

While the world's footwear industry has overwhelmingly adopted cutting tables, one major producer has not—India. Here, the vast majority of factories continue to use cutting dies in enormous quantities. HK Razdan, Managing Director of the Harman Group headquartered in Mumbai, provides an insight into this important aspect of India's footwear industry.



Cold steel cutting dies

It is hard to imagine a strip of steel with a ground knife-edge that can be bent to any shape, even at 120 degree angles, without damaging the edge. It is even more remarkable that it has a hardness of 49 HRC, a body hardness of 37 HRC or even lower and is made from low carbon content without any spring action or brittleness. This is exactly what was conceived by the early producers of this revolutionary raw material—Sandvik, Boehler and Martin Miller.

As shoe factory production increased and fashion requirements needed constant design changes, it became imperative that hand cutting was replaced by die cutting. This would also contain production costs as well cut response times in a competitive fashion environment. The first step was to find a way to shorten the time for production of cutting dies and, at the same time, to produce them at reasonably low cost. The answer was to use cold knife steel with the required characteristics.

Naturally, a new generation of machines had to be found to handle such

an unusual raw material and thus a whole new technology was developed to make cutting dies quickly, with precision and durability. The most important aspect of durability lies in the fact that the cutting edge should not need re-sharpening because it is then that

dimensional accuracy can be lost. The cutting edge of cold knife steel hardly needs any grinding or resharping. Only after prolonged use will some dies need a pass through the Widia tool to remove any burrs that have been formed and so maintain the accuracy (Figure 1).➔

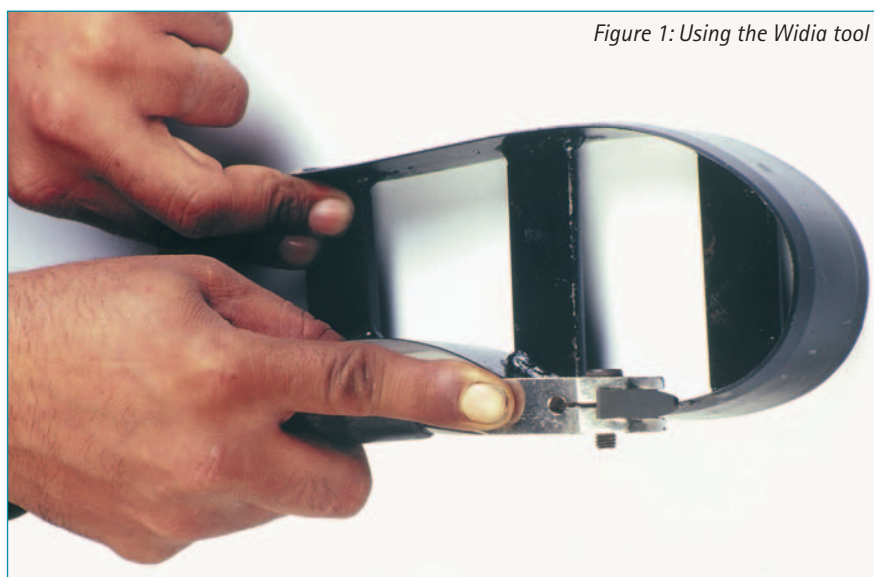
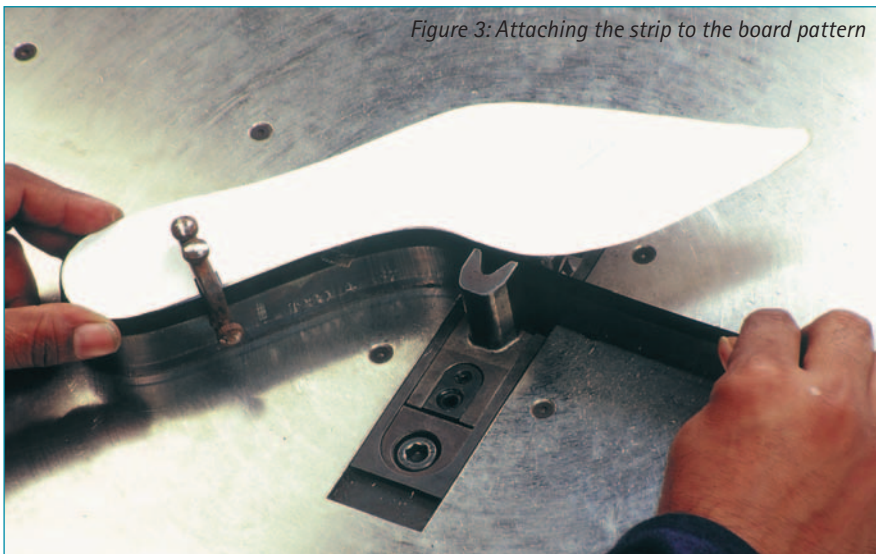


Figure 1: Using the Widia tool

Figure 2: The coil stand



Figure 3: Attaching the strip to the board pattern



No shoe factory—unless it is really large—normally makes its own dies as it would be unable to keep a die-shop busy full time. There is a further angle to consider. If a die maker makes a mistake the factory can always reject the die. If the 'baby' is born in-house there is a tendency to tolerate its defects and sub-standard dies may get used. It is always preferable for shoe factories to source their dies from suppliers engaged in die production only, as the die maker also interacts with many shoe manufacturers and the experience thus gained provides an invisible advantage to all concerned.

Producing a die

The method of production is not really complicated and the fine dividing line between a bad, good or perfect die is

indeed the experience of the die maker. I was the first person to introduce cold steel clicking dies to India. This was in 1978. Starting out in a very small way, the Harman Group now has fifteen die factories spread right across the country. The secret is to locate small die making plants close to the point of consumption, rather than have a very large production concentrated in one factory. A constant and consistent interaction with the customer is the essence of this business. In practical terms, a production area of about 100 sq m is ideal. However, if local laws are not too strict one can manage on 80.

The cold knife steel comes in 50 to 70m coils, in widths of 19mm, 32mm and 50mm. Some countries prefer 20mm, 30mm and 50mm wide strip.

These measurements represent the final height of the die. The strip may have a single cutting edge 'BE' or a double edge 'BD'. The latter means that a single die can be used for cutting both left and right components for a pair of shoes simply by turning it over. Because of the sharp cutting edges, it is dangerous to open a coil without first loading the coil on to its stand (Figure 2).

A board pattern created on a pattern-grading machine or by hand is measured around its circumference with a thread or, more commonly these days, by an electronic pattern circumference-measuring machine. The total linear development of the circumference indicates the length of steel to be cut from the roll. This is done with a long handled shear or pneumatic cutter and usually with 1.5 to 2.0 cm added to the actual length required. As operators gain experience this wastage is reduced to a minimum.

The steel is then marked with the reference number of the die and a pattern clip used to attach the steel strip and board pattern together (Figure 3). The strip is taken to a foot-operated die-bending machine. The bender places the steel between hammer and anvil of the machine and hammers the strip along the edge of the pattern until the steel strip conforms to the board pattern. The ends have to be joined next. Excess material is cut away and the edges are ground at a 45 degree angle, leaving a small 'ear' projection at one end of the cutting edge. This is so that when the ends are pressed together, there is a 'V' groove at the joint.

The die—less the pattern—is clamped on to a welding fixture of which there are many types, including vice grip, round revolving and pneumatic tables. Because of the inherent composition of the cold knife steel, it is recommended to weld using carbon dioxide gas and low heat generating welding wire of about 1.6mm diameter on a CO₂/MIG welding machine. This prevents the welding heat from being conducted to the knife-edge and weakening it.

After welding, the die is taken to an aluminium table fitted with a special tool. The ear created during end grinding is overlapped on to the edge by a hammer. All dies usually have a corner and this overlapping reinforces it and gives the die its strength (Figure 4). This cannot of course be done for insole and

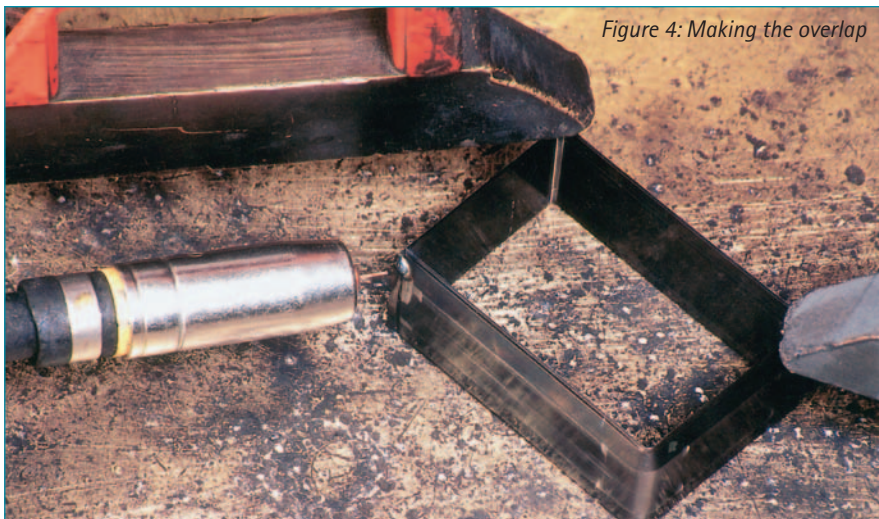


Figure 4: Making the overlap

sole dies. We have now completed a hollow 'punch'. At this stage size codes can be added to the cutting edges by a code-marking machine so that the components of the upper cut from the die can be identified for respective size.

The die must now be reinforced further

by welding-in some braces. Usually about 4mm thick mild steel, they must be cold drawn and about 20 to 30mm wide. They are cut on a hydraulic shear, according to the cavities and load-bearing corners where they have to be welded and which is usually in the middle of the height of

the die to make it strong enough for long usage. In some dies, one may need to cut cold drawn mild steel plates to the internal shape of the die to provide extra strength at points of stress. For moccasin and other dies needing round perforating tubes or fancy punches in the middle area of the die, holes are drilled into the braces or plates. These have an internal diameter equal to the external diameter of the punches to be inserted. Using a pricker press, these punches or prickers (markers) are press fitted so that they can be eventually replaced if damaged or removed and re-used on other dies. (See header image).

Due to the low body hardness of cold knife steel, this type of die must not be subjected to impact. They should only be used on hydraulic cutting presses, which will not damage the cutting edge due to the hydraulic action, aluminium top-plate and polypropylene cutting pad. 

All images courtesy of Harman Group

MDM 6

Two Component
Meter Mix and
Dispense Machine

The alternative equipment
for the application of
liquid reactive resins such
as polyurethane resins

Example:
Inlays for shoe soles



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