Safety in Mines Research Advisory Committee

Final Project Report

DEVELOPMENT OF AN EFFECTIVE PINCHBAR

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EXECUTIVE SUMMARY

A significant proportion of rockfall accidents occur during re-entry into a workplace, when the initial inspection and making safe procedures are carried out to stabilise the rock before work in the area begins. The reason is that making safe is one of the most stressful and dangerous activities an underground miner can undertake. The operator often is unable to work at a safe distance and is sometimes forced to work directly underneath unstable rock ilise the rock effectively and efficiently from a safe distance before work begins when attempting to “make safe”. The equipment currently used is archaic and there is a need to devise a simple system to enable operators to stab in the area. Studies undertaken through the University of Laval, Canada, have shown that scaling (making safe) with conventional hand-held equipment is difficult, arduous and stressful, with operators needing to rest for rapidly increasing amounts of time after only 8 minutes of activity. This is almost a guarantee that excavations requiring a lot of barring will not be made safe adequately.

During a previous project GEN 801, Investigate a possible system for “making safe”, a literature and international survey on existing systems as well as a problem survey of different mines (gold, platinum and coal) was conducted. A functional analysis was done from which a specification was drawn up. Different concepts for making safe were generated and evaluated against a system specification. The following concepts were recommended for further development:

- A “lightweight pinch bar” where the bar is manufactured of composite materials.
- “Mechanical jaws”: A hand held and operated mechanical system, which makes use of hydraulic pressure activated jaws to pry rocks loose.

During this project both concepts were developed to a tested prototype. An experimental development model was first designed, built and tested, after which design reviews were held and prototypes built. The prototypes were tested in the laboratory after which the design was again modified. The prototypes were then evaluated underground in platinum, gold and coal mines. The underground evaluations showed that the prototypes were effective but that they could be further improved with certain minor modifications.

The underground evaluations showed that both the lightweight pinch bar and the mechanical “jaws” can be successfully used for making safe. The equipment is designed to reduce exposure to falls of ground, and to assist in reducing operator stress and fatigue.

These tools will have an impact in addressing rock fall fatalities and injuries associated with making safe or barring activities. The tools will also improve the overall quality of barring, especially in excavations requiring a lot of work, and this will reduce the rockfall hazard from loose pieces becoming dislodged in the longer term. It is recommended that both making safe tools be manufactured and marketed by an industrial partner once they have been improved, based on the findings of the underground trials.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to the Safety in Mines Research Advisory Committee (SIMRAC) for financial support of project SIM 020201 and also for the interest and technical input of the SIMRAC Technical Committee. The input and assistance of Grinaker Mining, who was chosen as the industrial partner for the project, is also appreciated. The team would also like to thank the mines where tests were conducted.

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1 INTRODUCTION

A significant proportion of rockfall accidents occur during barring (making safe) operations to stabilise the rock before work in the area begins. The reason is that making safe is one of the most stressful and dangerous activities an underground miner can undertake. The operator often is unable to work at a safe distance and is sometimes forced to work directly underneath unstable rock when attempting to “make safe”. The equipment currently used is archaic and there is a need to devise a simple system to enable operators to stabilise the rock effectively and efficiently from a safe distance before work begins in the area.

The University of Laval has investigated scaling operations (barring) using conventional hand-held pinchbars in small mines (Planeta, 1995). The results indicate clearly that the process is physically demanding on operators, because it entails considerable percussion and traction efforts with a relatively heavy steel bar to dislodge loose rock. Studies at the Mouska Mine (Laflamme et al., 1993) show that loose rock detection using percussion requires 20-30% of the time, while penetration and prying loose require the remaining 70-80%. Because of the physical demans of the latter, operators tire quickly, and after only 8 minutes of activity, operators need to rest for 26% of the time. This is a clear indication of the arduousness and stressfulness of the task (Planeta, 1995).

The equipment developed during this project is designed to minimise the physical effort of operators by:

- Reducing weight of equipment to reduce stress during percussion;
- Reducing effort of penetration and prying loose rock.

This equipment will reduce the exposure to fall of ground hazards, by improving barring quality through a reduction of stress and physical effort by the operator.

This is the final report on project SIM 020201. During this project two prototype systems were developed and tested, and in conjunction with each other, should be able to reduce the arduousness of barring.

2 METHODOLOGY

The two selected concepts, the lightweight pinch bar and the mechanical “jaws” were developed as two separate products. The same development approach was adopted for each concept, and the development was carried out in parallel. The development process is summarised below.

Lightweight pinch bar:

- The concept developed during project GEN 801 was revisited and certain modifications were made.
- A detail design was made of the experimental development model (XDM) and drawings were generated.
- Different length models were built.
- The different length models were tested in the laboratory to determine strength, flexibility and durability.
- Comparative tests with other pinch bars were conducted.
- A workshop was held with industry to assess the results and confirm the scope of the project.
- The project progress was presented to SIMRAC before proceeding.
- Taking the results of the surface tests into account, design reviews were held.
- Prototypes of different lengths were manufactured.
- Prototype lightweight pinchbars were sent to gold, platinum and coalmines for underground evaluation.

Mechanical “jaws”:

- The concept developed during project GEN 801 was revisited and certain modifications were made.
- A detail design was made of the experimental development model (XDM) and drawings were generated.
- The XDM was manufactured.
- The functionality of the XDM was tested in the laboratory.
- A workshop was held with industry to assess the results and confirm the scope of the project.
- The project progress was presented to SIMRAC before proceeding.
- Taking the results of the surface tests into account, a design review was held.
- A prototype was manufactured for underground evaluation, which was conducted at a gold and coal mine.

3 LIGHTWEIGHT PINCH BAR

3.1 Concept

The concept consists a lightweight composite material bar with two steel tips. The steel tips are similar to those on existing steel pinch bars. In figure 3-1 the lightweight pinch bar is schematically shown.

The following design aims were set:

- The tube should have the same strength as that of a steel pinch bar.
- The flexibility of the pinch bar to be the same as that of a steel pinch bar.
- The weight of the pinch to be similar to that of an aluminium pinch bar.
- The diameter of the bar has to be ergonomically acceptable.

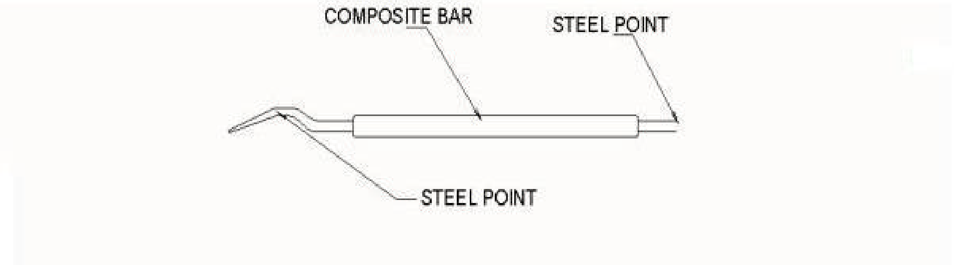


Figure 3-1: Lightweight pinch bar concept

3.2 Design of Experimental Development Model (XDM)

Two different designs for the tubes were done. Both designs make use of standard steel tips. The pinch bars can be built with either the 19mm or 25mm steel tips. The first design of the bar is based on a glass fibre (GRP – Glass Reinforced Plastic) tube that is manufactured around a 40mm conduit pipe. A mixture of 600 bi-directional and 620 unidirectional weave is used. To fit the steel tip into the tube, fibreglass is wound around the steel tip to increase the thickness and to create a bonding surface between the glass and the tube. In figure 3-2 the layout of the lightweight pinch bar with the manufactured glass fibre tube is shown.

FIG. 3.2

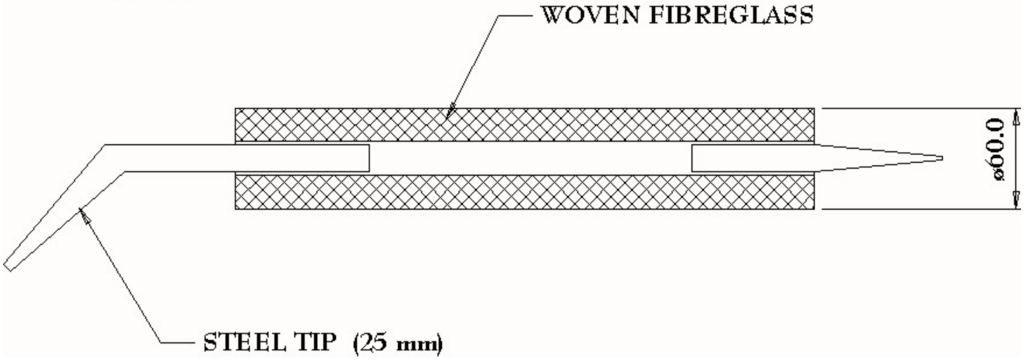


Figure 3-2: Layout of lightweight pinch bar with manufactured bar.

Due to the high cost of manufacturing the glass fibre bar an alternative to the manufactured tube was sought. An extruded glass fibre tube manufactured from glass chop strands was proposed. A 38mm diameter tube was used. Although a 40mm diameter is more ergonomically correct the 38mm GRP tube was the only size available (Department of Trace and Industry, UK, 2000). For mass production the building of a 40mm mandrill for the production of the tube may be viable. In figure 3-3 the layout of the lightweight pinch bar with the extruded fibreglass tube is shown.

FIG. 3.3

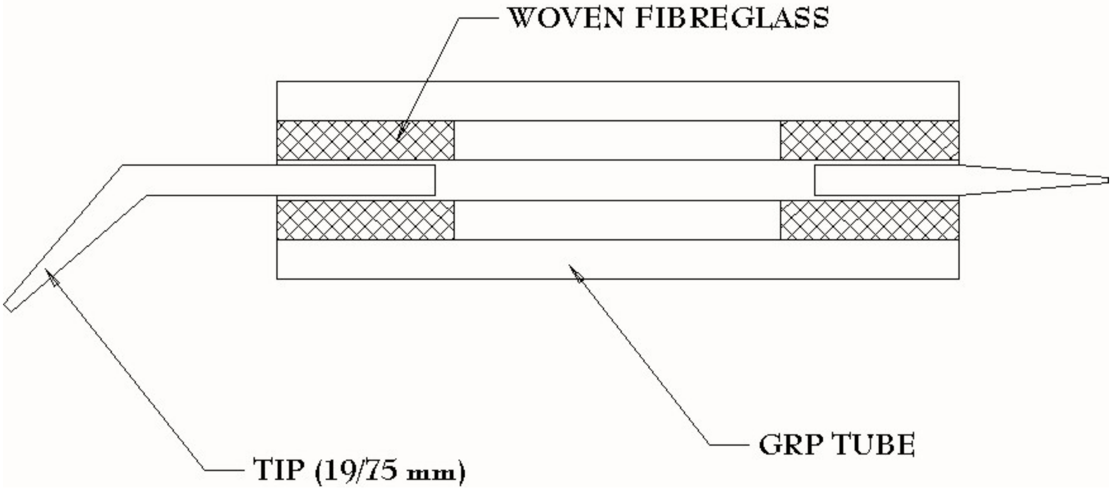


Figure 3-3: Layout of lightweight pinch bar extruded fibreglass tube.

3.3 Building and testing XDM

Both lightweight pinch bars, with the manufactured glass fibre tube and the extruded glass fibre tube were built and tested in the laboratory. In figure 3-4 a photo of the lightweight pinch bar with the manufactured tube is shown and in figure 3-5 a photo of the pinch bar with the extruded glass fibre tube is shown. In table 3-1 a summary of the comparative test results of both XDM pinch bars as well as a 25mm hexagonal steel pinch bar are shown. Figure 3-6 shows the stiffness of the lightweight pinch bar with the extruded glass fibre tube in comparison to that of the 25mm steel pinch bar.

Figure 3-4: XDM lightweight pinch bar with manufactured glass fibre bar.

Figure 3-5: XDM lightweight pinch bar with extruded glass fibre tube.

Table 3-1: Comparative test results of XDM pinch bars and a 25mm steel pinch bar.

Pinch bar type	*Unclamped Length (m)*	*Clamped Length (m)*	*Total Mass (kg)*	*Mass (kg) for clamped length (2,6m)*	*Deflection (25kg load @ clamped length) (mm)*	*Bending / Breaking load (kg)*
Lightweight (extruded tube)	3.5	2.6	4	3.3	930	35
Manufactured Fibreglass tube	3.2	2.6	8.5	7.1	205	80 +
25mm hexagonal steel	2.9	2.6	13	11.7	275	80

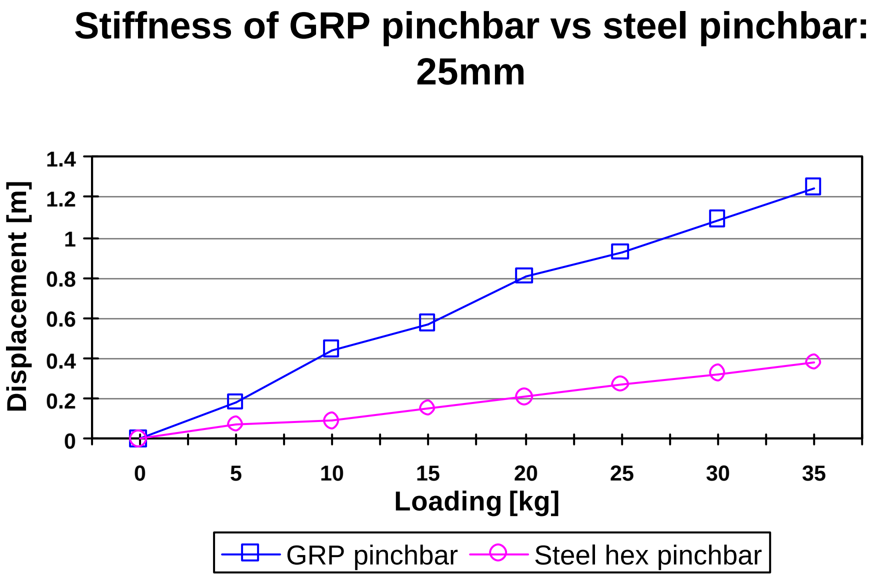


Figure 3-6: Stiffness of a 2.8m lightweight pinch bar with an extruded glass fibre tube and a 25mm steel pinch bar.

The lightweight pinchbar is by far the lightest of the three, but suffers from a reduction in stiffness. Although the stiffness of the XDM pinch bar with the extruded fibreglass tube bar is lower than that of the steel pinch bar the bending/braking strength is the same as the mode of failure for both is the bending of the steel tips.

3.4 Design review

During the design review the comparative test results were evaluated and compared to the design aims that were set. In order to achieve the same flexibility as that of a steel pinch bar the weight of the lightweight pinch bar would have to be increased and it was decided that the lighter weight was more important than the stiffness. The lighter weight combined with the cost advantage of the extruded fibreglass tube is more important than the higher stiffness of the manufactured fibreglass tube.

The inclusion of a “knock off” capability of the tips was investigated, which would have the advantage that only the tips would have to be taken for re-sharpening. This capability can be included in the design or as a different model. It was decided against this capability for the prototype development as this would add to the weight and cost of the pinch bar.

The design of the prototype lightweight pinch bar included the following:

- Use of extruded fibreglass tube – 38 mm.
- Use different steel tips 19mm and 25mm for different applications.
- Different lengths: 1.8m
  2.0m
  2.8m
  3.5m - for use in coalmines.

The connection of the steel bits into the fibreglass tube was made easier and cheaper. A low-density foam plug is pushed into the tube to the desired depth. The tube is placed upright and the steel bit is placed in the centre, resting on the foam plug. The area around the hexagonal tip is then filled with resin and chop strand. To strengthen the tube at the end to prevent it from splitting open a single layer of glass and resin is wound around the tube in the area of the tip. In figure 3-7 the layout of the connection between the steel bit and the fibreglass tube is shown. Figure 3-8 shows the assembly drawing of the lightweight pinch bar.

FIG. 3.7

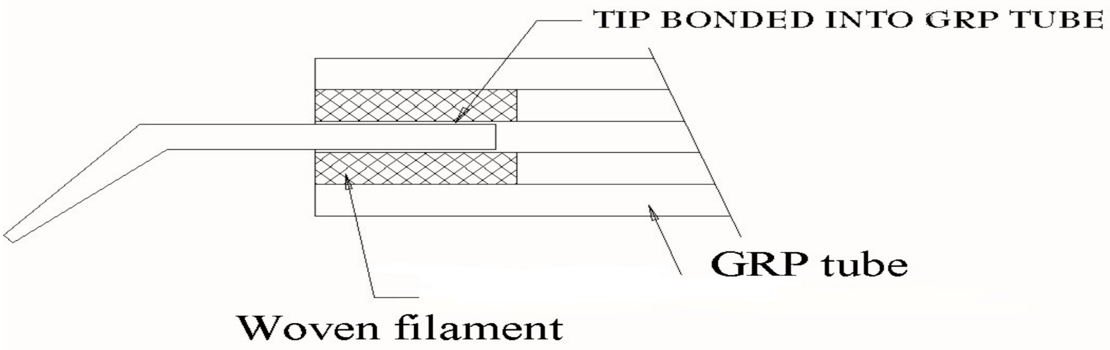


Figure 3-7: Layout of connection between steel bit and fibreglass tube.

FIG. 3.8

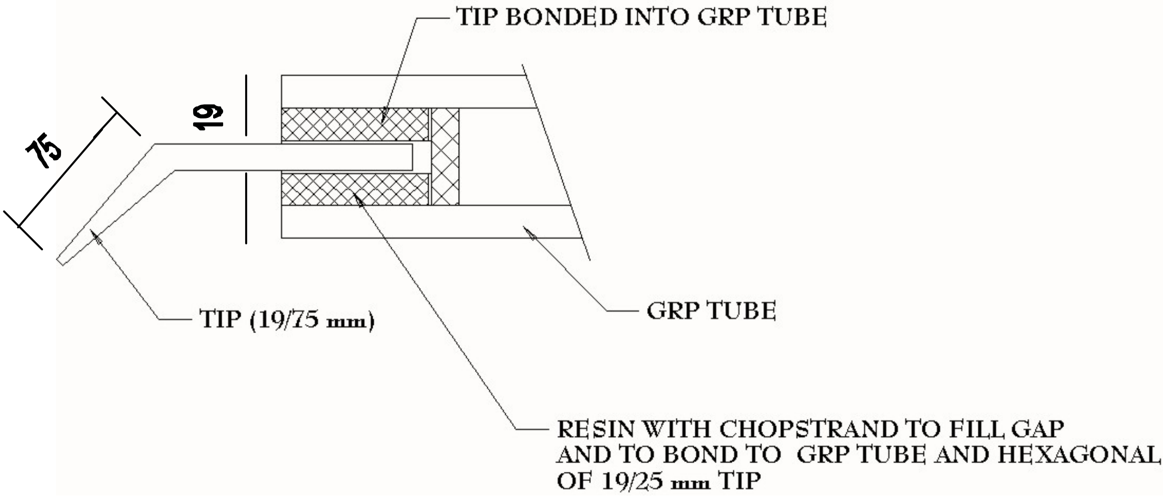


Figure 3-8: Assembly drawing of lightweight pinch bar.

3.5 Prototype Construction

The following numbers and lengths of the prototype lightweight pinch bars were built for tests and underground evaluations:

1.5m	6	
1.8m	3	
2.0m	3	
2.6m	4	
3.0m	1	
3.5m	5	
4.0m	2	
5.0m	5	On special request for a coalmine.

In figure 3-9 a photo of a lightweight pinch bar is shown.

Figure 3-9: Photo of lightweight pinch bar.

3.6 Comparative tests

The prototype lightweight fibreglass pinch bars were comparatively tested with aluminium, 25mm square steel tube and 19mm and 25mm solid hexagonal steel pinch bars. Table 3-2 shows a summary of the results of the comparative tests. From the table it can be seen that the lightweight pinch bars are significantly lighter than the steel pinch bars and compare favourably with the mass of aluminium pinch bars. In figure 3-10 the weight comparison of the pinch bars is shown. In figure 3-11 the deflection comparison of the pinch bars under a load of 25 kg at 2,6m length is shown. Although the deflection of the lightweight pinch bars is higher than that of the solid steel pinch bars, it is less than that of the bar manufactured from square tubing. The braking load (the load at which permanent bar deformation occurs) of the lightweight pinch bar is also superior to that of the aluminium and square tube bars. Interestingly the 1.6m lightweight pinch bar has similar deflection to that of the 19mm solid steel hexagonal bar. This appears improbable when compared to the excessive bending of the longer 25mm lightweight bar but the tests show that the bending of the lightweight bars increases exponentially the further one moves away from the end where the solid steel tip is infused into the tube.

Table 3-2: Comparative test results of p pinch bars

Pinch bar type	***Unclamped Length (m)***	***Clamped Length (m)***	***Mass (kg)***	***Mass (kg) for 2,6m length***	***Deflection (25kg load @ clamped length) (mm)***	***Bending / Breaking load (kg)***
Lightweight 25mm tip	3.5	2.6	4	3.3	930	35
Aluminium	2.6	2.6	4.5	4.5	465	25 +
25mm hexagonal steel	2.9	2.6	13	11.7	275	80
25mm square tube	2.6	2.6	4.5	4.5	940	30
Lightweight 19mm tip	1.6	1.6	1.8	2.7	215	50 +
19mm hexagonal steel	1.63	1.6	4.6	7.5	215	50

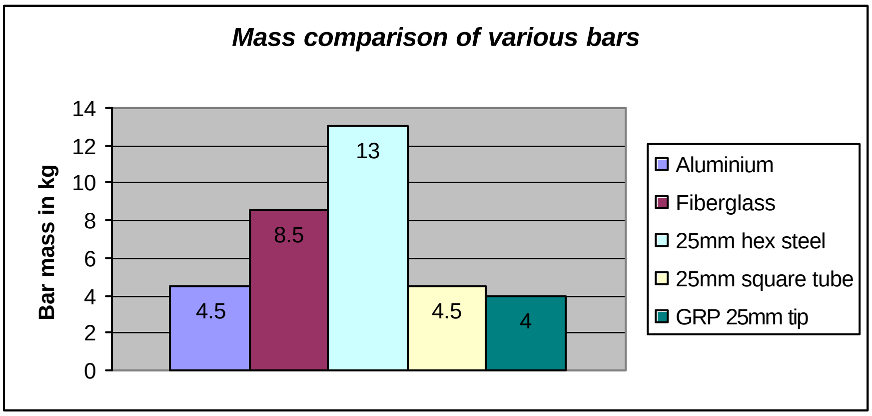


Figure 3-10: Weight comparison of pinch bars.

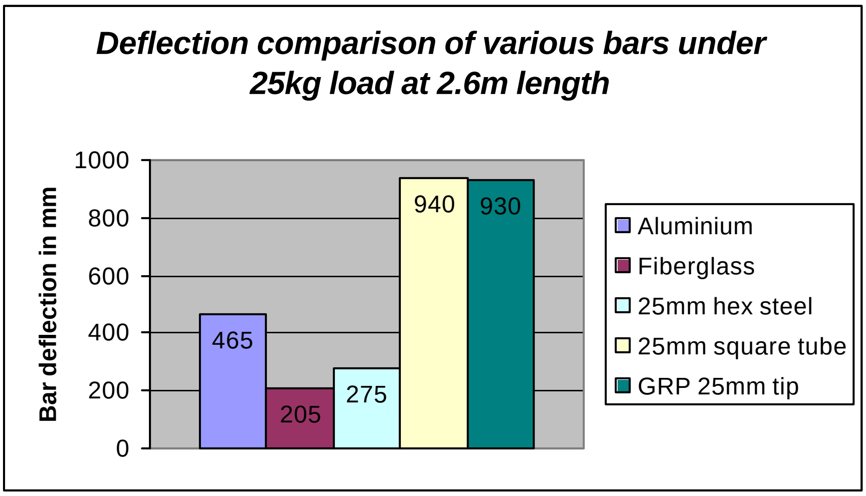


Figure 3-11: Deflection comparison of pinch bars.

3.7 Underground evaluation

The lightweight pinch bars were evaluated at Driefontein Gold Mine, Karee platinum mine and Bank colliery. In the gold and platinum mines the evaluation was done in the gully as well as in the stope areas. Figures 3-12, and 3-13 show photos of the operation in the gold mine and in the coalmine. Video material showing the operation and handling of the pinch bars was taken during these tests and is attached as Appendix A (a CD is attached to this report). A number of pinch bars were left with the mines for continued use and positive feedback has been received.

Figure 3-12: Lightweight pinch bar in operation in gold mine.

Figure 3-13: Lightweight pinch bar in operation in coal mine.

The following results and comments were obtained during the underground evaluations:

? Due to its relative lightweight, the work rate is much higher than with other pinch bars (especially steel).
? The lightweight makes it easier to maneuver.
? Sounding loose rock is very effective as the hollow tube acts as a sound box.
? A hand guard to protect the hands from falling or detached rocks is a necessity.
? Depending on the stoping width or height of roof different length pinch bars are required.
? Depending on the type of work 19mm or 25mm tips are required.
? In the specific coal mine the pinch bars longer than 4m-length were too long.
✍ Contrary to the gold mines where a striking action is used to chisel off loose rock, the coalmines make use of a levering action. The barring technique has the operator insert the chisel end of the bar into the cracks between rock layers and lever the bottom layer loose. This highlighted the fact that the chisel tips used in the lightweight pinch bars are too short i.e. the chisel point does not protrude far enough into the crack to allow for sufficient levering off of the bottom rock layer.
✍ A different steel tip is required for the pinch bars in coalmines. It is recommended that a tip be used where the chisel tip point bends out at a 45? angle to the chisel shaft and where the chisel point protrudes at least 100mm from the shaft. See figure 3-14.

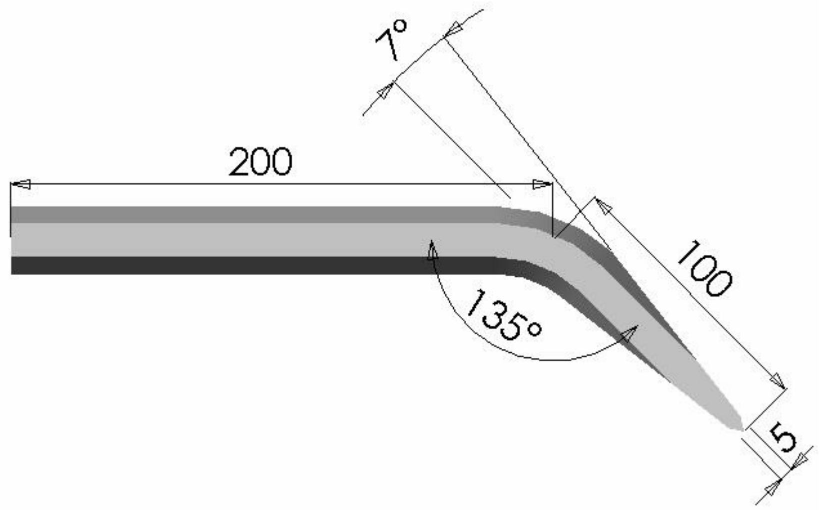


Figure 3-14: Recommended tip (25mm) to be used for coalmine pinch bars

- The durability of the pinch bars is good. Only one pinch bar was reported broken. This pinch bar was used in the coalmines and the evidence suggests that the glass fibers of the tube were mechanically damaged, i.e. the pinch bar got caught between two sharp edges. Figure 3-15 shows a photo of the damaged pinch bar.
- A number of requests were received to buy pinch bars.

Figure 3-15: Damaged pinch bar.

4 MECHANICAL “JAWS”

4.1 Concept

The concept consists of a prying mechanism connected to a rod. The purpose of this tool is to reduce operator effort in prying rock loose. The rod is carried by the operator who manoeuvres the prying mechanism (hydraulically operated “jaw”) into a crack (see figure 4-1). The prying mechanism comprises a pair of jaws with sharp tips so that they can be inserted into a crack. The jaws are opened hydraulically to apply a prying action to the rock mass when the tip is inserted into a crack. A lever operated hydraulic pump placed at the base of the rod supplies the hydraulic fluid under pressure. The hydraulic reservoir forms part of the rod, making it a self-contained system. The rod is hinged at a position close to the operating end (jaws) to be able to direct the prying mechanism towards a crack. The direction of the prying mechanism is preset. A remotely operated slide hammer is positioned behind the prying mechanism to force the jaws into exposed cracks prior to the actuation of the prying mechanism. In figure 4-2 the layout of the system is shown and detail of the front end of the rock prying apparatus appears in figure 4-3.

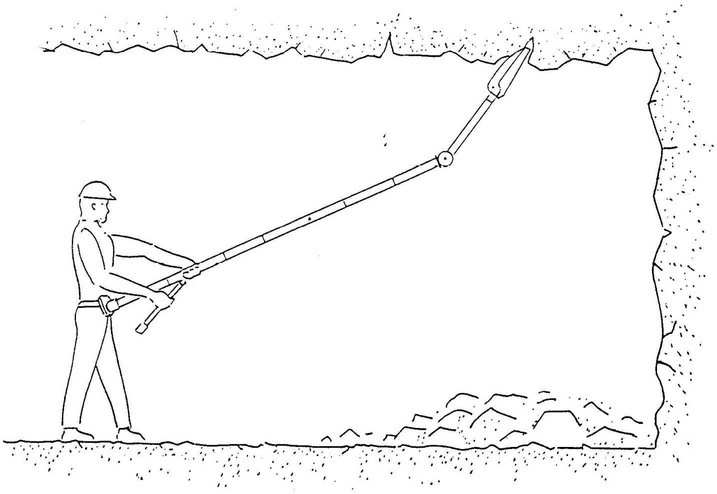


Figure 4-1: Rock prying apparatus in use

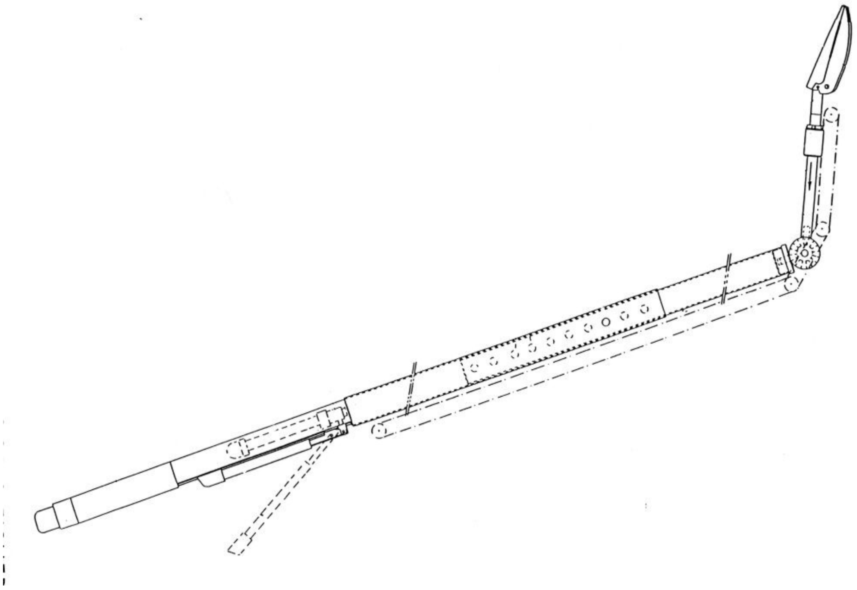


Figure 4-2: Layout of rock prying apparatus

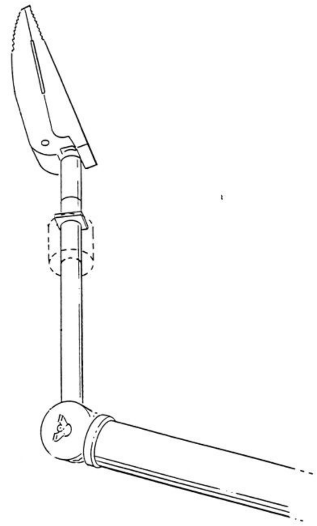


Figure 4-3: Detail of front end of rock prying apparatus

4.2 Design of Experimental Development Model (XDM)

The experimental development model (XDM) mechanical “jaws” was designed in detail and detail drawings of all the components were made. The design consists of the “jaws” that can exert a force of 5000 N (500kg) and the hydraulic pump and a rod (tube) connecting the jaws to the pump. The hydraulic system is self-contained with a reservoir placed in the tube. A sliding hammer is placed behind the jaws to hammer the jaws into a chosen crack. Figure 4-4 shows the solid model and figure 4-5 the assembly drawing of the mechanical “jaws”.

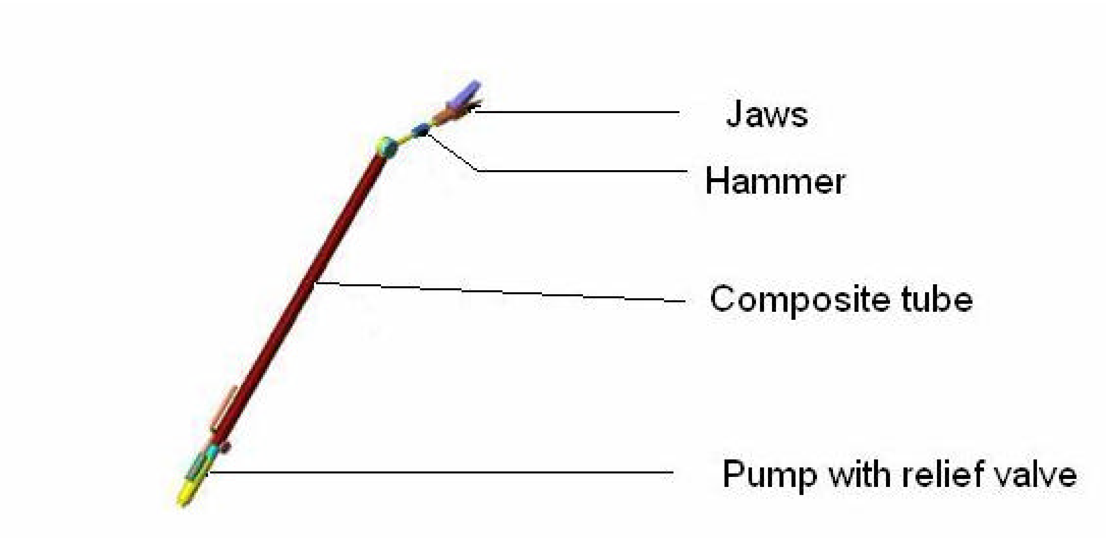
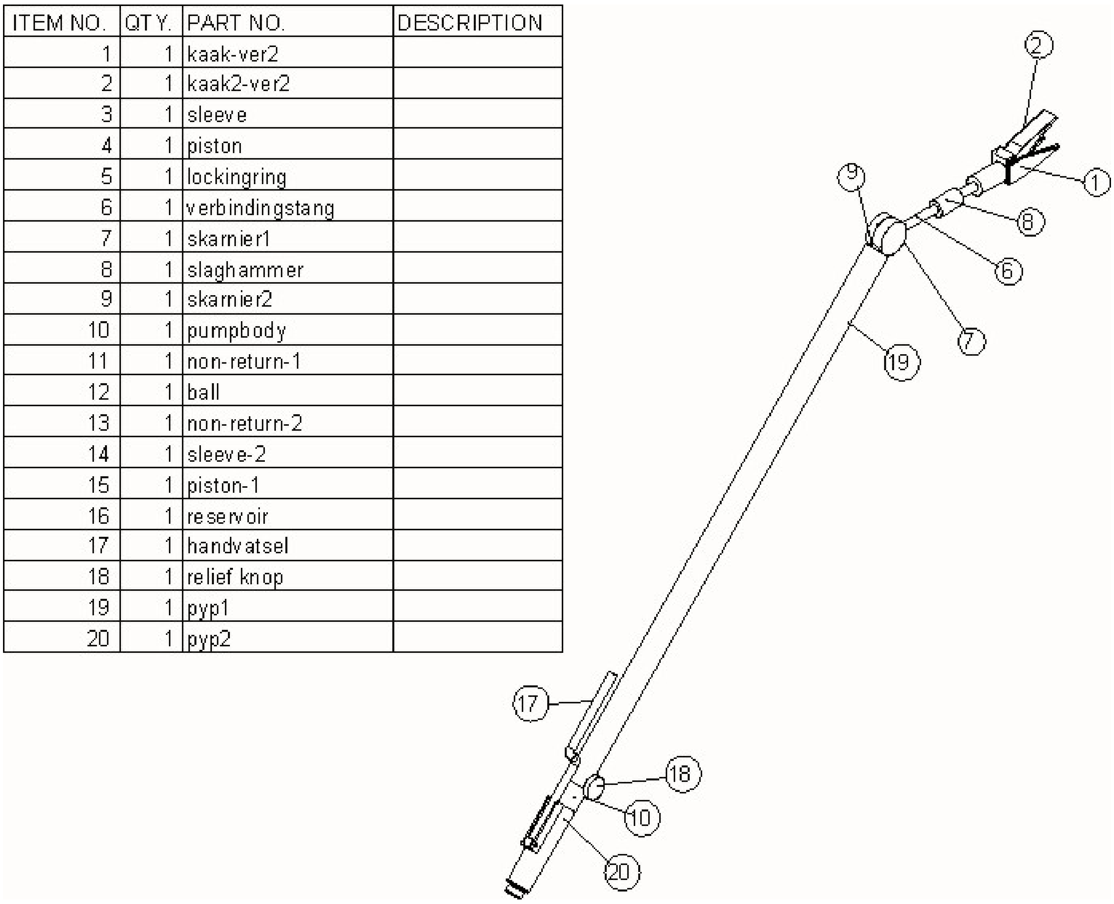


Figure 4-4: Solid model of XDM mechanical “jaws”.



ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	kaak-ver2	
2	1	kaak2-ver2	
3	1	sleeve	
4	1	piston	
5	1	lockingring	
6	1	verbindingstang	
7	1	skarnier1	
8	1	slaghammer	
9	1	skarnier2	
10	1	pumpbody	
11	1	non-return-1	
12	1	ball	
13	1	non-return-2	
14	1	sleeve-2	
15	1	piston-1	
16	1	reservoir	
17	1	handvatsel	
18	1	relief knop	
19	1	pyp1	
20	1	pyp2	

Figure 4-5: Assembly drawing of XDM mechanical “jaws”.

4.3 Building and Testing XDM

The sub-components were individually tested in the laboratory before they were assembled in the XDM.. Figures 4-6 and 4-7 show the pump and "jaws" of the XDM. The XDM was functionally tested in the laboratory. The following problems came to the fore during the tests:

- The sliding hammer is very difficult to handle and the complexity of the rope system connected to the hammer will cause durability problems.
- The complexity of the pump and in particular the non-return valves needed to be simplified.
- The composite tube ends being glued to the pump body will lead to maintainability problems since the internal components are not accessible.
- The bleeding of the hydraulic system proved to be very difficult and this part of the design has to be revised.

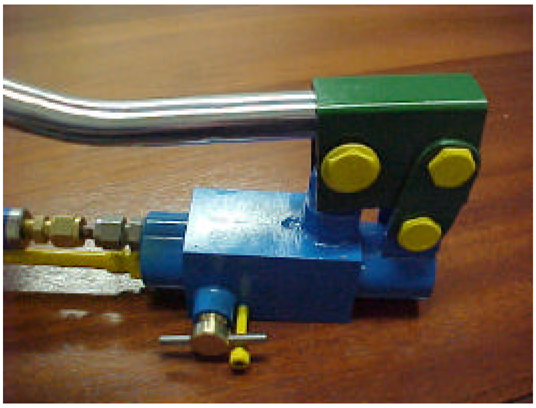


Figure 4-6: Photo of the XDM pump.

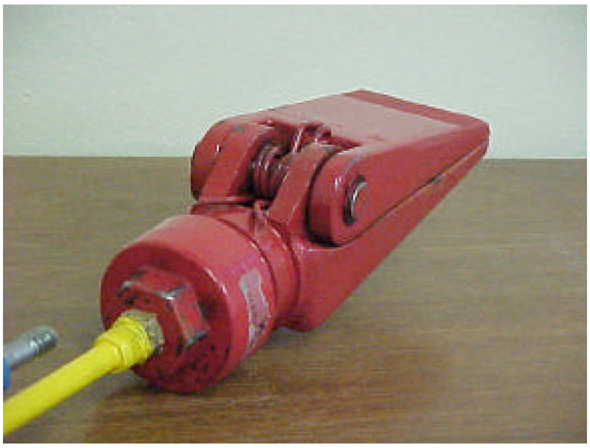


Figure 4-7: Photo of the XDM "jaws".

4.4 Design review

The design review, building of prototypes and laboratory testing of the prototypes was an iterative process. The prototype was rebuilt or changed according to the review after which the prototype was again tested. During the design review the following changes to the design of the mechanical “jaws” were implemented:

- The design of the pump, which was simplified to improve the manufacturability, reliability and maintainability.
- The design of the non-return valves in the pump to have them as a modular unit that can be manufactured on a lathe instead of doing the machining on a milling machine.
- The composite tube ends to screw onto the pump body instead of gluing them on, which will improve access and the maintainability of the system.
- The design of the sliding hammer was changed so that the hammer action is accomplished by means of a spring instead of it being operated by a rope. The spring-loaded hammer action works like a Schmidt Hammer, by pushing the tip against the rock. This loads the mechanism, which is released to provide an impact force by pushing further against the rock. In figure 4-8 a drawing of the spring-loaded hammer action is shown.
- The hydraulic reservoir was moved to the bottom of the pump to improve the manufacturability of the non-return valves. To overcome the problem of feeding the pump a spring-operated plunger was placed into the reservoir creating a positive pressure in the reservoir, which also alleviated the bleeding problem.

Figures 4-9 and 4-10 show the solid model of the prototype design and the assembly drawing. A full set of drawings is attached in Appendix B.

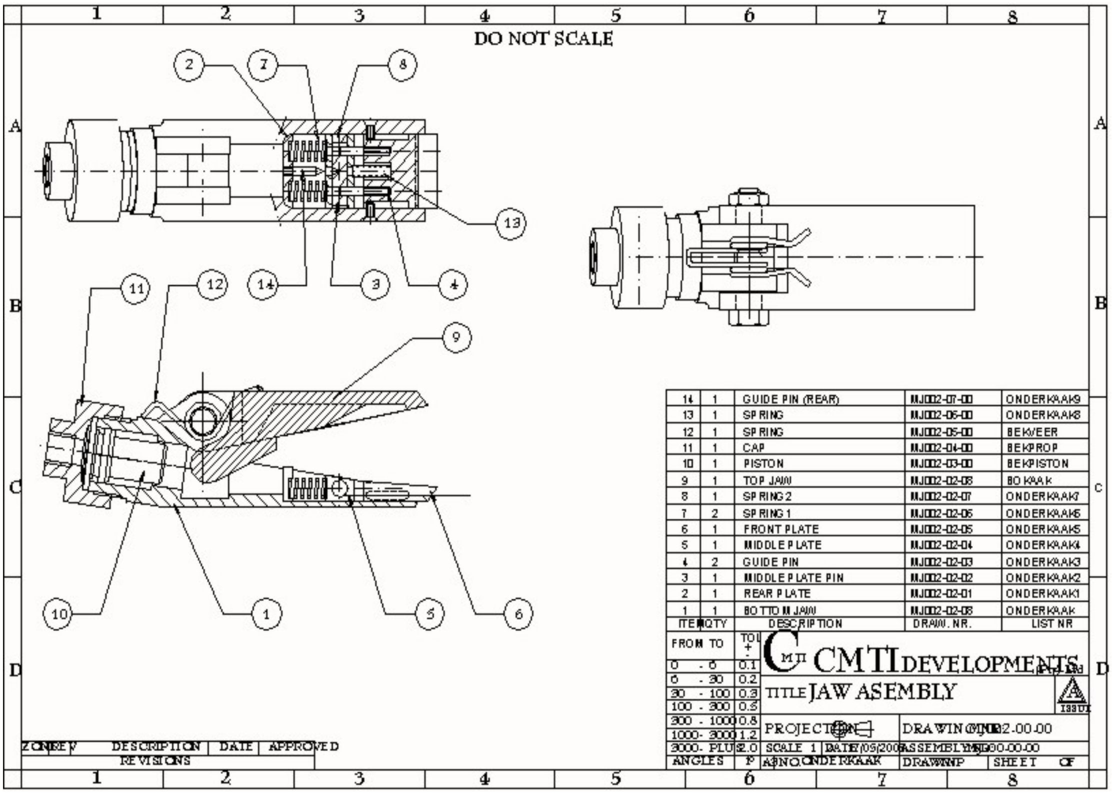


Figure 4-8: Drawing of the spring-loaded hammer action.

Figure 4-9: Solid model of prototype mechanical “jaws”.

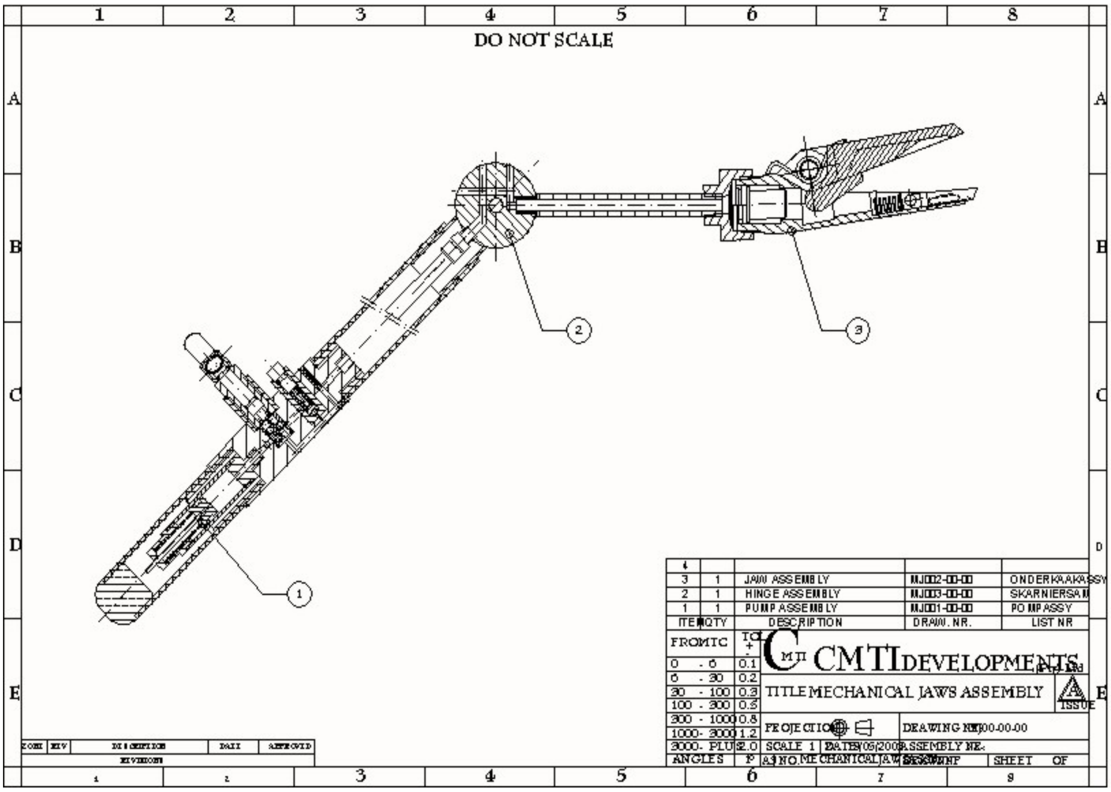


Figure 4-10: Assembly drawing of prototype mechanical “jaws”.

4.5 Prototype Construction

As discussed in 4.4 the building of the prototype was an iterative process with the design review and laboratory testing of the prototype. Different models of the prototype were built and evaluated. In figure 4-11 a photo of the final prototype is shown and figures 4-12 and 4-13 show photos of the pump and the “jaws” with the spring-loaded hammer action.

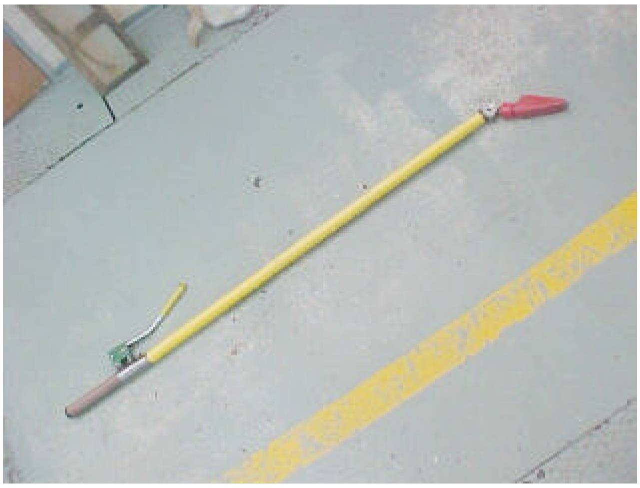


Figure 4-11: Photo of the prototype mechanical “jaw” assembly.

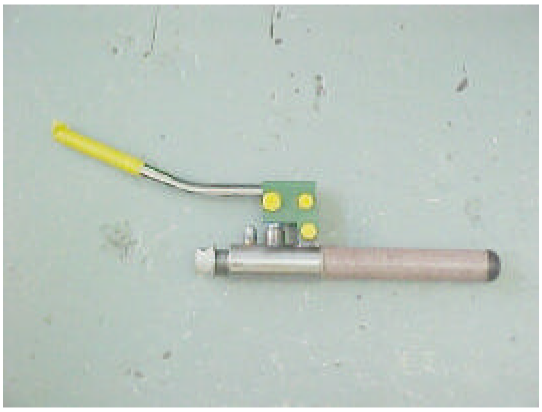


Figure 4-12: Photo of the pump.

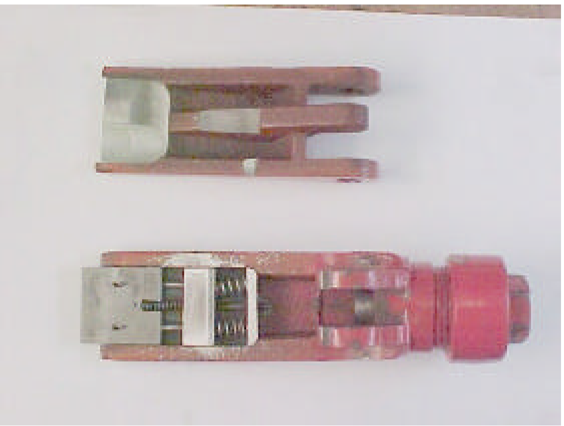


Figure 4-13: Photo of the “jaws” with the spring-loaded hammer action.

4.6 Underground evaluation

The mechanical “jaws” prototype was evaluated at Driefontein Gold Mine and Bank colliery. Figure 4-14 shows photos of the underground evaluation. Video material showing the operation and handling of the mechanical “jaws” bars was taken during the evaluation and is attached as Appendix A (a CD is attached to this report).

Figure 4-14: Photos of mechanical “jaws” in underground operation.

The evaluation produced the following results and comments:

? The mechanical “jaws” can be successfully used to dislodge rocks.

? In some overhead positions, where the length of the tube was too short to comfortably reach the crack, the mechanical “jaws” was difficult to handle (see figure 4-15).

? Although the tool is relatively lightweight the weight of the “jaws” should be reduced so that it can be easily manoeuvred. This can be done by redesigning the “jaws”.

? Depending on the stoping width or height of roof a different length tube is required. Different models for different jobs.

Figure 4-15: Photo showing the difficulty of operating in an overhead position.

? The tips of the “jaws” are too wide and can only fit into and successfully work in cracks of 10mm width or greater (see figure 4-16).

Figure 4-16: Photo showing difficulty of getting the “jaws into the crack.

? The jaws need to open wider to dislodge most loose rocks.

? The spring-loaded hammer does not improve the insertion of the tips of the “jaws” into the crack. It is also in some positions difficult to press the “jaws” hard enough to load the hammer. It is recommended that the mechanical “jaws” be built without the hammer mechanism.

- Sounding loose rock can be done with the mechanical “jaws” as the hollow tube acts as a sound box.
- A hand guard to protect the hands from falling or dislodged rocks is a necessity.

5 CONCLUSION AND RECOMMENDATIONS

Barring equipment currently used is archaic and there is a need for a simple system to enable operators to stabilise the rock effectively and efficiently from a safe distance before work begins in an area. The operator often is unable to work at a safe distance and is sometimes directly underneath unstable rock when attempting to “make safe”. Furthermore, current methods are physically demanding on the operator, which can lead to poor concentration, improper completion of tasks, and accidents.

During this project two concepts, namely the lightweight pinch bar and the mechanical “jaws” were developed to the tested prototype stage. An experimental development model for each concept was first designed, built, and tested after which design reviews were held and prototypes built. The prototypes were tested in the laboratory after which the design was again modified. The prototypes were then evaluated underground in platinum, gold and coal mines. The underground evaluation revealed that the products could be further improved with certain minor modifications.

Although the prototypes were successfully tested underground these tests revealed that the tools could still be improved. The following changes to the prototype designs are recommended:
Lightweight pinch bar:

- The pinch bars should be available with different size steel tips: 19mm and 25mm.
- Different length pinch bars should be available for different stoping widths or height of roof.
- For the coalmines a different steel tip is required. It is recommended that a tip be used where the chisel tip point juts out at a 45° angle to the chisel shaft and where the chisel point protrudes at least 100mm from the shaft to facilitate proper levering of the loose rock.

Mechanical “jaws”:

- The mechanical “jaws” should be available in different lengths.
- The tips of the “jaws” should be narrower to fit easier into cracks.
- In order to dislodge more rocks with one opening, the “jaws” should be able to open wider.
- Reduce the weight of the “jaws” by modifying its design.
- The hammer action on the tips does not help to insert the tips into cracks and can be done away with.

The underground evaluations showed that both the lightweight pinch bar and the mechanical “jaws” can be successfully used for making safe. The mechanical “jaws” needs modifications to ease penetration into cracks. Depending on the job or conditions the pinch bar and/or the mechanical “jaws” can be used. Different tools for different jobs. The lightweight pinchbar could be used to sound and penetrate a crack, and then to insert the jaws and pry the rock loose. This process will reduce operator effort and stress considerably, leading to better quality and safer barring in underground excavations.

6 REFERENCES

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7 APPENDIX A

VIDEO MATERIAL OF UNDERGROUND OPERATION

8 APPENDIX B

DETAIL DRAWINGS OF MECHANICAL “JAWS”