Aug. 18, 1931. J. KÜPPERS 1,819,102

APPARATUS FOR DRYING

Filed May 31, 1930

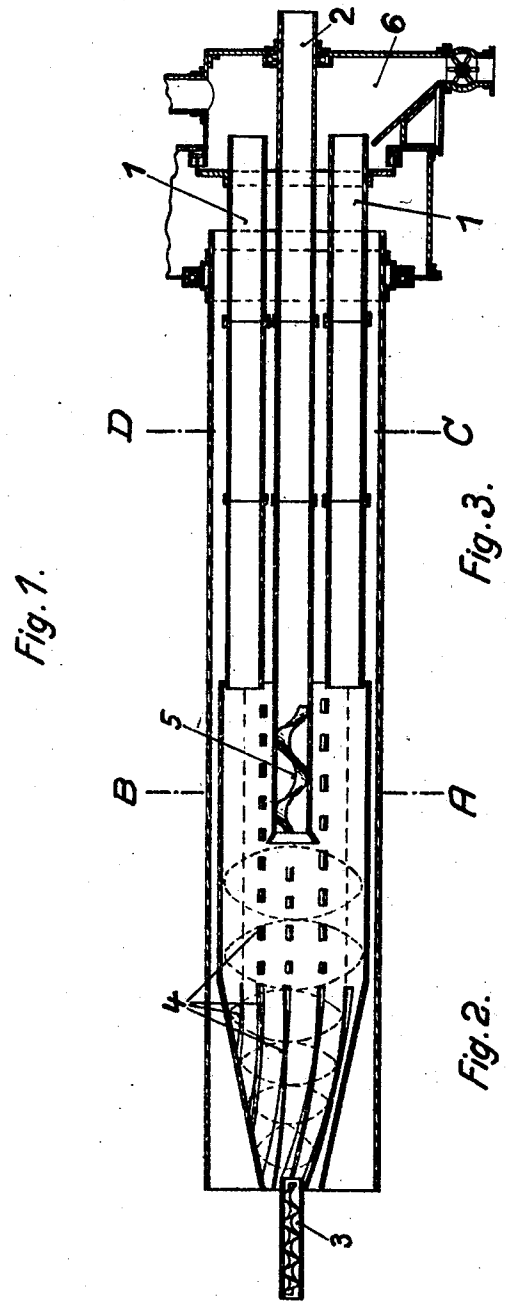


Fig. 1.

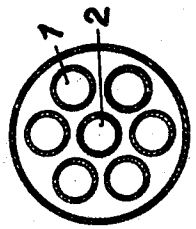


Fig. 3.

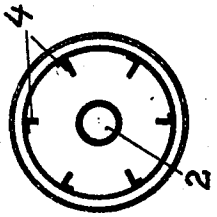


Fig. 2.

Inventor:
J. Küppers
by: Marks & Clerk
Attys.

Patented Aug. 18, 1931

1,819,102

UNITED STATES PATENT OFFICE

JOHANN KÜPPERS, OF HOMBERG, NIEDERRHEIN, GERMANY, ASSIGNOR TO THE FIRM SACHTLEBEN AKTIENGESELLSCHAFT FUR BERGBAU UND CHEMISCHE INDUSTRIE, OF HOMBERG, NIEDERRHEIN, GERMANY, A CORPORATION OF GERMANY

APPARATUS FOR DRYING

Application filed May 31, 1930, Serial No. 458,550, and in Germany December 6, 1929.

The present invention relates to a process and apparatus for the drying of various substances, particularly those that undergo decomposition or oxidation at high temperatures. The new process, and the apparatus required for carrying it out, are particularly suitable for the drying of lithopone. In drying lithopone the disadvantage arises that the partially dried product is very liable to decompose or oxidize at a rather high temperature, so that it is necessary to work at a comparatively low temperature. On the other hand the wet pigment, in consequence of its water content, may be exposed to high temperatures without any risk of its quality deteriorating.

According to the invention the drying of these substances is effected in drying drums, the material under treatment being simultaneously heated indirectly in a direct current from outside and directly by gases led over the material in counter-current. The direct drying is effected in stages, by supplying to the moist parts of the material more highly heated drying air or drying gases than to the drier parts.

According to a further feature of the invention the hot air led through the central tube may be constrained to traverse a considerably longer path through the material to be dried than hitherto, not in straight lines but with a helical or revolving motion.

For carrying out this process, apparatus has been found advantageous of which one constructional form is illustrated in the accompanying drawings, which show the essential features of this invention.

Figure 1 shows the drying drum in longitudinal section,

Figure 2 a cross section on the line A—B in Fig. 1, and

Figure 3 a cross section on the line C—D in Fig. 1.

The drying drum consists of a tube, which is rotated about its longitudinal axis. In order to obviate the phenomena of the so-called trickling of the partially dried material, and of the extensive formation of dust, which occur with the apparatus hitherto known, a portion of the tube is divided into separate tubes 1 and 2, through which the material to be dried passes, and in counter-current thereto the drying gas. The front portion of the tube is conical in shape, in order that the dust carried along by the drying gases may be deposited upon the moist material introduced. This front portion is not divided into separate tubes but forms a large chamber which has on the walls spirals 4, by which the material is fed to the tubes of the rear portion during the rotation of the furnace. In order to facilitate the movement, the tube has a slight inclination in a rearward direction.

The tubes 1 of the rear portion serve for the passage of the cooler drying gases, while the tube 2 located in the centre of the cross section projects into the front chamber and serves for the conveyance of the warmer gases. Of course no material should be carried in this tube, since otherwise this would come into contact with highly heated gas even in a dry condition, which is just what is to be avoided according to the invention.

Into the central tube 2 there may be fitted a worm thread 5. By this means, intimate contact of the drum wall and of the moist material with the hot air is obtained. The path which the hot air has to traverse is multiplied in length, in consequence of the eddies produced, and the drying action is thereby increased. The hot air leaving the tube 2 is well mixed with that originating from the tube 1. The dry lithopone particles carried along with the dry air undergo a centrifugal movement and are thereby deposited upon the still wet lithopone.

The material to be dried is introduced into the conical portion of the drying drum by known devices, for instance a worm conveyor

3, and travels slowly forwards in consequence of the slight inclination of the drum, assisted by the wall spirals and by the influence of the rotation. It comes into contact, still in a rather moist condition, with the gases passing through the tube 2, which are at a temperature of about 600° C. for example, and gives up to them a portion of its water vapour. The gases serving for the further drying of the material, which pass through the tubes 1, have a considerably lower temperature, for instance from 100 to 150° C.

The dried material drops into a chamber which is shut off from the atmosphere by means of known devices.

The direct drying gases drawn off may be freed from the dust of the dried material which they have carried with them by washing.

As compared with the usual method of drying, drying in stages presents the great advantage of enabling the temperatures to be so regulated according to the moisture content of the material that no deterioration of quality occurs. This method of drying by stages with direct current, combined with simultaneous direct and indirect drying, is entirely different from the ordinary method of drying with direct current, in which the substances with the highest percentage of water are brought into contact with the hottest gases, for it is clear that in the case of the latter process the whole of the water vapour taken up by the gases from the material has to be carried over the material that has already been dried, thereby giving rise to decomposition phenomena.

What I claim is:—

1. Apparatus for drying moist deposits, comprising an external casing rotatable about its longitudinal axis, a chamber for moist material in one end of the external casing, the part of the said chamber nearest to the end of the external casing being conical in shape, means for admitting material to be dried into the conical end of the chamber, a plurality of tubes for the conveyance of material to be dried extending rearwards through the external casing from the rear end of the chamber, means for introducing moderately heated drying gases into the said tubes at the rear end, and a longer tube extending rearwards from the interior of the chamber for the admission of highly heated gases to the chamber.

2. Apparatus for drying moist deposits, comprising an external casing rotatable about its longitudinal axis, a chamber for moist material in one end of the external casing, the part of the said chamber nearest to the end of the external casing being conical in shape, means for admitting material to be dried into the conical end of the chamber, a plurality of tubes for the conveyance of material to be dried extending rearwards through the external casing from the rear end of the chamber, means for introducing moderately heated drying gases into the said tubes at the rear end, a longer tube extending rearwards from the interior of the chamber for the admission of highly heated gases to the chamber, and a worm thread fitted into the longer tube and adapted to impart a rotary movement to the gases flowing through it.

In testimony whereof I affix my signature.

JOHANN KÜPPERS.