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(54) METHOD OF MEASURING UNIT AREA WEIGHTS OF INDIVIDUAL LAYERS IN MATERIALS COMBINATIONS

(71) I, PERTTI PUUMALAINEN, a Finnish national, of 10 B 43 Puistokatu, Kuopio, Finland, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention concerns a procedure for measuring unit area weights (base weights) in materials combinations comprising a base material, thereupon a precoating, and upon which latter there is a surface coating or layer.

It is known in prior art to measure the unit area weight of a coating on paper by utilizing x-rays. The procedure is then: to add to the coating substance a given quantity of marker substance, in which capacity zinc oxide, for instance, has been used, and which is irradiated with primary x-rays. The x-ray radiation obtained from the specimen is composed of rays emitted when electrons return from higher to lower levels (fluorescence radiation) and of the rays originating in the scattering of the primary radiation, and which constitute the background radiation. The energy of the fluorescence radiation obtained is characteristic of the excited substance, and the intensity of the fluorescence radiation at a given characteristic energy of the substance is proportional to the amount of substance present. It has been possible by the said method to measure coating weights with 2% accuracy within less than 6 seconds when 1% zinc oxide was added to the coating colour.

The aim of the present invention is to provide a simple method for measuring, e.g. from a moving paper or cardboard web, the unit area weight of more than one layer, and in which connection no marker substance need be used in the coats, instead of which the measurement can be made directly from a specimen.

According to the invention we provide a procedure for measuring unit area weights of individual layers in materials combinations having a base material layer, thereupon a precoat layer and upon which latter there is a surfacing layer, characterised in that the materials combination is irradiated with x-rays which excite the characteristic x-ray radiation of a substance in the precoat layer, the intensity of which is measured on both sides of the plane of the materials combination, in addition to which the absorption in the materials combination of the primary radiation from the radiation source is measured, whereby from the results of measurement obtained the unit area weights of the different layers are calculated and the unit area weights in the layers are continuously controlled.

One achieves with the aid of the invention that the coating quantities are continuously controlled to be exactly as desired, while in methods of prior art coating substances have been consumed in unnecessary excess. It is thus understood that a considerable amount of coating substances is saved by virtue of the present invention.

In the following, the procedure of the invention is described by the aid of an example, wherein the unit area weights of the coats or layers upon a moving cardboard web are measured. The precoat of the cardboard was a $CaCO_3$ coat, and upon this there was kaolin as surfacing coat. In the drawing, the cardboard base material layer has been indicated with reference numeral 1, the $CaCO_3$ layer thereupon with 2, and the topmost kaolin layer with 3. The combination is irradiated with radiation from a ^{55}Fe radioisotope source 4, the x-rays emitted by this source exciting the characteristic secondary x-ray radiation of the calcium present in layer 2, and the intensity of which is measured by means of detectors 6

and 7 on both sides of the materials combination. The detector 5 is furthermore used to measure the absorption of the primary radiation from the ^{55}Fe source in the cardboard-coating combination. From the results of measurement obtained, which are mathematically dependent on the unit area weights of each coat, the unit area weights of both coating layers ($CaCO_3$ and kaolin) and of the cardboard are found by the principle of solving three equations for three unknowns. If the detectors 5, 6 and 7 are directly connected to a computer, the procedure may be applied on-line in a paper or cardboard coating machine. It is then possible to achieve a measuring accuracy of $\pm$ 0.5 g/m^2 with a measuring interval of 10-20 sec.

WHAT I CLAIM IS:—

1. Procedure for measuring unit area weights of individual layers in materials combinations having a base material layer, thereupon a precoat layer and upon which latter there is a surfacing layer, characterised in that the materials combination is irradiated with x-rays which excite the characteristic x-ray radiation of a substance in the precoat layer, the intensity of which is measured on both sides of the plane of the materials combination, in addition to which the absorption in the materials combination of the primary radiation from the radiation source is measured, whereby from the results of measurement obtained the unit area weights of the different layers are calculated and the unit area weights in the layers are continuously controlled.

2. Procedure according to claim 1, characterised in that the materials combination is cardboard or paper overlayed with a $CaCO_3$ precoat and upon this latter as surface coating layer, kaolin.

3. A procedure as claimed in Claim 1, substantially as hereinbefore described.

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