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(54) **A MACHINE FOR GRINDING SEMI-FINISHED PRODUCTS, PARTICULARLY BILLETS**
MASCHINE ZUM SCHLEIFEN VON HALBZEUG, INSBESONDERE KNÜPPELN
MACHINE A RECTIFIER DES PRODUITS SEMI-FINIS, EN PARTICULIER, DES BILLETES

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WO-A-96/22173 **DE-A- 3 524 561**
GB-A- 2 309 184 **US-A- 1 582 608**

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Description

Technical Field

[0001] The present invention relates to a machine for grinding semi-finished products, particularly billets, according to the preamble of claim 1. The invention further relates to a grinding wheel for the above mentioned machine according to the preamble of claim 7 (see for example US-A-1 582 608).

Background Art

[0002] A grinding machine having the features outlined above is known from WO-A-9622173.

[0003] Billets produced by rolling generally have surface irregularities mainly due to cracks, scum and other processing residues resulting from the melting and cooling processes.

[0004] To eliminate these surface irregularities, it is known, before the billets are sent for subsequent processing, to provide for their surfaces to be ground with the use of grinding machines with circular grinding wheels. In a machine of this type, the grinding wheel is rotated about its own axis and is brought into contact with the billet with a sliding movement relative thereto in order to remove a predetermined thickness of material and consequently to improve the surface quality of the billet. In billets of larger cross-section such as those having widths of up to 200 mm and more, surface grinding takes place by aligning the grinding wheel along the axis of movement of the billet and by performing several forward runs of the billet, the grinding wheel being moved transverse the axis of movement for each run so as to grind the billet over the entire width of its surface. However, this involves the disadvantage that processing times are lengthened and an optimal surface quality is not achieved because of the appearance of small surface ridges which delimit adjacent ground surface portions and which are created when the grinding wheel is moved transversely between one forward run and the next.

[0005] Another problem encountered is due to the fact that, with conventional grinding machines, predetermined thicknesses of material can be removed from the billet. Since, as a result of the rolling process, the billet has a typical surface shape with depressions extending longitudinally, the action of the grinding wheel involves the elimination of these depressions by the undesired removal of a greater quantity of material than is actually necessary for the surface grinding of the billet.

Disclosure of the Invention

[0006] The problem upon which the present invention is based is that of providing a machine for grinding semi-finished products, particularly billets, which is designed structurally and functionally so as to overcome all of the

problems complained of with reference to the prior art mentioned.

[0007] This problem is solved by the invention by means of a machine for grinding billets formed in accordance with claim 1.

[0008] The grinding wheel according to the invention is defined in claim 7.

Brief Description of the Drawings

[0009] The characteristics and advantages of the invention will become clearer from the following detailed description of a preferred but not exclusive embodiment thereof, described by way of non-limiting example, with reference to the appended drawings, in which:

Figure 1 is a partial side elevational view of a grinding machine according to the invention,

Figure 2 is a section taken on the line II-II of Figure 1,

Figure 3 is a front elevational view of the machine of the preceding drawings,

Figure 4 is a side elevational view showing a detail of the machine of the previous drawings, on an enlarged scale,

Figures 5 and 6 are an axial section and a side elevational view, respectively, of a grinding wheel with which the grinding machine according to the invention is equipped,

Figure 7 is a plan view of the grinding wheel of Figures 5 and 6,

Figure 8 is a schematic view showing, in plan, pairs of grinding wheels with which the grinding machine of the present invention is equipped, and

Figure 9 is a schematic front elevational view of the grinding wheels of Figure 8.

Best Mode of carrying out the Invention

[0010] With reference to Figures 1 to 4, a machine formed in accordance with the present invention is generally indicated 1 and is intended for grinding semi-finished products such as, for example, foundry billets 2, one of which is shown partially in the drawings.

[0011] The machine 1 comprises a substantially parallelepipedal framework 3 formed by two opposed frames 4 rigidly interconnected by means of four uprights 4c. Each frame 4 is formed by pairs of rigidly-interconnected longitudinal and transverse elements indicated 4a, 4b. The billet 2 being ground is guided beneath the framework 3 along an axis of movement indicated by the axis B in Figure 2 and arranged parallel to the longitudinal elements 4a.

[0012] The machine 1 further comprises a first frame and a second frame, indicated 6 and 7, respectively, which are mounted on the framework 3 and are movable relative thereto as explained in detail in the following description.

[0013] The first frame 6 is mounted inside the framework 3 and is also of parallelepipedal shape. The frame 6 is formed by pairs of first longitudinal elements 6a connected by first transverse elements 6b and rigidly interconnected by means of first uprights 6c.

[0014] At one end of each longitudinal element 4a of the framework 3, at the same end of the framework, a respective arm 8 is articulated about a corresponding pin 8a projecting inside the framework. Each arm 8 is in turn articulated at its opposite axial end to a central portion of the respective first longitudinal element 6a of the first frame 6, by means of a corresponding pin 9. The arms 8 thus constitute a parallelogram device for moving the first frame 6 relative to the framework 3. As a result of a pivoting movement of the arms 8 about the axes of the pins 8a, their points of articulation to the first frame 6 describe paths along arcs of circles centered on the axes of the pins 8a, so as to cause the first frame 6 to move in a direction which, for limited angles of pivoting about the pins 8a, is approximately straight and directed substantially along the axis Y of Figure 1.

[0015] A pair of actuators such as, for example, two hydraulic jacks 10 shown schematically in Figure 1, is provided for moving the first frame 6. Each jack 10 is mounted on a support element 11 extending from the respective upper longitudinal element 4a of the framework 3 and has a rod 12 acting on the first frame 6 in the region of the points of articulation to the arms 8.

[0016] The second frame 7 is mounted inside the first frame 6 and has a similar parallelepipedal shape. The frame 7 is formed by a pair of opposed end structures rigidly interconnected by means of uprights 7c. Each end structure is formed by pairs of rigidly interconnected second longitudinal elements 7a and second transverse elements 7b. The lower end of the second frame 7 also has connecting cross members 13 preferably formed by parallel and spaced-apart channel-sections. The cross-members 13 serve to support two pairs of supports 14 with bearings 15 between which two respective shafts 16, 17 are supported for rotation. A respective circular grinding wheel 18, 19 is keyed to each shaft 16, 17. Each shaft 16, 17 is also arranged, at one of its ends, for coupling to a respective pulley, not shown, for rotating the corresponding grinding wheel 18, 19 about its axis of rotation, indicated M1, M2 respectively in Figure 2, by means of a belt transmission.

[0017] The belt transmissions are driven by respective electric motors 20 of which only one is shown in Figure 3. The motors 20 are fixed to a support plate 20a provided on the upper end of the second frame 7.

[0018] The grinding wheels 18, 19 are positioned, relative to the second frame 7, with parallel axes of rotation M1 and M2 which are inclined angularly to an axis transverse the axis B of movement of the billet 2. The transverse axis is parallel to the articulation axis of the pins 9, which is indicated K in Figure 2, and which is perpendicular to the direction of movement B. The angle at which the axis M2 (or M1) is inclined to the axis K is

indicated C in Figure 2. The angle C may have values of between 5° and 45° and the value selected is preferably 30°.

[0019] The second frame 7 is also mounted for pivoting on the first frame 6 about an axis K1 parallel to the axis K. The second frame 7 has supports 21 which are fixed in central positions on the second longitudinal elements 7a of the upper end of the frame 7 and are intended to be engaged on corresponding pins 9 for rotation about the axis K1. It will be noted that the interaxial spacing D between the rotation axes M1, M2 of the grinding wheels 18, 19 is arranged symmetrically with respect to the pivot axis K1 so that the loads on the pivoting frame 7, which are due mainly to the weight of the grinding wheels themselves, are distributed in a balanced manner relative to the pivot axis K1.

[0020] It will be noted that the pivot axis K1 of the second frame is spaced from the axes of rotation M1, M2 of the grinding wheels 18, 19 on the opposite side to the working plane of the grinding wheels identified by the surface 2a of the billet.

[0021] Each grinding wheel 18, 19 comprises a central hub 22 which is intended to be keyed to the corresponding shaft 16, 17 and on which a ring of abrasive material is mounted. The ring is of the type with an interrupted edge and is thus composed of a plurality of structurally independent grinding-wheel sectors 23. More particularly, the grinding wheel comprises six identical sectors 23 each of which is defined peripherally by edge profiles 24. The profiles are inclined angularly to the axis of rotation M1, M2 of the grinding wheel, as can be seen in Figure 7. The angle of inclination, indicated T, selected for the edge 24 is preferably between 10° and 20°.

[0022] Each abrasive sector 23 is restrained on the hub 22 by means of a pair of jaws 25 clamped by screws 26 extending through the hub. It will be noted that each grinding-wheel sector 23 is spaced from the adjacent sectors peripherally by a distance indicated S in Figure 7.

[0023] When the machine 1 is in operation, initially, the grinding wheels 18, 19 are moved, by means of the parallelogram device operated by the jacks 10, into contact with the surface 2a of the billet 2 being ground. The billet 2 is guided beneath the framework 3 along the axis B with a sliding movement relative to the grinding wheels 18, 19 which in turn are rotated about their own axes M1 and M2 by means of the motors 20.

[0024] By virtue of the inclination of the axes of rotation M1, M2 of the grinding wheels to the axis transverse the axis B of movement of the billet, the surface 2a of the billet is ground throughout its width during the forward movement of the billet, as a result of the contributions of the grinding surfaces of both grinding wheels, as shown schematically in Figure 8. This advantageously enables billets having cross-sections of much greater width than the abrasive face of the grinding wheel to be ground in a single forward run of the billet.

[0025] When the abrasive material of the grinding wheels has become worn, with a consequent reduction in their diameter, they are kept in contact with the surface 2a of the billet by virtue of the pivoting permitted by the arms 8 of the parallelogram device. Figure 4 shows, in continuous outline, one of the grinding wheels 18, 19 placed in contact with a large billet 2 (for example having a cross-section of 200-200 mm) and, in broken outline, the grinding wheel in conditions of maximum wear (minimum diameter of the abrasive ring) in contact with the surface of a smaller billet (for example, with a cross-section of 40x40 mm).

[0026] The pivoting of the frame 7 supporting the grinding wheels about the axis K1 enables the grinding wheels to follow closely the surface profile of the billet and the depressions which normally characterize the surface 2a as a result of the rolling process. During the forward movement of the billet 2, the grinding wheel 18 swings as a result of the variation of slope encountered and consequently urges the other grinding wheel 19 into contact with the surface 2a. This advantageously enables the pair of grinding wheels to follow the uneven shape of the surface 2a, removing the minimum quantity of material required by the grinding, preventing the formation of surface concavities as well as the removal of a greater and undesirable thickness of material. Figure 9 shows schematically and on an enlarged scale, the surface 2a of the billet processed by the pair of grinding wheels 18, 19. The imaginary line of the profile of the surface 2a obtained as a result of the grinding is shown in broken outline.

[0027] The provision of grinding wheels having sectors with edge profiles which are inclined to the axis of the grinding wheel enables the abrasive surface to penetrate the billet better and, in addition, the contact between the surface of the billet and the edge takes place more gradually than with conventional grinding wheels which have edge profiles parallel to the axis of the grinding wheel and in which each grinding-wheel sector consequently strikes the billet with the entire front of the edge during rotation. The use of grinding wheels with inclined edge profiles advantageously improves grinding penetration as well as achieving more uniform power absorption, at the same time preventing power-absorption peaks when the edge profile contacts the surface of the billet. Moreover, the abrasive material of the billet wears more evenly, optimizing the useful life of the grinding-wheel sectors.

[0028] The invention thus solves the problem set, achieving the aforementioned advantages in comparison with known solutions.

[0029] Naturally, the principle of the invention remaining the same, the forms of embodiment and details of construction may be varied widely with respect to those described and illustrated purely by way of non-limiting example, without thereby departing from the scope of the invention as defined by the appended claims.

Claims

1. A machine for grinding semi-finished products, particularly billets (2), comprising a framework (3) on which the billet (2) being ground is guided along a predetermined axis (B) of movement, and at least one grinding wheel (18,19) which is mounted on the framework (3) and is rotated about its own axis (M1,M2) as well as being in contact with the billet (2) in order to grind the surface (2a) thereof, the axis of rotation (M1,M2) of the at least one grinding wheel (18,19) being inclined angularly to an axis (K) transverse the axis (B) of movement of the billet, **characterized in** comprising a first frame (6) movable relative to the framework (3) and a second frame (7) for supporting the at least one grinding wheel (18,19), said second frame (7) being mounted for pivoting on the first frame (6).
2. A machine according to Claim 1, comprising a plurality of grinding wheels including at least one pair of grinding wheels (18,19) having respective axes of rotation (M1,M2) inclined angularly to the axis (K) transverse the axis of movement of the billet (2).
3. A machine according to Claims 1 or 2, in which the axis of pivoting of the second frame (7) is arranged transverse the direction (B) of movement of the billet (2) and is spaced from the axis of rotation of the grinding wheels (18,19) on the opposite side to the working plane of the grinding wheels.
4. A machine according to one or more of the preceding claims, comprising means for moving the first frame (6) relative to the framework (3) along an axis approximately perpendicular to the working plane of the grinding wheels, the means comprising pairs of arms (8) articulated at their opposite axial ends to the framework (3) and to the first frame (6), respectively, the points of articulation to the first frame (6) being contained within a plane of symmetry of the frame perpendicular to the working plane of the grinding wheels.
5. A machine according to one or more of the preceding claims, in which the at least one grinding wheel (18,19) comprises a ring of abrasive material with an interrupted edge.
6. A machine according to Claim 5, in which the at least one grinding wheel (18, 19) comprises a plurality of grinding-wheel sectors (23), the sectors having, peripherally, edges having profiles (24) which are inclined angularly to the axis of the grinding wheel (M1,M2).
7. A grinding wheel for a machine for grinding billets according to one or more of the preceding claims,

comprising a ring of abrasive material with an interrupted edge, said ring comprising a plurality of grinding sectors (23), the sectors having, peripherally, edges having profiles (24) which are inclined angularly to the axis (M1, M2) of the grinding wheel, the grinding wheel being **characterized in that** each sector (23) is independently restrained on a hub (22) of the grinding wheel by means of a respective pair of jaws (25) clamped to the hub.

Patentansprüche

1. Maschine zum Schleifen von Halbzeug, insbesondere Knüppeln (2), mit einem Rahmenverbund (3), auf dem der zu schleifende Knüppel (2) entlang einer vorbestimmten Bewegungsachse (B) geführt ist, und mit wenigstens einer Schleifscheibe (18, 19), die am Rahmenverbund (3) angebracht ist und um ihre eigene Achse (M1, M2) rotiert und am Knüppel (2) zum Schleifen von dessen Oberfläche (2a) anliegt, wobei die Rotationsachse (M1, M2) der wenigstens einen Schleifscheibe (18, 19) mit einer Achse (K) quer zur Bewegungsachse (B) des Knüppels einen Winkel bildet, **dadurch gekennzeichnet, dass** die Maschine einen ersten Rahmen (6), der relativ zum Rahmenverbund (3) bewegbar ist, und einen zweiten Rahmen (7) für die Aufnahme der wenigstens einen Schleifscheibe (18, 19) aufweist, wobei der zweite Rahmen (7) am ersten Rahmen (6) schwenkbar gehalten ist.
2. Maschine nach Anspruch 1, mit einer Vielzahl von Schleifscheiben mit wenigstens einem Paar von Schleifscheiben (18, 19) mit entsprechenden Rotationsachsen (M1, M2), die mit der Achse (K) quer zur Bewegungsachse des Knüppels (2) einen Winkel bilden.
3. Maschine nach Anspruch 1 oder 2, bei der die Schwenkachse des zweiten Rahmens (7) quer zur Bewegungsrichtung (B) des Knüppels (2) angeordnet ist und von der Rotationsachse der Schleifscheiben (18, 19) auf der der Arbeitsebene der Schleifscheiben abgewandten Seite beabstandet ist.
4. Maschine nach einem oder mehreren der vorhergehenden Ansprüche, mit Mitteln zum Bewegen des ersten Rahmens (6) relativ zum Rahmenverbund (3) entlang einer Achse, die in etwa rechtwinklig zur Arbeitsebene der Schleifscheiben angeordnet ist, wobei die Mittel Paare von Armen (8) aufweisen, die an ihren gegenüberliegenden axialen Enden mit dem Rahmenverbund (3) bzw. mit dem ersten Rahmen (6) verbunden sind, wobei die Anlenkpunkte zum ersten Rahmen (6) sich in einer Symmetrieebene des Rahmens befinden, die rechtwinklig zur

Arbeitsebene der Schleifscheiben angeordnet ist.

5. Maschine nach einem oder mehreren der vorhergehenden Ansprüche, bei der wenigstens eine Schleifscheibe (18, 19) einen Ring aus abrasivem Material mit einem unterbrochenen Rand aufweist.
6. Maschine nach Anspruch 5, bei der wenigstens eine Schleifscheibe (18, 19) eine Vielzahl von Schleifscheibensegmenten (23) aufweist, wobei die Segmente entlang ihres Umfangsrandes ein Profil aufweisen, welches mit den Achsen der Schleifscheiben (M1, M2) einen Winkel bildet.
7. Schleifscheibe für eine Maschine zum Schleifen von Knüppeln entsprechend einem oder mehreren der vorhergehenden Ansprüche, mit einem Ring aus abrasivem Material mit einem unterbrochenen Rand, wobei der Ring eine Vielzahl von Schleifsegmenten (23) aufweist, wobei die Segmente entlang ihres Umfangsrandes Profile (24) aufweisen, die mit den Achsen (M1, M2) der Schleifscheibe einen Winkel bilden, wobei die Schleifscheibe **dadurch gekennzeichnet ist, dass** jedes Segment (23) separat auf einem Nabenteil (22) der Schleifscheibe mittels einer auf dem Nabenteil (22) angebrachten Klemmvorrichtung (25) festgehalten ist.

Revendications

1. Machine destinée à rectifier des produits semi-finis, en particulier des billettes (2), comportant un bâti (3) sur lequel la billette (2) qui est rectifiée est guidée le long d'un axe prédéterminé (B) de déplacement, et au moins une meule (18, 19) qui est montée sur le bâti (3) et est entraînée en rotation autour de son propre axe (M1, M2) tout en étant en contact avec la billette (2) afin de meuler la surface (2a) de celle-ci, l'axe de rotation (M1, M2) de la au moins une meule (18, 19) étant incliné angulairement par rapport à un axe (K) transversal à l'axe (B) de déplacement de la billette, **caractérisée en ce qu'elle** comporte un premier bâti (6) mobile par rapport au bâti (3) et un deuxième bâti (7) destiné à supporter la au moins une meule (18, 19), ledit deuxième bâti (7) étant monté pour pivotement sur le premier bâti (6).
2. Machine selon la revendication 1, comportant plusieurs meules comprenant au moins une paire de meules (18, 19) ayant des axes de rotation (M1, M2) respectifs inclinés angulairement par rapport à l'axe (K) transversalement à l'axe de déplacement de la billette (2).
3. Machine selon la revendication 1 ou 2, dans laquelle l'axe de pivotement du deuxième bâti (7) est dis-

posé transversalement à la direction (B) de déplacement de la billette (2) et est espacé de l'axe de rotation des meules (18, 19) sur le côté opposé au plan de travail des meules.

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4. Machine selon une ou plusieurs des revendications précédentes, comportant des moyens destinés à déplacer le premier bâti (6) par rapport au bâti (3) le long d'un axe approximativement perpendiculaire au plan de travail des meules, les moyens comportant des paires de bras (8) articulés au niveau de leurs extrémités axiales opposées sur le bâti (3) et sur le premier bâti (6) respectivement, les points d'articulation sur le premier bâti (6) étant contenu à l'intérieur d'un plan de symétrie du bâti perpendiculaire au plan de travail des meules. 10 15
5. Machine selon une ou plusieurs des revendications précédentes, dans laquelle la au moins une meule (18, 19) comporte un anneau de matière abrasive avec un bord interrompu. 20
6. Machine selon la revendication 5, dans laquelle la au moins une meule (18, 19) comporte plusieurs secteurs de meule (23), les secteurs ayant, de manière périphérique, des bords ayant des profils (24) qui sont inclinés angulairement par rapport à l'axe de la meule (M1, M2). 25
7. Meule pour une machine destinée à rectifier des billettes selon une ou plusieurs des revendications précédentes, comportant un anneau de matière abrasive avec un bord interrompu, ledit anneau comportant plusieurs secteurs de meule (23), les secteurs ayant, de manière périphérique, des bords ayant des profils (24) qui sont inclinés angulairement par rapport aux axes (M1, M2) de la meule, la meule étant **caractérisée en ce que** chaque secteur (23) est retenu de manière indépendante sur un moyeu (22) de la meule au moyen d'une paire respective de mâchoires (25) serrées sur le moyeu. 30 35 40

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