

Alternative Bucket Point Retainer Systems – “Greasywedge” & “Easywedge”

Rodney Clarke, Keech Castings Australia Pty Limited
Peter Brown, Warkworth Mining Pty Limited

SUMMARY

Approximately four years ago, Keech Australia Pty Limited was approached by Peter Brown of Warkworth Mining Pty Limited, to investigate the practicability of an alternative method of retaining tooth points on existing designed bucket lips.

Keech Castings in conjunction with Warkworth Mining have been developing two systems. The initial system developed was a Mechanical Locking Device called the "Easy Wedge" which works on the principal of two tapered blocks pulled together by a bolt which in turn expands two vertical legs that lock the tooth point in position.

The second system which is undergoing field evaluation is a Hydraulic Locking Device. This device has been christened the "Greasy Wedge" and it works on the principal of force being transferred through a medium extending two pistons that lock the tooth point in position.

The "Easy Wedge" and "Greasy Wedge" systems eliminate the use of large hammers when changing retainers on large bucket tooth points. This significantly reduces the risk of mine personnel incurring a lost time injury.

INTRODUCTION

Open cut mining has numerous risks involved with many types of routine tasks performed by mine personnel.

One particular area which has a high lost time injury rate is Dragline bucket and shovel dipper maintenance. Mine personnel are regularly exposed to direct and indirect injury as a result of high energy exchanges through the use of large sledge hammers.

Data Period 1/1/91 to 30/6/94

Main Category	>5 Days Lost Time	>30 Days Lost Time	=<30 Days Lost Time
Maintenance	19	6	32

Information supplied by the NSW Minerals Council

As the workforce ages in the coal industry, there is an increased risk of personnel sustaining a lost time injury of significant duration.

"The average and mean age of open cut employees in NSW is 40.68. The percentage of open cut employees over 35 years of age in NSW is 74.4%". Data December 1995.

Information supplied by Joint Coal Board.

It was this need for an improved method of retaining the bucket tooth points which motivated Warkworth Mining to enquire if suppliers could design an alternative retainer system.

Keech Castings Australia and Warkworth Mining formed a working relationship between supplier and purchaser. From this successful relationship, two systems have been designed - the "Easy Wedge" and the "Greasy Wedge".

1.0 Problem

To reduce the incidence of lost time injury by reducing the risk to mine personnel when changing dragline bucket and shovel dipper points.

1.1 Direct Injury

Mine personnel are exposed to direct risk of sustaining a lost time injury or permanent disability when swinging large sledge hammers. There are high energy exchanges when the head of the hammer strikes the top of the traditional tapered wedge. The person actually using the hammer may sustain serious jarring to hands and arms, hernia and more severe lower lumbar muscular strains as well as hearing loss and eye injuries may be incurred if the correct safety equipment is not worn.

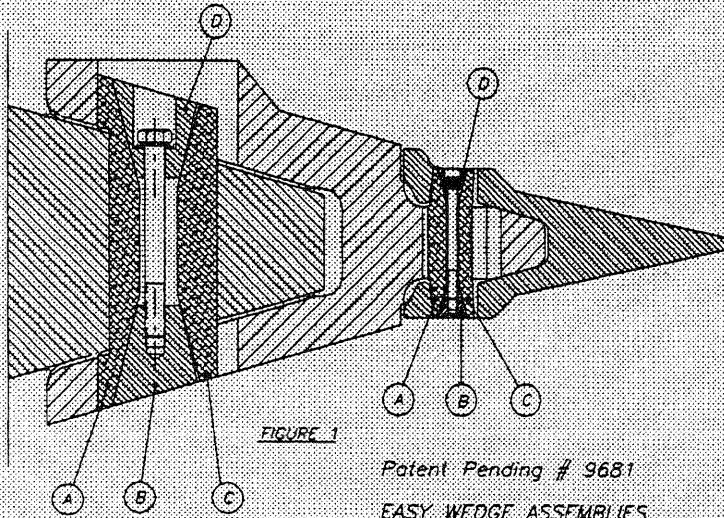
1.2 Indirect Injury

Mine personnel within the immediate work area may also be indirectly exposed to risk of sustaining a lost time injury or a permanent disability if struck by flying fragments of steel generated from the impact of steel on steel.

2.0 Objectives

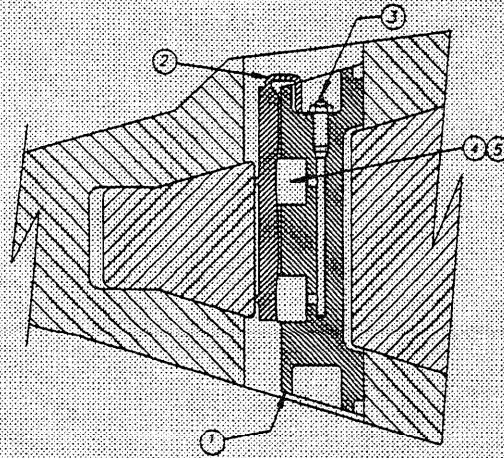
Encourage original equipment manufacturers and ground engaging tools suppliers to engineer safer and less strenuous methods of installing dragline shovel and shovel dipper point retainer pins.

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DS-101B

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3.0 Easy Wedge (Figure 1)

This is a mechanical locking device, the concept was devised approximately five years ago. The mechanics of the wedge work on tapers. The Easy Wedge had some basic but important design parameters. It was necessary for it to:

- ▶ fit existing bucket lips and nose designs
- ▶ no specialised tooling required
- ▶ simple operation
- ▶ easy to install
- ▶ easy to remove

Initially the Easy Wedge was installed in four separate pieces which proved time consuming and cumbersome after numerous design changes the Wedge was refined to enable it to become a drop in unit.

3.1 Installation

- ▶ Lower the fully assembled unit down through the pin hole in the tooth point. Easy Wedge will locate in the correct position.
- ▶ Turn the bolt in a clockwise direction as the bolt tightens two tapered blocks are pulled together which in turn expand two vertical legs, this forces the tooth point onto the nose and into the locked position.
- ▶ The bolt is then tensioned to appropriate torque and a polyurethane plug is installed to eliminate the build up of dirt around the head of the bolt.

It is important to note that after half a shift the wedges should be retensioned after initial installation.

3.2 Removal

After the service life of the tooth point has expired, the polyurethane dirt plug is removed to access the head of the bolt, fully undo the bolt in a counter-clockwise direction. The bolt head will become proud of the countersunk hole.

Strike the head of the bolt using a hand hammer - this will break the bottom tapered block from the locked position and allow it to fall out, remove the top block and push the two vertical legs downwards through the tooth points.

4.0 Greasy Wedge (name given to Hydraulic Wedge) (Figure 2)

This hydraulic locking device is being developed as an alternative to the mechanical "Easy Wedge". It had to comply to the existing design parameters used for "Easy Wedge", but with the hydraulic wedge Warkworth Mining and Keech Castings were looking to increase the benefits when using this type of alternative retainer.

The new hydraulic wedge had to be:

1. Reusable
2. Repairable
3. Non tradesperson installation

This presented a range of new challenges in not only the design by also the materials used to manufacture the actual castings.

One area which is still under evaluation is the actual medium used to transfer and maintain the force which extends the pistons.

There are two problems with using general purpose grease.

1. Air is trapped within grease during manufacturing processes, under extreme loads the trapped air will separate from the grease causing in the Greasy Wedge a loss of pressure, and therefore the force applied to the pistons.
2. In the event that an inexperienced person could possibly use an oxy acetylene cutting torch to try and remove a Greasy Wedge, there is a real possibility of an explosion being triggered by pure oxygen mixing with the grease under pressure.

Keech Castings are working with several lubricating companies to find a safe and suitable medium. The most promising substance is a material very similar to petroleum jelly.

4.1 Installation

The Greasy Wedge is installed by lowering the main valve body down into the tooth point. It will self locate into the correct position, install the spacer in a downward position until "U" hanger touches the bottom face inside the recess which houses the check valve. This aligns the spacer with the pistons correctly. Pump in the correct medium - this will allow the pistons to extend and transfer force which will lock the point onto the nose. Continue to pump until the safety relief valve located in grease gun vents. Install the polyurethane dirt plug to protect the valve.

It is important to note that after half a shift the wedges should be retensioned.

4.2 Removal

Once the service life of the tooth point has expired, the polyurethane dirt plug is removed allowing access to the valve. Turn valve counter-clockwise several turns, this unseats the valve allowing pressure to vent into an internal chamber.

The spacer will loosen, though it will require a hand hammer and punch to knock the spacer down past the pistons. The spacer has a cambered surface which as it is passing downwards, it forces the pistons to retract. The spacer drops through the main valve body may be easily removed.

5.0 Conclusion

The "Easy Wedge" and the "Greasy Wedge" are viable alternatives to the standard spool and wedge currently available. They greatly reduce the risk of direct and indirect injury to mine personnel as they carry out routine and breakdown bucket tooth replacement.

There is no doubt in our minds that if mines continue using large hammers when changing tooth point retainers, their workforce will suffer a far greater rate of injuries than mines using these alternative methods.

Warkworth Mining as an employer have a legal and moral obligation to provide a workplace as safe as possible for all its employees