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(11) Publication number:

0 436 718 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art.
158(3) EPC

(21) Application number: **88907777.2**

(51) Int. Cl.⁵: **C21B 11/00**, **C21B 13/00**,
C22B 5/10

(22) Date of filing: **09.09.88**

(86) International application number:
PCT/JP88/00911

(87) International publication number:
WO 89/02477 (23.03.89 89/07)

(30) Priority: **10.09.87 JP 225253/87**
29.01.88 JP 20472/88

(43) Date of publication of application:
17.07.91 Bulletin 91/29

(84) Designated Contracting States:
AT BE DE FR GB IT NL SE

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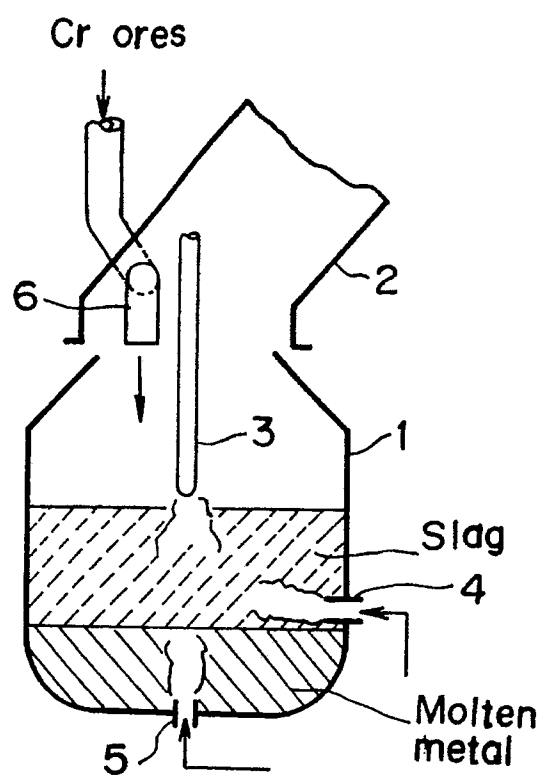
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EP 0 436 718 A1

(54) **METHOD OF CHARGING ORE IN MELT-REDUCTION.**

(57) 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.

FIG_1



A METHOD OF CHARGING CHROMIUM ORES IN A SMELTING REDUCTION

TECHNICAL FIELD

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

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.

Cr raw ores are very fine in grain diameters, and ordinarily around 90% contain those having 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 are lost up to 30% by upflowing gas.

For avoiding flying losses, an injection charging may be suggested, but special facilities are required independently therefor, and transporting pipes are easily injured by hard Cr ores. Thus, such measures could not be adopted actually.

In view of these circumstances, Cr raw ores are formed into pellets or briquets, inviting high production costs. If the ores are agglomerated, specific surface areas of the ores are made small so that a pre-heating time is made long and the reduction rate is lowered to lengthen the treatment time.

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.

In this smelting reduction method of iron ores, the flying loss of ores is not a big problem because the ores are coarse, but the coal as combustion fuel is flid and lost considerably. According to the inventors' studies, why yield of the coal is inferior in the top charge method, is because the coal is broken by rapid increasing of 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 charge method abruptly becomes high temperature and cracked, and parts of fine powders generated by the heat cracking 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.

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

For accomplishing this object, in the invention, powder Cr raw ores, or iron ores and coal are charged 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.

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 to enable to charge the raw materials as checking effectively the flying losses.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs.1 to 5 concern the smelting reduction of Cr ores, and Fig.1 explains one embodiment of the invention;

Fig.2 explains another embodiment of the invention;

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

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

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

Figs.6 to 8 concern the smelting reduction of iron ores;

Fig.6 explains a further embodiment of the invention;

Fig.7 explains a still further embodiment of the invention; and

Fig.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' chutes.

DETAILED DESCRIPTION OF THE INVENTION

The invention will be explained in detail.

Fig.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. As the smelting reduction method by the converter type, there have been various proposals or studies which are different in the gas blowing practices. For example, as shown in Fig.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 nearly the furnace mouth.

The charging chute 6 is determined at a height of its lower end so that it does not contact the furnace body when the furnace is tilted.

Fig.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.

For charging Cr ores through the chute 6 or 6', while the gas (air or N₂) is jetted toward the outside of the chute from the nozzle 7 provided in a circumferential direction of the inner part around the chute as shown in Fig. 3, the powder Cr raw ores may be charged into the furnace, thereby to enable to exactly avoid the flying losses of the raw materials.

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 exactly avoided. Besides, the jet gas also serves as a purge gas for preventing invasion of CO and CO₂ of the furnace into the chute.

Fig.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 Fig.1.

Fig.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 Fig.2.

In the above mentioned chargings of the iron ores and the coal by the chute 6 or 6', while the gas (the air or N₂) is jetted toward the outside of the chute from the nozzle 7 provided in a circumferential direction of the inner part in vicinity of the chute as shown in Fig.3, the iron ores and the coal may be charged into the furnace, thereby to enable to exactly 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 Fig.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%

Fig.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.

Fig.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 Fig. 6. The comparative method did not use the charging chute as shown in Fig. 6, and practised the smelting reduction while charging the raw materials. The producing conditions are as follows.

Table 1

	Comparative Method	Invention Method
O ₂ for decarburization (Nm ³ /Hr)	1300	1300
O 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

Fig.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.

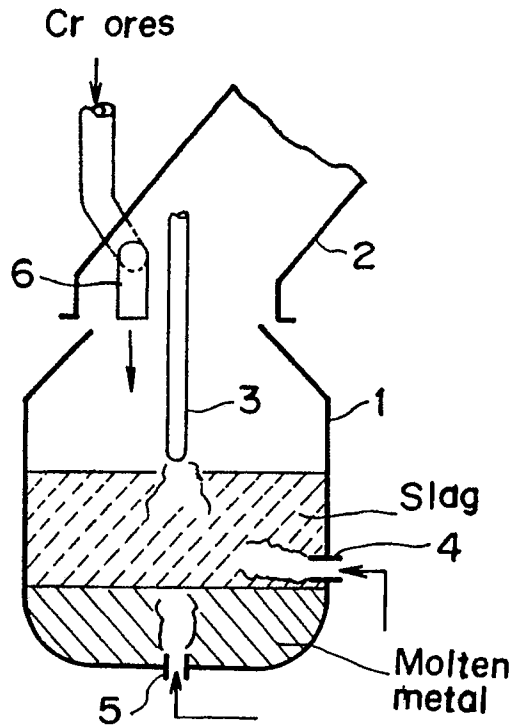
INDUSTRIAL APPLICATION

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

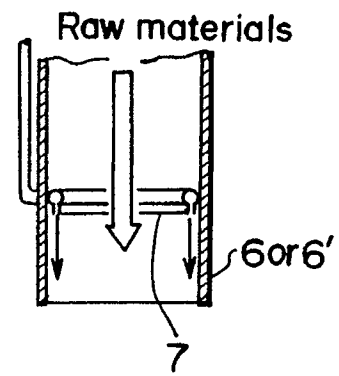
Claims

1. A method of charging raw materials in a smelting reduction of ores, using a smelting reduction furnace of a converter type, comprising charging powder Cr raw ores into a furnace through a charging chute extending in vicinity of a mouth of the furnace or connected to a furnace body.
2. A method of charging raw materials in a smelting reduction of ores, using a smelting reduction furnace of a converter type, comprising charging powder Cr raw ores into a furnace through a charging chute extending in vicinity of a mouth of the furnace or connected to a furnace body, while a gas is jetted toward an outside of the chute from a nozzle provided in an circumferential direction of an inside nearly the end of the chute.
3. A method of charging raw materials in a smelting reduction of ores, using a smelting reduction furnace of a converter type, comprising charging iron ores and coal into a furnace through a charging chute extending in vicinity of a mouth of the furnace or connected to a furnace body.
4. A method of charging raw materials in a smelting reduction of ores, using a smelting reduction furnace of a converter type, comprising charging iron ores and coal into a furnace through a charging chute extending in vicinity of a mouth of the furnace or connected to a furnace body, while a gas is jetted toward an outside of the chute from a nozzle provided in an circumferential direction of an inside nearly the end of the chute.

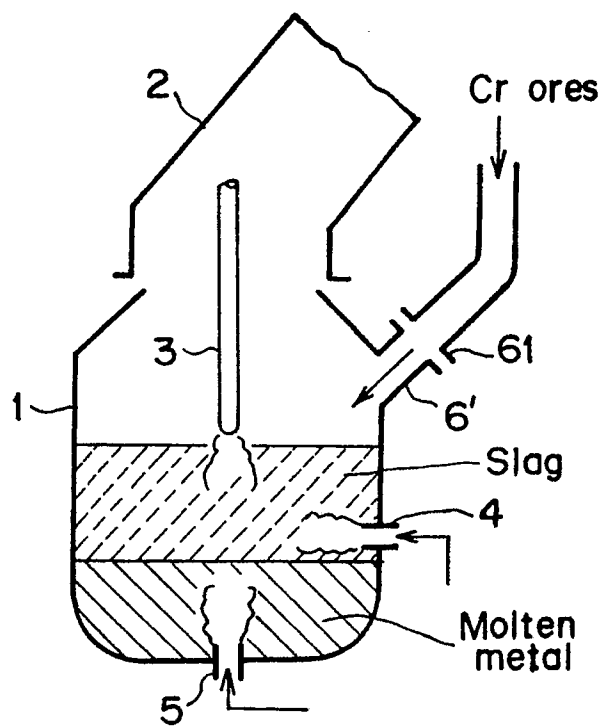
FIG_1



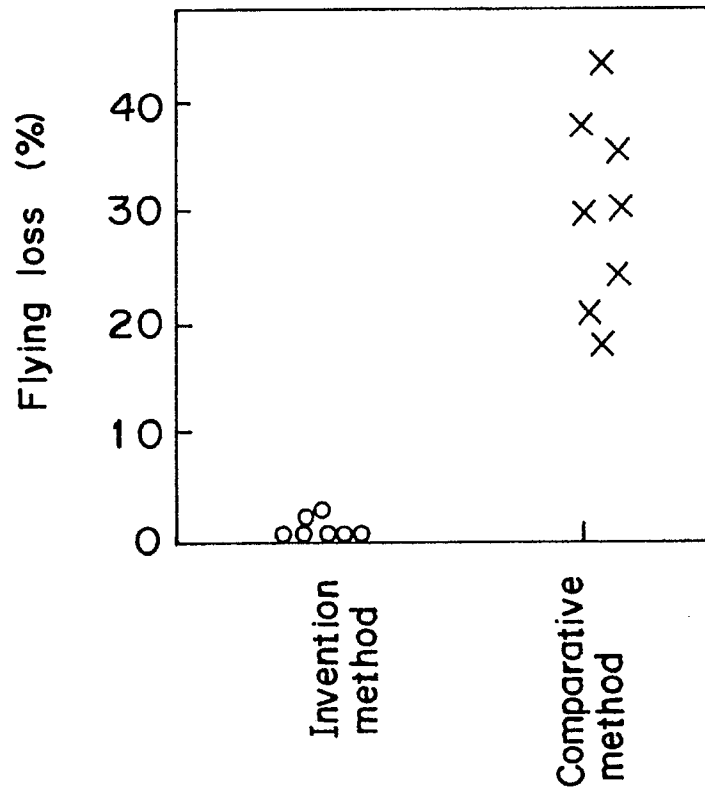
FIG_3



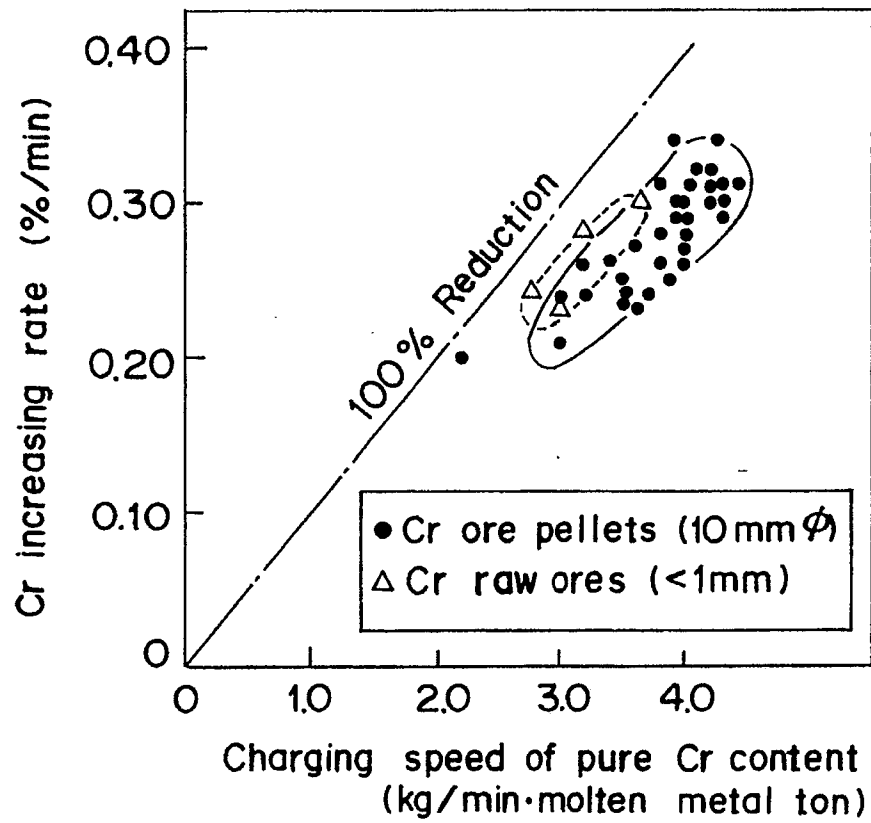
FIG_2



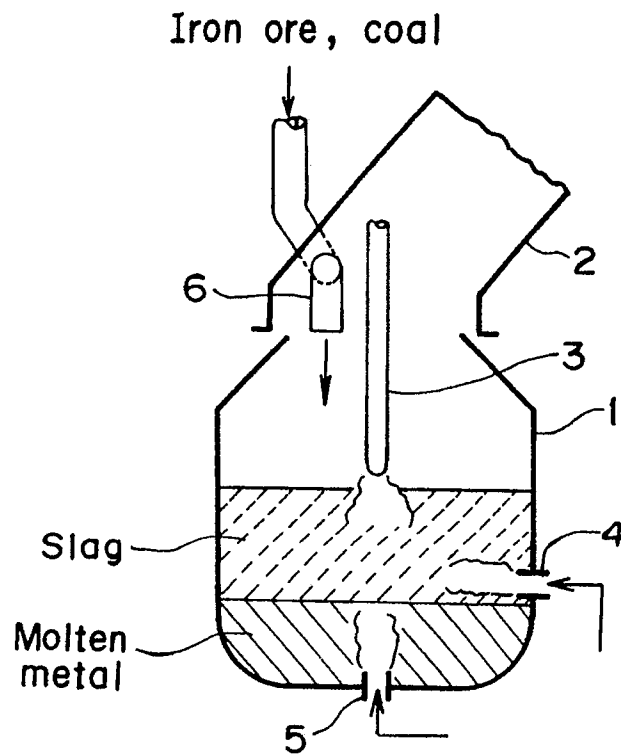
FIG_4



FIG_5



FIG_6



FIG_7

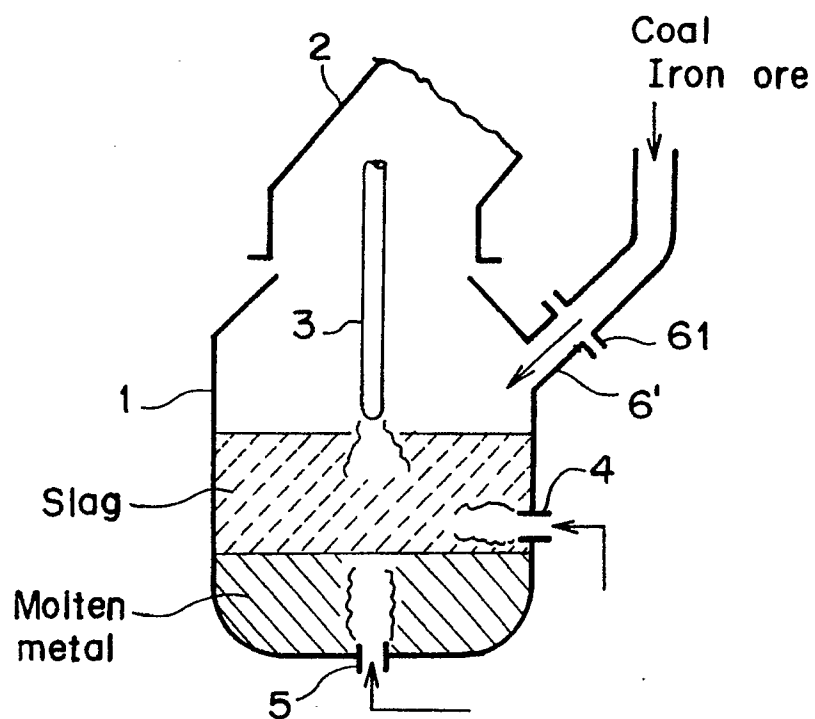
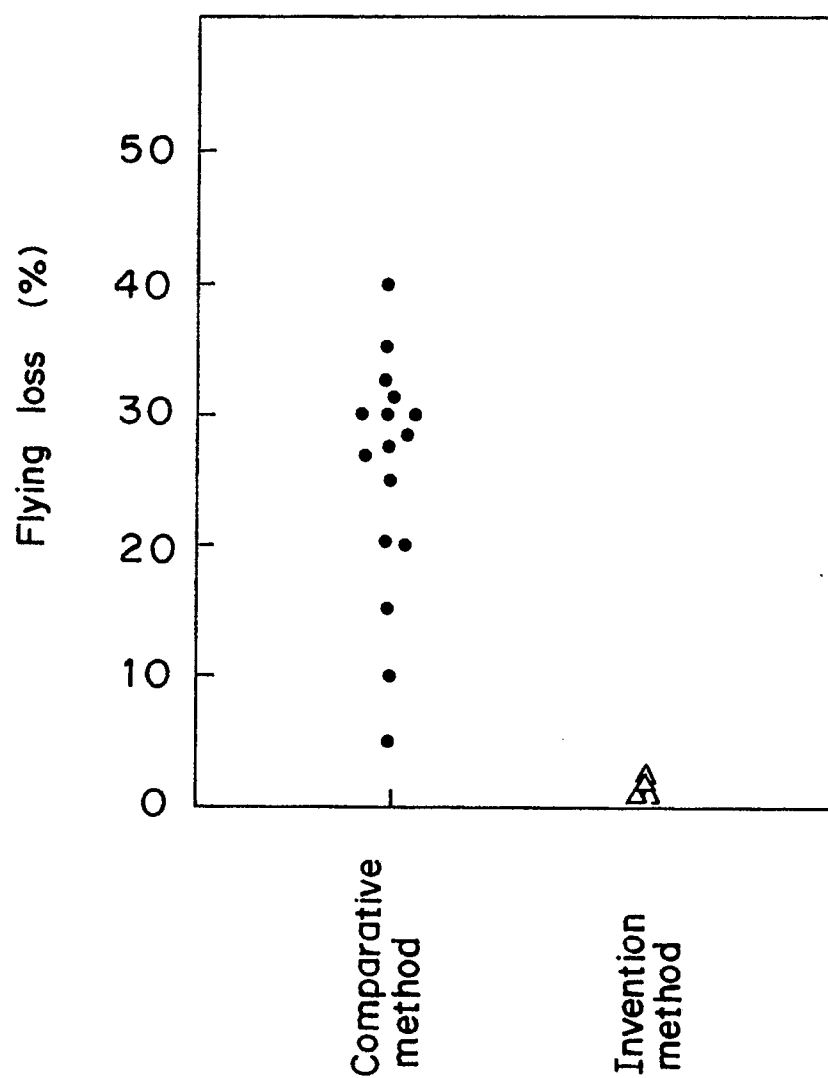


FIG. 8



INTERNATIONAL SEARCH REPORT

International Application No PCT/JP88/00911

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
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. ¹³
A	JP, A, 54-158320 (Nippon Steel Corporation) 14 December 1979 (14. 12. 79) Fig. 1 (Family: none)	1, 3
<p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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</p> <p>"&" document member of the same patent family</p>		
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		