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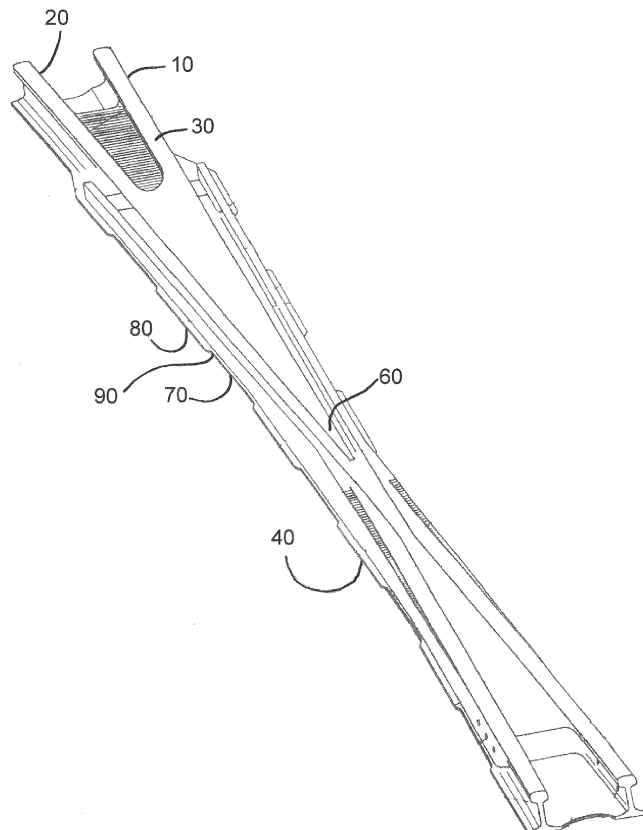
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(54) **IMPROVED STEEL RAILWAY CROSSING**

(57) A steel railway crossing is subjected to explosive device hardening (EDH) on both its top, running surface and its bottom, support surface. The EDH increases the

hardness of the running surface and the ultimate tensile stress of the support surface.

FIG. 1



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Description

Field of the Disclosure

[0001] The disclosure relates to steel railway crossings and the manufacturing thereof.

Background and Prior Art

[0002] Hard steel railway crossings such as high manganese steel railway crossings are commonly used on railway lines with heavy usage due to their work hardening and high toughness properties. The crossings are key components of turn outs and any other places where train wheels have to transfer from one track onto another track. The crossing surface in contact with the train wheels may be pre-hardened using EDH hardening to increase its service life. Current manganese crossing can suffer from failure mechanisms induced by poor support conditions, which leads to vertical movement of the crossing as it "sinks" under the weight of the train which can lead to fractures in the crossing. Repair or replacement of these crossings is generally expensive and disruptive to the rail schedule and hence this disclosure aims to overcome at least some of the known disadvantages.

Summary of the Disclosure

[0003] Accordingly, the disclosure provides a steel railway crossing having a body with a top running surface and a bottom support surface. The body has a first hardness and a first UTS. The top running surface has been exposed to an EDH cycle to achieve a second hardness greater than the first hardness. The bottom support surface having been exposed to an EDH cycle to achieve a second UTS greater than the first UTS.

[0004] In a further aspect there is disclosed a method of manufacturing a railway crossing comprising the steps of: casting at least a section of a steel railway crossing. The at least one section has a top running surface and a bottom support surface. It comprises the steps of exposing at least a portion of the top running surface to a first EDH cycle to increase wear and deformation resistance of the running surface and exposing at least a portion of the bottom support surface to a second EDH cycle to increase UTS of the section.

[0005] In yet a further aspect there is disclosed a steel railway crossing having a top running surface with a hardness greater than 240 BHN and a bottom support surface with a UTS greater than 840 MPa.

Brief Description of the Figures

[0006] The disclosure will be described with reference to the accompanying drawings, in which:

Fig. 1 shows an exemplary depiction of a crossing in accordance with the current disclosure;

Fig. 2 is a flow chart of a method of manufacturing the crossing of Fig. 1.

Description of Preferred Embodiments

[0007] Fig. 1 shows an exemplary railway crossing 10 such as a high manganese steel railway crossing. Crossing 10 is provided with a body 20 with a top running surface 30 and a bottom support surface 40. The top running surface 30 is the surface that is in contact with the train wheels (not shown). The bottom support surface 40 is the surface of which portions rest on load bearing members 50 such as bearers (not shown). The top running surface 30 may have various elements such as a nose 60 which is exposed to impacts from the train wheels where the wheel changes from one track onto another and "lands" on the nose 60. Although the wheel contact surface itself will harden over time due to wheel-rail contact known as work-hardening, areas like the nose 60 need to be sufficiently hard right at installation to avoid height reduction (due to wheel impact) of the nose 60. If the nose 60 is insufficiently hard the wheel impacts compact the nose 60 thereby inducing sinkage. Sinkage leads to an increase in the drop of the wheel onto the nose 60, resulting into a cycle of ever increasing impacts hence continuing a cycle of deterioration of the nose 60.

[0008] To achieve the desired hardness, the top running surface 30, or at least the relevant sections thereof, may be exposed to a first Explosive Device Hardening (EDH) cycle 100 to change the hardness of metal from a first hardness 32 to a second hardness 34 which is greater than the first hardness 32. The first EDH cycle 100 includes at least a first EDH event 110 that hardens the metal by severe plastic deformation caused by the shock wave. The explosive 65 used may be any suitable kind such as Semtex or a cyclonite, epoxy resin and ethyl diamine composite. The explosive sheet usually has a thickness in the range of 2 - 5 mm. Both the surface hardness and depth of hardening increase with the thickness of the explosive 65 and number of shots given.

[0009] After an EDH event 110, the body 20 may still have the original first hardness 32 in the range of 180 - 215 BHN whereas the top running surface 30 will have a second hardness 34 such as 240 - 270 BHN. In an embodiment the top running surface 30 will have a second hardness 34 of about 255 BHN. The first EDH cycle 100 may include a second EDH event 120. The second EDH event 120 may raise the hardness of the top running surface 30 to a second hardness 34 of >300 BHN. In an embodiment the top running surface 30 will have a second hardness 34 of about 320 BHN.

[0010] The bottom support surface 40 may have sections 70 which have not been machined after casting. The bottom support surface 40 may be provided with machined sections 80 to provide a precise surface 85 with which the crossing 10 can engage a load bearing member 50. Transition zones 90 are the areas where a non-machined section 70 and a machined section 80 bor-

der.

[0011] The bottom support surface 40, or sections thereof, may be exposed to a second EDH cycle 200 to increase the Proof Stress (PS) and the Ultimate Tensile Stress (UTS) of the bottom support surface 40. After an EDH event 210, the body 20 may still have the original first UTS 230 in the range of 640 - 690 MPa with a first PS 235 in the range of 295 - 325 MPa whereas the bottom support surface 40 will have a second UTS 240 in the range of 840 - 880 MPa with a second PS 237 in the range of 355 - 390 MPa. In an embodiment the bottom support surface 40 has a second UTS 240 of about 860 MPa. In this embodiment the bottom surface support 40 may have a second PS 237 of about 370 MPa.

[0012] The second EDH cycle 200 may include a second EDH event 220. The second EDH event 220 may raise the second UTS 240 of the bottom support surface 40 to >1070 MPa with a second PS 237 of >465 MPa. In an embodiment the bottom support surface 40 has a second UTS 240 of about 1100 MPa. In this embodiment the bottom surface support 40 may have a second PS 237 of about 485 MPa.

[0013] In an embodiment the crossing 10 has a top running surface 30 with a second hardness 34 greater than 240 BHN and a bottom support surface 40 with a second UTS 240 greater than 840 MPa.

[0014] In an embodiment the crossing 10 further has a body 20 with a first hardness 32 less than 215 BHN and/or a first UTS 230 less than 690 MPa.

Industrial Applicability

[0015] The load bearing member 50 is designed to support the crossing 10, however, in cases where the load bearing member 50 itself is not sufficiently supported (e. g. after subsidence or sinkage of the underoil), the load bearing member 50 will not sufficiently support, or may even pull down, the crossing 10 thereby inducing tensile stresses in the bottom support surface 40. The tensile stresses could cause the bottom support surface 40 to fracture leading to the crossing 10 having to be repaired or replaced. Steel crossings, and high manganese steel crossings in particular may be susceptible to fracturing, given that it is difficult to quality check these crossings after casting due to the open structure of the steel. The open structure does not lend itself for quality examination techniques such as ultrasound. Defects such as microfractures or excessive porosity may therefore go undetected which may lead to failures themselves during use, or may form the starting point for more severe fractures when the load bearing member 50 pulls down on the crossing 10. Areas that may be particularly prone to failures, higher stresses and/or defects are the transition zones 90.

[0016] Exposing at least a portion of the bottom support surface 40 to the second EDH cycle 200 will improve the UTS leading to raised or improved fatigue resistance on the base of the CMX, reducing or delaying risk of cracking

under poor support. It will further improve quality inspections of the bottom support surface 40 as defects may be exposed as more readily detectable larger fractures or holes.

[0017] To manufacture a high manganese steel railway crossing 10 in accordance with this disclosure, a method of manufacture such crossing 10 may include the following steps:

Casting at least a section of a steel railway crossing 10 having a body 20, a top running surface 30 and a bottom support surface 40 in step 400. Step 410 comprises exposing (at least a portion of) the top running surface 30 to a first EDH cycle 100 to increase wear and deformation resistance of the top running surface 30. In optional step 420 the bottom support surface 40 may undergo machining to provide machined sections 80. Step 430 comprises exposing (at least a portion of) the bottom support surface 40 to a second EDH cycle 200 in step 430 to increase the UTS of the bottom support surface 40. Optional step 440 comprises inspecting the quality of the crossing 10.

Claims

1. A steel railway crossing having a body with a top running surface and a bottom support surface; said body having a first hardness and a first UTS; said top running surface having been exposed to an EDH cycle to achieve a second hardness greater than said first hardness.
said bottom support surface having been exposed to an EDH cycle to achieve a second UTS greater than said first UTS.
2. A steel railway crossing according to claim 1 wherein said second hardness is greater than 240 BHN
3. A steel railway crossing according to any of the preceding claims wherein said second UTS is greater than 840 MPa.
4. A steel railway crossing according to any of the preceding claims wherein said first hardness is less than 215 BHN and said first UTS is less than 690 MPa.
5. A method of manufacturing a railway crossing comprising the steps of:

casting at least a section of said railway crossing from steel, said at least one section having a top running surface and a bottom support surface; exposing at least a portion of said top running surface to a first EDH cycle to increase wear and deformation resistance of said running surface; exposing at least a portion of said bottom support surface to a second EDH cycle to increase UTS strength of said section.

6. A method of manufacturing a railway crossing according to claim 5, wherein said first EDH cycle comprises multiple EDH events.
7. A method of manufacturing a railway crossing according to any of claims 5 to 6, wherein said second EDH cycle comprises a single EDH event. 5
8. A method according to any of claims 5 to 7, further comprising the step of machining portions of the bottom support surface before the second EDH cycle. 10
9. A method according to any of claims 5 to 8, further comprising inspecting the crossing for defects exposed by the second EDH cycle. 15
10. A steel railway crossing having a top running surface with a hardness greater than 240 BHN and a bottom support surface with a UTS greater than 840 MPa. 20

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FIG. 1

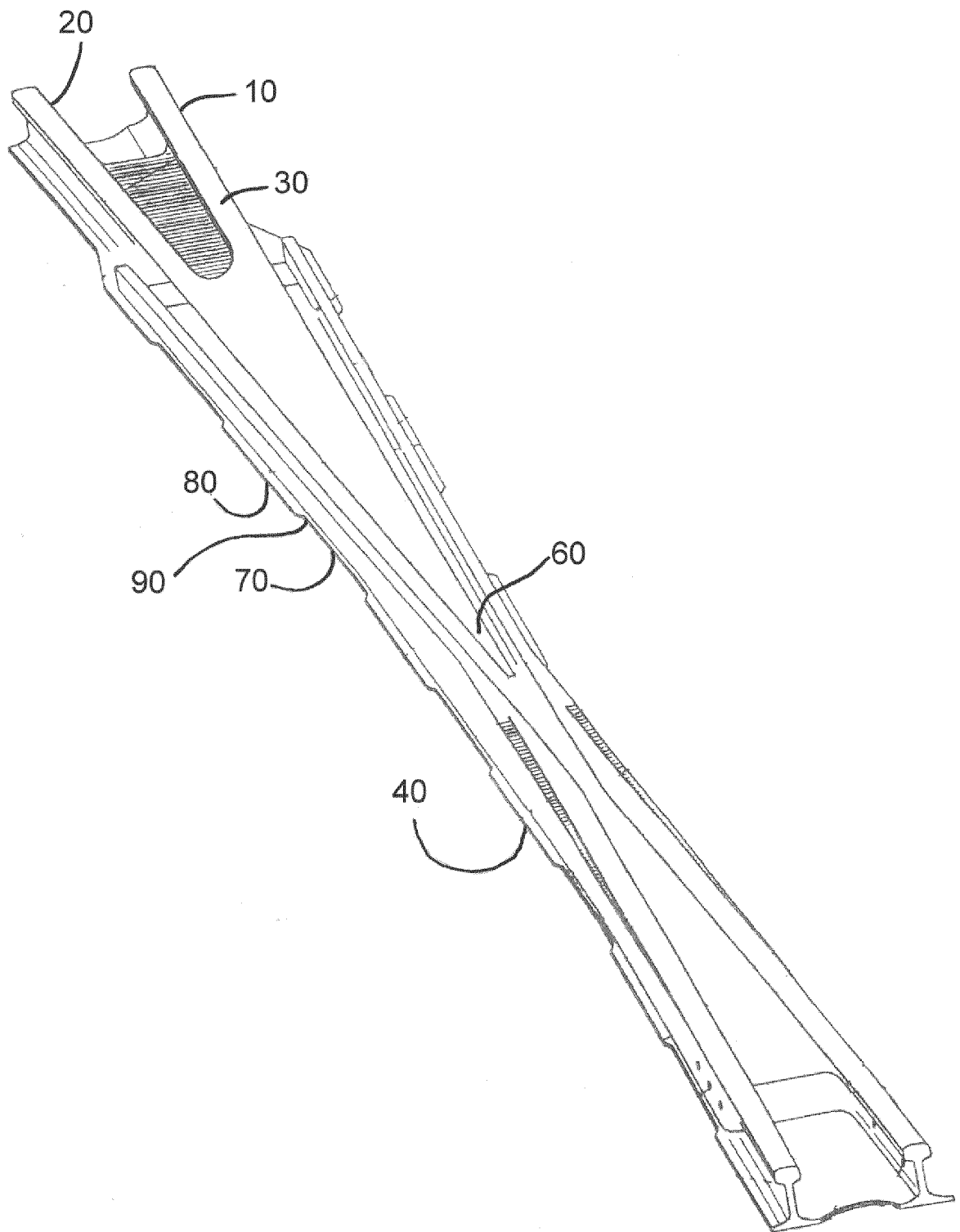
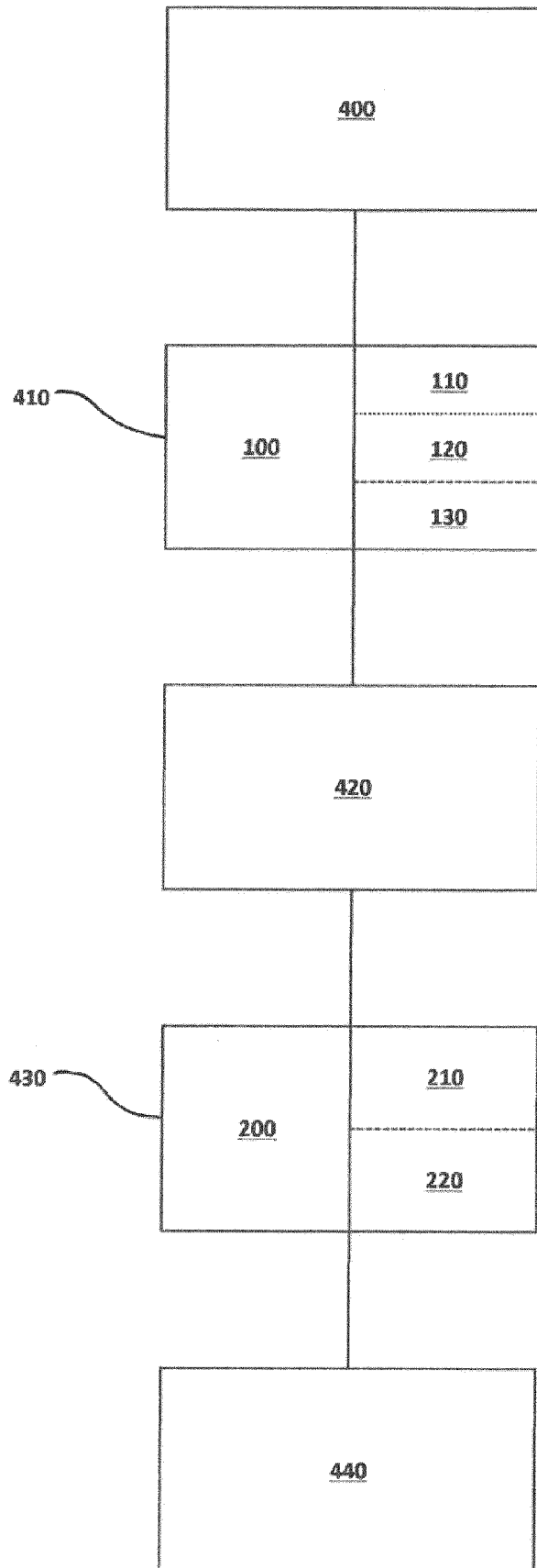


FIG. 2





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