MAPPING THE PROFILE OF THE BURDEN WITH A LASER LIGHT
COMMONWEALTH OF AUSTRALIA
Patents Act 1952-1973
APPLICATION FOR A PATENT

XXIV We Centre du Recherches Metallurgiques-Centrum Voor Research in de Metallurgie

47, Rue Montoyer, Brussels, BELGIUM

hereby apply for a grant of a Patent for an invention entitled:

TOPOGRAPHICAL MAPPING OF THE CHARGE
"OF A SHAFT FURNACE"

which is described in the accompanying complete specification.

This Application is a Convention Application and is based on the Application(s) numbered: 897.331

for a Patent or similar protection made in Belgium

on 19 July 1983

Our address for service is care of GRIFFITH HASSEL & FRAZER,

Dated this 17th day of July 1984

CENTRE DE RECHERCHES METALLURGIQUES-CENTRUM
VOOR RESEARCH IN DE METALLURGIE

By their Patent Attorneys

GRIFFITH HASSEL & FRAZER

TO: THE COMMISSIONER OF PATENTS
COMMONWEALTH OF AUSTRALIA
AUSTRALIA

DECLARATION FOR CONVENTION PATENT APPLICATION

(Note: (1) To be signed by the applicant(s), if individual(s). If applicant is a Company, to be signed by a person on its behalf. (2) This is a comprehensive form, and parts inappropriate to a particular application should be cancelled.)

COMMONWEALTH OF AUSTRALIA

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION

FOR A PATENT OR PATENT OF ADDITION

In support of the Convention application No. (a).................................................................

made by (b) CENTRE DE RECHERCHES METALLURGIQUES-CENTRUM

VOOR RESEARCH IN DE METALLURGIE

for a patent/patent of addition for an invention entitled (c) Topographical mapping of the charge of a shaft furnace

We (d) ALFRED DECKER, Director of research and on behalf of

CENTRE DE RECHERCHES METALLURGIQUES-CENTRUM VOOR RESEARCH IN

METALLURGIE, of 47, Rue Montoyer, Brussels, Belgium

do solemnly and sincerely declare as follows:

1. I/we am/we are the applicant(s) for the patent/patent of addition
   (or, in the case of an application by a body corporate)

(a) Insert No. if available

(b) Insert full name(s) of applicant(s)

(c) Insert title of invention

(d) Insert full name(s) of declarant(s)

(e) Insert address(es) of declarant(s)

(f) Insert country in which first basic application was filed

(g) Insert date of first basic application

(h) Insert full name(s) of basic applicant(s)

(i) Insert full name(s) of actual inventor(s)

(j) Insert address(es) of actual inventor(s)

(k) National patent in which applicant(s) derive(s) title from actual inventor(s)

(l) Insert signature(s) of declarant(s)

(Note: No attestation or other signature is required)

Date of declaration: 30/7/1954

Declared at Brussels, Belgium
A method of obtaining a topographical map of the charge of a shaft furnace, comprising: (a) directing a discontinuous incident light beam towards the upper surface of the charge; (b) successively scanning different points on the said surface so as to locate the point of incidence of the incident light beam, the direction of the said incident light beam being maintained fixed at least until the moment when the said point of incidence is located; (c) determining the level of the said point of incidence by optical triangulation; (d) repeating steps (a) to (c) for a plurality of points on the said surface; and (e) calculating therefrom a topographical map of the charge.

A method as claimed in any of claims 1 to 3, in which the incident light beam is a laser beam.
TO BE COMPLETED BY APPLICANT

Name of Applicant: Centre de Recherches Metallurgiques-Centrum Voor Research in de Metallurgie

Address of Applicant: 47, Rue Montoyer, Brussels, Belgium

Actual Inventor: Roger Franssen and Robert Pirlet

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Complete Specification for the invention entitled: TOPOGRAPHICAL MAPPING OF THE CHARGE OF A SHAFT FURNACE

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

(Note: The description is to be typed in double spacing, using type face, in an area not exceeding 250 mm in depth and 160 mm in width, on tough white paper of good quality and it is to be inserted inside this form.)
Topographical mapping of
the charge of a shaft furnace.

The present invention relates to a method of obtaining a
topographical map of the charge of a shaft furnace, in
particular a blast furnace.

What is understood by topographical map in the context
of the present invention is a map of the upper surface
of the furnace charge with respect to a horizontal
reference plane.

Modern blast furnace throats, in particular those
equipped with rotary charging hoppers, provide numerous
possibilities for distributing the materials forming the
charge of the furnace. Consequently it is possible to
select from among these possibilities the one which is
most suitable in each particular case, notably as a
function of the nature of the materials to be charged or
of the type of batch to be produced.

It should, however, be possible to check the conformity
of the actual topography chart of the charge with
respect to the desired topography selected for the
reasons given above.
It is very important to be familiar with the actual topography chart of the charge, since it enables the charging programme to be adjusted such that the regularity of the functioning of the shaft furnace, in particular, can be improved and the wear of the refractory can be made uniform.

There has already been proposed, in particular in Belgian Patent no. 874,960, a method of telemetry by optical triangulation enabling the topography of the charge contained in a chamber to be determined by continuously sweeping the surface of this charge over a particular plane.

This continuous method, which is undisputedly advantageous for numerous applications, nevertheless encounters two major disadvantages when it is applied to a shaft furnace. These two disadvantages are the weak reflection of the incident light by the charge and the high absorption of the light by the atmosphere prevailing above the charge. These two effects do not allow the radiation light intensity necessary for optical triangulation to be received.

The present invention used a discontinuous or pulsed light beam to enable these two disadvantages to be overcome.
The invention provides a method in which the upper surface of the charge is locally illuminated by means of a light beam and the light beam reflected by the charge is picked up, in which a discontinuous incident light beam is directed towards the said charge surface; different points on the said surface are scanned by successive steps so as to locate the point of incidence of the said incident light beam, the direction of the said incident light beam being maintained fixed at least until the said point of incidence is located; the level of the said point of incidence is determined by optical triangulation; these operations are repeated at a plurality of points on the said surface; and there is calculated therefrom a topographical map of the said charge.

Preferably, the surface of the charge is swept along a predetermined path by means of the discontinuous light beam, different points on the said path are scanned by successive steps so as to locate the point of incidence of the said incident light beam, the direction of the said incident light beam being maintained fixed at least until the moment when the said point of incidence is located, the level of the said point of incidence is determined by optical triangulation, these operations are repeated at a plurality of points on the said path and there is calculated therefrom the topographical profile of the charge along the said path.
This procedure is advantageously applied in cases where awareness of the topographical profile along a particular path, for example a diameter or a spiral, enables the entire topography to be determined sufficiently precisely.

Of course, it would not depart from the scope of the invention if the topographical profile along a plurality of predetermined paths were determined so as to obtain an image which is more representative of the actual surface of the charge.

Preferably, a pulsed light beam is used as the incident beam and the different points on the surface are scanned by successive steps at a rate associated with the pulsation frequency of the said incident light beam, each scanning period between two successive steps corresponding in terms of time to at least one pulse of the said incident light beam.

The method of the invention is based on our observation that the degree of attenuation of a light pulse by the atmosphere prevailing above the charge depended not on the intensity, but also on the wavelength, of the light emitted.
In practice, the method can be performed by using a laser, for example, as an emitter which is directed in a direction predetermined in accordance with a reference direction. The pulse reflected by the charge is picked up by means of a receiver with a narrow field of vision which is adjustable in a step-by-step manner and by means of which a plurality of points on the known path swept by the incident laser beam is successively aimed at. When the receiver records a pulse reflected by the charge, the angular position of the incident beam and of the receiver is determined and the level of the corresponding point on the surface of the charge is determined by optical triangulation. The orientation of the emitter is subsequently modified and the above-described operations are repeated.
The claims do not teach:
1. A method of charging a discontinuous surface with a charged particle at a point of
different conductivity.
2. A method of maintaining a point of
different conductivity.
3. A method of maintaining a point of
different conductivity.
4. A method of maintaining a point of
different conductivity.
5. A method of maintaining a point of
different conductivity.
6. A method of maintaining a point of
different conductivity.
7. A method of maintaining a point of
different conductivity.
8. A method of maintaining a point of
different conductivity.
9. A method of maintaining a point of
different conductivity.
10. A method of maintaining a point of
different conductivity.

Which is different from the prior art.
The claims defining the invention are as follows:

1. A method of obtaining a topographical map of the charge of a shaft furnace, comprising: (a) directing a discontinuous incident light beam towards the upper surface of the charge; (b) successively scanning different points on the said surface so as to locate the point of incidence of the incident light beam, the direction of the said incident light beam being maintained fixed at least until the moment when the said point of incidence is located; (c) determining the level of the said point of incidence by optical triangulation; (d) repeating steps (a) to (c) for a plurality of points on the said surface; and (e) calculating therefrom a topographical map of the charge.

2. A method as claimed in claim 1, including sweeping the surface of the charge along at least one predetermined path by means of the discontinuous light beam, the topographical map calculated being the topographical profile of the charge along the said path.

3. A method as claimed in claim 1 or 2, in which the incident light beam is a pulsed light beam and the said different points on the surface are scanned at a rate which is related to the pulsation frequency of the incident light beam, each scanning period between two
successive steps corresponding in terms of time with at least one pulse of the incident light beam.

4. A method as claimed in any of claims 1 to 3, in which the incident light beam is a laser beam.

Dated this 17th day of July 1984

Centre de Recherches Métallurgiques-Centrum Voor Research in de Metallurgie
By their Patent Attorney
GRIFFITH HASSEL & FRAZER