

P 1585

P.7351

John & Kernick
Patents, Trade Marks and Designs

REPUBLIC OF SOUTH AFRICA

Patents Form No. 1.
(New Constitution)

THE PATENTS ACT, 1952, AS AMENDED.

APPLICATION FOR A PATENT.
(WITH AUTHORISATION OF AGENT)

3

Filing date and Application No.

76/5287

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ANSOEKERS VERHAAR
APPLICANTS REPRESENTATION

Full Name(s) of Applicant(s): NATIONAL INSTITUTE FOR METALLURGY

Address(es) of applicant(s): 1 Yale Road, Milner Park, Johannesburg,
Transvaal Province, Republic of South Africa.

Full name(s) of inventor(s): LAWRENCE BRUCE MCRAE

I/We do hereby declare that I/we are in possession of an invention the title of which is

"IMPROVEMENTS RELATING TO BRIQUETTES"

I/we are the assignee(s)/legal representative(s) of the inventor(s). To the best of my/our knowledge and belief there is no lawful ground of objection to the grant of a patent to me/us on this application and we pray that a patent may be granted to me/us for the invention.

I/We enclose the provisional/complete specification.

I/We hereby appoint the partners and qualified staff of the firm of John & Kernick jointly and severally, to act for me/us in all matters relating to this application and any letters patent granted thereon.

Dated this 28th day of July 1976

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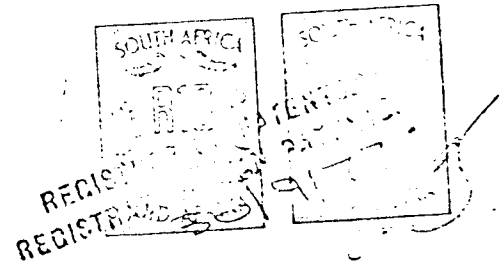
Table of Classification	
Class	Sub-class

Signature of Applicant and Agent

Application No. 76/5287

P. 7351

REPUBLIC OF SOUTH AFRICA



The Patents Act, 1952

COMPLETE SPECIFICATION

(a) Here insert title verbally agreeing with that in the application form.

"IMPROVEMENTS RELATING TO BRIQUETTES"

(b) Here insert (in full) name, address, and calling of applicant(s) as in application form.

We, NATIONAL INSTITUTE FOR METALLURGY and MIDDELBURG STEEL AND ALLOYS (PROPRIETARY) LIMITED, of: 1 Yale Road, Milner Park, Johannesburg, Transvaal Province, Republic of South Africa and Devonshire House, 49 Jorissen Street, Braamfontein, Johannesburg, Transvaal Province, Republic of South Africa,

do hereby declare this invention, the manner in which and the method by which it is to be performed, to be particularly described and ascertained in and by the following statement:—

THIS INVENTION relates to briquettes of the type used in the agglomeration of charge material for metallurgical processes and to a method for making such briquettes.

In this specification the term "briquette" refers to any unit of agglomerated fines material in which the agglomeration comprises a compacting or compressing stage.

To enable such briquettes to retain their form after the moulding and compressing stage, and to resist disintegration during use, a binding agent is available, and the specific choice of an agent is determined generally by the nature of the ore fines being agglomerated and the required properties for the final briquettes.

An object of this invention is to provide a briquette having improved

properties and a method for making such a briquette.

According to this invention a briquette comprises a mixture of chromite ore material; a reducing agent in a predetermined ratio, at least some of the reducing agent being in a solid form at the time of making the briquet; and a suitable binder.

Further according to the invention the solid reducing agent is char, charcoal, coke, coal or any other carbonaceous material or a combination of these; the predetermined ratio includes a reducing agent content in the range between less than, and a determined amount greater than, the stoichiometric amount required for complete reduction of the ore to the metallic state; the briquette includes a binding agent or any other required additives or both; the ore material is chromite; and all the reducing agent is in a solid form.

Still further according to the invention the binding agent is calcium ligno sulphonate or molasses and lime, or these in combination with another binder; and the reducing agent is present in a determined amount greater than the stoichiometric amount required for complete reduction of the ore to the metallic state.

The invention further provides a method of making a briquette as defined above comprising briquetting in known manner a mixture of at least a finely divided ore material and a finely divided solid reducing agent in a predetermined ratio.

The invention also provides for any metallurgical process utilizing

briquettes of the type defined above and in particular for a process in which the ore in the briquettes undergoes pre-reduction in the upper regions of an electric smelting furnace.

In an example of the invention briquettes comprise a mixture of finely divided chromite ore, a reductant, for example coal, char, coke or charcoal or a combination of any of these, and a suitable binding agent. The amount of reductant used may vary considerably and may be well below the stoichiometric amount required for complete reduction of the chromite or in small excess of this amount.

Fabrication of the mixture into briquettes was done in known manner and included a stage in which the mixture was compressed in the co-operating pockets of a roll press.

A series of experimental tests were carried out using char as a reductant, calcium ligno sulphonate as a binder and a chromite of the following general analysis:

Cr_2O_3	44,72%
FeO	23,61%
SiO_2	2,60%
Al_2O_3	14,80%
MgO	11,80%
CaO	0,34%

The briquettes were made in the manner described above using a chromite : char : binder (calcium ligno sulphonate) in the ratio of 100 : 15 : 4.

Smelting took place in a furnace having two preformed graphite electrodes and rated at 67 KW. Rounds containing 11,9 kg of briquettes, 0,9 kg SiO₂, 0,75 kg serpentine, 0,4 kg limestone and 1,0 kg char were used to charge the furnace. The number of rounds charged to the furnaces was governed by the condition of the furnace and the amount of material retained after a tap.

From a total of eight heats the results shown in Table 1 were obtained.

TABLE 1

Smelting log |

Total Rounds Charged	Total kWh	Total time (min)	Total metal yield kg	Total-slag yield kg
22	501,1	1374	103,05	133,05

The overall slag to metal ratio was 1,29 to 1 and the total power consumption was 4863 kWh per ton of metal. This is considerably less than has been obtained previously in tests where pelletized fines not containing a reducing agent were smelted. The power consumption figure is about 16% greater than that for a full size furnace producing charge chrome from oxide ores. However, remembering that the heat losses for small furnaces are many times greater than for large production furnaces, it may be deduced that there has actually been a considerable saving of power.

This decrease in power consumption is attributed to the pre-reduction which took place as the briquettes descended in the furnace. In order to investigate the amount of pre-reduction that could occur, tests were conducted in which samples of briquettes were heated under a protective atmosphere at selected temperature for increasing lengths of time. After this treatment, the degree of metallization of the briquettes was determined by an acid-leach technique.

The results are depicted graphically in Figure 1 where percentage metallization is plotted against time for three temperatures, viz. 1200°C, 1300°C and 1400°C. From this graph it may be seen that considerable metallization occurs in a relatively short time when the briquettes are heated.

The metal and slag produced during the eight heats were analysed. The average results are shown in Tables 2 and 3.

TABLE 2
Metal analysis

Cr %	Fe %	C %	Si %	S %
55,23	34,76	7,33	2,25	0,016

TABLE 3
Slag analysis

Cr ₂ O ₃ %	FeO %	SiO ₂ %	Al ₂ O ₃ %	MgO %	CaO %	S %
9,68	6,11	24,5	27,5	28,0	4,6	0,21

From Table 2 it may be seen that the sulphur content of the metal produced was within the allowable maximum of 0,03 per cent. Furthermore, the total recovery of the chromium metal was 82 per cent and of the iron 85,4 per cent, while the accountability of chromium and iron over the whole smelt was 95,4 per cent and 101,2 per cent respectively which is acceptable within the practical limits of mass measurement and chemical analysis.

This test showed that the invention provides a number of benefits including the following:

- a. A reduction of the power consumption per unit mass of production of the alloy;
- b. Calcium ligno sulphonate may be used as a binder;
- c. Finely divided reductant may be used - this is generally thought of as being unsuitable for metallurgical processes.

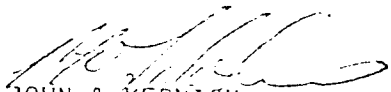
It is obvious from the above description that the invention could be applied profitably in industry.

Having now particularly described and ascertained our said invention and in what manner the same is to be performed, we declare that what we claim is:-

1. A briquette comprising a mixture of chromite ore material, a reducing agent in a predetermined ratio, at least some of the reducing agent being in a solid form at the time of making the briquette; and a suitable binder.
2. A briquette as claimed in claim 1 in which the solid reducing agent is char, charcoal, coke, coal or any other carbonaceous material or a combination of these.
3. A briquette as claimed in either of claims 1 or 2 in which the predetermined ratio includes a reducing agent content in the range between less than, and a determined amount greater than, the stoichiometric amount required for complete reduction of the ore to the metallic state.
4. A briquette as claimed in claim 3 in which the reducing agent is present in a determined amount greater than the stoichiometric amount required for complete reduction of the ore to the metallic state.
5. A briquette as claimed in claim 3 in which the reducing agent content is approximately sixty per cent of the stoichiometric amount required for complete reduction of the ore to the metallic state.
6. A briquette as claimed in any of the preceding claims in which the binding agent is calcium ligno sulphonate or molasses and lime, or these in combination with other binders.

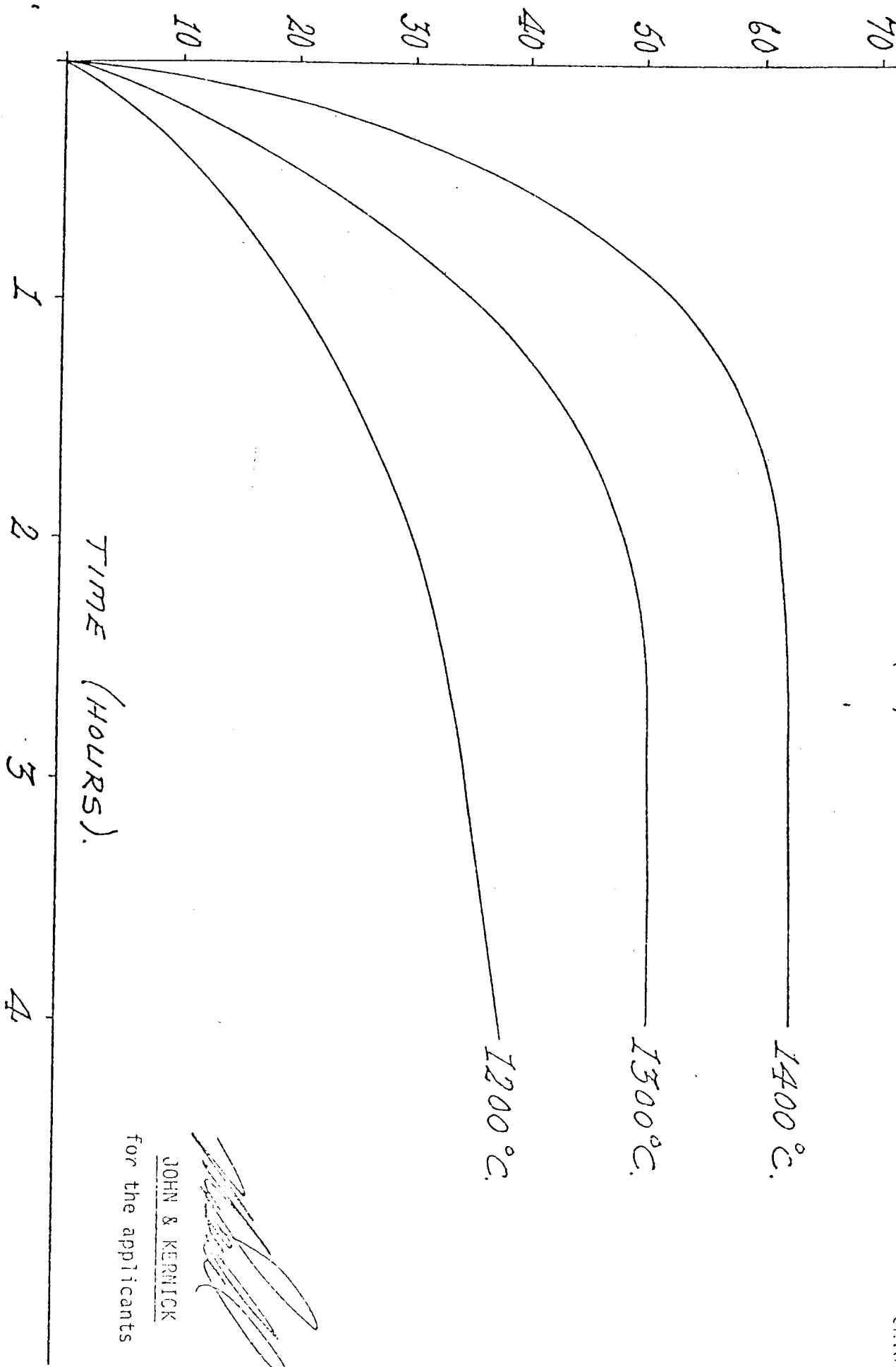
7. A briquette as claimed in any of the preceding claims in which all the reducing agent is in a solid form.
8. A briquette substantially as herein described.
9. A method of making a briquette as claimed in any of the preceding claims comprising briquetting in known manner a mixture of at least a finely divided chromite ore material and a finely divided solid reducing agent in a predetermined ratio.
10. A method of making a briquette substantially as herein described.
11. A metallurgical process for producing ferrochrome alloys utilizing briquettes of the type claimed in any of claims 1 to 8.
12. A metallurgical process as claimed in claim 11 in which the ore in the briquettes undergoes pre-reduction in the upper regions of an electric smelting furnace.
13. A metallurgical process substantially as herein described.

DATED this 29th day of September, 1977.


JOHN & KERNICK

for the applicants

DEGREE OF METALLIZATION (%)



TIME (HOURS).

JOHN & KERNICK
for the applicants