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REDUCING MELTING OF INDIAN ILMENITE CONCENTRATE "Q" WITH CHARCOAL AS A REDUCING AGENT.

Supplement to the Report on "Technological Testing of Indian Ilmenite Concentrates", carried out in 1971

Carried out by the All-Union Research and Design Titanium Institute

Zaporozhie,

1971

A B S T R A C T

. In April of 19[illegible], when discussing in Bombay, in the Office of the firm "IRE" the report on research technological testing of Indian ilmenite concentrates two important items have been noted

[illegible] ilmenite concentrate "C" has a higher content of impurities, particularly alumina (1.6%) due to which the titanium dioxide content in the smelted slag becomes substantially lower (81.1% in place of [illegible]%).

[illegible] India is not in the possession of a high grade reducing agent of the anthracite type and, therefore, to assure the operation of a pilot plant for melting of ilmenite concentrate anthracite either has to be imported or replaced by ash-rich (up to 20%) blast-furnace coke or sulphur-rich (up to [illegible]%) petroleum coke (both of them do not meet the requirements of the process).

In connection with this a decision has been made to carry out additional investigations for the purposes of which Titanium Institute was provided with a new sample of concentrate "O" showing the following analysis, in %: TiO_2 - 60,60; Fe_2O_3 - 24.15; FeO - 9,25; Al_2O_3 - 0,40; Mn - 1,59; Cr_2O_3 - 0.12; V_2O_5 - 0.15; MgO - 0,89; P_2O_5 - 0,17; ZrO_2 - 0,50; SiO_2 - 0,80 according to the data, presented by Mr Sommey.

2. Test meltings were carried out according to the practised procedures, described earlier in the report in detail. Unlike the earlier investigations of this series of test meltings, ceylonese charcoal was used as a reducing agent, obtained by the coking of coconut shells.

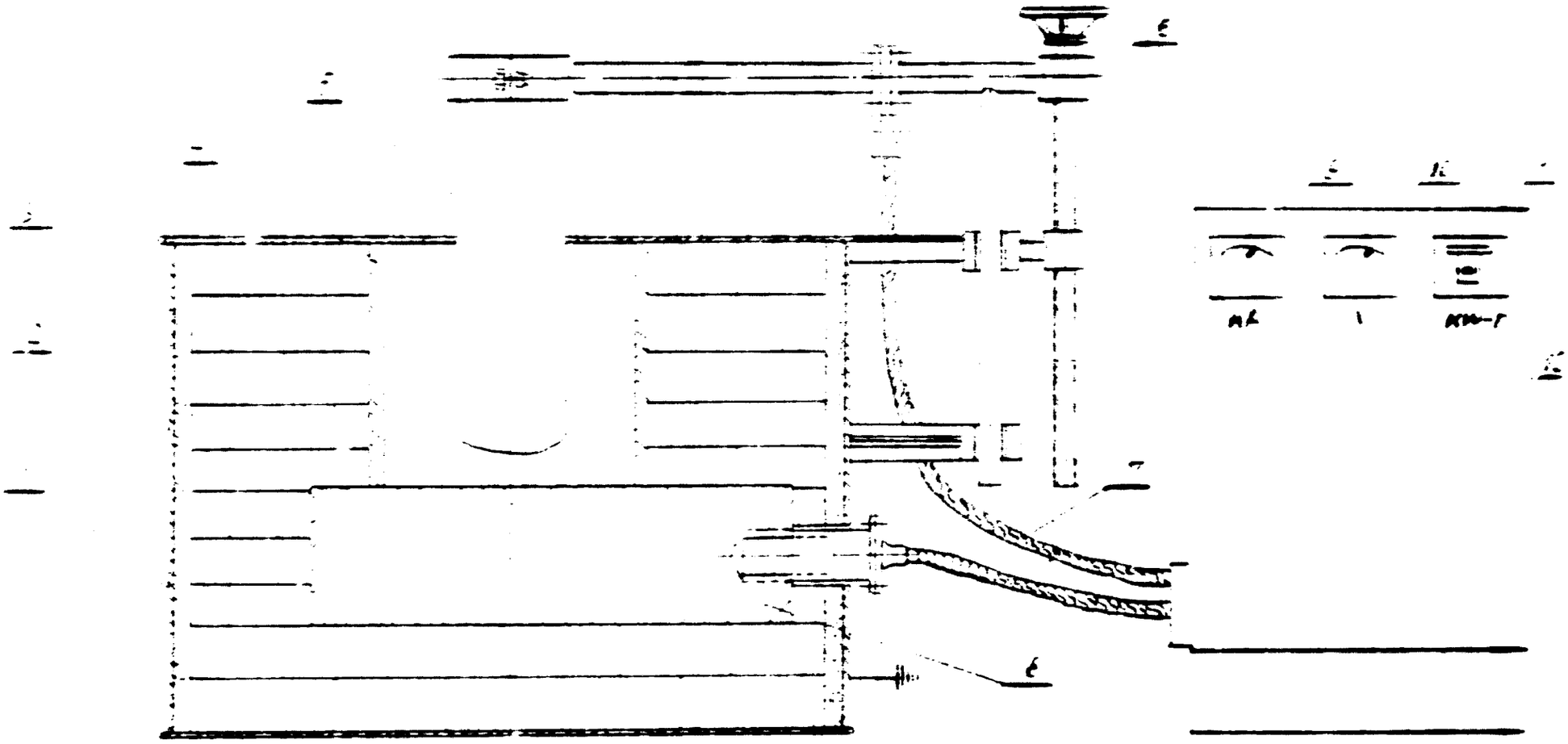
Before melting coal was crushed to a particle size of less than 1,0mm, and then in the mixture with a starting concentrate melted in a laboratory furnace.

The consumption of charcoal amounted to 0,210kg per 1 kg of the concentrate, which was 1,5 times in excess of a theoretical quantity of carbon required for a complete reduction of iron oxides to metallic iron and titanium dioxide to Ti_3O_5 (in commercial meltings of the concentrate in the closed furnaces carbon was about 1,1-1,3 times in excess.

3. The ceylonese charcoal showed the following chemical analysis, in %: 71,25 of carbon, 21,9 of volatile matter, 2,31 of ash and 4,54 of moisture. A particular feature of this reducing agent is its low ash content (2,31%) which makes it advantageous over anthracite, characterised by higher ash content (8,23%) and low quality, as far as sulfur and phosphorus contents are concerned. Thus the new tested reducing agent was advantageous by its chemical composition and reacting power over not only the proposed blast-furnace coke and petroleum coke, but also the earlier used anthracite.

4. The reducing melting process proceeded normally in stable electrical conditions. All the consumption rates of the titanium-bearing slag production process remain approximately at the same level as in the melting with anthracite (rf. the report).

5. The investigations showed, that the use of purer concentrate "Q" and coked coco-nut shell charcoal resulted in the production of higher-graded melted products, characterised by the following



20 kV laboratory arc furnace 1 - jacket. 2 - roller 3 - magnesite lining 4 - graphite electrode 5 - graphite electrode ø 80mm. 6 - tilting mechanism. 7 - lever 8 - connection cable from choke 9 - ammeter 10 - voltmeter. 11 - power consumption counter 12 - 20 kV/c transformer.

chemical analysis, in %:

- titanium-bearing slag: 41,2 TiO_2; 43,38 TiO_2; 4,64 TiO; 2,28 FeO; 0,63 $Fe_{met.}$; 0,51 SiO_2; 0,31 CaO; 1,76 MgO; 2,19 Al_2O_3; 0,49 MnO; 0,85 ZrO_2; 0,106 Cr_2O_3; 0,25 V_2O_5; 0,021 P_2O_5;

- metal : 1,45 C; 0,067 Si; 0,066 Cr; 0,057 Mn; 0,21 Ti; 0,03 Ni; 0,19 P; 0,019 S.

The slag by its chemical composition may serve as a starting raw material to be chlorinated and processed into titanium tetrachloride and metal containing about 0,20% of P and 0,020% of S may be processed into steel and ferroaluminium.

7. Thus the additional investigations showed the feasibility of obtaining a high-grade slag from concentrate Q of a new composition, although it appeared still to contain more than 0,40 alumina. Nevertherless the application of charcoal as a reducing agent obtained by coking caco-nut shells in place of anthracite prooved to be expedient.

Due to the application of a reducing agent in the melting of concentrates it makes it feasible to obtain a high-grade metal with low contents of sulphur and phosphorus. The replacement of anthracite by charcoal in the conditions of the technology being practised is not connected with any new engineering arrangements (only a roll crusher is to be mounted to crush coked charcoal to a particle size of less than 10mm).

In connection with the above-expounded it should be expedient for the Indian side either to use homemade coco-nut charcoal or buy it in Ceylon.

Director of Titanium Institute
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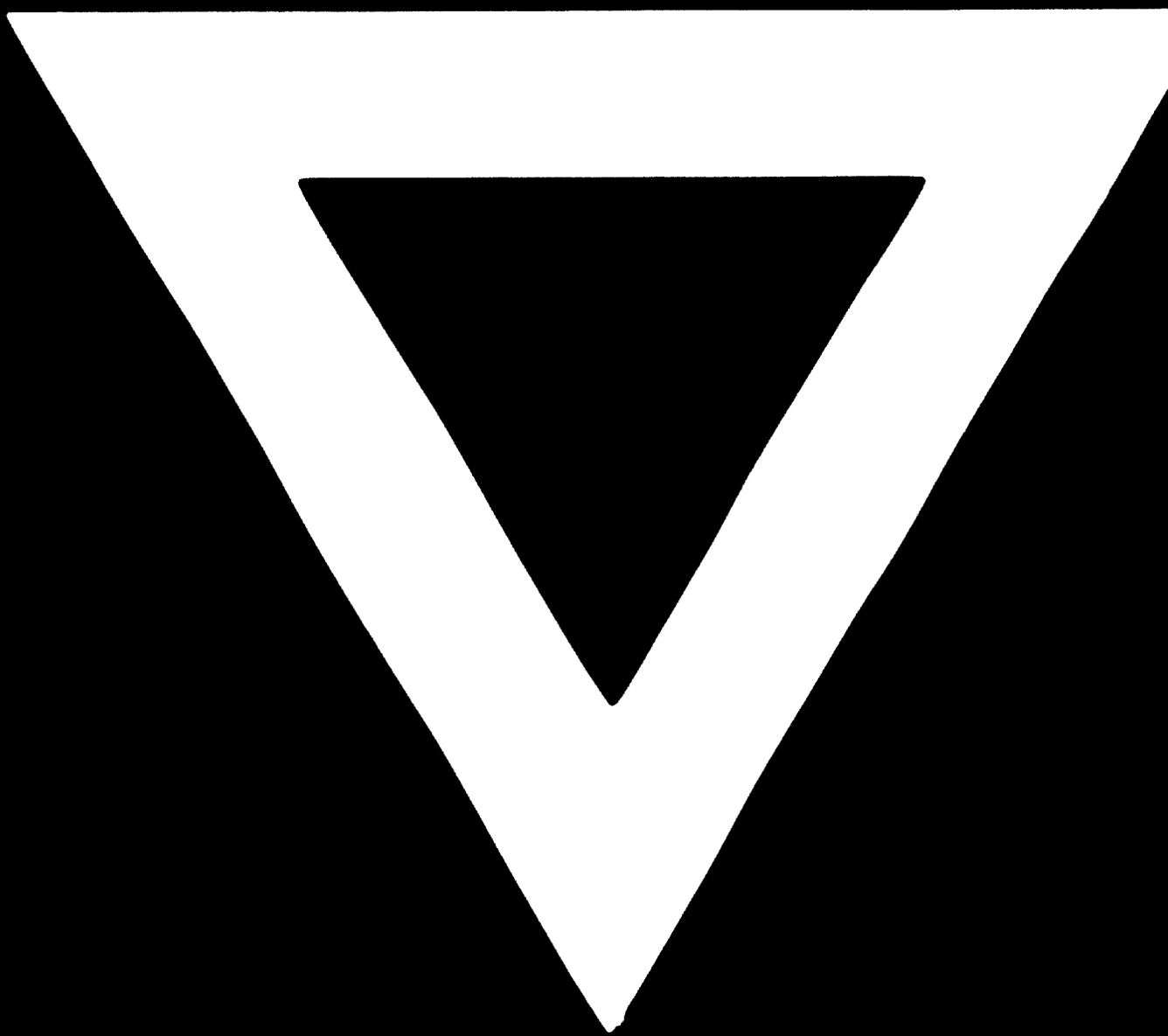

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