Tow Opening Machine

By Shigeru Watanabe*

1. Introduction

It is sometimes preferable to open the tow of chemical fibers uniformly flat and horizontally before processing. This is sometimes done when the tow is opened in a ribbon lap shape on the Perlohrke or Pacific converter. This article deals with two types of tow-opening machines designed by the author.

2. Opening by vibration

a. Construction

About 200,000～300,000 den. tow is fed at a speed of 5～10m./min. through the horizontal slit which is vibrated vertically so that it will open in a width of 20 cm. In Fig. 1, showing a general view of the device, the tow is pulled in with a pair of rollers in the back, passes through the slit, and goes out from the front rollers.

b. Measuring method

The opened tow, 20 cm wide, is divided into 1 cm. sections, into which light is let. The brilliance of the light is measured with a photo-cell. The brilliance of the light has a linear relation to denier per cm. By means of this relation we can calculate the density of fiber and its standard deviation and ultimate figure out numerically whether the tow has opened uniformly.

c. Experimental results

Fig. 2 Characteristic curves of tow opening.

The abscissa in Fig. 2 shows the slit amplitude, cm, the ordinate does its frequency, cycle/min. Of the three curves, the central one gives the best condition for opening. Above the upper curve the tow vibrates laterally, resulting in a twisted or tangled tow. Below the lower curve the tow cannot be opened fully.

3. Opening by air jet

a. Construction

In this device the tow is opened by air jet coming out through the slit as shown in Fig. 3.

The slit is carefully made and a special device is attached to the jet box on which the slit is fixed, because the air jet must be in perfect parallel flows.

b. Experimental results

Using the same method as in b under 2, the tow is measured and the results are shown in Table 1. Fig. 4 are examples of the opened tow.

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Fig 4 Typical examples of low opening.

$\sigma$: Standard deviation
$p$: Static pressure in the box (water column)
$a$: Slit clearance
C3C1, C3C2, C3C3: Same parts of low
D3a1, D3a3

$\sigma = 21.1\% \quad p = 600\text{ mm } H_2O \quad a = 1\text{ mm.}$

$\sigma = 19.3\% \quad p = 600\text{ mm } H_2O \quad a = 1\text{ mm.}$

$\sigma = 21.1\% \quad p = 600\text{ mm } H_2O \quad a = 1\text{ mm.}$

$\sigma = 28.0\% \quad p = 200\text{ mm } H_2O \quad a = 2\text{ mm.}$

$\sigma = 19.9\% \quad p = 200\text{ mm } H_2O \quad a = 2\text{ mm.}$

$\sigma = 55.8\% \quad p = 200\text{ mm } H_2O \quad a = 1\text{ mm.}$

$\sigma = 27.3\% \quad p = 600\text{ mm } H_2O \quad a = 1\text{ mm.}$

$p = 200\text{ mm } H_2O$ (thrice) passed through the air jet three times
Table 1 Numerical data

<table>
<thead>
<tr>
<th>Stat. press in jet box (Water column mm.)</th>
<th>Passed through the air jet</th>
<th>Once</th>
<th>Twice</th>
<th>Thrice</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Slit clearance (mm.)</td>
<td>Width (cm.)</td>
<td>Width (cm.)</td>
<td>Width (cm.)</td>
</tr>
<tr>
<td></td>
<td>Standard deviation ((%))</td>
<td>(\sigma (%))</td>
<td>(\sigma (%))</td>
<td>(\sigma (%))</td>
</tr>
<tr>
<td>200</td>
<td>1</td>
<td>38.6</td>
<td>9</td>
<td>44.8</td>
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<tr>
<td></td>
<td>2</td>
<td>18.2</td>
<td>8</td>
<td>28.0</td>
</tr>
<tr>
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<td>2</td>
<td>17.5</td>
<td>9</td>
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<tr>
<td></td>
<td>1</td>
<td>36.3</td>
<td>9</td>
<td>40.5</td>
</tr>
<tr>
<td>600</td>
<td>1</td>
<td>27.4</td>
<td>9</td>
<td>30.2</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>25.8</td>
<td>9</td>
<td>17.7</td>
</tr>
</tbody>
</table>

Simple Method of Measuring the Moisture Content in Fibrous Materials

By Megumi Suzuki

1. Introduction

It is important for all industries to measure the moisture content of fibrous materials for the sake of accuracy of tests of fundamental experiments, manufacturing processes and finished goods.

The traditional moisture-measuring apparatus utilizes heat convection conduction by the use of heaters. For several years now, however, ultrared ray has been widely used in the U.S.A. and also in Japan for the measuring of moisture content. Use of ultrared ray is based on the principle of radiation. Radiation has the highest efficiency when heat moves during drying by heating. Another feature of radiation is that it enables rapid heating.

Apparatus for moisture-measuring by the use of ultrared ray has been perfected by Cenco and also by Townson and Mercer, Ltd. A manufacturer in Japan has perfected a type of apparatus called "Quick Moisture-Measuring Apparatus," which combines a balance for analytical purposes and optical magnifying apparatus. But this apparatus requires a fairly long time for measuring.

The author has devised what he calls a "simple method" of measuring moisture by the use of the traditional equipment. The simple method makes the length of time taken for measuring immaterial: the result of measuring is the same whether it takes one or two minutes or one or two seconds.

The simple method also does away with such problems as the instability of the measuring instrument and lack of uniformity of the thickness of the material tested—problems which are met with when measuring continuous moisture of the resistance type or high-frequency type.

2. Principle

See Fig. 1.

\[ A = \text{weight of the material at first time.} \]
\[ B = \text{weight of the material at time 1.} \]
\[ C = \text{weight of the material at time 2.} \]
\[ a = \text{weight of moisture.} \]
\[ b = \text{weight of fibrous part.} \]
\[ \alpha = \text{the drying coefficient.} \]
\[ a + b = A \]
\[ \alpha e^{-\alpha t} + b = B \]