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GRADER BLADE

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Stoody 143-O Open Arc Welding Wire, published on 4 January 2008 [retreived from internet 25 June 2020]

ABSTRACT

A grader blade including: a body having a front face spaced from and substantially parallel to a rear face and a bottom edge face extending between said front and rear faces; one or more recesses in and spaced about at least part of said front and rear faces, each recess having a depth; a composite or niobium carbide hardfacing inlay substantially filling each said recess substantially to said depth to provide an exposed surface; and a niobium carbide hardfacing overlay in the form of a substantially continuous layer covering the exposed surfaces of the hardfacing inlay, at least part of the front and rear faces and substantially all of the bottom edge face.

GRADER BLADE

THIS INVENTION relates to a grader blade.

The invention has particular application to grader blades used in road making and road maintenance. However, the invention is not limited to this particular field of use.

Graders have one or more blades attached to a mouldboard. The grader blades are normally replaceable because the part of the blade which engages the ground wears away. Increasing the service life of the grader blade or blades will be advantageous both in terms of return on investment in the wear part due to increased service life and cost savings due to decreased downtime.

The present invention aims to provide an improved grader blade having a longer service life than grader blades of the prior art. Other aims and advantages of the invention may become apparent from the following description.

With the foregoing in view, the present invention resides broadly in a grader blade including:

a body having a front face spaced from and substantially parallel to a rear face and a bottom edge face extending between said front and rear faces;

one or more recesses in and spaced about at least part of said front and rear faces, each recess having a depth;

a composite or niobium carbide hardfacing inlay substantially filling each said recess substantially to said depth to provide an exposed surface; and

a niobium carbide hardfacing overlay in the form of a substantially continuous layer covering the exposed surfaces of the hardfacing inlay, at least part of the front and rear faces and substantially all of the bottom edge face.

In another aspect, the present invention resides broadly in a method of hardfacing a grader blade having a body portion having a front face spaced from and substantially parallel to a rear face and a bottom edge face extending between said front and rear faces, the method including:

forming or providing one or more recesses in and spaced about at least part of said front and rear faces to a predetermined depth;

applying a composite or niobium carbide hardfacing inlay to substantially fill each said recess said depth to provide an exposed surface; and

applying a substantially continuous layer of weld to cover the exposed surfaces of the niobium carbide hardfacing inlay, all of the bottom edge face and at least part of the front and rear faces adjacent the bottom edge face to form a hardfacing overlay.

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The hardfacing inlay, being effectively a discontinuous layer spaced about the front and rear faces, may function as plurality of keys to which the hardfacing overlay attaches. Preferably, there is more than one recess, but the recesses in spaced disposition about the first and second faces may be joined to form a contiguous recess. In such form, an effective plurality of channels or the like is provided.

The hardfacing overlay may be formed from one or more layers formed by laying up a plurality of beads of weld alongside and/or atop one another in succession.

Preferably, the hardfacing overlay is a composite hardfacing, being a composite weld comprising a weld matrix having supported therein a wear resistant material in grit-like form. The weld matrix is preferably mild steel.

The niobium carbide hardfacing preferably also includes vanadium carbide and more preferably also includes tungsten carbide, not in grit-like form. In such form, these constituents are intentional products in a microalloyed steel, hereinafter referred to as a weldable alloy. When provided in grit-like form in the overlay, the carbide or carbides are sized for addition to a weld puddle.

The weldable alloy may also include chromium. The non-ferrous metals are generally in the form of carbides or generally form carbides. For example, the weldable alloy may be an alloy having up to 2% carbon, up to 10% chromium carbide, up to 10%

niobium carbide and up to 15% tungsten carbide with other elements in minor percentages including vanadium carbide, titanium carbide, silicon, and the balance being iron, but such concentrations may not necessarily be reflected in the as-welded product. Boron may be added or provided to enhance hardenability. Other non-ferrous constituents may be included. Chromium carbide may also be limited to trace amounts to avoid the possibility of weld cross-checking in the finished product. The weldable alloy is applied to the body portion and over the exposed surface of the hardfacing inlay to form the hardfacing overlay by welding. The weldable alloy may be, for example, about 400 to 500 Brinell, but it will be appreciated that weldable alloys outside this range may also be used.

It will be appreciated that the hardfacing overlay is formed from a material selected to improve the wear and impact resistance of the as-welded product. It will also be appreciated that, due to dilution of at least some of the material of the weldable alloy in the as-welded state or the hardfacing overlay may have a composition falling outside the specification of the weldable alloy as supplied.

In one form, both the inlay and overlay hardfacing are formed from the same weldable alloy, the weldable alloy being selected for its surprisingly high impact resistance. In such form, the hardfacing penetrates the substrate to a depth of up

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to 5 mm, more preferably more than 4 mm. It will be appreciated that there may be a compositional change in the first and second hardfacing portions in the as-welded condition from the weldable alloy as supplied, irrespective as to whether the first and second hardfacing portions are formed from the same or from different materials.

Preferably, the recesses are provided in the form of a plurality of parallel grooves running parallel to and spaced from the bottom edge face. In a particularly preferred form, the grooves on the front face have substantially the same spacing from the bottom edge face as the grooves on the rear face. Accordingly, as the grader blade wears, two of the hardfacing inlays are exposed at the same time, one on each of the front and rear faces.

In order that the invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate a preferred embodiment of the invention, and wherein:

Fig. 1 is an end elevation of a grader blade according to the invention;

Fig. 2 is a plan view of the grader blade of Fig. 1; and

Fig. 3 is a side elevation of the grader blade of Fig. 1.

The grader blade 10 illustrated in Figs. 1 to 3 has a rear face 11 opposed to a front face 12 substantially parallel thereto

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and a bottom edge face 13 extending between the first and second faces, each face being substantially planar. The edge face is at a non-perpendicular angle to the first and second faces so that when engaging the ground in its normal orientation, the bottom edge is substantially horizontal and the front and rear faces slope to the left in the orientation shown in Fig. 1. The normal direction of travel for the grader blade illustrated in Fig. 1 is from left to right. Twelve grooves are provided in the body, five in the rear face, six in the front face and one in the bottom edge face, each extending along the length of the blade. The grooves are illustrated with a hardfacing inlay therein and typically having the reference numeral 14.

A hardfacing overlay 15 covers all of the bottom edge face and that part of the front and rear faces adjacent thereto to extend part-way up the blade, including covering the hardfacing inlay filling the grooves. The hardfacing overlay sits proud of the front and rear faces, but if preferred, a rebate may be provided to a depth which permits the outer surface of the hardfacing overlay to be substantially coplanar with the remainder of the front and rear faces.

In use, the hardfacing may be applied using weld wire from 1.6 to 2.0 mm gauge, using a voltage in the range of from 24 to 32 volts, preferable in the range of 26 to 28 volts, and a current of 250 to 650 amps, preferably 300 to 500 amps. The

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preferred weld wire is Vecalloy H advanced welding wire as hereinbefore described, the use of which is normally for the application of smooth banding onto drill pipe. Published literature, though not necessarily forming part of the common general knowledge in the art, especially in view of the alloy being only recently discovered, recommends that the weld be cooled rapidly. However, the inventor has surprisingly discovered that not accelerating the cooling of the weld results in a superior hardfacing.

Additionally, the provision of a trailing shield protects the weld from ingassing or development of gaseous inclusions in the as-welded hardfacing. Although an inferior impact resistance may result, the second hardfacing may have discrete grits of wear resistant material added to the weld pool, particularly for applications requiring high abrasion resistance and/or roughness. The preferred form and composition of the present invention has been found experimentally to provide superior performance for grader blades in road-making applications.

The welding procedure preferably includes provision of water cooling to the welding torch and water cooling around the shielding gas. The preferred shielding gas is an argon and oxygen blend. Preferably, the blend is about 2% oxygen. The shielding is preferably selected to prevent cracking and checking of the weld, but also to provide deeper than normal penetration of the

weld into the substrate. Moreover, the interpenetration occurs between the first, discontinuous keying layer of weld, (the inlay,) and the second substantially continuous layer of weld, (the overlay,) to provide a grader blade which is well suited to use on unsealed road surfaces, particularly mining haul roads and more particularly iron ore haul roads.

Although the invention has been described with reference to one or more specific examples, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms and fall within the broad scope and ambit of the invention as herein set forth and defined by the following claims.

Editorial Note

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non-sequential
claims .
Claim pages
starts on page
no 9-12 .

Page 9 have
(1-4) claims.

Page 10 -12
have (1 -12)
claims.

Total numbers
of claim
should be 16.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A grader blade including:

a body having a front face spaced from and substantially parallel to a rear face and a bottom edge face extending between said front and rear faces;

one or more recesses in and spaced about at least part of said front and rear faces, each recess having a depth;

a composite or niobium carbide hardfacing inlay substantially filling each said recess substantially to said depth to provide an exposed surface; and

a niobium carbide hardfacing overlay in the form of a substantially continuous layer covering the exposed surfaces of the hardfacing inlay, at least part of the front and rear faces and substantially all of the bottom edge face.

2. The grader blade according to claim 1, wherein the hardfacing inlay consists substantially of a composite weld comprising a weld matrix having supported therein a wear resistant material in grit-like form.

3. The grader blade according to claim 1, wherein the niobium carbide hardfacing inlay consists of a weldable alloy.

4. A grader blade according to any one of the preceding claims, wherein the hardfacing inlay is effectively a discontinuous

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A grader blade including:

a body having a front face spaced from and substantially parallel to a rear face and a bottom edge face extending between said front and rear faces;

one or more recesses in and spaced about at least part of said front and rear faces, each recess having a predetermined depth;

a composite or niobium carbide hardfacing inlay consisting substantially of a weldable alloy substantially filling each of said one or more recesses to said predetermined depth and applied in a first operation; and

a niobium carbide hardfacing overlay comprising a weldable alloy in the form of a substantially continuous layer covering the hardfacing inlay, at least part of the front and rear faces and substantially all of the bottom edge face and applied in a subsequent operation.

2. A grader blade according to claim 1, wherein the hardfacing overlay includes a wear resistant material in grit-like form.

3. A grader blade according to any one of the preceding claims, wherein the hardfacing inlay forms a discontinuous layer spaced about the front and rear faces so as to function as a plurality of keys to which the hardfacing overlay attaches.

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4. A grader blade according to any one of the preceding claims, wherein the recesses are provided in the form of a plurality of channels running parallel to and spaced from the edge face.

5. A grader blade according to claim 4, wherein the recesses in spaced disposition about the first and second faces are joined to form a continuous recess comprising a plurality of channels.

6. The grader blade according to claim 5, wherein the channels on the front face have substantially the same spacing from the bottom edge face as the channels on the rear face.

7. A grader blade according to any one of the preceding claims, wherein the weldable alloy includes niobium carbide and vanadium carbide.

8. A grader blade according to any one of the preceding claims, wherein the weldable alloy includes tungsten carbide in microscopic or nanoscale form.

9. A method of hardfacing a grader blade having a body portion with a front face spaced from and substantially parallel to a rear face and a bottom edge face extending between said front and rear faces, the method including:

forming or providing one or more recesses in and spaced about at least part of said front and rear faces to a predetermined depth;

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applying a composite or niobium carbide hardfacing inlay comprising a weldable alloy to substantially fill each said recess to said depth to provide an exposed surface; and

subsequently applying a substantially continuous layer of weld to cover the exposed surfaces of the niobium carbide hardfacing inlay, all of the bottom edge face, and at least part of the front and rear faces adjacent the bottom edge face, to form a hardfacing overlay.

10. The method according to claim 9, wherein the weldable alloy includes any one or more of niobium carbide, vanadium carbide and/or tungsten carbide.

11. The method according to claim 10, wherein the weldable alloy has up to 2% carbon, up to 10% chromium, up to 10% niobium, up to 15% tungsten and boron.

12. The method according to any one of claims 9 to 11, wherein the weldable alloy is applied to the body portion and over the exposed surface of the hardfacing inlay to form the hardfacing overlay by welding.

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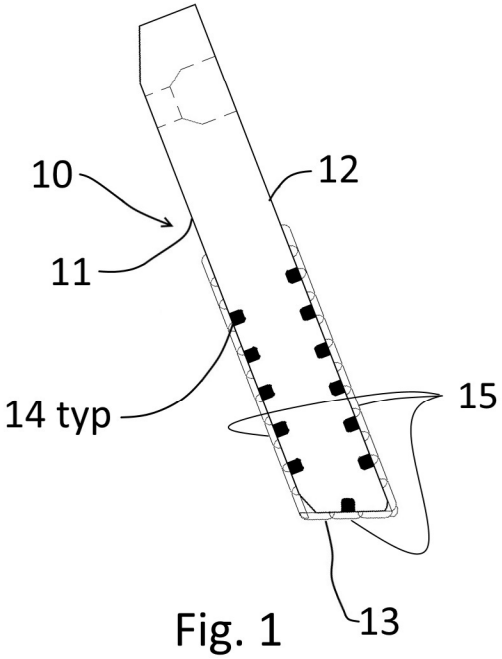

Fig. 1

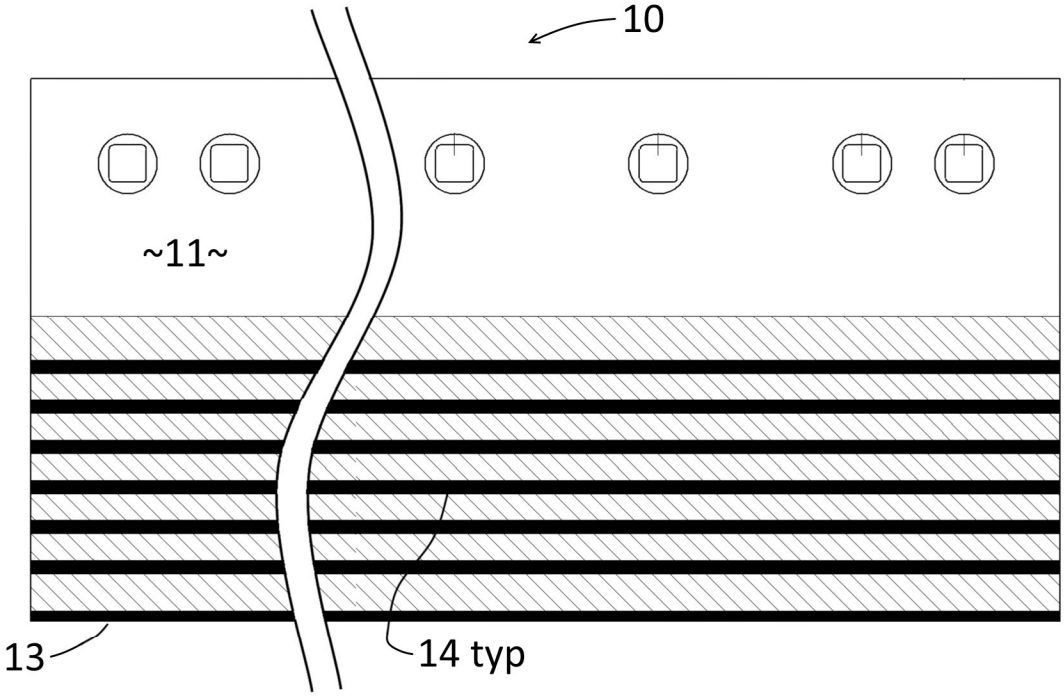

Fig. 2

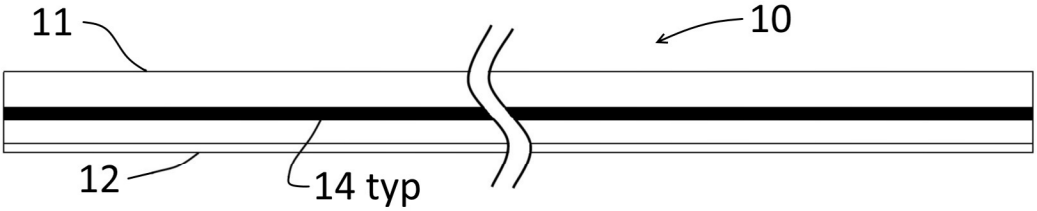

Fig. 3