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(54) **Method for transverse rolling of ball products, in particular out of scrap railway rail heads**

(57) A method for cross rolling of products such as balls, in particular the ones obtained from heads of scrap railway rails, whereby billet (1) in the form of a head cut off a scrap railway rail is placed between two flat tools (2) and (3) which have initial wedges (4) and (5), behind which there are wedges (6) and (7) which have longitudinal grooves (8) and (9) of a semicircular profile, next the flat tools (2) and (3) begin to move in the opposite directions with the same velocity (V), and during this time the moving initial wedges (4) and (5) cut into the billet (1)

and make it rotate, thereby forming a semi-finished product (10) which has the form of a rod whose diameter ($D1$) is bigger than or equal to the diameter ($D2$) of a ball (11), next the wedges (6) and (7) with the grooves (8) and (9) cut into the semi-finished product (10) and form the balls (11), which are in the final stage of the rolling process separated from one another by cutters (12) and (13) located at the end of the flat tools (2) and (3). The process is done in a configuration wherein only one of the flat tools (2) or (3) moves in a sliding motion with the velocity (V), while the other tool (2) or (3) does not move.

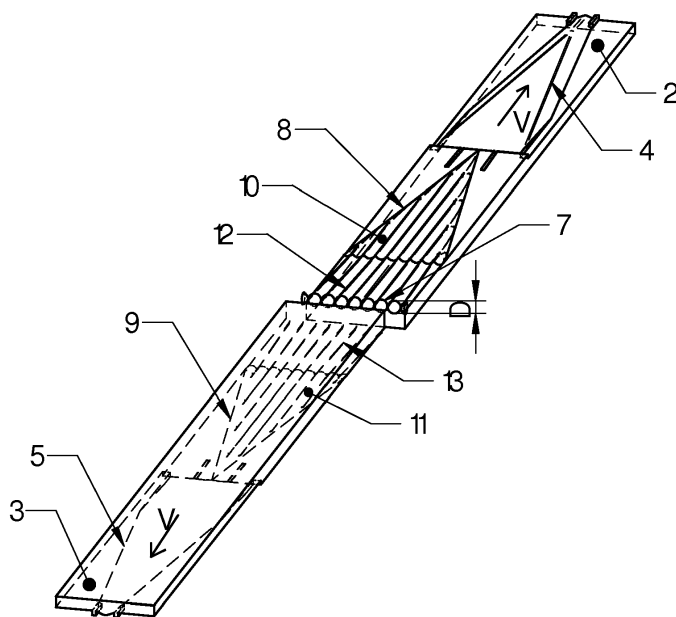


Fig. 3

Description

[0001] The present invention relates to a method for cross rolling of products such as balls, in particular the ones obtained from heads of scrap railway rails.

[0002] There are numerous methods for producing balls which are then used in ball mills or rolling bearings. The most commonly employed methods include casting, die forging, and rolling. In casting, balls are cast from cast steel into permanent moulds made of metal, or so-called metal moulds. Die forging of balls is usually performed using friction presses with billets in the form of rods made from steel which contains increased amounts of carbon and manganese. Immediately after the process of die forging using eccentric presses, flash trimming is performed. The process of producing balls is most efficient if cross rolling is employed. During one roll turn, one ball is produced. Within one minute it is possible to produce even up to 160 balls of approximately 30 mm in diameter or 40 balls of approximately 120 mm in diameter. Balls are rolled in helical rolling mills equipped with two rolls, each roll having single grooves cut over the screw line, their length being generally equal to 3.5 of the coil. The axes of the rolls are inclined relative to the axis of the billet (rod), usually at the angle ranging from 3° to 7°. In the course of rolling, the rolls turn in the same direction, while the billet turns in the opposite direction. In order to obtain good rolling results, the billet diameter should approximately equal 0.97 of the diameter of finished balls. The diameter of the rolls is from 5 to 6 times bigger than the diameter of balls. Information on helical rolling of balls is presented in the following book: W. Dobrucki, Zarys obróbki plastycznej metali, Wydawnictwo "Ślask," Katowice 1975.

[0003] There is another method for cross-wedge rolling of four balls, described in: Z. Pater, Walcowanie poprzeczno-klinowe, Wydawnictwo Politechniki Lubelskiej, Lublin 2009. This method consists in using two flat tools which move in the opposite directions, thereby forming balls from the billet in the form of a rod whose diameter is equal to the ball diameter. The tools used in rolling consist of two parts: a forming wedge and a cutting pad. The forming wedge, which is of a typical shape, has longitudinal wedge grooves of a transverse circular profile, and the distance between the grooves is smaller than the diameter of the ball being formed. The effect of the forming wedge is that balls connected by cylindrical connectors, whose diameter is approximately half of the ball diameter, are produced. To separate the formed balls a cutting pad needs to be used, the effect of which is that the connectors are transformed into the missing parts of the balls. A characteristic of this is that during the cutting process, the balls are drawn aside by the grooves, which are located in this part of the tool at the angle towards the rolling direction, or the direction in which the wedge tool moves.

[0004] The essence of the method for cross rolling of products such as balls, in particular the ones obtained

from heads of scrap railway rails, is that a billet in the form of a head cut off a scrap railway rail is placed between two flat tools with initial wedges, behind which there are wedges with longitudinal grooves of a semi-circular profile, next the flat tools begin to move in the opposite directions with the same velocity, and during this time the moving initial wedges cut into the billet and make it rotate, thereby forming a semi-finished product in the form of a rod whose diameter is bigger than or equal to the ball diameter, and then the wedges with the grooves cut into the said semi-finished product, thereby forming balls which are in the final stage of the rolling process separated from one another by cutters located at the end of the flat tools. The process is done in a configuration wherein only one of the flat tools moves in a sliding motion, while the other does not move.

[0005] The advantage of the invention is that it makes possible to simultaneously form many balls, the quantity of which depends on the tool width. Thanks to the application of this invention, it is possible to form balls using cheap material obtained from scrap railway rails. The invention is environment-friendly as its application will decrease the amount of scrap for metallurgical processing that reaches steel mills.

[0006] An exemplary embodiment of this invention is shown in the attached drawings, wherein Fig. 1. shows the beginning of the cross rolling process as well as the type of the billet used, Fig. 2 illustrates the moment of the rolling process when the semi-finished product in the form of a rod is produced by the initial wedges, and Fig. 3 shows the end of the rolling process and the produced balls.

[0007] The method for cross rolling of products such as balls, in particular the ones obtained from heads of scrap railway rails, consists in that the billet 1 in the form of a head cut off a scrap railway rail is placed between two flat tools 2 and 3 which have the initial wedges 4 and 5, behind which there are the wedges 6 and 7 with the longitudinal grooves 8 and 9 of a semicircular profile, next the flat tools 2 and 3 begin to move in the opposite directions with the same velocity V , and during this time the moving initial wedges 4 and 5 cut into the billet 1 and make it rotate, thereby forming the semi-finished product 10 in the form of a rod whose diameter D_1 is bigger than or equal to the diameter D of the ball 11, and then the wedges 6 and 7 with the grooves 8 and 9 cut into the said semi-finished product, thereby forming the balls 11, which are in the final stage of the rolling process separated from one another by the cutters 12 and 13 located at the end of the flat tools 2 and 3. The process is done in a configuration wherein only one of the flat tools 2 or 3 moves in a sliding motion with the velocity V , while the other tool 2 or 3 does not move.

Claims

1. A method for cross rolling of products such as balls,

in particular the ones obtained from heads of scrap railway rails, whereby a billet (1) in the form of a head cut off a scrap railway rail is placed between two flat tools (2) and (3) which have the initial wedges (4) and (5), behind which there are wedges (6) and (7) with longitudinal grooves (8) and (9) of a semicircular profile, next the flat tools (2) and (3) begin to move in the opposite directions with the same velocity (V), and during this time the moving initial wedges (4) and (5) cut into the billet (1) and make it rotate, thereby forming a semi-finished product (10) which has the form of a rod whose diameter ($D1$) is bigger than or equal to the diameter ($D2$) of a ball (11), next the wedges (6) and (7) with the grooves (8) and (9) cut into the semi-finished product (10) and form the balls (11), which are in the final stage of the rolling process separated from one another by cutters (12) and (13) located at the end of the flat tools (2) and (3).

2. A method according to claim 1, whereby the process is done in a configuration wherein only one of the flat tools (2) or (3) moves in a sliding motion with the velocity (V), while the other tool (2) or (3) does not move.

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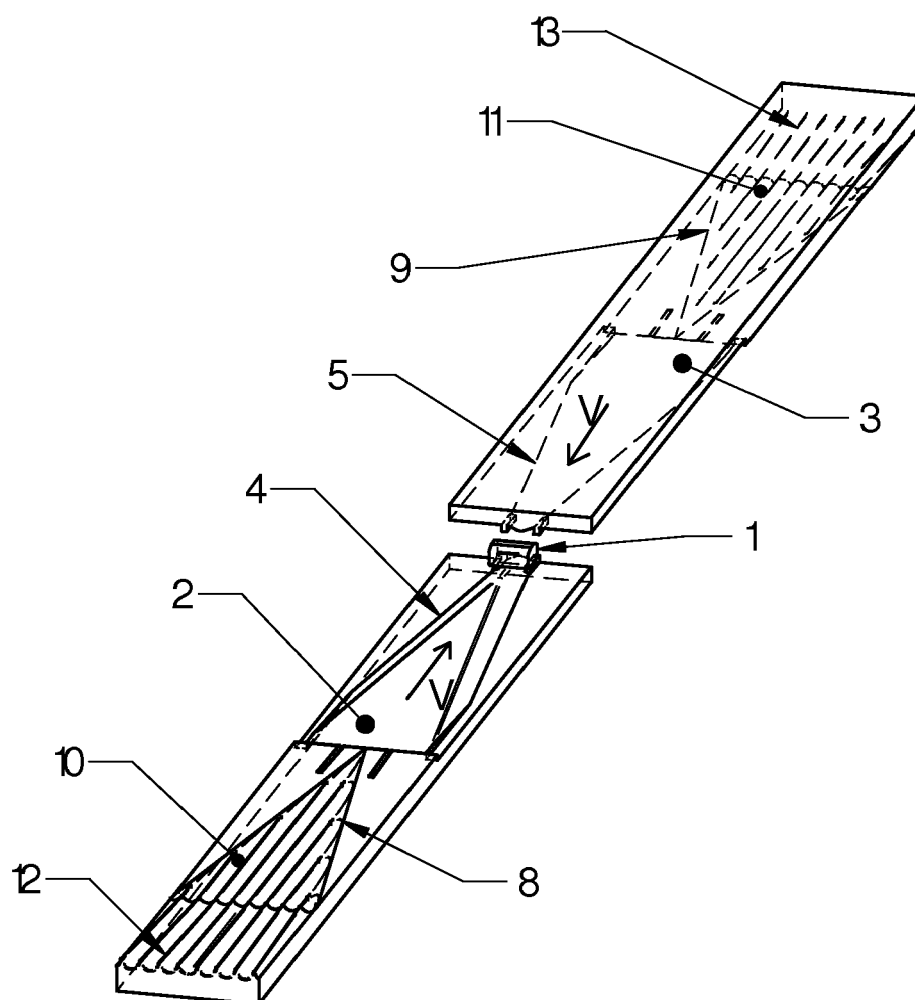


Fig.1

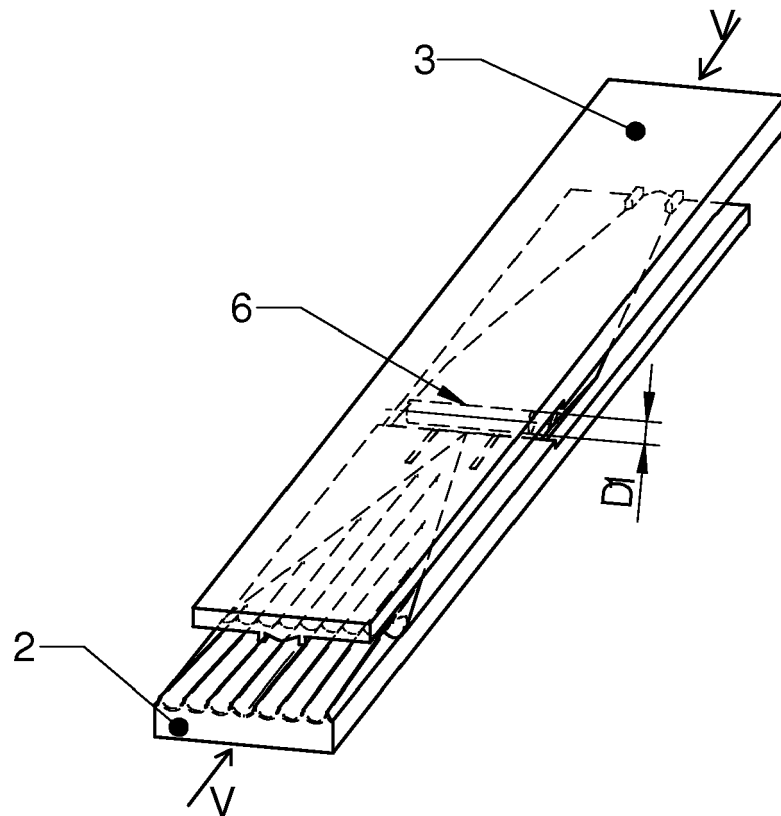


Fig. 2

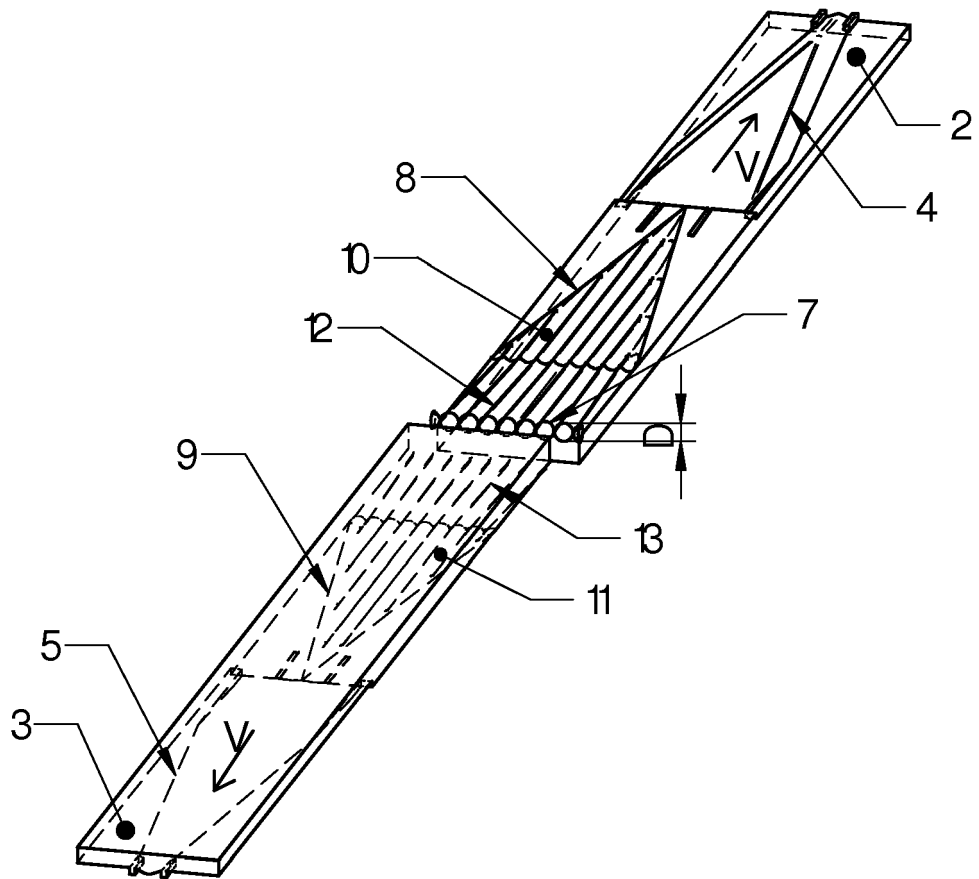


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 12 46 1525

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 3 206 828 A (TAKEFUSA KIKUCHI) 21 September 1965 (1965-09-21) * column 1, line 10 - column 2, line 30; figures 1-10 *	1,2	INV. B21H1/14
A	DE 541 623 C (HOESCH KOELN NEUESSEN AKT GES) 15 January 1932 (1932-01-15) * the whole document *	1,2	
A	DE 199 13 178 A1 (JUNG WOLFGANG [DE]) 5 October 2000 (2000-10-05) * column 1, line 42 - column 2, line 58 * * column 3, line 26 - column 5, line 11; figures 1-10 *	1,2	
			TECHNICAL FIELDS SEARCHED (IPC)
			B21H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 October 2012	Examiner Ritter, Florian
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03/82 (P04/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 46 1525

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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18-10-2012

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3206828	A	21-09-1965	NONE	

DE 541623	C	15-01-1932	NONE	

DE 19913178	A1	05-10-2000	AU 4110500 A	09-10-2000
			DE 19913178 A1	05-10-2000
			WO 0056480 A1	28-09-2000

REFERENCES CITED IN THE DESCRIPTION

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Non-patent literature cited in the description

- **W. DOBRUCKI.** Zarys obróbki plastycznej metali, Wydawnictwo. Śląsk, Katowice, 1975 [0002]
- **Z. PATER.** Wydawnictwo Politechniki Lubelskiej, Lublin. Walcowanie poprzeczno-klinowe, 2009 [0003]