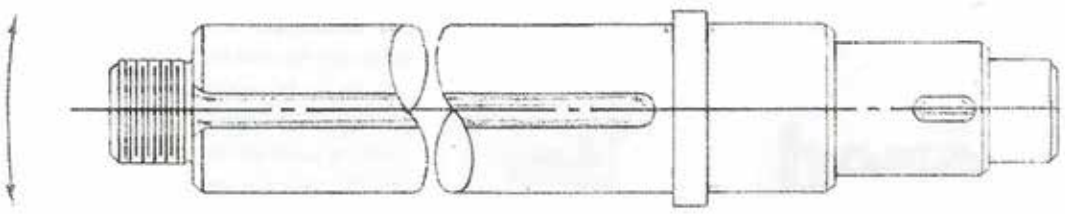

Fig. 3 Worn Shafts

be unable to hold the finished tool size. But there's worse to come. An out-of-tolerance bore will wear the tube mill shaft ***(fig. 3)***, and a worn shaft will in turn wear out the tube mill stands – it's a vicious circle.

That's not the end of the problems caused by grinding, because old technology will also destroy the roll's face ***(fig 4)***. This wear occurs when the roll and spacer move against one another. Because the roll face has a rough finish through being ground, it will begin to wear the spacer: then two surfaces will continue to wear one another at an accelerated rate. In fact, the spacer will wear faster than the roll, eventually causing a mismatch between the two components – requiring them both to be repaired or replaced.

At this stage, it's worth pointing out that with today's new technology, it will actually cost you less to simply replace a roll in need of reconditioning, rather than suffer the consequence of grinding and plating the bore and the face.

The Keyway

As damaging as grinding is to roll forming tooling, it's not the only problem that flows from the tube industry's tendency to stick with the old technology. Let us examine the keyway – the small square key that drives the roll from its shaft. This key forms the drive link from the shaft to the tube mill's roll and its tooling.

Now, I know for a fact that not everybody is familiar with the keyway and what it does, but the crucial point is that its production hasn't changed since the 1930's.

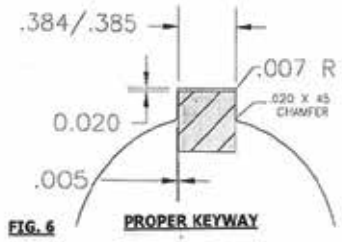

FIG. 6

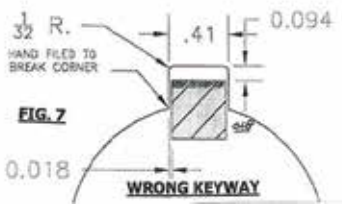

FIG. 7

The keyway is mechanically cut into the soft, pre-heat treated roll with a broach. This is a crude technique, with the broach often leaving a jagged oversized keyway in the roll. In addition, the broaching tool can often wander and machine the keyway at an angle, or it may leave deep tool marks and sharp corners on the roll, resulting in stress cracking and breakage.

The above consequences that result from old fashioned keyway cutting, while severe in their own right, unfortunately don't get to the nub of the whole problem.

Keyways should be cut ***(fig. 6)*** – according to the ASTM handbook – at 0.003" - 0.005" over the key size of the shaft. Keeping to this tolerance is crucial.

It's true to say that the present old broach method can achieve this requirement fairly well when working with a pre-heat treated roll. But, when the roll is heat treated – and this must happen to achieve the proper hardness – the