United States Patent [19]

Leoben et al.

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[54] **DREDGING BUCKET HAVING A REINFORCED EDGE**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.** **E02f 9/28;** B23p 3/00

[58] **Field of Search**.......... 75/123 N, 126 B, 128 A, 75/126 A; 29/196.1, 191, 196.6; 37/141 R, 141 T, 142 R, 142 A, 118 R; 164/98, 111; 76/101 A

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[57] **ABSTRACT**

A reinforced dredging bucket of hardened manganese steel has an edge formed from a plurality of successively alternating, integrally cast first and second regions. The first regions consist of the main bucket metal formed from a composition consisting of 0.5 to 2 % carbon; 6 to 30 % manganese; and up to 3 % silicon, chromium, molybdenum, and vanadium, singly or in combination, the rest being iron and steel impurities. The second regions, which may project beyond the first regions to form teeth, consist of a wear-resistant material formed from 1.2 to 4 % carbon; 15 to 30 % chromium; 0.2 to 10 % manganese; 0.1 to 5 % silicon; up to 10 % nickel; and up to 10 % of elements forming carbides and/or nitrides, the rest being iron and steel impurities.

2 Claims, 2 Drawing Figures

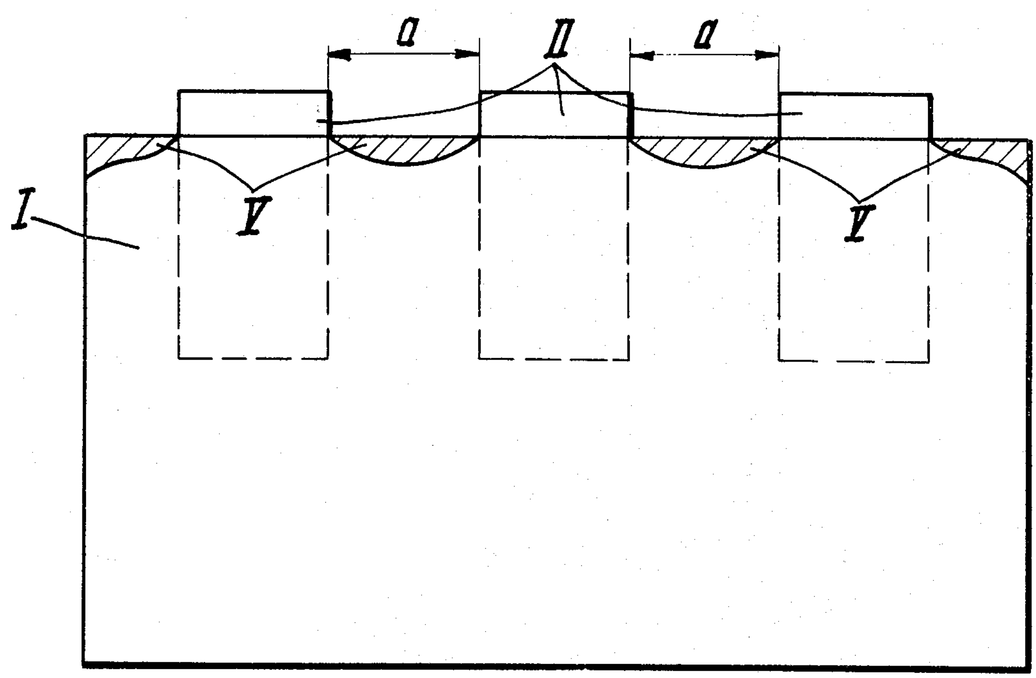

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Fig. 1

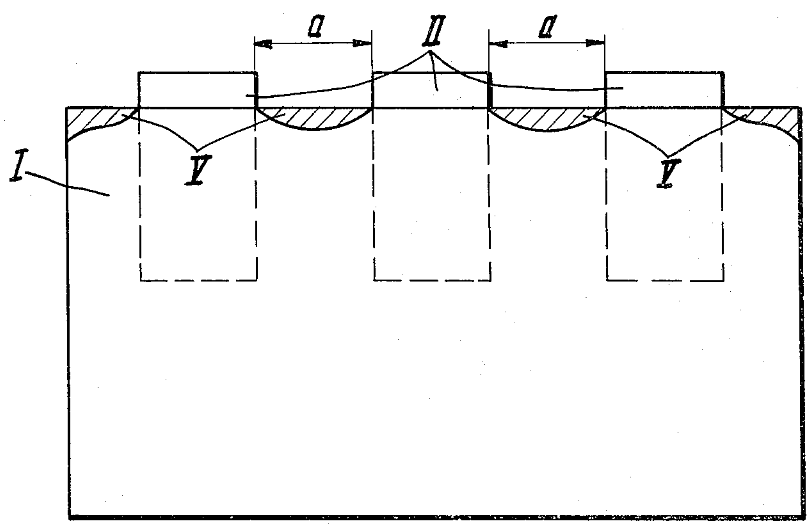
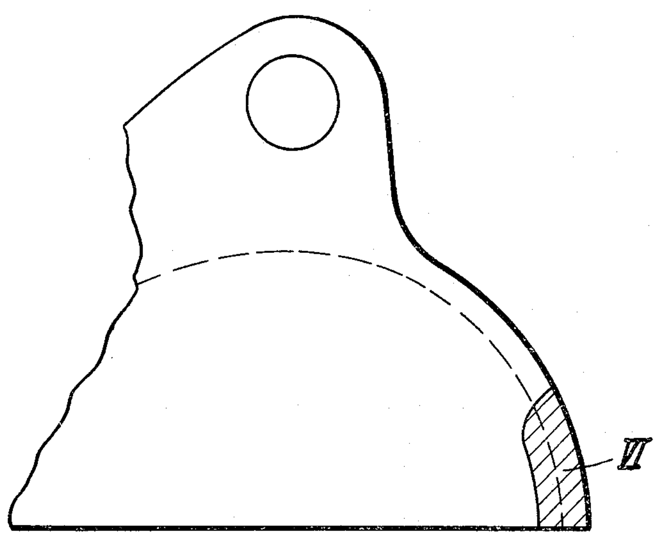


Fig. 2



DREDGING BUCKET HAVING A REINFORCED EDGE

The invention relates to a dredging bucket cast in hard manganese steel with a wear-resistant working edge, such buckets being adapted for use, for example, on a conveyor chain. In this specification, % refers to percentage by weight.

As a rule dredging buckets which are made of wearresistant steels (consisting of **0.5** to **2** % carbon; **8** to **30** % manganese; and up to **3** % silicon, chromium, molybdenum and vanadium, singly or in combination, the rest being iron and impurities) are produced by casting in a mold. The wearing edges of dredging buckets are exposed to frictional abrasion. The resulting worn portions are repaired by welding on wear-resistant materials. The generally expected working life of a dredging bucket is some **5** years, with **10** to **15** welding repairs in that period for maintaining its functional capacity.

The welding work requires prolonged immobilization of an entire conveyor chain, which is composed as a rule of **120** to **140** dredging buckets. Apart from the considerable cost of the welding metal such as wires, the work itself is time-consuming and expensive. Owing to the nature of the lining alloys that are normally employed, only a replacement layer of the same kind, or in the case of hard alloys just one or a few layers, can be produced in most cases. In addition, this necessitates holding welding experts in readiness right at the working site, in order to carry out the necessary repairs then and there.

Proposals for reducing the conveyor laydown times to an economically acceptable minimum have been directed at exchanging complete buckets, and doing the welding work at one time on those that are in most need of repair. This again has occasioned increased costs of transportation and has required very great capital outlay, since in practice almost every conveyor chain with **20** to **30** dredging buckets requires spare buckets, so that the production time saved and the gain thus obtained counterbalanced each other.

The present invention is described below, by way of example, with reference to the accompanying drawings, in which:

FIG. **1** is a view in elevation of an experimental manganese steel plate one edge of which is provided with wear resistant teeth; and

FIG. **2** is a fragmentary side elevation of a dredging bucket, parly in section.

EXPERIMENTATION

Extensive experiments testing various types of steel for wear have shown that a steel containing **2.6** % carbon, **25** % chromium, and **5** % manganese, the rest being iron and impurities normally found in steel, is ten times more resistant to wear than a steel with **1.2** % carbon, **12** % manganese, and **1.5** % chromium, the rest being iron and impurities. Unfortunately, however, casting tests have revealed that the first-mentioned type of steel is technically unsuitable for producing dredging buckets.

A further attempt at mounting small cast pieces of this wear-resistant quality upon the base body by means of a mechanical bond had to be abandoned, because the joint would not stand up under the working stresses encountered.

Three small steel anti-wear plates II (FIG. **1**) whose composition was **2.6** % carbon and **5** % manganese were then placed by casting in one edge of an experimental plate I of manganese steel whose composition was **1.2** % carbon, **12** % manganese, and **1**% silicon, and this edge was exposed to wear. The cast-in anti-wear plates II project about **10** mm from the edge of the hard manganese steel plate I, and are spaced **35** mm apart. The test plate was driven at a peripheral speed of **3** m per second through a bed of abrasive. Quartz sand interspered with basalt splinters was used as the abrasive. The initial duration of the test was four weeks. Visual inspection revealed that the anti-wear plates experienced practically no wear during this period, while the zones between the anti-wear plates exhibited slight erosion. This erosion is shown by hatchings V in FIG. **1.**

A subsequent test period of **6** weeks under the same test conditions surprisingly revealed that the parts between the anti-wear plates suffered no further erosion. The anti-wear plates themselves displayed only minor effects of wear and preserved a smooth polished condition.

A dredging bucket in accordance with the invention is shown in section in FIG. **2.** The anti-wear teeth are cast into the edge zone VI which is subject to wear.

PREFERRED EMBODIMENT OF THE INVENTION

The invention provides a dredging bucket cast in hard manganese steel consisting of **0.5** to **2**% carbon, **6** to **30** % manganese, up to **3** % silicon, chromium, molybdenum, and vanadium, the rest iron and impurities, the invention consisting in that cast into the wearing edge of the dredging bucket are teeth of a material resistant to wear. The teeth employed here may consist of a wear-resisting steel consisting of **1.2** to **4** % carbon, **15** to **30** % chromium, **0.2** to **10** % maganese, **0.1** to **5** % silicon, up to **10** % nickel, and up to **10** % of elements forming carbides and nitrides, such as tungsten, molybdenum, vanadium, tantalum, niobium, and titanium, joinly or separately, the rest being iron and impurities.

The spacing of the teeth may be between **5** and **150** mm according to the type of stress encountered in service. It must, however, be borne in mind that if the spacing is too wide the erosion may become so deep that the teeth lose their hold in the body of the bucket and fall out. As the wear experiment described above shows the most advantageous spacing a (FIG. **1**) between two teeth is from **30** to **60** mm in practice.

Further experiments have shown that the wear resistance of the dredging buckets does not decrease if the teeth do not project from the working edge.

Although the invention is illustrated and described with reference to a plurality of preferred embodiments thereof, it is to be expressly understood that it is in no way limited to the disclosure of such a plurality of preferred embodiments, but is capable of numerous modifications within the scope of the appended claims.

What is claimed is:

1. As an improved article of manufacture, a reinforced dredging bucket of hard manganese steel, the bucket having an edge formed from a plurality of successively alternating, integrally cast first and second regions, each first region consisting by weight of **0.5** – **2** % carbon, **6** – 30 % manganese, up to **3** % of at least one element selected from the group consisting of silicon, chromium, molybdenum, and vanadium, the remainder being iron and steel impurities, each second region consisting by weight of **1.2** – 4 % carbon, **15** – 30 % chromium, **0.2** to **10** % manganese, **0.1** – 5 % silicon, up to **10** % nickel, up to **10** % of at least one carbide-forming or nitride-forming element selected from the group consisting of tungsten, molybdenum, vanadium, tantalum, niobium, and titanium, the remainder being iron and steel impurities.

2. The improved article as defined in claim **1**, in which the second regions extend outwardly beyond the first regions to define teeth on the edge of the bucket.

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