
Southern
Illinois University
Carbondale

The development of a novel resin grout anchor system

by

A.J.S. (Sam) Spearing PhD PE CEng CSci

Associate Professor

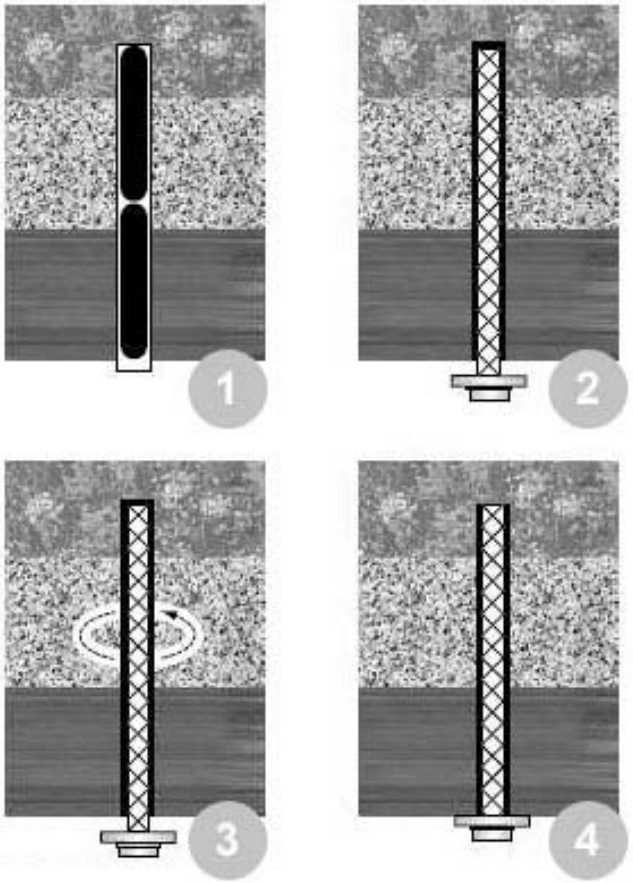
Dept of Mining & Mineral Resources Engineering

SIUC

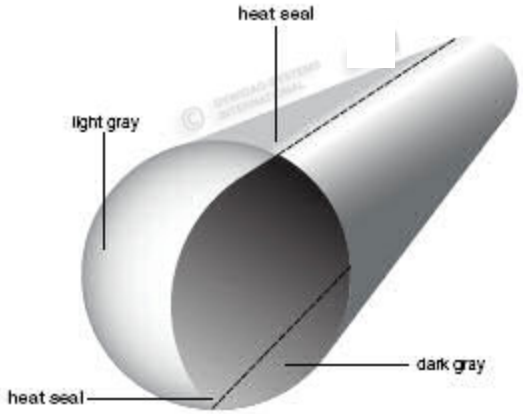
Background

- The most common type of rock bolt support on underground mines is resin grouted rebar.
- The US coal mining industry installs about 100 million rock bolts per year and over 90% use resin cartridges.
- The polyester resin technology has not changed since it was introduced around 1970.
- The use of resin assisted bolts continues to grow internationally.

Resin cartridges

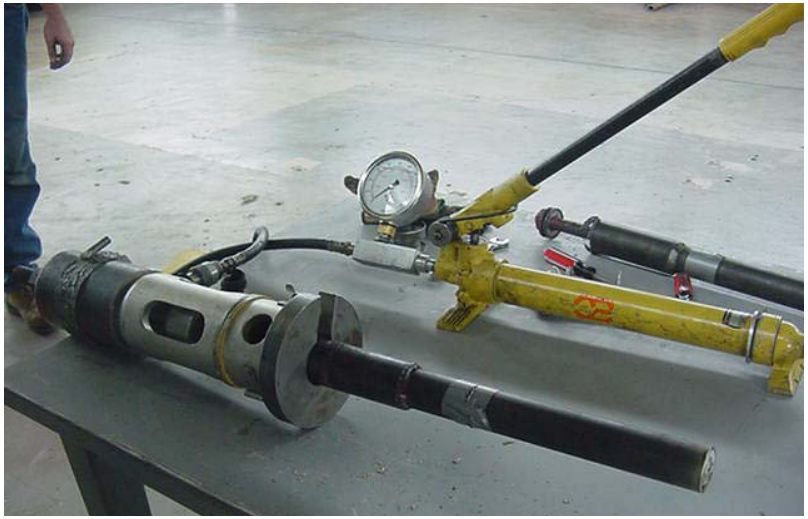


Installation method



Coal mine support

Resin and rebar anchoring



Technology Summary

- Mechanical key to secure rebar in holes quickly and effectively
- Developed by:
  - Henk Pretorius, ISO Pty Ltd, South Africa
  - Sam Spearing, MMRE, SIUC
- Underground construction and mining applications.

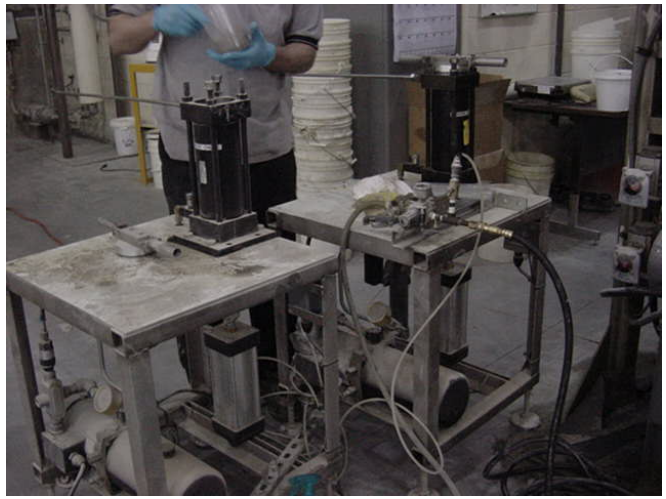
Project Funding

- We as the inventors filed the provisional patent – time saver.
- Applied in early 2008 for an SIUC seed fund which was declined.
- Obtained industry funding to prove the feasibility of the system.
- Used our own funding to totally prove the system (almost complete).

Main resin design requirements

- Performance (ASTM F432 mainly)
- Durability
- Shelf life (12 months)
- Thixotrophy
- Low toxicity
- Low flammability
- Gelling and strength gain times
- Cost

Performance testing



Technology advantages

- Significant cost reduction
- Lower toxicity
- Lower flammability
- “Green” product – uses a waste product for the main filler.
- Improved performance (still to be proven)

The Competition

- Three main producers currently in the USA, all supply resin and bolts.
- All use polyester based limestone filled systems with benzoyl peroxide as the the catalyst.

Current Developmental Status

- Performance – Work needed
- Durability - Acceptable
- Shelf life - Acceptable
- Thixotrophy - Acceptable
- Low toxicity - Acceptable
- Low flammability - Acceptable
- Gelling and strength gain times - Work needed
- Cost - Excellent

Technology Market

- Currently there is little product differentiation between the suppliers.
- US market about $100m per year.
- The new system would use the same mixing and filling equipment.
- A resin reactor would be built to manufacture the specific resin system and catalyst (Southern Illinois?).

Technology Opportunities

- Optimum commercialization would be to be through an existing supplier who is already involved.
- Small resin reactor and catalyst plant could be separate or tied to the resin cartridge supplier.

Intellectual Property Protection

- Patent search conducted.
- Provisional patent filed…..decision needed as to whether to keep secret or file. Chemically based patents often help the competition by “teaching” them the base technology so they can find an alternative.