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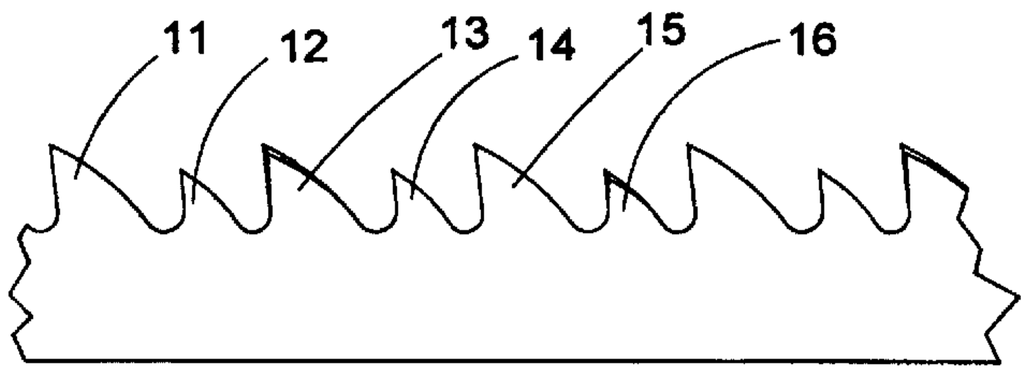
(54) **SCIE A RUBAN AMELIOREE**
(54) **IMPROVED BANDSAW**



(57) L'invention concerne une lame de scie à ruban, dotée de dents réparties par groupes récurrents, dans lesquels chaque dent a une hauteur importante, moyenne ou faible et une position droite, gauche ou non classée. Le groupe est formé par combinaison de diverses hauteurs réparties en sous-groupes comportant un premier nombre d'éléments et par combinaison de diverses positions réparties en sous-groupes comportant un deuxième nombre d'éléments, ces nombres étant très grands. Le groupe récurrent a donc un nombre de dents égal au produit des premier et second nombres, toutes les dents classées ayant la même largeur quelle que soit leur hauteur. Si, par exemple, la hauteur de dent varie par sous-groupes de deux et la position par sous-groupes de trois, on obtient un groupe récurrent dont le nombre de dents est égal à six. Lorsque le groupe de hauteurs comporte trois dents et le groupe de positions comporte quatre dents, on obtient un groupe récurrent dont le nombre de dents est égal à douze.

(57) Bandsaw blade with teeth arranged in recurrent groups, where each tooth has a height either high, medium or low, and a setting either right, left or unset, and the group is formed by having tooth height variations in subgroups with a first number of members, and setting variations in subgroups with a second number of members, where the first and second numbers are incommensurable, making the number of teeth in the recurrent group equal to the product of the first and the second numbers, and where all set teeth have the same setting width regardless of height. One example is where tooth height varies in subgroups of two and setting in subgroups of three, making the number of teeth in the recurrent group equal to six. Another example is with three teeth in the height group and four in the setting group, making the number of teeth in the recurrent group equal to twelve.

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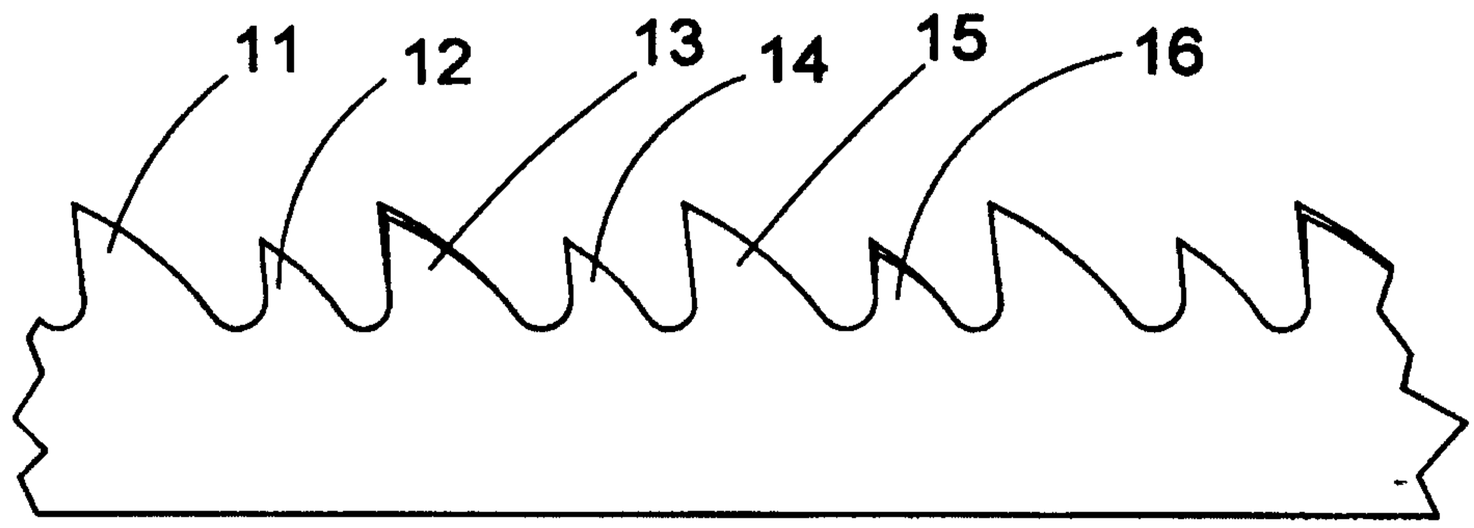
(54) Title: IMPROVED BANDSAW

(57) Abstract



Bandsaw blade with teeth arranged in recurrent groups, where each tooth has a height either high, medium or low, and a setting either right, left or unset, and the group is formed by having tooth height variations in subgroups with a first number of members, and setting variations in subgroups with a second number of members, where the first and second numbers are incommensurable, making the number of teeth in the recurrent group equal to the product of the first and the second numbers, and where all set teeth have the same setting width regardless of height. One example is where tooth height varies in subgroups of two and setting in subgroups of three, making the number of teeth in the recurrent group equal to six. Another example is with three teeth in the height group and four in the setting group, making the number of teeth in the recurrent group equal to twelve.

Improved Bandsaw

Background

Bandsaws have long been used for cutting of hard materials such as metal bars or profiles, their main advantage being that they can be made thinner that circular saws, thus wasting less material. They have some disadvantages that have restricted their use, however, since the bandsaw blade looses its torsional stiffness when the feed force is high. This means that many tooth shapes and arrangements have been suggested with the purpose of reducing the feed force and any force components that might twist the blade. Well known such tooth arrangements include having some teeth straight and longer than others to guide the tooth edge laterally, and letting teeth with unequal edge shapes cut thick but narrow chips known as the "triple chip" method.

Lateral forces on the toothed edge of the bandsaw may be minimized by letting such teeth that have large lateral forces occur in pairs with opposite setting. If the distance between teeth is small enough they will both be in the cut must of the time, and their individual lateral forces will cancel. However, small distance also means that a larger number of teeth will be cutting simultaneously, with a large feed force when cutting solid sections, which is not desirable, or small feed force on each tooth, which means inefficient cutting and excessive wear.

Another problem is the low in-plane stiffness for feed forces acting in unison, with a great risk of vibrations if many teeth at equal distances are cutting, causing chattering, noise and corrugations of the cut surfaces. On the other hand, if few teeth are cutting the lateral forces will not cancel.

These problems make it difficult to design an optimal bandsaw even for a well defined task, and even more so if the bandsaw is to be used for a variety of tasks involving different thickness and material.

Numerous tooth arrangements have been suggested and tried in order to make a bandsaw able to produce good surfaces in a variety of conditions. Differences in tooth height are used not only for lateral guidance, but also to let a few longer teeth do most of the cutting in hard materials still with a reasonable cutting depth, and having all teeth actively cutting in soft materials. Differences in tooth distances are used to avoid chattering and to locate teeth in pairs without getting too many cutting at the same time. Differences in setting are used to divide the kerf width into narrow chips with better thickness and controlled chip curling. Three set widths is traditional, unset-left-right, but five or more also occur, where lower teeth have larger set widths.

For rational production, the teeth should be arranged in recurrent groups, corresponding to the widths of grinding, milling and setting tools. Very long recurrent groups require large tools, large machines and large machining forces.

Many suggested tooth arrangements, such as in the patent US 4,727,788 include all three variations, but are then complicated and costly to manufacture. The present invention is a tooth arrangement for metal bandsaws which is equally useful for hard and soft materials, which causes less vibrations than previously known designs with that usage, and which still is simple to manufacture with adequate precision.

Description

The invention is described with reference to the figures, where figure 1 shows a bandsaw blade from the side, and figure 2 a cross-section through the same.

The first operation in manufacture of bandsaw teeth is cutting teeth in the edge of a steel strip by grinding or blanking. The teeth can have different height and different pitch distance. According to the present invention, different height is important, different pitch is optional for special materials. If the steel strip is made of two alloys, as is commonly the case, the tips of the teeth will consist of a harder alloy such as high-speed steel, while the body and back of the strip is made of a tough crack-resistant steel alloy. In many cases, however, tips of tungsten carbide are welded onto the teeth, to get even higher

hardness. The teeth are then set by knocking or pressing them to either side, or leaving some unset. Many setting patterns include teeth set to different width which is very difficult to achieve in practice, but according to the invention only one setting width is used. Many patterns combining different tooth heights, pitches and setting widths comprise a large number of teeth in a recurrent group, which is one reason why it is difficult to do the setting with high precision, and also requires more expensive tooling. According to the invention, the long recurrent group is achieved by combining a short group for height and pitch with another short group for setting, where the groups have incommensurable number of members. The long group will then have as many members as the product of the members of the smaller groups.

Figure 1 shows a part of a bandsaw blade according to the invention, where the teeth of a long recurrent group of six teeth are marked (11-16). The group is the result of a tooth height and pitch group of two teeth, one high and one low (H-L), and a setting group of three teeth, one unset, one right and one left (O-R-L). As is common with saw blades for metal, the front rake face of every tooth is normal to the blade sides. The first tooth in the group (11) is high and unset, the second tooth (12) is low and set right, the third tooth (13) is high and set left, the fourth tooth (14) is low and unset, the fifth tooth (15) is high and set right, the sixth tooth (15) is low and set left. No two teeth in this group of six (HO - LR - HL - LO - HR - LL) have the same combination of height and setting, and each of the six possible combinations of the two height alternatives and three settings occurs once.

When cutting hard materials and large sections, only the high teeth cut, and as they are located with equal distance, the saw blade will function as a blade with coarse but even pitch, with equal tooth loading and low vibration level, and the teeth will cut to adequate depth. There is, however, one great improvement, since according to the invention the low set teeth between the high teeth are set with the same setting width as the high teeth. shown in figure 2, and will then slide against the kerf sides without cutting, thereby stabilizing the saw blade laterally and suppressing any tendency for lateral vibrations

which otherwise occur where a cutting tooth enters or leaves the kerf, and which otherwise create copies of the work piece contour lines.

When cutting softer materials and thinner sections, the feed can be great enough to let all six teeth cut, although initially with smaller cutting depth for the low teeth. If the pitch distance is smaller in front of a high tooth, and larger in front of a low tooth, the cutting depth and tooth wear will soon become more equal between high and low teeth, with optimal durability for saw blades in this application.

Although described above with a tooth height and pitch group of two and a setting group of three, the invention can be realized with other incommensurable tooth numbers, such as three/four, and the height and pitch group need not be the one with lesser number of teeth. Examples of recurring tooth height groups are high-low or high-low-low or high-low-medium, and examples of setting groups are ORL, or OROL. Excepting th e case mentioned with a tooth height group of two and a setting group of three, the number of teeth in the recurrent group my exceed the number of possible combinations of height and setting, and thus some teeth in the group will have the same combination, although with different sequence of neighbors. However, the balance between right and left will always be maintained, whether the feed is so slow that only high teeth cut, or larger so that low teeth cut a depth which is a certain fraction of what the high teeth do.

In a tooth height group, the height difference should be enough to avoid any cutting action with set low teeth when cutting hard materials, which for most saw dimensions means that low teeth should be at least 0.1 mm lower than high teeth before setting.

It will also be possible within the invention to use a tooth height group with three levels. such as High-Low-Medium.

CLAIMS

1. Bandsaw blade with teeth arranged in recurrent groups, where each tooth has a height either high or low, and a setting either right, left or unset, characterized by having tooth height variations in subgroups with two members where a high tooth is followed by a low tooth, and having setting variations in subgroups with three of members, one straight, one set to the right and one set to the left, and the number of teeth in the recurrent group being six, where all set teeth have the same setting width regardless of height.

2. Bandsaw blade according to claim 1, where low teeth are at least 0.1 mm lower than high teeth before setting.

3. Bandsaw blade with teeth arranged in recurrent groups, where each tooth has a height either high, medium or low, and a setting either right, left or unset, characterized by having tooth height variations in subgroups of three members, and having setting variations in subgroups of four members including two straight, and the number of teeth in the recurrent group being twelve.

Fig. 1

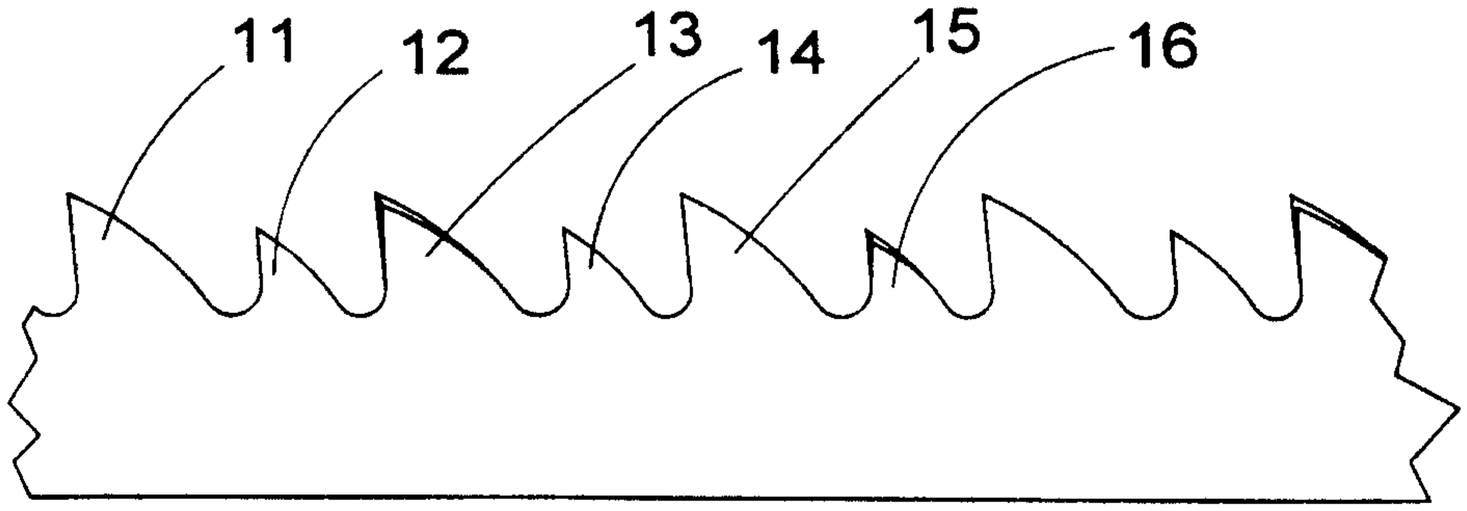


Fig. 2