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⑤④ **Mill for dispersing a pigment in a carrier fluid.**

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Description

The present invention relates to a mill of the type comprising a cylindrical casing having a predetermined internal radius and a rotor rotatably mounted within the said casing for dispersing a pigment in a carrier fluid, by means of a grinding medium, for example microspheres, contained in the said casing.

A necessity which arises in the paint industry is to disperse pigment in a carrier fluid, causing the breaking down and crushing of the pigment into its elementary particles, and in such a way that the carrier fluid is interposed between individual particles, completely wetting their external surfaces.

To meet this known requirement so-called sand or microsphere mills of the type described above are known and widely used, in which the dispersion is effected by imparting a velocity gradient to the mixture, thereby subjecting it to a localised shearing action.

The grinding medium, sand, microspheres or the like, contained in the mill, renders the dispersion more rapid, favouring the breaking down and crushing of the pigment.

An example of a mill of the type specified is that in which a plurality of rings supported from the rotor by spokes, serve to cause the desired dispersion of the pigment in the carrier fluid. Although this is advantageous from various points of view and serves the intended purpose, mills of this type require a high driving power the rotor. This is normally provided by an electric motor of approximately 40 horsepower. Furthermore, it is necessary for the pigment-carrier fluid mixture to spend a prolonged period inside the mill in order to obtain the desired degree of dispersion of the first in the second.

To disperse the pigment in the carrier fluid mills are also known in which the casing has a square instead of a circular cross section: this makes it possible to achieve, for a given rotor speed, an improved shearing effect. Although this evidently increases the quantity of mixture in the mill, part of this remains in a virtually stagnant zone in the corners of the casing, with a corresponding increase in the quantity of grinding medium which must be provided in the casing. Furthermore the power requirement remains high.

There are also known and used mills of the type known commercially under the name Netzsch, in which the rotor and the casing are provided with respective pluralities of rods. Such mills, which are known to subject the mixture to a good shearing effect, and do not retain internally a large quantity of mixture and of grinding medium, still require a high driving power, and further have a highly complicated construction, with the well known inconveniences which inevitably follow from this.

US—A—3,448,931 discloses a process for grinding solids, in particular an aqueous slurry of unmilled titanium dioxide particles by means of a great quantity of grinding medium in respect of

the mill capacity (2200 lb and 3400 lb (1000—1543 Kg) of Ottawa sand in respect of about 250 l and 1600 l of capacity of the mill respectively in example 1 and 2) and recovering them by filtration or by use of a centrifuge. This process is a preliminary phase putting at disposal a pigment, which have to be dispersed, in a subsequent phase, in a carrier fluid.

The problem which is at the root of the present invention is that of devising a mill of the type specified, which satisfies the said requirements while at the same time overcoming the cited disadvantages of the mills of the prior art.

This problem is resolved by a mill of the type specified which is characterised in that the rotor is provided with a plurality of coaxial discs, of external radius R_2 and thickness s , spaced part along the length of the rotor at a mutual spacing d between two and three times the thickness s , the difference between the internal radius R_1 of the casing and the external radius R_2 of the discs being substantially equal to the thickness s of the said discs. To advantage the apparent volume of the grinding medium in the said casing, that is, the volume including the free space between the microspheres or the like, is a predetermined proportion, between 30% and 40%, of the capacity of the mill.

Further characteristics and advantages of the mill according to the present invention will be apparent from the description which follows referring to a preferred embodiment, given by way of non-limiting example, with reference to the appended single figure, which shows an elevation view in partial section of a mill according to the invention.

With reference to the appended drawing, reference numeral 1 indicates generally a mill according to the invention.

The mill 1 comprises a cylindrical casing 2, having its axis X—X disposed vertically with an internal radius R_1 and provided with opposite end walls 3 and 4. In particular the lower end wall 3 is fixed to the casing 2 by means of dogs 5 and screws 6. The upper end wall 4 is fixed to the casing 2 by means of four spaced apart columns, all indicated by reference numeral 7. There is thus defined between the casing 2 and the end wall 4 an annular aperture 8 interrupted by the said columns 7.

In correspondence with the aperture 8 the mill 1 is provided with a wire gauze 9 extending between the casing 2 and the end wall 4, inside the columns 7. Around the aperture 8 the mill 1 is provided with an annular collection gutter 10 fixed to the casing 2.

The lower end wall 3 of the mill 1 is provided with an inlet port 11, connected to a pipe 12 through a connector 13. A mixture of pigment and carrier fluid is introduced continually into the casing 2 in the direction of arrow F, through the pipe 12 and the port 11.

Reference numeral 14 indicates a non-return valve mounted in the inlet port 11 for permitting flow of the mixture in the direction of the arrow F

and for preventing flow in the opposite direction. The valve 14 is in itself entirely conventional and is therefore represented schematically and will not be described in detail.

The casing 2 is formed by two tubular coaxial elements 15, 16 between which an interspace 17 is defined. A helical element 18 is inserted in the interspace 17 and defines therein a helical path 19 extending throughout the length of the casing 2 between two end apertures 20 and 21 formed in the outer tubular element 16, and provided with respective connectors 22 and 23. A coolant fluid, for example water, is made to flow through the helical path 19.

The casing 2 defines a cylindrical chamber 24 the axis X—X of which extends between the opposite end walls 3 and 4, and the volume of which will be referred to in the description which follows as the capacity of the mill 1.

Within the casing 2 there is rotatably mounted a rotor 25, the axis X—X of which extends longitudinally in the chamber 24. The rotor 25 has a lower end 26 spaced a short distance from the lower end wall 3, and an opposite, upper end rotatably supported in the upper end wall 4 by rolling bearings which are entirely conventional and which are not therefore shown.

Reference numeral 28 indicates a shaft coaxial with the rotor, fixed to the latter, and projecting from the end wall 4. The shaft 28 is adapted to be connected, in a known manner, to drive means, not shown, for rotating the rotor 25 at an angular speed between 1000 and 2000 revolutions per minute, and preferably at 1450 revolutions per minute.

The rotor 25 is provided with a plurality of coaxial discs, each indicated 29, there being sixteen in the example described. The discs 29, are all identical, have an outer radius R_2 and a thickness s and are spaced apart at regular intervals along the rotor 25. In particular the spacing d between neighbouring discs 29 is chosen to be between two and three times the thickness s while the radius R_2 is so chosen that the difference between R_1 and R_2 is approximately the same as the thickness s .

In the example illustrated $R_1=80$ mm, $s=8$ mm, $R_2=72$ mm and $d=24$ mm.

To advantage the rotor 25 comprises a central shaft 30 on which the discs 29 are keyed, the latter being maintained at the desired inter-disc spacing d by spacer sleeves indicated 31, having an outer radius approximately half the radius R_2 of the discs 29.

In the example illustrated the spacer sleeves 31 have a radius of 30 mm.

The casing 25 contains a grinding medium, generally indicated by reference numeral 32, comprising microspheres or sand or the like. The quantity of the grinding medium, in terms of apparent volume, is chosen to be between 30% and 40% of the capacity of the mill 1.

A coarsely formed mixture of a pigment and of a carrier fluid in suitable mutual proportions is fed continually at a predetermined rate to the inlet

port 11. This rate is to advantage chosen so that the interior of the mill contains a volumetric quantity of the said mixture substantially equal to the volume of the grinding medium 32.

Under these conditions, as a result of the previously mentioned angular speed of the rotor 25, the grinding medium 32 and the said mixture become intermixed and distributed within the chamber 24 along the internal walls of the casing 2, forming internally a surface of revolution indicated 33 and having a shape corresponding to a parabolic section. As fresh mixture is fed through the port 11 the mixture which is in the casing 2 is displaced upwardly in the casing, and is subjected to the desired action of dispersion of the pigment in the carrier fluid, until it reaches the aperture 8. The wire gauze 9 retains the grinding medium 32, while allowing the mixture to flow through it into the gutter 10 where it collects.

From tests carried out the resulting paraboloid has its vertex at a point on the axis X—X at a considerable distance from the lower end wall 3, approximately 9—10 metres and the combination of the grinding medium and the mixture contained in the casing 2 therefore has a thickness which is for practical purposes equal throughout the length of the casing 2.

In particular, this thickness, measured at the upper and lower ends of the casing 2, is indicated in the drawing by A and B respectively and has the values $A=14$ mm and $B=16$ mm.

The mill according to the invention has an effective shearing action on the pigment-carrier fluid mixture, causing a rapid dispersion of the first in the second, due to the fact that the combination of the grinding medium and the mixture is entirely localised at the periphery of the rotor, where the peripheral speed is highest.

Furthermore the mill according to the invention absorbs a significantly lower power compared with mills of the prior art, for a given product load. For driving the rotor it is sufficient to use an electric motor of 10 horsepower, for a productivity of the mill comparable to that of the mills mentioned in the preamble.

Furthermore the mill according to the invention has, for a given product load, significantly smaller dimensions, with evident advantages as regards costs, both initial costs and maintenance costs. The running costs are also reduced, as will be apparent when one considers that a much smaller quantity of product is lost in each production run.

Obviously numerous modifications and variants may be made in the mill described above to meet specific requirements, all of which are within the scope of protection of the present invention as defined in the following claims.

Claims

1. Method of dispersing a pigment in a carrier fluid utilising a mill of the type comprising a cylindrical casing (2) having a predetermined internal radius " R_1 " and a rotor (25) rotatably mounted within the said casing for dispersing the

pigment in the carrier fluid by means of a grinding medium (32), for example microspheres or the like, contained in the said casing (2), the rotor (25) being provided with a plurality of coaxial discs (29) of external radius " R_2 " and thickness " s " spaced apart along the length of the rotor (25) at a mutual spacing " d " between two and three times the thickness " s ", the difference between the internal radius " R_1 " of the casing (2) and the external radius " R_2 " of the discs (29) being substantially equal to the said thickness " s " of the discs (29), characterised in that the apparent volume of the grinding medium (32) in the said casing (2), that is the volume including the free space, is between 30% and 40% of the capacity of the mill, in that a mixture of pigment and of carrier fluid is fed continually to the mill to maintain in the latter a volumetric quantity of said mixture substantially equal to the volume of the grinding medium (32), and in that the rotor (25) is driven at a predetermined angular speed, in order to have the grinding medium (32) and said mixture distributed in the casing (2) to form internally a surface of revolution (33) having a shape corresponding to a parabolic section.

2. A mill of the type comprising a cylindrical casing (2) having a predetermined internal radius " R_1 " and a rotor (25) rotatably mounted within the said casing (2) for dispersing a pigment in a carrier fluid, by means of a grinding medium (32), for example microspheres sand or the like, contained in said casing (2), the rotor (25) being provided with a plurality of coaxial discs (29), of external radius " R_2 " and thickness " s ", spaced apart along the length of the rotor (25) at a mutual spacing " d " between two and three times the said thickness " s ", the difference between the internal radius " R_1 " of the casing (2) and the external radius " R_2 " of the discs (29) being substantially equal to the said thickness " s " of the discs (29), characterised in that the apparent volume of the grinding medium (32) in the said casing (2), that is the volume including the free space, is a predetermined proportion, between 30% and 40%, of the capacity of the mill.

Patentansprüche

1. Verfahren zum Dispergieren eines Pigments in einem Trägerfluid unter Anwendung einer Mühle des Typs, umfassend ein zylindrisches Gehäuse (2) mit einem vorbestimmten Innenradius " R_1 " und einen Rotor (25), der rotierbar innerhalb des Gehäuses befestigt ist zur Dispergierung des Pigments in dem Trägerfluid mittels einem in dem Gehäuse (2) enthaltenen Mahlmedium (32), beispielsweise Mikrokügelchen oder dergleichen, wobei der Rotor (25) mit einer Vielzahl coaxialer Scheiben (29) mit Außenradius " R_2 " und Dicke " s " ausgestattet ist, die entlang der Länge des Rotors (25) mit einem gegenseitigen Abstand " d ", der zwischen dem zwei- und dreifachen der Dicke " s " liegt, getrennt voneinander verteilt sind, wobei die Differenz zwischen dem Innenradius " R_1 " des Gehäuses (2) und dem

Außenradius " R_2 " der Scheiben (29) im wesentlichen gleich der Dicke " s " der Scheiben (29) ist, dadurch gekennzeichnet, daß das Scheinvolumen des Mahlmediums (32) in dem Gehäuse (2), d.h. das den freien Raum beinhaltende Volumen, zwischen 30% und 40% der Kapazität der Mühle beträgt, daß eine Mischung aus Pigment und Trägerfluid kontinuierlich der Mühle zugeführt wird, um in letzterer eine volumetrische Menge der Mischung beizubehalten, die im wesentlichen gleich dem Volumen des Mahlmediums (32) ist, und daß der Rotor (25) mit einer vorbestimmten Winkelgeschwindigkeit angetrieben wird, so daß das Mahlmedium (32) und die Mischung in dem Gehäuse (2) derart verteilt werden, daß im Inneren eine Rotationsfläche (33) einer Form entsprechend einem Parabschnitt gebildet wird.

2. Mühle des Typs, umfassend ein zylindrisches Gehäuse (2) mit einem vorbestimmten Innenradius " R_1 " und einen Rotor (25), der rotierbar innerhalb des Gehäuses (2) befestigt ist zur Dispergierung eines Pigments in einem Trägerfluid mittels einem in dem Gehäuse (2) enthaltenen Mahlmedium (32), beispielsweise Mikrokügelchen, Sand oder dergleichen, wobei der Rotor (25) mit einer Vielzahl coaxialer Scheiben (29) mit Außenradius " R_2 " und Dicke " s " ausgestattet ist, die entlang der Länge des Rotors (25) mit einem gegenseitigen Abstand " d ", der zwischen dem zwei- und dreifachen der Dicke " s " liegt, getrennt voneinander verteilt sind, wobei die Differenz zwischen dem Innenradius " R_1 " des Gehäuses (2) und dem Außenradius " R_2 " der Scheiben (29) im wesentlichen gleich der Dicke " s " der Scheiben (29) ist, dadurch gekennzeichnet, daß das Scheinvolumen des Mahlmediums (32) in dem Gehäuse (2), d.h. das den freien Raum beinhaltende Volumen, einen vorbestimmten Anteil, zwischen 30% und 40%, der Kapazität der Mühle beträgt.

Revendications

1. Procédé pour disperser un pigment dans un fluide porteur, utilisant un moulin du type qui comprend un boîtier cylindrique (2) ayant un rayon interne prédéterminé " R_1 " et un rotor (25) monté rotativement dans ce boîtier pour disperser le pigment dans le fluide porteur au moyen d'un organe de broyage (32), par exemple des microsphères ou similaires, contenues dans le boîtier (2), le rotor (25) étant muni d'une pluralité de disques coaxiaux (29) de rayon externe " R_2 " et d'épaisseur " s " espacés sur la longueur du rotor (25) suivant un intervalle mutuel " d " de deux à trois fois l'épaisseur " s ", la différence entre le rayon interne " R_1 " du boîtier (2) et le rayon externe " R_2 " des disques (29) étant sensiblement égale à ladite épaisseur " s " des disques (29), caractérisé en ce que le volume apparent de l'organe de broyage (32) dans le boîtier (2), c'est-à-dire le volume comprenant l'espace libre, est de 30 à 40% de la capacité du moulin, en ce qu'un mélange de pigment et de fluide porteur est fourni continuellement au moulin pour maintenir

dans ce dernier une quantité volumétrique dudit mélange sensiblement égale au volume de l'organe de broyage (32), et en ce que le rotor (25) est entraîné à une vitesse angulaire prédéterminée, de façon que l'organe de broyage (32) et ledit mélange soient distribués dans le boîtier (2) pour former à l'intérieur une surface de révolution (33) ayant un profil correspondant à une section parabolique.

2. Moulin du type comprenant un boîtier cylindrique (2) ayant un rayon interne prédéterminé " R_1 " et un rotor (25) monté rotativement dans le boîtier (2) pour disperser un pigment dans un fluide porteur, au moyen d'un organe de broyage (32), par exemple du sable en microsphères ou

similaire, contenu dans le boîtier (2), le rotor (25) étant muni d'une pluralité de disques coaxiaux (29), de rayon externe " R_2 " et d'épaisseur " s ", espacés le long du rotor (25) suivant un intervalle mutuel " d " de deux à trois fois ladite épaisseur " s ", la différence entre le rayon interne " R_1 " du boîtier (2) et le rayon externe " R_2 " des disques (29) étant sensiblement égale à ladite épaisseur " s " des disques (29), caractérisé en ce que le volume apparent de l'organe de broyage (32) dans ledit boîtier (2), c'est-à-dire le volume comprenant l'espace libre, est une proportion prédéterminée, entre 30 et 40%, de la capacité du moulin.

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