Ireland, and
   John Elsby, of 7 Thrum Close, Leeming, Western Australia, Australia 6155.

5. The facts upon which the applicant(s) is/are entitled to make this application are as follows:-

   The Applicant is the Assignee of the actual Inventors by virtue of an Assignment dated 30th May 1990.

DECLARED at Shannon this 31st day of December 1990

PATRICK PURCELL, DIRECTOR,
ROCK DRILL TECHNICAL SERVICES LIMITED
1. A method of seating a cutting insert in a seating recess in rock drilling and cutting equipment, in which discrete particles of a ductile material softer than the recess or the insert are placed in the seating recess in a pre-determined volume, the insert then being seated in the recess by applying a force to it sufficient to cause the particles to be pressed and fused together so as to mould around a seating surface of the insert and fill any gap which might otherwise remain between said seating surface and the base of the recess.
The following statement is a full description of this invention including the best method of performing it known to me/us:
The present invention relates to rock drilling and cutting equipment, for example rock drill bits, which include cutting inserts or buttons, commonly known as "button bits", particularly providing a method for seating the hardened cutting inserts or "buttons" in recesses in the cutting faces or bits of such equipment.

Most rock drill bits used in percussive drills and inserts in rotary tunneling equipment, such as raised drill cutters, full face tunnel boring cutters, etc., comprise tungsten carbide cutting inserts, generally cylindrical in shape having a domed "cutting" surface at one end and a generally flat "seating" surface at the other end. The body of the bit or cutter is generally made of hardened steel and is machined with a plurality of cylindrical recesses or sockets on its face to receive and seat the inserts, for example with an interference fit of 0.04 to 0.06 mm. When assembled, the domed ends of the inserts protrude from the face of the bit or cutter to provide the cutting "teeth".

The seating of the inserts in the sockets in bits and cutters is extremely important, but often the base of the socket is not flat or does not conform exactly to the base or "seating" end of the insert, with the result that inserts often do not seat properly, or tend to cause stress concentrations around the edges or base of the sockets which may result in premature failure of the equipment. However, it is
very difficult in practice to avoid a small gap between the "seating" end of the insert and the base of the socket on account of the necessity for a good interference fit to prevent the insert from loosening in use. It is known to place a shim or thin strip or strips of copper at the base of the socket to take up this gap, or the base of the insert may be sintered, but even with these methods, a gap may remain. A copper shim is really only effective when the base of the insert and the base of the socket are in approximate conformity. For instance, the seating gap between a flat-based insert and a socket having a conical base would not be satisfactorily filled with a copper shim.

The present invention addresses these problems by providing a seating method which results in an intimate seat for the insert and which also provides a means of shock absorbance, in use.

According to the present invention, there is provided a method of seating a cutting insert in a seating recess in rock drilling and cutting equipment in which discrete particles of a ductile material softer than the recess or the insert are placed in the seating recess in a predetermined volume, the insert then being seated in the recess by applying a force to it sufficient to cause the particles to be pressed and fused together so as to mould around a seating surface of the insert and fill any gap which might otherwise remain between said seating surface and the base of the recess.

The ductile material is preferably a metal or a metal alloy, such as lead or aluminium.

The discrete particles are preferably pellets, for example provided by lead shot.

The insert is most preferably seated in the recess with a press fit.

The method is preferably carried out without application of heat to either the insert or the recess. Alternatively, the insert and/or the recess may be subjected to a preliminary tempering step.
The invention also provides a drill bit whenever produced according to a method as described herein.

A preferred embodiment of a method of seating or cutting insert in a recess in the face of a rock drill bit will now be described with reference to the accompanying drawings in which:

Figure 1 is a side elevation of a typical "button" or cutting insert for a rock drill bit,

Figures 2a and 2b show a detail in cross-section of two different recesses in a rock drill bit, adapted to receive the cutting insert of Figure 1,

Figures 3a and 3b show the first step in the process of the present invention whereby lead shot is placed in the base of the recess,

Figures 4a and 4b show, in cross-section, the manner in which a cutting insert as shown in Figure 1 seats into the recess in accordance with the present invention, and

Figure 5 shows, in cross-section, to an enlarged scale, a cutting insert and a recess having non-conforming seating surfaces.

Figure 1 shows a typical "button" or cutting insert 1 for a rock drill bit, which is generally cylindrical in shape, having a domed "cutting" surface 2, and a flat "seating" surface 3. The insert 1 may also include a tapered portion 4. Such inserts are generally made of carbide material for example tungsten carbide.

Figures 2a and 2b illustrate two different profiles of a typical recess 5 in a rock drill bit 6. The base 7 of the recess (see Figure 2a) may comprise a conical surface caused by a drill tip during machining, or the base 8 (see Figure 2b) may include a flattened region formed by a subsequent machining operation, or by a flat-bottomed drill. However, the base of the recess may be neither truly conical nor flat, and may be domed or comprise a conical surface with helical
indents as caused for example by a SUMITOMO Multi-Drill (Trade Mark) tool.

Figure 5 shows a cutting insert 10 defining a frusto-conical seating base and a socket 11 defining a conical base which do not conform. It has been found that copper shim is unsatisfactory to close the seating gap 12, but in accordance with the present invention, such a gap may be closed and stress concentrations at points X substantially reduced because the lead shot tends to mould around the corners of the insert to provide a cushion.

In accordance with a preferred process of the present invention, a quantity of lead shot 9 is firstly placed in the base of the recess as shown in Figures 3a and 3b. The cutting insert 1 is then fitted into the recess 5, preferably with a press fit. Once the base 3 of the insert contacts the lead shot, it squeezes the particles into any gap which would otherwise remain between it and the base 7 or 8 of the recess. The discrete particles of lead shot are fused together so as to mould around the base 3 of the insert so as to provide an intimate seating contact with the recess.

On account of the substantial difference in hardness between the lead shot on the one hand and the insert 1 and the rock drill bit 6, the layer of lead forms a cushion which acts in use as an effective shock absorber. This also helps to avoid the problems of stress concentrations in the bit.
The Claims defining the invention are as follows:—

1. A method of seating a cutting insert in a seating recess in rock drilling and cutting equipment, in which discrete particles of a ductile material softer than the recess or the insert are placed in the seating recess in a pre-determined volume, the insert then being seated in the recess by applying a force to it sufficient to cause the particles to be pressed and fused together so as to mould around a seating surface of the insert and fill any gap which might otherwise remain between said seating surface and the base of the recess.

2. A method as claimed in Claim 1 in which the ductile material is a metal or a metal alloy.

3. A method as claimed in Claim 2 in which the metal is lead.

4. A method as claimed in Claim 2 in which the metal is aluminium.

5. A method as claimed in Claim 1 in which the discrete particles are in the form of pellets.

6. A method as claimed in Claim 5 in which the particles are lead shot.

7. A method as claimed in any of the preceding claims in which the insert is seated in the recess with a press fit.

8. A method as claimed in any of the preceding claims, with the modification that heat is first applied to either the insert or the recess, prior to seating the insert in the recess.

9. A method as claimed in Claim 8 wherein the insert and/or the recess are first subjected to a preliminary tempering step.
10. A method of seating a cutting insert in a rock drill bit, substantially as described herein with reference to, and as shown in, the accompanying drawings.

11. A rock drill bit whenever produced by a method as claimed in any one of the preceding claims.

DATED 2nd DAY OF SEPTEMBER 1991
ROCK DRILL TECHNICAL SERVICES LIMITED
By their Patent Attorneys
KELVIN LORD AND COMPANY
PERTH, WESTERN AUSTRALIA.