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PRODUCTION OF IRON OR HIGH CARBON FERR IN A CONVERTER-TYPE SMELTER
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- (56) Prior Art Documents
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US 3169055
- (57) Claim

1. A method of charging raw materials in a smelting reduction of ores using a smelting reduction converter furnace comprising a vessel for holding molten metal and slag, means for supplying a first gas into said slag, a mouth, and a hollow chute located at the mouth of said furnace for supplying raw ore therethrough into said vessel; said method comprising the steps of

charging raw ore into said vessel of said furnace through said hollow chute; and

concurrently with the charging of raw ore supplying a second gas inside said hollow chute and substantially about the inner circumferential periphery thereof and in the same direction of travel as the charging raw ore, so as to substantially surround the raw ore while

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travelling through the hollow chute and while travelling
into said vessel of furnace, thereby to prevent flying
of said charging raw ore.

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特許協力条約に基づいて公開された国際出願

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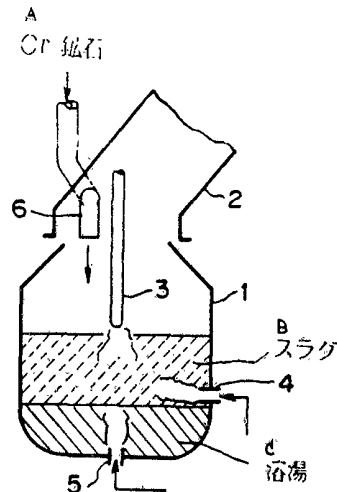
PATENT OFFICE

(54) Title: METHOD OF CHARGING ORE IN MELT-REDUCTION

(54) 発明の名称 溶融還元における鉱石の投入方法

(57) Abstract

This invention relates to a method of preventing, during the melt-reduction of Cr ore or iron ore, the scatter loss of the ore and coal at the time of charging. In the present invention, the ore and coal are charged down into a furnace from a shoot extended near a furnace port or connected to a furnace body. The ore and coal are charged down into the furnace while a gas is jetted outward of the shoot from nozzles disposed in the circumferential direction inside and near the tip of the shoot so that the raw materials can be charged more effectively while reducing the scatter loss.



A ... Cr ore

B ... slag

C ... molten metal

(57) 要約

この発明は、Cr 鉱石や鉄鉱石の溶融還元において、
鉱石や石炭の投入時の飛散ロスを防止するための方法
に関する。この発明では炉口部近傍に延出または炉
体に接続された投入シュートにより、鉱石や石炭を炉
内に落下投入するようにした。また、上記投入シュ
ート先端近傍内方の周方向に配されたノズルから、シュ
ート外方に向けガスを噴射しつつ、鉱石や炭材を炉内
に落下投入することにより、飛散ロスをより効果的に
抑えつつ原料投入を行うことができる。

情報としての用途のみ

PCTに基づいて公開される国際出願のパンフレット第1頁にPCT加盟国を同定するために使用されるコード

AT	オーストリア	FR	フランス	MR	モーリタニア
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COMPLETE SPECIFICATION

(ORIGINAL)

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Application Number:
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Published:

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Complete Specification for the invention entitled:
A METHOD OF CHARGING CHROMIUM ORES IN A SMELTING REDUCTION

The following statement is a full description of this invention, including the best method of performing it known to me:-

TECHNICAL FIELD

The present invention relates to a method of charging powder Cr ore raw materials, iron ores and coal in a smelting reduction thereof.

5 BACKGROUND OF THE INVENTION

High Cr steel as stainless steel has been conventionally produced from ferrochromium as raw material. In view of saving energy and securing low production cost, a so-called smelting reduction method has been recently remarked, which directly obtains high Cr molten metal from Cr ores. In this method, Cr ores, coal and so on are charged into a reduction furnace of a converter type for reducing Cr so as to directly produce high Cr molten metal therefrom.

15 Cr raw ores are very fine in grain diameters, and ordinarily around 90% have grain diameters of not more than 1 mm. Therefore, when powder Cr raw ores are charged into the reduction furnace from its top part onto the bath, they lose up to 30% by upflowing gas.

20 To avoid flying losses, an injection charging may be used, but special facilities are required independently therefor, and transporting pipes are easily damaged by hard Cr ores. Thus, such measures could not be adopted in practice.

25 In view of these circumstances, Cr raw ores are formed into pellets or briquettes, resulting in high



production costs. If the ores are agglomerated, the specific surface areas of the ores reduce so that a pre-heating time is increased and the reduction rate is lowered to increase the treatment time.

5 On the other hand, as an iron making method in place of the furnace production, the smelting reduction method of iron ores has been remarked as stated above in view of saving the energy and securing the low production cost.

10 In this smelting reduction method of iron ores, the flying loss of ores is not a big problem because the ores are coarse, but a considerable amount of coal combustion fuel is lost.

15 According to the inventors' studies, the reason why yield of the coal is inferior in the top charge method is because the coal is broken by the rapid increase in temperature. Since the coal has volatility and the interior of the smelting furnace is at very high temperature (more than 1400°C), the coal charged by top
20 charge method abruptly increases in temperature, cracks and fine powders are exhausted out of the furnace together with the exhausted gas. The flying of the coal makes unit consumption of carbonaceous materials deteriorate in the smelting reduction of the iron ores.

25 The present invention is to provide a method of charging ores, carbonaceous material as checking their flying losses in the smelting reduction method of Cr



ores, iron ores and so on.

SUMMARY OF THE INVENTION

To accomplishing this object in the invention, powder Cr raw ores, or iron ores and coal are charged
5 into the furnace through a charging chute extending nearly a furnace mouth of the smelting furnace of the converter type or connected to the furnace body thereof, so that the flying losses of the ores and coal are checked.

10 In addition, the powder Cr raw ores, the iron ores and the coal are charged into the furnace while the gas is jetted toward the outside of the charging chute, thereby enabling charge to the raw materials as checking effectively the flying losses.

15 Accordingly, the invention provides a method of charging raw materials in a smelting reduction of ores using a smelting reduction converter furnace comprising a vessel for holding molten metal and slag, means for supplying a first gas into said slag, a mouth, and a
20 hollow chute located at the mouth of said furnace for supplying raw ore therethrough into said vessel; said method comprising the steps of

charging raw ore into said vessel of said furnace through said hollow chute; and

25 concurrently with the charging of raw ore supplying a second gas inside said hollow chute and substantially



about the inner circumferential periphery thereof and in the same direction of travel as the charging raw ore, so as to substantially surround the raw ore while travelling through the hollow chute and while travelling into said vessel of furnace, thereby to prevent flying of said charging raw ore.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURES 1 to 5 concern the smelting reduction of Cr ores, and FIGURE 1 explains one embodiment of the invention;

FIGURE 2 explains another embodiment of the invention;

FIGURE 3 explains a gas jetting from an end of the charging chute;

FIGURE 4 investigates the flying losses of grain Cr raw ores of the invention method and the comparative method;

FIGURE 5 investigates Cr increasing rate in the molten metal when powder Cr raw ores are charged and pelletized Cr raw ores are charged;

FIGURES 6 to 8 concern the smelting reduction of iron ores;

FIGURE 6 explains a further embodiment of the invention;

FIGURE 7 explains a still further embodiment of the invention; and

FIGURE 8 investigates the flying losses of grain Cr raw ores of the invention method and the comparative method.

In the drawings, 1 is a furnace body, 6, 6' are chutes.

DETAILED DESCRIPTION OF THE INVENTION

The invention will now be explained in detail.

FIGURE 1 shows one embodiment of the invention in the smelting reduction of Cr ore, where the reference numeral 1 is the furnace body, and 2 is an exhausting hood provided at a top part of the furnace body. In the smelting reduction method by the converter type, there have been various proposals or studies which have different gas blowing practices. For example, as shown in FIGURE 1, the gases are blown from a top blowing lance 3, a side blowing tuyere 4 and a bottom blowing tuyere 5 for carrying out the smelting reduction.

During the treatment, Cr ores are supplied together with carbonaceous materials, and in the invention, the powder Cr raw ores are supplied by the chute 6 extending through the exhaust hood 2 to near the furnace mouth.

The charging chute 6 is determined so that the height of its lower end does not contact the furnace



body when the furnace is tilted.

FIGURE 2 shows that the powder Cr and raw ores are charged via a chute 6' connected to the upper part of the furnace body 1, and also in this case the same effect could be obtained.

The charging chute 6' may be separated at a part 61 on the way, and when the furnace body is tilted, this part 61 is separated.

When charging Cr ores through the chute 6 or 6', the gas (air or N_2) is jetted toward the outside of the chute from the nozzle 7 provided in a circumferential direction around the inner part of the chute as shown in FIGURE 3, so that powder Cr raw ores may be charged into the furnace and the flying losses of the raw materials are thereby avoided.

If the gas is jetted from the nozzle provided in the circumferential direction within the chute toward the outside of the chute, the powder Cr ores are guided in the gas jetting direction and the ore flying is avoided. Besides, the jet gas also serves as a purge gas for preventing invasion of CO and CO_2 from the furnace into the chute.

FIGURE 6 shows a further embodiment of the invention in the smelting reduction of the iron ores, where the iron ores and the coal are charged into the furnace from the chute 6. Other structures are the same

as illustrated in FIGURE 1.

FIGURE 7 shows that the iron ores and the coal are charged via the chute 6' connected to the top part of the furnace body 1, and the structure is the same as illustrated in FIGURE 2.

In the abovementioned chargings of the iron ores and the coal by the chute 6 or 6', while the gas (the air or N_2) is jetted toward the outside of the chute from the nozzle 7 provided in a circumferential direction of the inner part in the vicinity of the chute as shown in FIGURE 3, the iron ores and the coal may be charged into the furnace to thereby check the flying losses of the raw materials.

EXAMPLE 1

The smelting reduction was carried out as charging the powder Cr raw ores into the smelting reduction furnace (capacity: 5 ton) of the converter type by the method as shown in FIGURE 1. The dispersion in grain diameters of the charged Cr raw ores are as follows.

+1mm	+0.5mm	+0.25mm	+0.149mm	-0.149mm
1.7%	3.8%	20.1%	42.9%	31.5%

FIGURE 4 shows the flying losses of Cr raw ores at the above charging in comparison with the case (comparative method) not using the charging chute, from which it is seen that the flying losses of Cr raw ores were considerably decreased by the present invention method.

FIGURE 5 investigates Cr reducing rate (Cr increasing rate in the molten metal) when grain Cr raw ores were charged as they were, and the pelletized Cr raw ores were charged, from which it is seen that the former is shorter to pre-heat the ores, and is faster to reduce Cr than the latter.

EXAMPLE 2

The smelting reduction was carried out as charging the Cr iron ores and the coal into the smelting reduction furnace (capacity: 5 ton) of the converter type by the method as shown in FIGURE 6. The comparative method did not use the charging chute as shown in FIGURE 6, and practised the smelting reduction while charging the raw materials. The producing conditions are as follows.



TABLE 1

	Comparative Method	Invention Method
0 ₂ for decarburization (Nm ³ /Hr)	1300	1300
0 ₂ for post combustion (Nm ³ /Hr)	1300	1300
Gas flow rate (m/sec)	7.7	7.7
Unit consumption of carbonaceous material (including the flying loss) (kg/molten metal ton)	950	665
Unit consumption of the flying loss of carbonaceous material (kg/molten metal)	285	0

FIGURE 8 shows the flying losses of the coal in comparison with the case not using the chute (the comparative method), from which it is seen that the flying losses of the coal was decreased considerably by the present invention method.

INDUSTRIAL APPLICATION

The present invention is useful for charging of raw materials or the coal as the carbonaceous materials in the smelting reduction of the Cr ores or the iron ores.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of charging raw materials in a smelting reduction of ores using a smelting reduction converter furnace comprising a vessel for holding molten metal and slag, means for supplying a first gas into said slag, a mouth, and a hollow chute located at the mouth of said furnace for supplying raw ore therethrough into said vessel; said method comprising the steps of

charging raw ore into said vessel of said furnace through said hollow chute; and

concurrently with the charging of raw ore supplying a second gas inside said hollow chute and substantially about the inner circumferential periphery thereof and in the same direction of travel as the charging raw ore, so as to substantially surround the raw ore while travelling through the hollow chute and while travelling into said vessel of furnace, thereby to prevent flying of said charging raw ore.

2. The method of claim 1, wherein the charging raw ore is chromium ore.

3. The method of claim 1, wherein the charging raw ore is iron ore and coal.

4. The method of claim 1, wherein the second gas is supplied at least at the end of the hollow chute closest to the furnace mouth.



5. The method of claim 1, wherein the second gas is air.

6. The method of claim 1, wherein the second gas is nitrogen.

5 7. The method of claim 1, wherein the hollow chute comprises a first part fitted to the furnace, and a second part movably attached to the first part.

10 8. A method of charging raw materials in a smelting reduction of ores substantially as hereinbefore described with reference to the accompanying drawings.

DATED this 24 August 1991

CARTER SMITH & BEADLE

Fellows Institute of Patent Attorneys of Australia

Patent Attorneys for the Applicant:

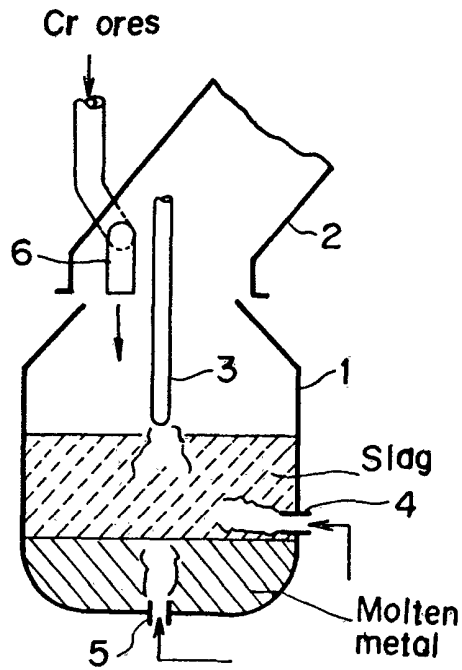
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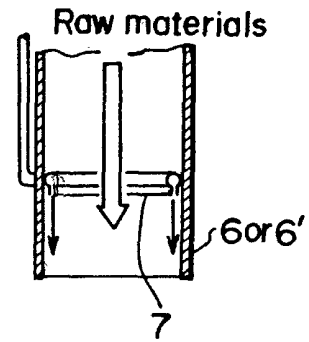
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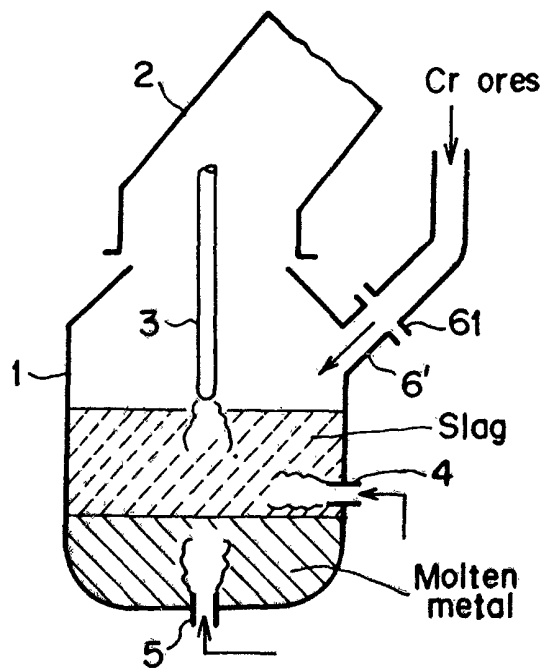
FIG_1



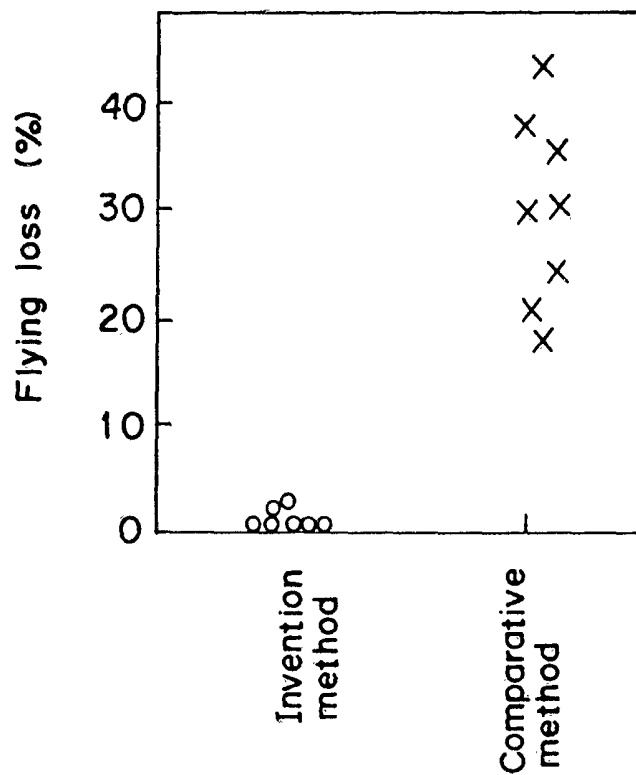
FIG_3



FIG_2



FIG_4



FIG_5

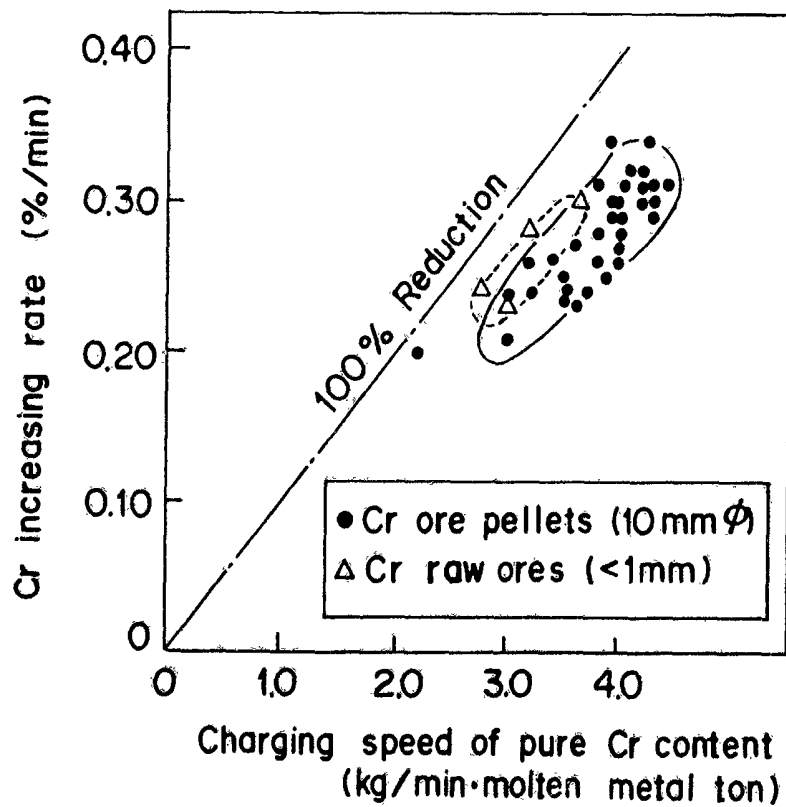


FIG. 6

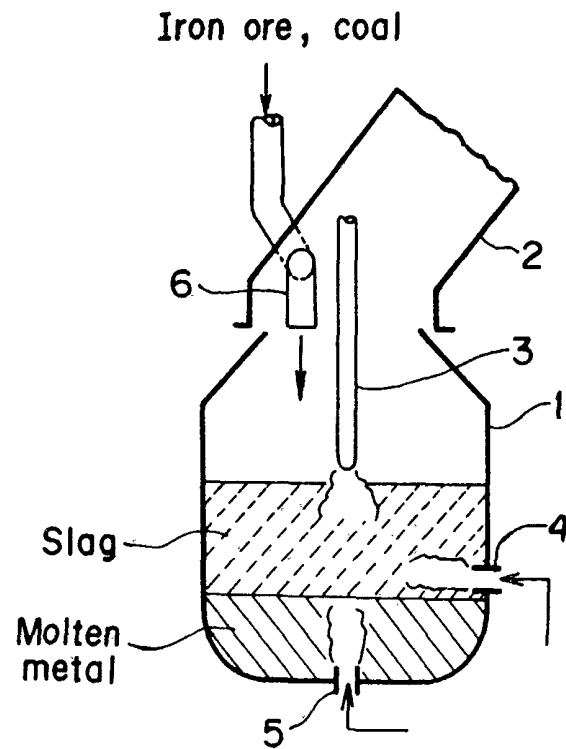
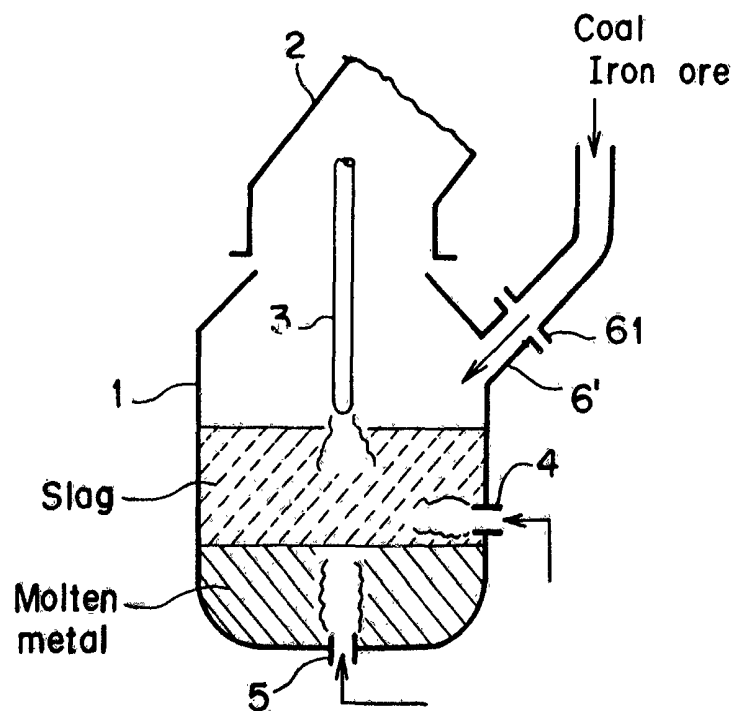
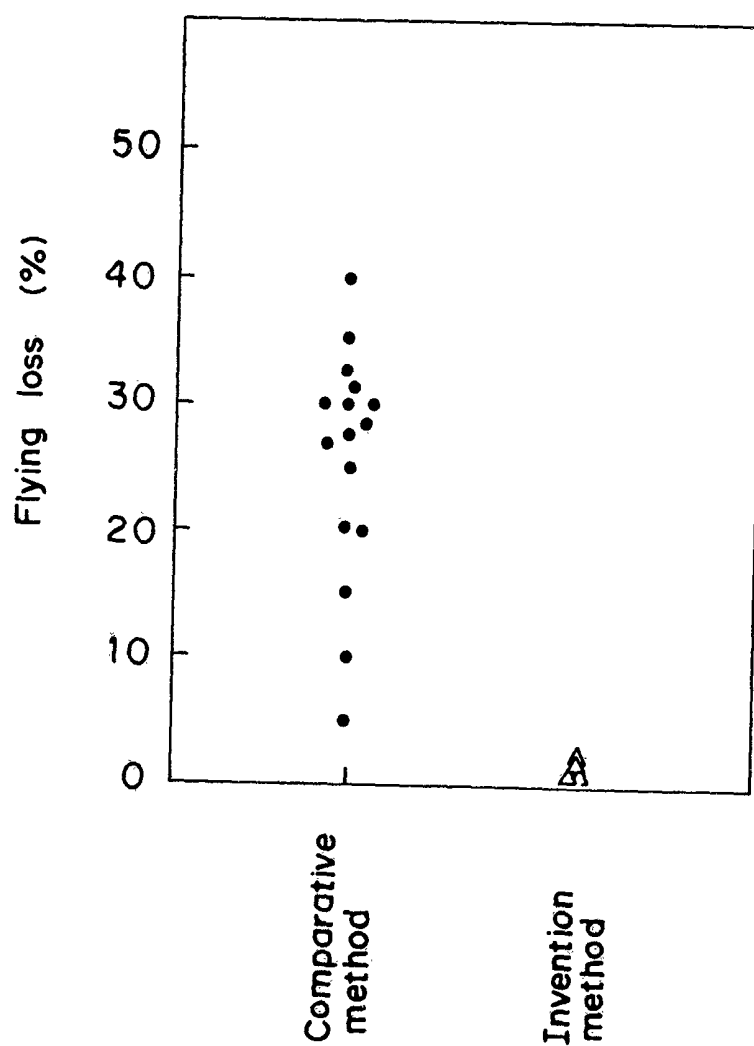


FIG. 7



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FIG. 8



INTERNATIONAL SEARCH REPORT

International Application No

PCT/JP88/00911

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁴		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl ⁴ C21B11/00, 13/00, C22B5/10		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC	C21B11/00, 13/00, C22B5/10	
Documentation Searched other than Minimum Documentation to the extent that such Documents are Included in the Fields Searched ⁸		
Jitsuyo Shinan Koho 1926 - 1988 Kokai Jitsuyo Shinan Koho 1971 - 1988		
III. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹
A	JP, A, 54-158320 (Nippon Steel Corporation) 14 December 1979 (14. 12. 79) Fig. 1 (Family: none)	1, 3
⁴ Special categories of cited documents ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "Z" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
November 30, 1988 (30. 11. 88)		December 12, 1988 (12. 12. 88)
International Searching Authority		Signature of Authorized Officer
Japanese Patent Office		

国 際 調 査 報 告

国際出願番号PCT/JP 88/00911

I. 発明の属する分野の分類		
国際特許分類 (IPC) Int. Cl. ⁴ C21B11/00, 13/00, C22B5/10		
II. 国際調査を行った分野		
調 査 を 行 っ た 最 小 限 資 料		
分 類 体 系	分 類 記 号	
IPC	C21B11/00, 13/00, C22B5/10	
最小限資料以外の資料で調査を行ったもの		
日本国実用新案公報 1926-1988年 日本国公開実用新案公報 1971-1988年		
III. 関連する技術に関する文献		
引用文献の カテゴリ ※	引用文献名 及び一部の箇所が関連するときは、その関連する箇所の表示	請求の範囲の番号
A	JP, A, 54-158320 (新日本製鉄株式会社) 14. 12月. 1979 (14. 12. 79) 第1図 (ファミリーなし)	1, 3
※引用文献のカテゴリ 「A」特に関連のある文献ではなく、一般的技術水準を示すもの 「E」先行文献ではあるが、国際出願日以後に公表されたもの 「L」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献 (理由を付す) 「O」口頭による開示、使用、展示等に言及する文献 「P」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献 「T」国際出願日又は優先日の後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの 「X」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの 「Y」特に関連のある文献であって、当該文献と他の1以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの 「&」同一パテントファミリーの文献		
IV. 認 証		
国際調査を完了した日 30. 11. 88	国際調査報告の発送日 12. 12. 88	
国際調査機関 日本国特許庁 (ISA/JP)	権限のある職員 特許庁審査官 木 梨 貞 男	4 K 7 3 2 5