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RAPID DETERMINATION OF THE PERCENTAGES OF LIGHT AND BLACK CONSTITUENTS OF FINELY GRAINED MIXTURES

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Mineral coal in the state of finest comminution represents a mixture of light or black, or approximately black constituents, the light constituents being the contaminations, and the black constituents being the pure coal. The greater the contents of ashes in the coal are or the more the light constituents appear, the higher are the optical white contents of the mixture.

The determination of the optical white contents of the finely comminuted coal therefore offers a simple and reliable means for quickly ascertaining the percentage of ashes and pure coal. In this case the white contents in the tint of the mixture do not at all correspond to the white contents which are calculated from the quantities by weight and the white contents of the constituents, but the brightness is determined by other circumstances too.

On the one hand, the specific gravities of the constituents influence the result. A grain of a certain weight has so much larger a surface and cross-section, the lower its specific gravity is. As the tint depends upon the superficial area of the constituents, the influence of the single constituent upon the tint of the mixture is in the inverse ratio of its specific gravity.

On the other hand, the fineness of the graining of each of the constituents influences the tint of the mixture.

As the comminution of a single constituent progresses, the sums of the surfaces and the cross-sections which determine the action upon the tint are increased. Therefore the color-determining action is in the inverse ratio of the diameter of the bodies.

Now it is true that the specific gravities of the constituents can be ascertained approximately, but not the differences in the graining, being the averages of separate values amounting to fractions of a millimeter.

Consequently the percentages by weight of the constituents can be brought into a certain relation to the white contents of the mixture only by experiment, that is to say either by mixing together the constituents or by conclusion a posteriori from the analysis of the mixture.

For mixtures of constant white or light, and black or approximately black constituents the percentage by weight (white contents and black contents of the constituents to white contents and black contents of the mixture) may be brought into a certain relation by a formula in which the single letters have the following signification:

p_1 = percentages by weight of the one constituent;

p_2 = percentages by weight of the other constituent;

w_1 = white contents of the one constituent;

w_2 = white contents of the other constituent;

w_3 = white contents of the mixture;

b_1 = black contents of the one constituent;

b_2 = black contents of the other constituent;

b_3 = black contents of the mixture;

c = coefficient for changing from weight to surface.

This formula reads:

$$\frac{p_1 \cdot w_1 + p_2 \cdot w_2 \cdot c}{p_1 \cdot b_1 + p_2 \cdot b_2 \cdot c} = \frac{w_3}{b_3}.$$

The brightness of the mixture, that is to say, the above relation

$$\frac{w_3}{b_3} = \frac{\text{white contents}}{\text{black contents}}$$

is determined, if a minor degree of exactness is required, by means of gray-scales, otherwise by the photometer which permits of a high degree of exactness.

The brightness numbers ascertained by experiments are set in order according to the percentages by weight of the light and black constituents and arranged in curves or tables. From the series of numbers obtained in this manner the percentage of the light and black constituents (in the case of coal-dust the percentages of ashes and pure coal) can be read off forthwith, after the brightness of each single sample has been measured.

I claim:

1. The method of quickly ascertaining the percentages by weight of the light and dark constituents of finely grained mixtures which consists in preparing a number of mixtures containing different percentages of light and dark constituents, measuring the brightness of the different mixtures, recording the degrees of brightness together with the respective percentages on a chart, measuring the brightness of a similar mixture of unknown contents, and reading off its percentage from the said chart.

2. The method of quickly ascertaining the percentages by weight of the light and dark constituents of finely grained mixtures which consists in preparing a number of mixtures containing different percentages of ashes and coal, measuring the brightness of the different mixtures, recording the degrees of brightness together with the respective percentages on a chart, measuring the brightness of a similar mixture of unknown contents, and reading off its percentage from the said chart.

In testimony whereof I affix my signature.

MARTIN WITTE.