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## (54) IMPROVEMENTS IN OR RELATING TO BANDSAW WHEELS AND/OR HORIZONTAL BANDSAW MACHINES

(71) We, AMADA COMPANY LIMITED, a Japanese Company of 200, Ishida, Isehara-shi, Kanagawa-ken, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to bandsaw wheels for use in a horizontal bandsaw machine and to horizontal bandsaw machines.

Conventional horizontal bandsaw machines are normally provided with a saw head assembly including bandsaw wheels or pulleys which are mounted for rotation on spaced apart substantially parallel axes and around which an endless bandsaw blade is trained. One of the bandsaw wheels is power driven and acts as a driving wheel to drive the bandsaw blade through a frictional engagement between one flat side of the bandsaw blade and the peripheral face of the driving bandsaw wheel. Also, in order to tension adequately the bandsaw blade, one of the bandsaw wheels is normally drawn or biased, together with its shaft, in a radial direction away from the other wheel. Furthermore, one of the stretches of the bandsaw blade between the bandsaw wheels is normally slidably guided and held by a plurality of guide means with the blade's flat sides perpendicular to a work table on which workpieces to be cut are placed. Thus, conventional horizontal bandsaw machines are normally so designed that the saw head assembly is lowered towards the work table so that the bandsaw blade travelling around the bandsaw wheels may cut workpieces placed on the work table.

Such horizontal bandsaw machines have been much improved after continuous efforts over a long period of years and they are now widely used in many industries and at many large and small factories and shops as the most advantageous and economical means for cutting a wide variety of materials.

Unsuspectedly, however, problems with

horizontal bandsaw machines, even problems with the bandsaw wheels which are fundamental elements of bandsaws, are still unsolved, and these problems have sometimes even been considered simple and insignificant.

One of the problems with conventional bandsaw machines is that the bandsaw blade normally produces a very keen and screech-like noise especially on the bandsaw wheels during cutting. Such noise occurs primarily because the bandsaw blade is severely vibrated during cutting and, as a result, it collides with or vibrates against peripheral surfaces of the bandsaw wheels when travelling thereover. Of course, the keen and screech like noise from the bandsaw blade is very offensive to the ears and is also harmful to the health of operators of bandsaw machines. Furthermore, such noise is likely to become a contentious pollution issue, especially since the bandsaw machines are very widely used even in small factories and shops in non-industrial areas.

The vibration of the bandsaw blade causing the keen and screech like noise occurs primarily because the bandsaw blade is vibrated, because of its inherently flexible nature, not only sideways or laterally but also breadthways or vertically when cutting. In addition, the vibration of the bandsaw blade is increased or amplified because of the larger tensile stress in a first stretch of the bandsaw blade which has passed through a workpiece than in a second stretch of the band saw which is about to cut into the workpiece, because the bandsaw blade is driven and pulled by the driving bandsaw wheel under much tension. Accordingly, the vibration and the resultant noise of the bandsaw blade occur most severely in the second stretch of the bandsaw blade. Although the undesirable vibration of the bandsaw blade is reduced by sawblade guide means for slidably guiding the bandsaw blade, the vibration is too severe to be reduced to the desired amount by the guide means alone and consequently the bandsaw blade still vibrates to an undesirable extent whilst travelling

around the bandsaw wheels.

Furthermore, the vibration of the bandsaw blade does not only cause the keen screech-like noise but also, more seriously, detrimentally affects the cutting accuracy and life of the bandsaw blade and the rate at which the blade can cut and can cause cutting lubricant to be sprayed. The vibration of the bandsaw blade results, for instance, in a poor surface roughness of a cut workpiece, and also makes the initial part of a kerf wider than the later part and, therefore, an accurate, straight cut cannot be obtained. Since the bandsaw blade is vibrated both sideways and breadthways and is apt to float, the cutting rate is decreased. Also, the sideways vibration of the bandsaw blade results in the bandsaw blade being needlessly worn without performing cutting. Furthermore, since the vibrating bandsaw blade can spray cutting lubricant like a mist, the lubricant is irrecoverably lost from the bandsaw machine and splashes the operators and the surroundings.

Another fundamental and vexing problem of conventional horizontal bandsaw machines is that the bandsaw blade is apt to slip on the bandsaw wheels when travelling thereover. Such slippage occurs because the bandsaw blade is normally always flooded or bathed with cutting lubricant during cutting operations and the lubricant is carried onto the peripheral surfaces of the bandsaw wheels by the bandsaw blade and forms a film of lubricant between the bandsaw blade and the peripheral surfaces of the bandsaw wheels. The slippage of the bandsaw blade on the bandsaw wheels can result in the bandsaw blade being damaged since the blade is forced into the workpiece to be cut without cutting. Although the slippage of the bandsaw blade can be overcome to some extent by increasing the tension of the bandsaw blade between the bandsaw wheels, too much tension will cause the bandsaw blade to be prematurely worn or broken.

Thus, it has been required to improve horizontal bandsaw machines so that the bandsaw blade will neither vibrate nor slip substantially on the bandsaw wheels during cutting nor produce noise pollution.

It is an object of the present invention to overcome or at least mitigate at least one of the above mentioned disadvantages.

According to a first aspect of the present invention, there is provided a bandsaw wheel suitable for use in a horizontal bandsaw, which wheel has a rim having a plurality of grooves, insert means being provided in two or more of the grooves the insert means being so constructed that a plurality of radial protrusions, on which a bandsaw may be seated, are provided.

In one embodiment, the insert means

comprises one member which preferably has two or more flanges on an inner surface, each of the flanges on the inner surface being provided in a respective one of the grooves, and a plurality of flanges on an outer surface providing the radial protrusions on which a bandsaw blade may be seated.

In another embodiment, the insert means comprises two or more members, each member being provided in a respective groove; each member is, before being positioned in the respective groove, conveniently of substantially circular cross section.

According to a second aspect of the present invention, there is provided a horizontal bandsaw comprising bandsaw wheels rotatably mounted on a cutting head, the cutting head being supported on a base such that the cutting head can be raised and lowered with respect to the base, and a bandsaw blade trained around the bandsaw wheels, each of which wheels has a rim having a plurality of grooves, insert means being provided in two or more of the grooves, the insert means being so constructed that a plurality of radial protrusions, on which a bandsaw blade may be seated, are provided.

The present invention enables the provision of a horizontal bandsaw machine in which the noise produced by the bandsaw blade is minimised and/or the vibration of the bandsaw blade is minimised, and/or the bandsaw blade will not slip on the bandsaw wheels.

Accordingly, the present invention enables the provision of a horizontal bandsaw machine in which the cutting rate, the cutting accuracy and the life of the bandsaw blade are increased.

The present invention further enables the provision of a horizontal bandsaw machine with bandsaw wheels which are provided with means for absorbing vibration and affording friction and of a horizontal bandsaw machine in which such means for absorbing vibration and affording friction can be easily installed to the bandsaw wheels.

For a better understanding of the present invention and to show how the same may be put into effect, reference will now be made, by way of example, to the accompanying drawings, in which:—

Figure 1 shows a front elevational view of an embodiment of a horizontal bandsaw machine in accordance with the present invention,

Figure 2 shows a part-sectional side elevational view of a bandsaw wheel of the horizontal bandsaw machine of Figure 1, and in accordance with the present invention,

Figure 3 shows a part-sectional side ele-

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vational view of a further embodiment of a bandsaw wheel in accordance with the present invention, and

5 Figure 4 shows a part-sectional side elevational view of a further embodiment of a bandsaw wheel in accordance with the present invention.

10 Referring to the drawings, a horizontal bandsaw machine 1 comprises an oblong box-like base 3, a work table 5 situated on the base 3, a vice 7 mounted on the work table 5 to clamp a workpiece W and a saw head assembly 9 of substantially C-shaped construction forming spaced apart housing sections 11 and 13.

15 The saw head assembly 9 is so designed that it can be pivoted or swung down towards and up away from the vice 7 about a hinge pin 15 by suitable means such as a hydraulic motor 17. The hinge pin 15 pivotally connects an end of the saw head assembly 9 with the base 3. However, it will be understood that the present invention is applicable to any suitable known type of horizontal bandsaw machines such as, for example, that in which a saw head assembly 9 is vertically raised and lowered in its entirety along a single or plural vertical guide means.

20 Inside the housing sections 11 and 13 of the saw head assembly 9, there are provided driving and driven bandsaw wheels or pulleys 19 and 21, respectively, around which an endless bandsaw blade 23 is trained. The driving and driven bandsaw wheels 19 and 21 are mounted for rotation on spaced apart parallel shafts 25 and 27, respectively, and are substantially radially aligned with each other. Also, in order to tension adequately the bandsaw blade 23, one of the wheels, usually the driven wheel 21, is pulled or biased together with its shaft, usually the shaft 27, away from the other wheel, usually the driving wheel 19, by suitable means. The driving wheel 19 is power driven by a suitable motor, not shown, usually counterclockwise so as to drive and impart orbital motion to the bandsaw blade 23 trained therearound, while the driven wheel 21 is freely rotatable as the bandsaw blade 23 is driven by the driving wheel 19.

30 The bandsaw blade 23 is trained over the bandsaw wheels 19 and 21 in such a manner that its cutting edge projects from the axial inner ends of the bandsaw wheels 19 and 21. Also, the bandsaw blade 23 is slidably guided and held by guide means 29 and 31 with its flat sides perpendicular to the work table 5 at a cutting zone where cutting is performed.

35 The guide means 29 and 31 for guiding and holding the bandsaw blade 23 are detachably fixed to the lower ends of supporting arms 33 and 35, respectively, which are

so supported by a beam 37 fixed to the saw head assembly 9 as to depend therefrom. Either or both of the supporting arms 33 and 35 can be adjustably moved along the beam 37 in directions parallel to the cutting stretch of the bandsaw blade 23 to adjust the span between the guide means 29 and 31 according to the cross-sectional lengths of the cut to be made on the workpiece W. Also, the guide means 29 and 31 are usually designed to supply the bandsaw blade 23 with cutting lubricant. Although the guide means 29 and 31 have some effect in reducing the vibration of the bandsaw blade 23, the vibration is too severe to be reduced by them alone and accordingly the bandsaw blade 23 is apt to remain still severely vibrating while travelling around the bandsaw wheels 19 and 21.

40 As is now readily apparent, the bandsaw blade 23 travelling around the bandsaw wheels 19 and 21 will cut the workpiece W clamped by the vice 7 on the work table 5 as the saw head assembly 9 is lowered towards the work table 5. One of the fundamental problems is that the bandsaw blade 23 severely vibrates primarily between the workpiece W to be cut and the driven wheel 21 because there is a larger tensile stress in the stretch of the bandsaw blade 23 between the workpiece W and the driving wheel 19 than in that stretch between the workpiece W and the driven wheel 21. As a result, the bandsaw blade 23 is apt to remain vibrating in its entirety while travelling around the driving and driven wheels 19 and 21. Also, another fundamental problem is that the cutting lubricant will be carried onto the peripheral surfaces of the bandsaw wheels 19 and 21 by the bandsaw blade 23 with a result that it is likely to cause slippage of the bandsaw blade 23 on the bandsaw wheels 19 and 21.

45 The driving wheel 19 and the driven wheel 21 are, therefore, designed so as to reduce the vibration of the bandsaw blade 23 and prevent slippage of the same. The driving and driven wheels 19 and 21 may be identical in construction to each other, although of course they are to some extent different in function from each other. Accordingly, the further description will be begun with both wheels expressed as "bandsaw wheel 19, 21".

50 In general, the bandsaw wheel 19, 21 comprises a hub 39 in which the shaft 25, 27 is inserted, a disk-like web 41 formed on the hub 39 to project radially there from, an annular rim 43 formed on the periphery of the disk-like web 41 and an annular flange 45 radially projecting from one axial end of the annular rim 43. In the drawings, the annular rim 43 is shown as projecting axially from the periphery of the disk-like web 41 in both axial directions, but it may

be disposed so as to project only in one axial direction from the web 41. Thus, the bandsaw 23 is trained over the periphery of the annular rim 43 such that its back edge is adjacent to and parallel with the foot or inner side surface of the annular flange 45 and its cutting edge projects beyond the axial end of the annular rim 43 remote from the flange 45. The flange 45 acts as a stop to prevent the bandsaw blade 23 from deviating from its normal travelling path and thereby ensures that the cutting edge of the bandsaw blade 23 projects beyond the axial end of the annular rim and is not damaged thereby.

As shown in Figure 2, the annular rim 43 of the bandsaw wheel 19, 21 is provided at its periphery with a plurality of circumferentially extending annular grooves 47. An annular rubber-like member 49, such as plastics material, for example polyurethane or the like, which is of a vibration-absorbing and friction-affording nature, is situated in each of the grooves 47. The grooves 47 are preferably equi-spaced axially on the periphery of the annular rim 43, and the annular rubber-like members 49 should be diametrically or radially outwardly projected from the level, that is surface, of the periphery of the annular rim 43. Accordingly, a plurality of circumferentially extending channels, gutters, ditches or grooves 51 are formed between the annular rubber-like members 49 on and around the periphery of the rim 43 of the bandsaw wheel 19, 21. Thus, it will be understood that the bandsaw blade 23 travels on the annular rubber-like members 49 around the periphery of the bandsaw wheel 19, 21 without touching and colliding with the peripheral surface of the rim 43 of the bandsaw wheel 19, 21.

Thus, the annular rubber-like members 49 are effective not only to absorb the vibration of the bandsaw blade 23 but also to prevent the bandsaw blade 23 from touching and colliding with the peripheral surface of the rim 43 of the bandsaw wheel 19, 21. Accordingly, the vibration and the screech-like noise of the bandsaw blade 23 are greatly reduced.

Also, the channels 51 between the annular rubber-like members 49 can receive the cutting lubricant carried onto the periphery of the bandsaw wheel 19, 21 by the bandsaw blade 23 and, therefore, no film of the cutting lubricant normally forms between the bandsaw blade 23 and the periphery of the bandsaw 19, 21. Furthermore, the annular rubber-like members 49 apply a localised pressure to the bandsaw blade 23, since the pressure exerted to tension the bandsaw blade 23 is localised to the rubber-like members 49. Accordingly, the bandsaw blade 23 can be prevented from slipping

on the bandsaw wheel 19, 21.

Each of the grooves 47 of the bandsaw wheel 19, 21 may be so designed that its radially outer portion is smaller in axial cross-section than its radially inner portion, and each of the annular rubber-like members 49 may of any cross-sectional shape which snugly fits in each of the grooves 47 and outwardly projects therefrom. Therefore, in a further embodiment of a bandsaw wheel, as shown in Figure 3, each of the annular grooves 47' is in the form of a dovetail groove having a narrower outermost opening and a wider innermost base, while each of the annular rubber-like members 49' is in the form of a ring which is round in cross-section. The arrangement is such that the annular rubber-like rings 49' can be resiliently placed in the dovetail-like grooves 47' through their outermost openings and project radially outwardly therefrom even when pressed by the bandsaw blade 23.

Thus, it will be readily understood that the annular rubber-like rings 49' of an elastic nature can be resiliently forced into the dovetail-like grooves 47' through their narrower outermost openings but they are firmly held in the dovetail-like grooves 47' even while the bandsaw wheel 19, 21 is rotating. Also, the annular rubber-like rings 49' can be easily installed onto the bandsaw wheel 19, 21 both in initial assembling and in replacements of old worn ones.

There is shown in Figure 4 a further embodiment of a bandsaw wheel in which a single annular rubber-like member 49'' is mounted around the periphery of the annular rim 43 of the bandsaw wheel 19, 21. This annular rubber-like member 49'' has inner flange portions 49''a equal in number to that of the grooves 47 (47') and a plurality of outer flange portions 49''b. The annular rubber-like member 49'' is of an even thickness and covers the periphery of the rim 43 of the bandsaw wheel 19, 21. Each of the inner flange portions 49''a of the annular rubber-like member 49'' projects radially inwardly into a respective groove 47 (47') and is retained therein. Also, all the outer flange portions 49''b of the annular rubber-like member 49'' project radially outwardly to a small extent from the level, that is upper surface, of the periphery of the annular rubber-like member 49'' by an equal amount so as to form channels, gutters, ditches or grooves 51'' therebetween. The function of the annular rubber-like member 49'' is the same as that of the annular rubber-like members 49 and 49' of the other embodiments. Of course, the annular flange 45'' of the bandsaw wheel 19, 21 in this case has to be radially thicker than the annular flanges 45 of Figures 2 and 3 by a thickness of the body

of the annular rubber-like member 49". Thus, the annular rubber-like member 49" is retained on and around the periphery of the bandsaw wheel 19, 21 with its inner flange portions 49"<sup>a</sup> retained in the grooves 47 (47') and fulfills in its entirety the same functions as that of the annular rubber-like members 49 and 49' of the other embodiments.

As has been described, the bandsaw wheels 19 and 21 of the horizontal bandsaw machine 1 are provided at their peripheries with the annular rubber-like members 49, 49' or 49" which are made of material such as polyurethane or the like of a vibration-absorbing and friction-affording nature. However, such arrangements need not necessarily be made on all the driving and driven wheels 19 and 21. The keen and screech-like noise is much reduced by using a wheel as previously described with reference to Figures 2, 3 or 4 because the noise will occur most severely on the driven wheel 21 as has been hereinbefore described. Of course, however, it is the most desirable to use such a wheel for each of the driving and driven wheels 19 and 21 so as to reduce the vibration and resultant noise of the bandsaw blade 23 and prevent as much slippage of the blade as possible.

As has been described, the horizontal bandsaw machine 1 has been much improved in order to solve the various conventional problems by improving the bandsaw wheels 19 and 21, which have sometimes been considered simple and insignificant.

Firstly, it is a marked feature of the horizontal bandsaw machine 1 that the undesirable screech-like noise can be reduced to a minimum, basically since the bandsaw blade 23 causing the noise travels on the rubber-like members 49, 49' or 49" around the peripheries of the bandsaw wheels 19 and 21. Needless to add, the bandsaw blade 23 is prevented from producing the noise because of the rubber-like members 49, 49' or 49", since it is restrained from severely vibrating and also it will not directly collide with the rim 43 of each of the driving and driven wheels 19 and 21.

In this connection, actual tests in cutting a stainless steel bar (JIS(=Japanese Industrial Standard) : SUS-304) having a diameter of 250mm. revealed that an average loudness of 95 decibels in cutting with the conventional horizontal bandsaw machines was reduced to an average of 76 decibels in cutting with the driven wheel 21 only equipped with the rubber-like members (49'). Since the loudness of the noise is thus remarkably reduced even with the driven wheel 21 only being adapted as shown in Figures 2, 3 or 4, it will be much more

reduced if both of the driving and driven wheels 19 and 21 are so adapted. Thus, the horizontal bandsaw machine 1 should not be harmful to the health of the operators of the machines. Also, the very fact that the noise is greatly reduced in the horizontal bandsaw machine 1 is much appreciated nowadays since industrial noise pollution is likely to become a contentious issue.

A basic feature of the horizontal bandsaw machine 1 is that the vibration of the bandsaw blade 23 is absorbed by the rubber-like members 49, 49' or 49" and this feature can lead to further advantages. Since the bandsaw blade 23 will normally cut into the workpieces W in a straight manner without vibrating sideways, the cutting accuracy is increased, that is to say both the straightness of the cuts and the surface roughness of the cut workpieces W are improved. Since the bandsaw blade 23 is restrained from vibrating sideways and breadthways, the cutting rate of the bandsaw blade 23 will be increased. Also, the life of the bandsaw blade 23 is increased, since the sideways vibration of the bandsaw blade 23 is minimised and accordingly unnecessary wear of the bandsaw blade 23 without performing cutting is minimised. Furthermore, although vibration of the bandsaw blade 23 will cause the cutting lubricant to spray like a mist in conventional horizontal bandsaw machines, such a mist of cutting lubricant is absent from the horizontal bandsaw machine 1 and accordingly the cutting lubricant will not normally be lost from the machine and will not splash the operators or the vicinity of the machine.

Another basic feature of the horizontal bandsaw machine 1 is that the bandsaw blade 23 will not slip substantially on the bandsaw wheels 19 and 21, since the cutting lubricant carried onto the peripheries of the bandsaw wheels 19 and 21 by the bandsaw blade 23 is forced into the channels 51 or 51" between the rubber-like members 49, 49' or the outer flange portions 49"<sup>b</sup> of the rubber-like member 49". The bandsaw blade 23 will normally be prevented from slipping also since the pressure applied to the bandsaw blade 23 to tension the same is localised on the rubber-like members 49, 49' or the outer flange portions 49"<sup>b</sup> of the rubber-like member 49". Thus, the bandsaw blade 23 can be completely prevented from slipping on the bandsaw wheels 19 and 21 without too much tension on the bandsaw blade 23. Accordingly, the bandsaw blade 23 will not normally be broken or snapped because of too much tension on the same in the horizontal bandsaw machine 1. Also, since the bandsaw blade 23 is normally positively prevented from slipping on the bandsaw wheels 19 and 21, it will not be forced into

the workpieces to be cut without cutting and, therefore, neither the bandsaw blade 23 itself nor its teeth will normally be broken because of the slippages. Thus, the life of the bandsaw blade 23 can be lengthened in the horizontal bandsaw machine 1.

In this connection, slippage of the bandsaw blade 23 on the bandsaw wheels 19 and 21 can be reduced or prevented simply by the grooves 47 or 47' without the rubber-like members 49, 49' or 49", since the peripheral surfaces between the grooves 47 or 47' of the rim 43 will fulfil the same functions as the rubber-like members 49, 49' or 49" for the purpose of preventing the slippage of the bandsaw blade 23. Of course, without the rubber-like members 49, 49' or 49", the vibration and the resultant noise is not reduced. However, it is still one of the advantages of the horizontal bandsaw machine 1 that the bandsaw wheels 19 and 21 can be used without the rubber-like members 49, 49' or 49" but with the effect of preventing the slippage of the bandsaw blade 23 for example after the rubber-like members 49, 49' or 49" have been worn and until new ones can be obtained and installed.

Furthermore, the rubber-like members 49, 49' or 49" can be easily installed on the bandsaw wheels 19 and 21.

#### WHAT WE CLAIM IS:

1. A bandsaw wheel suitable for use in a horizontal bandsaw, which wheel has a rim having a plurality of grooves, insert means being provided in two or more of the grooves, the insert means being so constructed that a plurality of radial protrusions, on which a bandsaw may be seated, are provided.

2. A bandsaw wheel according to Claim 1, wherein the insert means comprises one member.

3. A bandsaw wheel according to Claim 2, wherein the member has two or more flanges on an inner surface, each of the flanges on the inner surface being provided in a respective one of the grooves, and a plurality of flanges on an outer surface providing the radial protrusions on which a bandsaw blade may be seated.

4. A bandsaw wheel according to Claim 1, wherein the insert means comprises two or more members, each member being provided in a respective groove.

5. A bandsaw wheel according to Claim 3, wherein each member is, before being positioned in the respective groove, of sub-

stantially circular cross section.

6. A bandsaw wheel according to any one of Claims 1 to 5, which wheel has a plurality of channels spaced apart in a direction parallel to an axis about which the wheel may rotate.

7. A bandsaw wheel according to any one of Claims 1 to 6, wherein the or each groove is annular.

8. A bandsaw wheel according to any one of Claims 1 to 7, wherein the or each groove has a cross-section substantially in the form of a dovetail.

9. A bandsaw wheel according to any one of Claims 1 to 8, wherein the or each member is rubber-like.

10. A bandsaw wheel according to any one of Claims 1 to 9, wherein the or each member is of plastics material.

11. A bandsaw wheel according to any one of Claims 1 to 10, wherein the or each member is of polyurethane.

12. A bandsaw wheel suitable for use in a horizontal bandsaw, substantially as hereinbefore described with reference to, and as shown in, Figures 1 and 2 of the accompanying drawings.

13. A bandsaw wheel suitable for use in a horizontal bandsaw, substantially as hereinbefore described with reference to, and as shown in, Figure 3 of the accompanying drawing.

14. A bandsaw wheel suitable for use in a horizontal bandsaw, substantially as hereinbefore described with reference to, and as shown in, Figure 4 of the accompanying drawing.

15. A bandsaw wheel suitable for use in a horizontal bandsaw, substantially as hereinbefore described with reference to, and as shown in, Figures 1 and 2 modified by Figure 3 of the accompanying drawing.

16. A bandsaw wheel suitable for use in a horizontal bandsaw, substantially as hereinbefore described with reference to, and as shown in, Figures 1 and 2 modified by Figure 4 of the accompanying drawing.

17. A horizontal bandsaw comprising bandsaw wheels rotatably mounted on a cutting head, the cutting head being supported on a base such that the cutting head can be raised and lowered with respect to the base, and a bandsaw blade trained

around the bandsaw wheels, each of which wheels has a rim having a plurality of grooves, insert means being provided in two or more of the grooves, the insert means 5 being so constructed that a plurality of radial protrusions, on which a bandsaw blade may be seated, are provided.

18. bandsaw whenever incorporating 10 the bandsaw wheel of any one of Claims 1 to 16.

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