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

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PATENT ABSTRACTS OF JAPAN, vol. 11, no. 139 (C-420)[2586], 7th May 1987;& JP-A-61 279 609 (SUMITOMO METAL IND. LTD) 10-12-1986

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PATENT ABSTRACTS OF JAPAN, vol. 11, no. 232 (C-437)[2679], 29th July 1987;& JP-A-62 44 533 (KAWASAKI STEEL CORP.) 26-02-1987

PATENT ABSTRACTS OF JAPAN, vol. 6, no. 244 (C-138)[1122], 2nd December 1982;& JP-A-57 143 419 (SHIN NIPPON SEITETSU K.K.) 04-09-1982

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Description

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

JP-A-61 279 609 discloses a method of charging chromium raw material, carboneous material and fluxing agent out of a bunker via a pipe into a furnace.

EP-A-79 182 describes a furnace comprising a hopper system for charging iron ore and carboneous material into a converter type smelting reduction furnace.

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 flied 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 object of 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.

The object is solved by the features of the claims 1 and 2.

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.

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 seperated at a part 61 on the way, and when the furnace body is tilted, this part 61 is seperated.

For charging Cr ores through the chute 6 or 6′, while the gas (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 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 CO_2 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 N_2) 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, while a gas is jetted toward the outside of the chute from a nozzle provided in an circumferential direction of the inside of the chute.

2. 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 the outside of the chute from a nozzle provided in an circumferential direction of the inside of the chute.

3. Method according to claims 1 and 2, wherein the gas jetting is provided near the end of the chute.

Patentansprüche

1. Verfahren zum Chargieren von Rohmaterialien bei der Schmelzreduktion von Erzen unter Verwendung eines Schmelzreduktionsofens vom Konvertertyp umfassend das Chargieren von pulverförmigen Cr Roherzen in einen Ofen über eine Rutsche, die sich in die Nahe der Mündung des Ofens erstreckt oder mit dem Ofenkörper verbunden ist, wobei ein Gas in Richtung der Außenseite der Rutsche von einer Düse eingeblasen wird, die in einer Umfangsrichtung der Innenseite der Rutsche vorgesehen ist.

2. Verfahren zum Chargieren von Rohmaterialien bei der Schmelzreduktion von Erzen unter Verwendung eines Schmelzreduktionsofens vom Konvertertyp, umfassend das Chargieren von Eisenerzen und Kohle in den Ofen über eine Rutsche, die sich in die Nähe der Mündung des Ofens erstreckt oder mit dem Ofenkörper verbunden ist, während ein Gas in Richtung der Außenseite der Rutsche von einer Düse eingeblasen wird, die in einer Umfangsrichtung der Innenseite der Rutsche vorgesehen ist.

3. Verfahren nach den Ansprüchen 1 und 2, wobei das Gas nahe dem Ende der Rutsche eingeblasen wird.

Revendications

1. Procédé de chargement de matières premières dans une opération de réduction par fusion de minerais, en utilisant un four de réduction par fusion du type convertisseur, comprenant l'opération de

chargement de minerais bruts Cr sous forme de poudre dans un four par une goulotte de chargement s'étendant à proximité de l'ouverture du four ou raccordée au corps du four, tandis qu'un gaz est pulvérisé vers l'extérieur de la goulotte à partir d'une tuyère montée dans une direction circonférentielle de l'intérieur de la goulotte.

2. Procédé de chargement de matières premières dans une étape de réduction par fusion de minerais, en utilisant un four de réduction par fusion du type convertisseur, procédé comprenant les étapes consistant à charger des minerais de fer et du charbon dans un four par une goulotte de chargement s'étendant à proximité de l'ouverture du four ou raccordée au corps du four, tandis qu'un gaz est pulvérisé vers l'extérieur de la goulotte à partir d'une tuyère montée dans une direction périphérique de l'intérieur de la goulotte.

3. Procédé selon les revendications 1 et 2, dans lequel la pulvérisation de gaz s'effectue à proximité de l'extrémité de la goulotte.

FIG_1

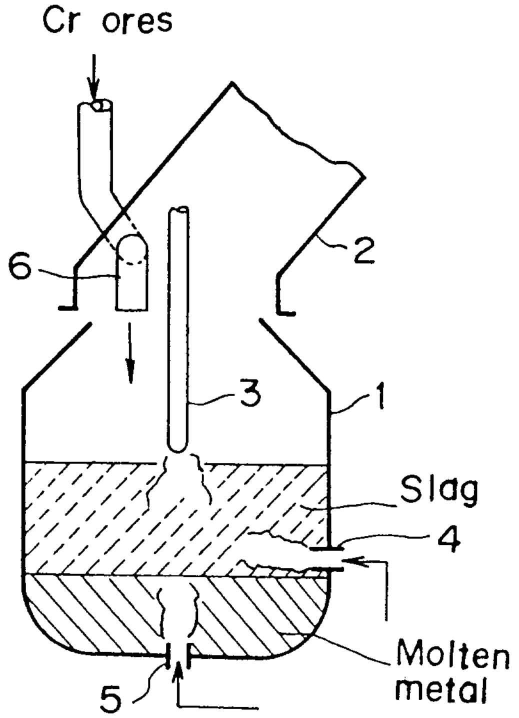


FIG_3

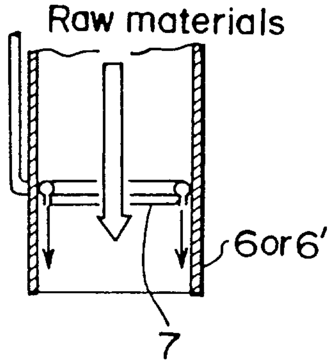


FIG_2

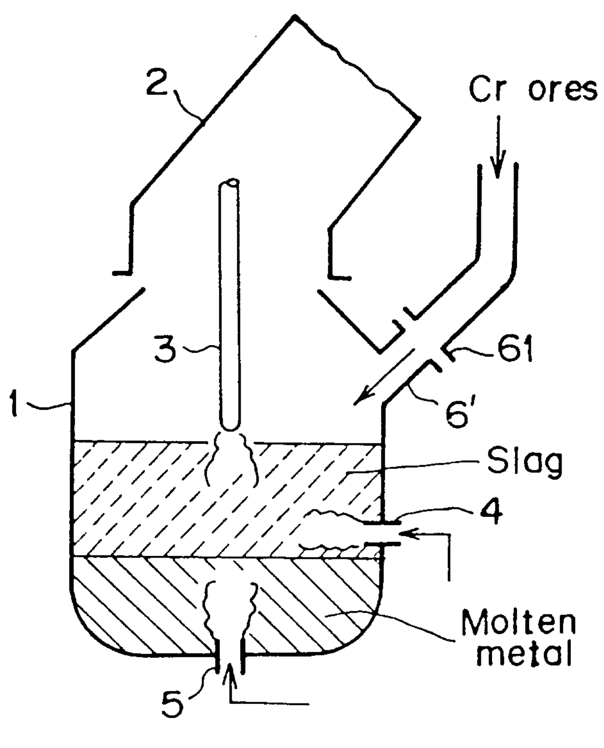


FIG_4

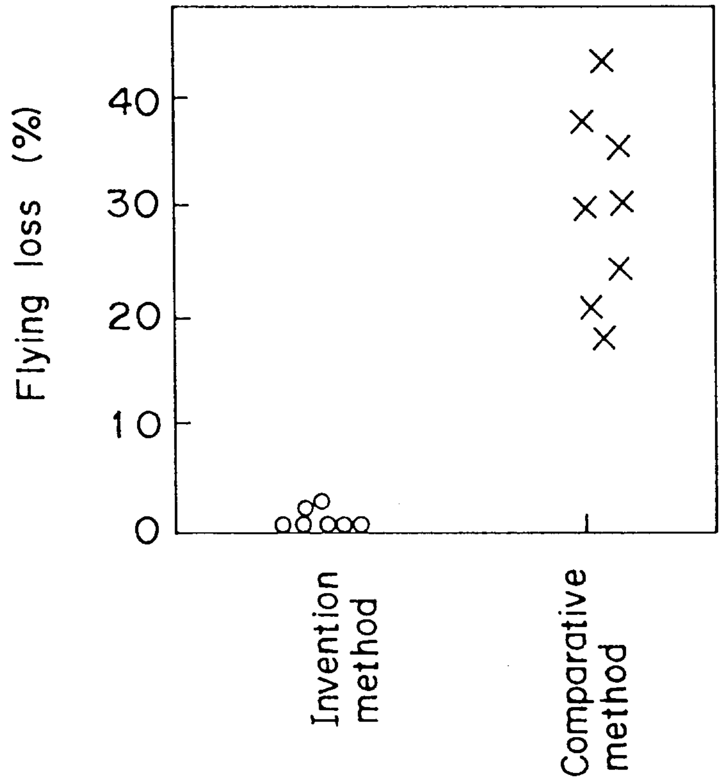

Flying loss (%)
40
30
20
10
0
Invention method
Comparative method

FIG_5

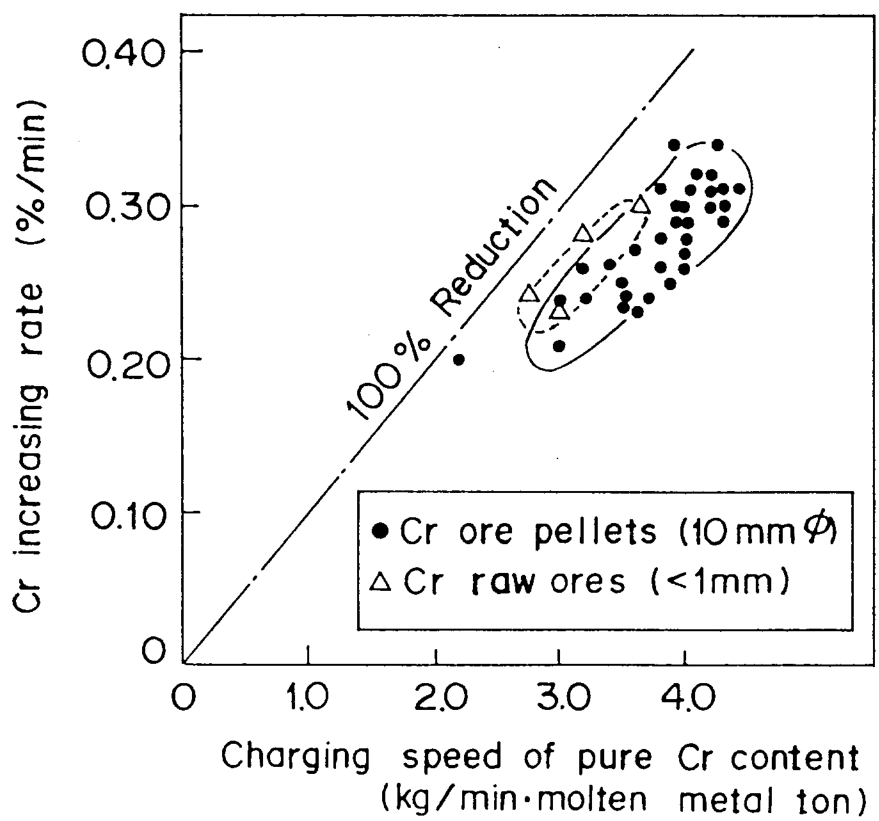

Cr increasing rate (%/min)
0.40
0.30
0.20
0.10
0
100% Reduction
● Cr ore pellets (10mmΦ)
△ Cr raw ores (<1mm)
0
1.0
2.0
3.0
4.0
Charging speed of pure Cr content
(kg/min·molten metal ton)

FIG_6

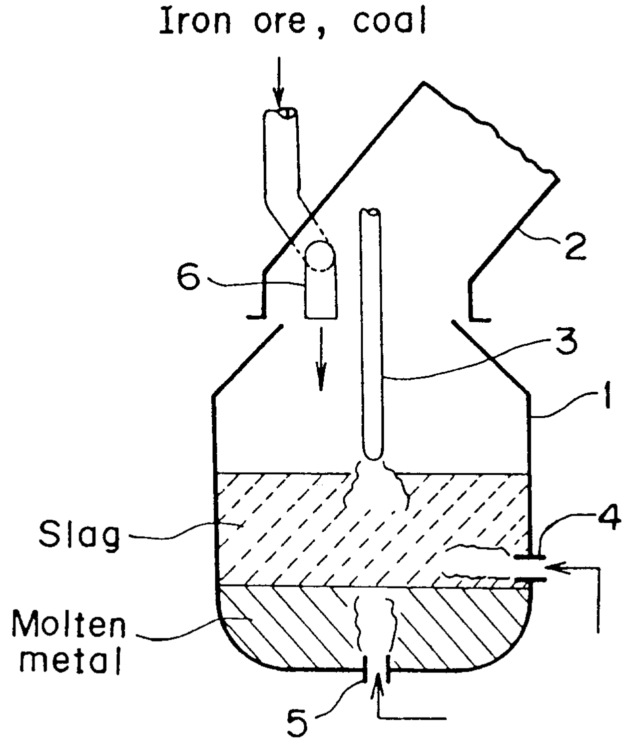

Iron ore, coal
2
6
3
1
Slag
4
Molten metal
5

FIG_7

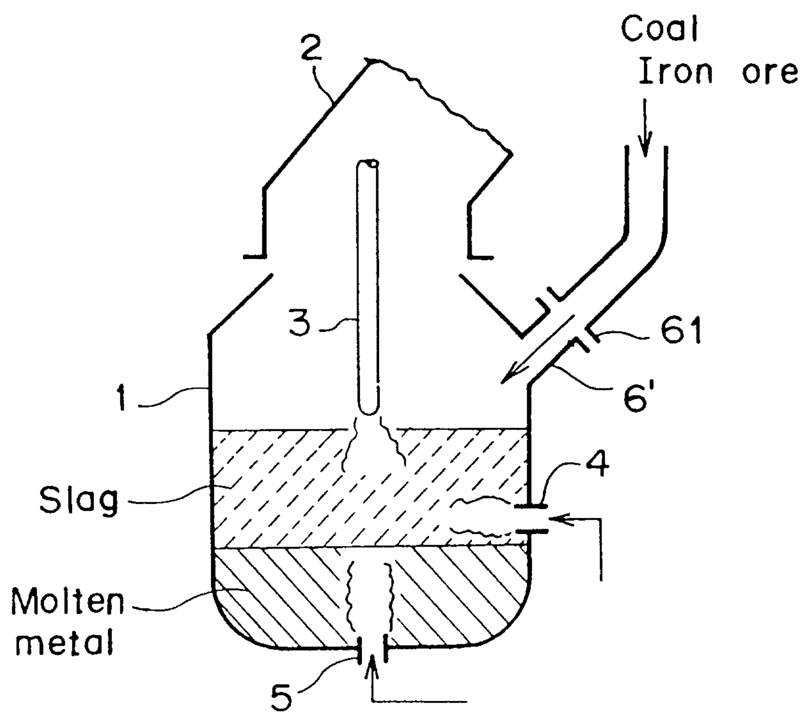
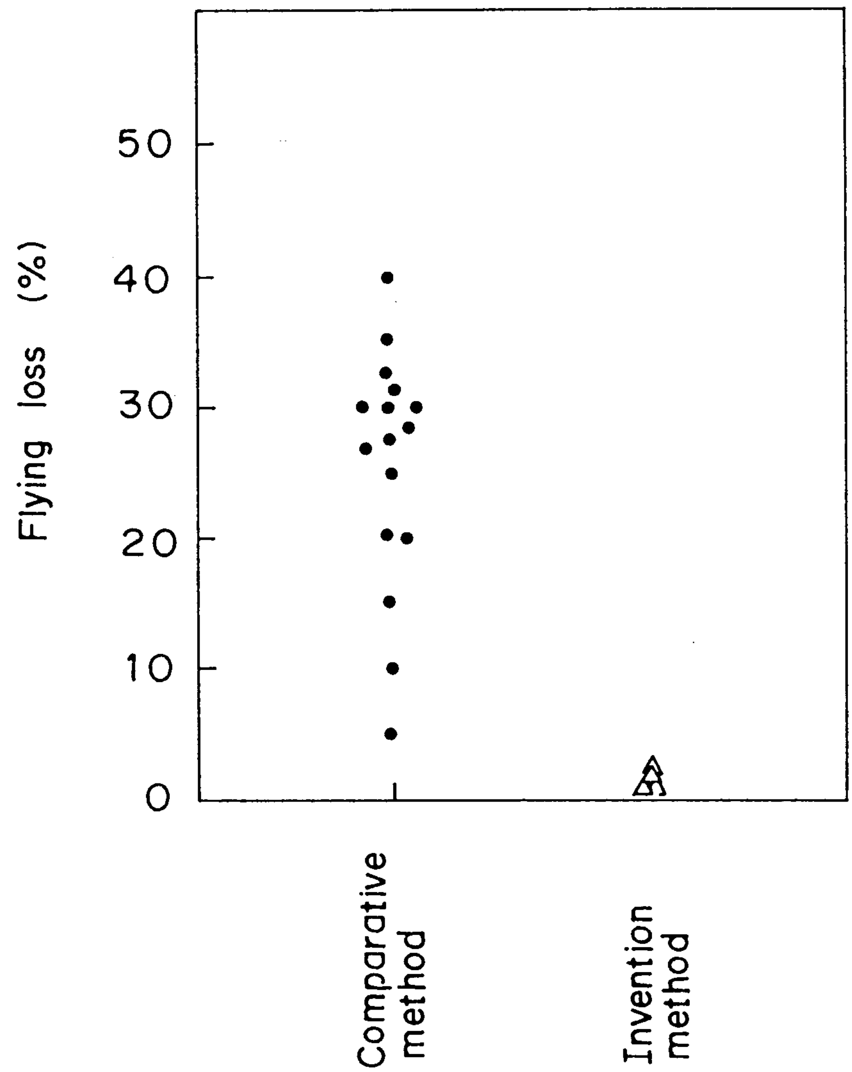

Coal
Iron ore
2
3
61
1
6'
4
Slag
Molten metal
5

FIG_8


Flying loss (%)
50
40
30
20
10
0
Comparative method
Invention method