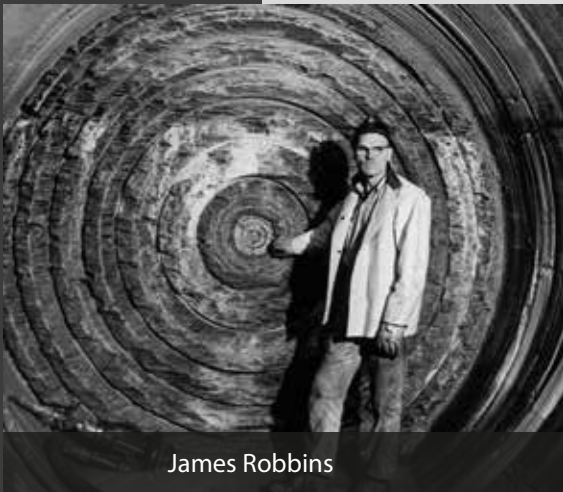


UNDERGROUND DEVELOPMENT

James Robbins



James Robbins

James (Jim) Robbins has been instrumental in the history of mining, being ultimately responsible for the hard rock tunnel boring machine (TBM) and whose company also went on to purchase the rights for the design of a raise boring machine which also became synonymous with the Robbins name. He

founded The Robbins Company in 1952, and went on to design and manufacture the world's first TBM for Mitry Constructors who were working on the Oahe Dam diversion project near Pierre, South Dakota, USA. The major breakthrough in the design of hard rock TBMs occurred in 1956 when disc cutters were first used exclusively to cut rock.

That first machine utilised a dual counter-rotating cutterhead fitted with rows of drag bits and dumbbell-shaped disc cutters to mine through weak shale. After achieving good advance rates, that machine and three subsequent tunnelling machines were used for six power tunnels and seven diversion tunnels at the Oahe Dam site.

On the first several machines pick cutters and disc cutters were used, but since then only disc cutters have been used to excavate hard rock on tunnels. As tunnelling machines were in the early stages of development, Jim Robbins would design and build a new piece of machinery to fit particular needs. He would then convince an owner or a successful contractor to fund the building and testing of the machine. Often there would be problems as the design was tested and improved. These improvements usually took place in the tunnel during construction. At that point, Robbins and the contractor would get together and work out

a solution. This was sometimes a collaborative process. At other times, the contractor would decide to withdraw the machine from the tunnel and carry on tunnelling with drill and blast methods.

Jim Robbins' work was terminated by his untimely death in 1958, having built seven tunnelling machines. No other tunnel machine designer or builder had yet emerged to that date, and would not emerge on the scene until about 1960. However, his contribution initiated an era of mechanical tunnelling and an industry that has grown to the present day. His son Dick Robbins took over as President of the company and took it forward to many more successes.

The Robbins Company begun by Jim Robbins also invented both the Main Beam and Double Shield TBMs. Robbins is best known for its very successful Main Beam TBMs, but has also been a pioneer in hard rock Double Shield machines. More specifically, it has manufactured 50 Robbins Double Shields for 85 projects totalling over 550 km of tunnel. The Robbins team builds the TBMs that now hold more than 90% of all world records for high speed tunnelling. And the TBMs have been successfully used in mining at a number of locations, notably at the Stillwater PGM mine, Magma copper mine and Grosvenor coal mine Decline Tunnel. Stillwater selected TBMs for mine development because of the benefits they offer over conventional mining methods. The mine has

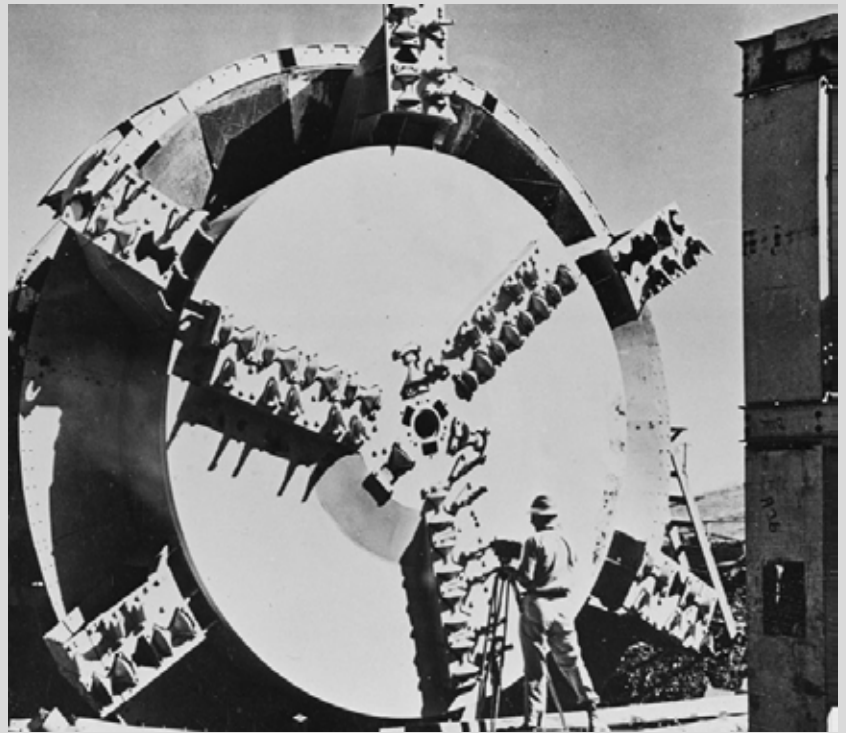


UNDERGROUND DEVELOPMENT

found that TBMs have increased advance rates over traditional mining methods. While the capital cost for TBMs is approximately 1.5 times that of conventional mining fleets, they only have 33% of the operating costs. SMC has used four TBMs for mining in the past, with the first TBM used at the Stillwater mine in 1988. The latest TBM bore at Stillwater is the Blitz Tunnel, a 7.1 km mine development tunnel.

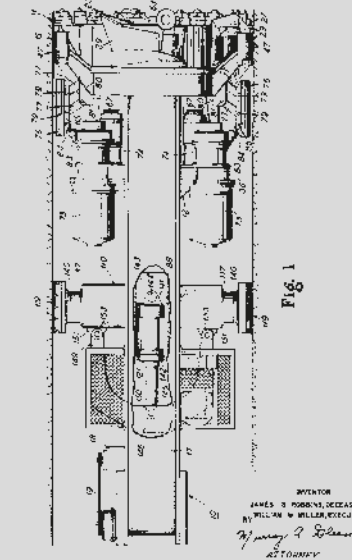
In terms of company history, The Robbins Company was bought by Atlas Copco in 1993 but following a decision to move away from the TBM business, Atlas Copco sold this to Boretec in 1998, which along with others formed the current group back under the original Robbins Company name.

Atlas Copco, however, did retain the raise boring business, which had begun with the first successful raise boring machine, the Robbins 41R, developed by The Robbins Company in 1962 under Dick Robbins when he set out to mechanise this hazardous task in mining. With pinned drill tubes and steel cutters, the 1.2 m diameter Robbins 41R was



launched and many of the early machines are still working. Since design and manufacturing of the raise borers moved to Sweden, 17 models have been developed in a product range that represents a long line of milestones in raiseboring technology. Recent innovations include the energy efficient VF drive and Measure While Drilling (MWD) system. Today's bestselling raise drill is the Robbins 73RH C which is capable of reaming 1.8-3.1 m diameter holes.

Oct. 30, 1962 J. S. ROBBINS 3,061,287
 TAPPING BEAMS FOR PULLEY HOOD TOSSELING MACHINES
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