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Taguchi et al.

[11] **3,888,637**

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[54] **RIPPER POINT PART**

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[52] **U.S. Cl.** ..... **29/191**; 29/196.1; 37/142 R; 172/747

[51] **Int. Cl.** **B32b 15/18**

[58] **Field of Search** ..... 172/747; 37/142 R; 29/191, 29/196.1

[56] **References Cited**

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[57] **ABSTRACT**

Improvement in a ripper point part for ripper devices equipped or construction vehicles and comprising a main portion of soft steel and a surface layer of hard steel arranged in front of said main portion.

9 Claims, 4 Drawing Figures

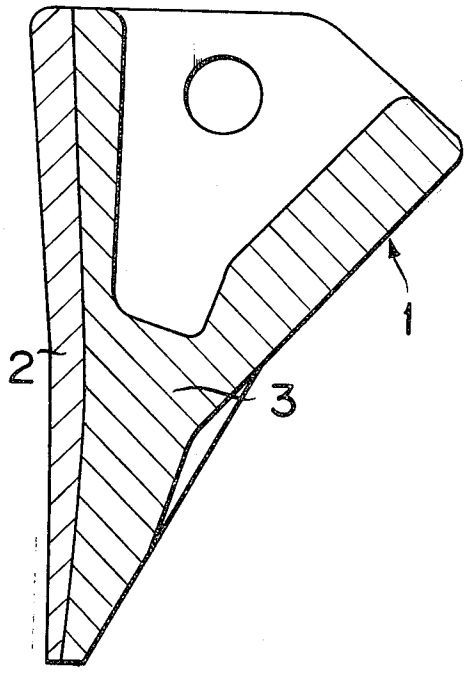


FIG. 1

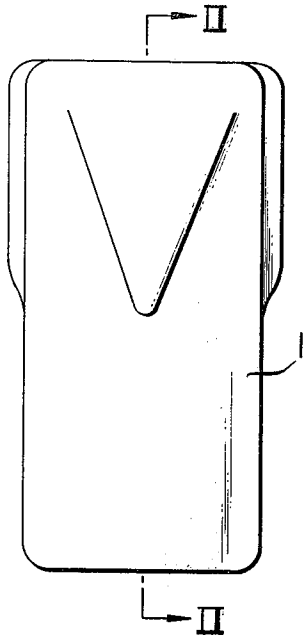


FIG. 2

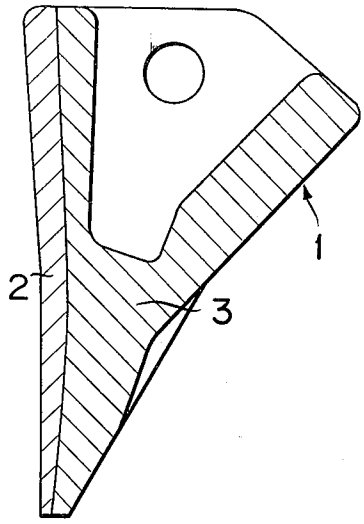


FIG. 3

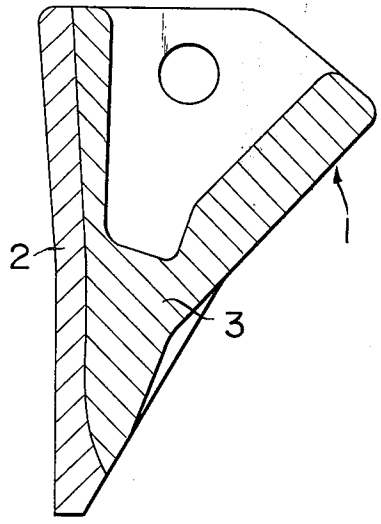
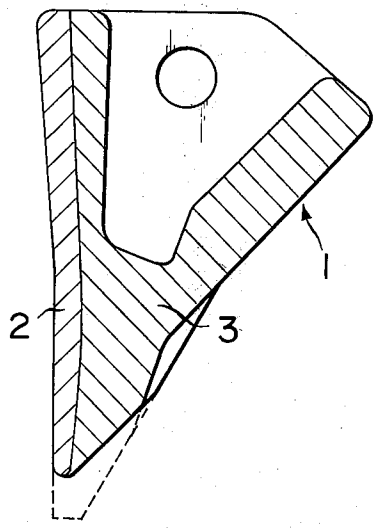


FIG. 4



RIPPER POINT PART

BACKGROUND OF THE INVENTION

The present invention relates to an improvement in a ripper point part for ripper devices equipped on construction vehicles such as bulldozers.

Construction vehicles such as bulldozers used to excavate hard road surfaces such as base rocks have ripper devices at the rear. The ripper devices have nail-shaped shanks operated by oil pressure and are designed to crush and excavate the ground surface, such as base rocks to by advancing the vehicle while pressing the ripper point attached at the tip of the shank into the ground.

As the conventional ripper points, medium carbon steel containing 0.3 – 0.4% by weight of carbon or medium carbon low-alloy forged steel or cast steel containing proper amount of manganese, chromium or molybdenum, are used. The ripper point of these materials, however, suffers severe wear upon use on hard base rock ground, so its life is usually 15 to 25 hours of operation.

Generally, the most effective way to improve wear resistance of steel is to increase its hardness. As an example, we may harden high carbon steel containing about 0.8 weight % of carbon and temper it at the low temperature of about 200°C. But the higher the hardness of steel rises, the lower is its toughness reduced, causing impact value to be lower. According to prior experience, the ripper point has been broken if it had not more than 3 kgm/cm^2 of impact value on a U-notched charpy test-piece, but the impact value of high carbon steel quenching by the above processes cannot reach this value at all. The reason why medium carbon alloy steels are mostly used in ripper point results from the consideration of the balance between wear resistance and toughness.

The cause of the short life of a ripper point is that it often reaches its working limit and becomes impossible to use before reaching to wear limit of its own body, since the tip of the point becomes round by wear and impossible to penetrate into the base rocks.

An object of the present invention is to improve the conventional ripper point.

Another object of the present invention relates to improvement in a ripper point for ripper devices equipped on construction vehicles such as bulldozers.

Still another object of the present invention is to provide ripper point parts having extremely long life.

Another object of the present invention is to provide a ripper point part combining wear resistance with toughness while maintaining sharpness of the tip while used, that is, having self-sharpenability.

SUMMARY OF THE INVENTION

A ripper point part according to the present invention comprises a main portion of softer steel and a surface layer of hard steel arranged in front of said main

portion. By forming the ripper point body into at least double layers of harder and softer steel and by using the difference of wear rate between each layer, the tip of the body can always be maintained sharp. Therefore it can stand long use without fear of becoming impossible to use due to of the tip deteriorating to an obtuse angle. Therefore, in comparison with conventional points one, it has an effect such that endurance increases outstandingly. Combining the hard layer with the soft one results in a superior effect such that toughness increases and at the same time wear resistance can increase, compared with points that are wholly composed of high carbon steel.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be readily understood from the following description, when read together with the drawings, wherein;

FIG. 1 is a plan view illustrating an embodiment of the ripper point part according to the present invention,

FIG. 2 is a sectional view along II — II in FIG. 1 illustrating an embodiment of the present invention,

FIG. 3 is a sectional view along II—II in FIG. 1 illustrating another embodiment of the invention, and

FIG. 4 is a sectional view illustrating the ripper point part of the present invention when the tip portion has become worn.

DETAILED DESCRIPTION OF THE INVENTION

As it is evident from FIG. 1 and FIG. 2, a body 1 of the ripper point part comprises a surface layer 2 of a relatively hard portion composed of such low-alloy steels as represented by the Japanese Industrial Standard (JIS) symbols such as SKS 51, SCM 5, MS, SKC 11 or SKT 4, and a soft main portion 3 composed of such steels as represented by JIS symbols such as SS or SMn 1. The steel surface layer 2 of hard material is arranged at the front side of the ripper point part 1. This hard layer 2 can be uniform in thickness as shown in FIG. 2. As shown also in FIG. 3, the thicker the tip of the hard layer is made, the lower can the initial wear speed can be.

The ratio of thickness of the front side surface layer 2 of harder material to that of the main part 3 of softer material at the back face is soft layer 1 – 7 to hard layer 1 in the range from about 4 cm from the tip to the working limit.

After they are adhesively combined with each other by high frequency heat pressure bonding, both the above-mentioned materials are oil-hardened at about 860°C and then tempered to about 200°C. For example, examples of combination of the above-mentioned hard material surface layer 2 and the above-mentioned soft material main part 3 of the ripper point formed in the structure as shown in FIG. 2 are shown in Table 1 by the JIS symbols.

Table 1 Combinations of the front side surface part material and the back face part material.

Test No.	The hard material surface layer			The soft material main part		
	JIS symbol	Surface hardness		JIS symbol	Surface hardness	
1	SKS 51	HRc	54	SS 41	HR_B	83
2	SKS 51	"	54	SM_n 1	HR_C	30
3	SCM 5	"	49	SS 41	HR_B	82
4	SCM 5	"	49	SM_n 1	HR_C	32
5	SCM 5	"	48	SCM 2	"	40
6	MS	"	57	SCM 21	"	25
7	MS	"	56	SCM 24	"	33
8	MS	"	56	SCM 2	"	40
9	SKC 11	"	56	SS 41	HR_B	80
10	KKC 11	"	56	SM_n 1	HR_C	34
11	SKT 4	"	52	SCM 21	"	27
12	SKT 4	"	53	SCM 24	"	32
13	SKT 4	"	52	SCM 2	"	41
14	SKT 4	"	47*	SCM 2	"	40

*adjusted by tempering temperature

The chemical compositions of the JIS-symbolized steel shown in Table 1 are as in Table 2.

Table 2

Steel type	The chemical compositions of steels The chemical composition (% by weight)								
	C	Si	Mn	P	S	Ni	Cr	Mo	V
SKS 51	0.79	0.19	0.30	0.008	0.007	1.57	—	—	—
SCM 5	0.47	0.17	0.80	0.017	0.023	—	1.11	0.31	—
MS	0.54	0.29	0.35	0.015	0.016	3.02	1.36	0.33	—
SKC 11	0.98	0.18	0.26	0.021	0.016	—	0.76	—	—
SKT 4	0.55	0.38	0.88	0.018	0.007	1.54	0.87	0.43	0.17
SM_n 1	0.32	0.30	1.42	0.009	0.013	—	0.11	—	—
SCM 21	0.15	0.28	0.77	0.014	0.018	—	1.05	0.20	—
SCM 24	0.23	0.26	0.75	0.010	0.009	—	1.10	0.39	—
SCM 2	0.30	0.20	0.80	0.014	0.016	—	1.08	0.21	—
SS 41	0.25	0.34	0.53	0.023	0.015	—	—	—	—

Testing durability of the ripper point part composed on the basis of combinations of each low-alloy steel in Table 1 on the ripping operation of bulldozers on the hard base rocks of tuff breccia results in as shown in Table 3.

Table 3

Working results of various types of the ripper point

Test No.	Combination of steels		Self-sharpenability	Wear Rate (mm/hr)	Life (hrs)	The ratio of thickness of the hard layer to the soft layer at the place of 50 mm from the tip
	The hard layer	The soft layer				
1–1	SKS 51	SS 41	◎	0.70	65	1:4
1–2	SKS 51	SS 41	◎	1.30	35	1:7
2	SKS 51	SMn 1	○	0.72	52	1:2
3	SCM 5	SS 41	○	1.30	41	1:6
4	SCM 5	SMn 1	Δ	1.23	33	1:5
5	SCM 5	SCM 2	Δ	0.90	26	1:5
6–1	MS	SCM 21	◎	0.80	60	1:4
6–2	MS	SCM 21	◎	1.35	37	1:7
7	MS	SCM 24	○	0.78	53	1:4
8	MS	SCM 2	Δ	0.70	35	1:2
9	SKC 11	SS 41	◎	0.65	70	1:4
10	SKC 11	SMn 1	○	0.62	53	1:2
11	SKT 4	SCM 21	○	0.88	55	1:5
12	SKT 4	SCM 24	○	0.85	48	1:3
13	SKT 4	SCM 2	○	0.84	32	1:1
14**	SKT 4	SCM 2	Δ	0.86	29	1:4
conventional	low-alloy cast steel		X	1.22	18	—

**the hard layer HR_c 47 the soft layer HR_c 40

By the way, in Table 3, ◎ represents the most superior, ○: superior, Δ: normal, and χ: inferior about self-sharpenability.

As it is evident from Table 3, the higher carbon content in the hard layer **2** and the higher the hardness, the lower is the wear speed of the ripper point, but the actual life cannot be determined only from the wear rate.

The test has made it clear that surface hardness of the hard layer **2** of the body **1** after being hardened and tempered is desired to be more than **45** on the Rockwell hardness C scale and that of the soft layer **3** to be less than **40** on the Rockwell hardness C scale.

Moreover, the rate of thickness of the hard layer to

the soft layer is an essential factor from the viewpoint of wear speed and self-sharpenability. As it is evident from the above-mentioned test, the thinner the hard layer the larger does wear speed become. Meanwhile the smaller the difference of thickness between the hard layer and the soft layer, the smaller is self-sharpenability. From these test results, the rate of thickness of the soft layer to that of the hard layer is preferably about 1 to 7 in the range of from at about 4 cm from the tip to the working limit. That is, at more than sevenfold there is little advantage in making double layer of hard and soft, and wear is bad and life becomes short because of the soft layer which occupies the most part of it. That is, also at less than onefold, wear becomes lower but self-sharpenability becomes inferior because wear speed as a whole is the same. That is, the ripper point according to the present invention has the most advantage in prolonging working life by self-sharpenability resulting from the difference of wear speed between the hard layer and the soft one.

Therefore, the tip of the ripper point body **1**, wearing as shown in FIG. **4**, will always be maintained at an acute angle. The vicinity of the tip portion, however, is originally thin and the wear speed difference is not always directly proportioned to use, so we may not be a slave of the above-mentioned ratio. And making the hard layer thick at the tip as shown in FIG. **3** can slow the initial wear speed.

Further, in the above-mentioned embodiment, the hard layer **2** and the soft layer **3** are integrated by high frequency heat pressure bonding, but they may be integrated by other means such as rolling, forge welding, brazing, friction welding, flash butt welding, electroslag welding, etc. Since these means are all well-known, an detailed explanation will not be provided.

The present invention has effects that the tip of the body is always maintained sharp by the difference of wear speed between both the layers, therefore there is no fear that the tip will become obtuse and impossible to penetrate into the rock in the early stage, and the durability force can increase more notably than that of the conventional points, because of forming the ripper point body in at least the double layer composed of soft and hard layer and setting the soft layer at several-folds of thickness to the hard one. The combination of the hard layer and the soft one also has a superior effect such that toughness can increase at the same time wear resistance can increase more than points wholly formed by high carbon steel.

What is claimed is:

1. A ripper point part comprising a main part of softer, low-alloy steel and a surface layer of harder low-alloy steel arranged at the front side of said main part, wherein said harder surface layer is adhesively combined integrally with said softer main part and the ratio of thickness of said harder surface layer to said softer main part is 1 to 5 through 1 to 9 at a location 40–50 mm from the point.

2. A ripper point part according to claim **1**, wherein the ratio of thickness of the hard surface layer to the soft main part in the range from at about 40mm from the tip to the working limit is 1 to 7.

3. A ripper point part according to claim **1**, wherein the hardness of the soft main part is less than 40 on Rockwell hardness C scale.

4. A ripper point part according to claim **1**, wherein the hardness of the hard surface layer is more than 45 on Rockwell C scale.

5. A ripper point part according to claim **1**, wherein the soft main part and the hard surface layer is adhesively combined integrally by means of high frequency heat pressure bonding.

6. A ripper point part according to claim **2**, wherein the hard surface layer has almost uniform thickness.

7. A ripper point part according to claim **2**, wherein the hard surface layer is thick at the tip portion.

8. A ripper point part according to claim **1**, wherein the steel of the surface layer is a material selected from the group consisting of SKS **51**, SCM **5**, MS, SKC **11** and SKT **4** in JIS symbols.

9. A ripper point part according to claim **1**, wherein the steel composing the main part is a material selected from the group consisting of SS, SMn **1** and SCM **24** in JIS symbols.

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