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(54) **Balance weight and manufacturing method for the same**

Ausgleichgewicht und Herstellungsverfahren dafür

Contrepoids et son procédé de fabrication

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(73) Proprietor: **Jakor, s.r.o.**
093 02 Vranov nad Topl'ou (SK)

(72) Inventors:
- **Dzurenda, Stefan**
  080 01 Presov (SK)
- **Mandul'ak, Jan**
  093 01 Vranov nad Topl'ou (SK)

(74) Representative: **Vojcik, Peter**
Razusova 28
040 01 Kosice (SK)

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Description

[0001] The present invention relates to a balance weight and manufacturing method for the same taking use of the iron ore concentrate in the primary forms and the compaction technology. The main balance weight application is for aggregate washing machines but also for the machines and devices where the damping unwanted vibrations or the compliance of centre is needed.

[0002] A widely used material for manufacturing of balance weights and wheel balancers in used aggregate washing machines of white goods is cast iron balance weights which are ideal for this application in light of characteristic density (7,2 g/cm^3), strength and shape integrality in context of aggregate washing machines design. However, disadvantages of this solution are the high difficulty of manufacturing, high casting costs and in specific instance the impossibility of achieving of required tolerance accuracy without additional machining. In summary their high price, despite the real ideal solution moves these balance weights into the minority segment of HIGH-END washing machines.

[0003] Most machines have concrete weights, which are making by oscillating manner in the form with the subsequent curing. The price frugality moves them like the majority solution for manufacturers of white goods despite a series of restrictions and disadvantages as their fragility, limit achievable density (3,6 g/cm^3), restrictions on the accessibility shapes and associated with structural constraints related to alone washing aggregate and correlative size needed space requirements. At present, see WO 01/42552, efforts to increase density of concrete mixtures by adding of scalings of the treatment process of steel. However, these activities have the effect of reducing of strength and flexibility of weights.

[0004] There are described the possibility of meeting production of balance weights by the thermoplastic, respectively thermosetting process when there is a hardening of the coupling matrix directly in the form where the panel is formed. However, this process has two simple restrictions on the use in the field of balance weights as the achievable compression pressure (density) and the achievable time for the reaction of thermoset, hardening.

[0005] In state of the art Chinese Patent Application No CN 1548615, the production of balance weight inside of drum machine is described consisting of powder mixture of plastic and iron in specific ratio depending on the weight to be balanced by. The balance weight is manufactured from mixture of molten plastic and iron powder in specific ratio and additional oil during melting. There is the significant shortening of the time of production by regulated ratio, same shape of balance weight but with different weight.

[0006] The balance weight based on dispersed metals such as iron, lead, copper, zinc, tin or a mixture of these metals bonded thermoplastic, thermosetting plastic or reactoplastic materials with precisely determined grain of dispersed metallic material and thermoplastic binders as polyethylene, polypropylene or polyvinyl chloride powder in liquid state in state of the art Slovak Utility Model Application No. 2375. There is the technology of manufacturing of balancing weight which has already kind of binders according to the following restrictions. If there are used thermoplastic materials like binder the restrictions are in from the view of achievable density because the used pressure fails to transform the individual fragments of dispersed metals. If reactoplastic or thermosetting materials are used as a binder, then the time needed for their activation ie. hardening is so long that the mere application of such a process becomes uneconomical.

[0007] Another point is that, without depending on the type of binder (thermoplastic, thermoset) production process in both cases is based only on the compaction principle of individual fragment of dispersed metal, what only reduces the distance but they are not transformed. It follows that achievable density is low, comparable to the existing concrete weights or in the case of application of clear dispersed metal, the achievable density would be high, however the costs to such material (clear dispersed metal) are in terms of actual utilization uneconomical.

[0008] In view of relatedness processes, previously used technology can divide into primary branches which consist of powder metallurgy, injection holding and thermoplastic or thermosetting process. The powder metallurgy is technology which uses high clear material with predefined dispersity on the input or in the case of several composite materials, but with the high purity of the material components of the input. These requirements imply high input costs in material security. The following process of manufacturing by powder metallurgy includes compaction of material so pressing of this material at relatively high pressures to prevent the porosity of the material and this metal pressing is subsequently sintered at a temperature closed to temperature of melting of sintered material or some of its composite components. Melting the material becomes compact and high strength. Analogously, the products of such technologies are relatively expensive. Metal Injection holding (MIM) is similar method of powder metallurgy. The difference is in the method of compaction (compression) of material, generally has many shortcomings such as high input material costs in terms of its purity, need to use lubricants in relation to the basic material to reduce abrasion and then also need to sinter so produced metal pressings.

[0009] Disadvantage of technical solutions for balance weight and manufacturing method for the same removes the proposed solution according to the invention, which is used the iron ore concentrate in primary form with Fe content greater than 64 wt% in. The mass fraction of Fe is more than 90% of body weight balancing. The iron ore concentrate in primary form contains many impurities, particularly oxides, which hinder its compaction. The balance weight and manufacturing method for the same according to the invention used the material which contains

oxides partially reduced by DRI (Direct Iron Reduction) for compaction. The effect of reduction of oxides is positive for compaction and especially at higher achievable density of balancing body. The iron ore concentrate is usually in the form of commercially available and creates the starting position of the invention.

[0010] The solution according the invention proposed for the balance weight and manufacturing method for the same the way that production takes place in compression utility to shape the future balancing of the body, into which is placed the iron ore concentrate and then it is put under pressure in the range 700 MPa - 1600 MPa to achieve the highest degree of transformation of the iron ore concentrate as particulate matter in the continuous substance. The result is then the possibility of release of compression pressing from compacting tool immediately after the application of compression pressure in regard to already achieved bond of individual particles. Operation cycle is accelerated thanks the option immediately after compressing to disengage of compression pressing from compacting tool compared with thermosetting process 4-16 times, as the dressing not to be remaining in the tool (form) where a reaction occurs ie. a heat curing. In this manner obtained bond between particles is sufficient for immediate disengage of pressing part from compacting tool but because of possible application of following process after compression. The adding epoxy resin or novolak type resin containing up to 5% by weight of balance weight input material as coupling matrices. The iron ore concentrate and adding coupling matrices are leaved open to temperature in the range 120°C - 200°C, to activate the matrice, depending on the specific type chosen coupling matrices after compressing and releasing from the tool already out of tool in the shape of balance weight. The application of coupling matrices in the form of resins which as reactoplastic hardens after exposure to temperatures of defined range and creates a strong bond between individual fragments of iron ore concentrate makes homogeneity of balance weight.

[0011] The encasing of balance weight after compaction by fluid or electrostatic or electro-kinetic application of 0,3 mm - 0,6 mm layers of material based on the high-density polyethylene, low-density polyethylene or another type of thermoplastic polyethylene. The continual encasing of balance weight into thin layer of polyethylene makes homogeneity of balance weight.

[0012] Use the mutual combination of the above procedures. The iron ore concentrate and added and the coupling matrix containing up to 5% of input material are put under pressure in the range 700 MPa - 1600 MPa and temperature in the range 120°C - 200°C depending on the specific type chosen coupling matrices to create the bond of fragments of iron ore concentrate of balance weight, then using the fluid encasing material on the base of polyethylene, high-density polyethylene, low-density polyethylene or another type of thermoplastic polyethylene up to 0,3 mm - 0,6 mm layers of material which creates the continual encasing. Another way the continual encasing can accrue on the balance weight from iron ore concentrate and coupling matrix by electrostatic or electro-kinetic application of material up to 0,3 mm - 0,6 mm layers of material based on the high-density polyethylene, low-density polyethylene or another type of thermoplastic polyethylene.

[0013] The example of chemical composition of reduced iron ore concentrate, use of materials forming the base of the invention is as follows:

The component	Weight ratio
Fe	70,160%
SiO_2	2,630%
Al_2O_3	0,106%
CaO	0,107%
MgO	0,202%
S	0,048%
P	0,010%
K_2O+Na_2O	0,050%
CO_2	0,155%
TiO_2	0,024%
LOSS	0,248%
H_2O	9,900%

[0014] The embodiment of solution according of invention relates to the balance weight and manufacturing method for the same the way that the iron ore concentrate is placed into compacting tool where is realized a compression. The effective pressure to achieve the status of creating of bond between individual particles in the context of the required density 4,2 kg/dm^3 ranges 950 MPa - 1350 MPa. The iron ore concentrate obtained the shape of the future balance weight under pressure. Then there is a moulding release from the compacting tool by the ejection system.

[0015] Another embodiment of the balance weight and manufacturing method for the same according the invention is that the coupling matrix is applying to the iron ore concentrate for example novolak type resin containing up to 5% by weight of balance weight input material. The iron ore concentrate is mixing with coupling matrix and that is creating a composite mixture of materials. That way prepared mixture is transported to the compacting tool and there is a compression of the prepared mixtures of materials under pressure 700 MPa - 1600 MPa and there is getting the final shape of balance weight under pressure. Then there is a moulding release from the compacting tool by the ejection system. The mouldings already outside the tool could be cumulative transported through heating tunnel where the coupling matrix hardens and creates a strong link between fragments of iron

ore concentrate after exposure to a defined temperature range, thus makes homogeneity of balance weight.

[0016] In another embodiment of the balance weight and manufacturing method for the same is the iron ore concentrate transported to the compacting tool. There is a compression of the prepared mixtures of materials under pressure 700 MPa - 1600 MPa and thus getting the final shape of balance weight. Then there is a moulding release from the compacting tool by the ejection system. The mouldings already outside the tool could be cumulative transported through heating tunnel where are surface warmed up to the temperature around 160 °C. They are immersed into the fluidised bath after reached the temperature. There they are caught a layer of thermoplastic polyolephin in powder form. Then the mouldings are transported through the heating tunnel again and trapped particles of the thermoplastic polyolephin from the fluidised bath are melt and created the continual 0,3 - 0,6 mm thick layer of polyolephine on the surface, thus makes encapsulation of balance weight.

[0017] It is an object of embodiments of the invention to provide an improved solution where is the continual layer thick for example 0,5 mm of polyolephine on the surface of balance weight from iron ore concentrate created by electrostatic (corona) or electro-kinetic (TRIBO) deposition.

[0018] The balance weight and manufacturing method for the same is can be used in various industries as industry production of household appliances, white goods. Use in mechanical and electrical engineering industry, concretely in the manufacture of balancing the head or blade for rotating equipment, particular shaft machine, weights for gravity displacement machine and devices of different types of lifts, cranes and lifting machine, to balance the ships, platforms and so on.

Claims

1. A balance weight for damping of unwanted mechanical vibrations and counterweight to various technological devices **characterized in that** an used iron ore concentrate in primary form contains Fe with an iron content greater than 64 wt% and the mass fraction of an iron ore concentrate represents more than 90% weight of balancing weight, wherein the used iron ore concentrate is subjected to a compression pressure in the range 700 MPa - 1600 MPa.

2. The balance weight according to claim 1, **characterized in that** a coupling matrice as reactoplast in the form of epoxy resin or novolak type with content to 5% of an input material of balance weight is admixed with an iron ore concentrate before a compaction.

3. The balance weight according to claim 1 and 2, **characterized in that** a material on the base of polyethylene, high density polyethylene, low density polyethylene or another type of thermoplastic polyolephin is applied onto already compacted balance weight as a 0,3 mm - 0,6 mm thick layer forming an encapsulation.

4. A manufacturing method for a balance weight for damping of unwanted mechanical vibrations and counterweight to various technological devices according to claim 1 **characterized in that** an iron ore concentrate is subjected to a compression pressure in the range 700 MPa - 1600 MPa by compaction.

5. The manufacturing method for balance weight according to claim 4, **characterized in that** a coupling matrice is admixed with an iron ore concentrate before a compaction.

6. The manufacturing method for balance weight according to claim 5, **characterized in that** an iron ore concentrate and a coupling matrice are exposed to the temperature in the range 120 °C - 200 °C.

7. The manufacturing method for balance weight according to claim 5 and 6, **characterized in that** a material on the base of polyethylene or another type of thermoplastic polyolephin is fluidly applied onto already compacted balance weight as a 0,3 mm - 0,6 mm thick layer.

8. The manufacturing method for balance weight according to claim 6 and 7, **characterized in that** a material on the base of polyethylene or another type of thermoplastic polyolephin is electrostatically or electro-kinetically applied onto already compacted balance weight as a 0,3 mm - 0,6 mm thick layer.

Patentansprüche

1. Ausgleichgewicht und Herstellungsverfahren dafür **dadurch gekennzeichnet, dass** die verwendet Eisen-Konzentrat in Primärformen Fe mit Fe-Gehalt größer als 64 Gew.% und der Massenanteil von Eisen-Konzentrat vertritt mehr als 90% Ausgleich des Körpergewichts, wobei der Rest aus Nichteisenkonzentrat, ausgestellt Kompressionsdruck im Bereich sein 700 MPa- 1600 MPa.

2. Ausgleichgewicht nach Anspruch 1, **dadurch gekennzeichnet, dass** die Kopplungsmatrize als Reaktoplast in Form von Epoxidharz oder Epoxidharzen Novolaktyps mit den Inhalt zu 5% der Input-Material der Gegengewichte ans Eisen-Konzentrat vor Verdichtung.

3. Ausgleichgewicht nach Anspruch 1 und 2, **dadurch gekennzeichnet, dass** aufs bereits Verdichtung

Gegengewicht ist aufgebrachte Material auf Basis von Polyethylen, Polyethylen hoher Dichte, Polyethylen niedriger Dichte oder eine andere Art von thermoplastischen Polyolefin bis 0,3 mm - 0,6 mm dicke Schicht Bildung Verkapselung.

4. Ausgleichgewicht Herstellungsverfahren nach Anspruch 1 und 2, **dadurch gekennzeichnet, dass** die verwendet Eisen-Konzentrat ist ausgestellt Kompressionsdruck im Bereich 700 MPa- 1600 MPa mit Verdichtungsverfahren.

5. Ausgleichgewicht Herstellungsverfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** vor das Verdichtungsverfahren die Kopplungsmatrize gemischt zur Eisenerz-Konzentrat.

6. Ausgleichgewicht Herstellungsverfahren nach Anspruch 5, **dadurch gekennzeichnet, dass** das Eisen-Konzentrat und die Kopplungsmatrize sind ausgesetzt der Temperatur im Bereich 120 °C.-200 °C.

7. Ausgleichgewicht Herstellungsverfahren nach Anspruch 5 und 6, **dadurch gekennzeichnet, dass** aufs bereits Verdichtung Gegengewicht ist fluid aufgebrachte Material auf Basis von Polyethylen, oder eine andere Art von thermoplastischen Polyolefin bis 0,3 mm - 0,6 mm dicke Schicht Bildung Verkapselung.

8. Ausgleichgewicht Herstellungsverfahren nach Anspruch 5 und 6, **dadurch gekennzeichnet, dass** aufs bereits Verdichtung Gegengewicht ist elektrostatische oder elektrokinetische aufgebrachte Material auf Basis von Polyethylen, oder eine andere Art von thermoplastischen Polyolefin bis 0,3 mm - 0,6 mm dicke Schicht Bildung Verkapselung.

Revendications

1. Contrepoids et son procédé de fabrication **caractérisé en ce que** le utilisé concentré de fer sous formes primaires contenant Fe avec la teneur en Fe supérieure à 64% en poids et la portion en masse de concentré de fer représente plus de 90% équilibrant le poids du corps, où le reste étant du concentré non ferreux, être délivré pression de compression dans la gamme 700 MPa- 1600 MPa.

2. Contrepoids la revendication 1, **caractérisé en ce que** la matrice de couplage que reaktoplast sous forme de résine époxy ou de résine type novolaque avec contenu à 5% de matières entrantes contrepoids aux concentré de fer avant compactage.

3. Contrepoids la revendication 1 et 2, **caractérisé en ce que** voici compactagé contrepoids est matériau appliquée à base de polyéthylène, de polyéthylène haute densité, polyéthylène basse dusité ou un autre type de polyoléfine thermoplastique à 0,3 mm - 0,6 mm d'épaisseur formant encapsulation.

4. Procédé de fabrication d'un contrepoids revendication 1 et 2, **caractérisé en ce que** le utilisé concentré de fer être délivré pression de compression dans la gamme 700 MPa - 1600 MPa.

5. Procédé de fabrication d'un contrepoids la revendication 4, **caractérisé en ce que** avant procédé de compactage le minerai de fer mélangé concentrer matrice de couplage.

6. Procédé de fabrication d'un contrepoids la revendication 5, **caractérisé en ce que** le concentré de fer et la matrice de couplage sont exposé 1 température sous plage 120 °C - 200 °C.

7. Procédé de fabrication d'un contrepoids la revendication 5 et 6, **caractérisé en ce que** à voici compactagé contrepoids est matériau fluide appliquée à base de polyéthylène, de polyéthylène haute densité, polyéthylène basse dusité ou un autre type de polyoléfine thermoplastique à 0,3 mm - 0,6 mm d'épaisseur formant encapsulation.

8. Contrepoids et méthode de fabrication la revendication 5 et 6, **caractérisé en ce que** à voici compactagé contrepoids est matériau électrostatique ou électrocinétique appliquée à base de polyéthylène, de polyéthylène haute densité, polyéthylène basse dusité ou un autre type de polyoléfine thermoplastique à 0,3 mm - 0,6 mm d'épaisseur formant encapsulation.

REFERENCES CITED IN THE DESCRIPTION

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- CN 1548615 **[0005]**
- SK 2375 **[0006]**