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Development of On-line Wall Thickness Gage for Seamless Steel Tubes

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Synopsis :
Through the joint efforts of Kawasaki Steel Corporation and Fuji Electric Co., Ltd., an on-line wall thickness gage was successfully developed for the first time in the world, and introduced into the medium diameter seamless tube mill of Kawasaki Steel's Chita Works. The gage is of the multi-beam type utilizing γ rays, with its epoch-making feature for measuring the wall thickness of pipe to an accuracy of 0.1mm and a response speed of 0.1 sec. with no physical touch to the pipe and by continuously scanning multiple points on the circumference of the pipe over its entire length while it is still hot. With the introduction of this equipment, the rolling line has been automated to a great extent, and the instant feed back of measured values to the mill by the process computer has resulted in marked improvements in quality and yield.

The body can be viewed from the next page.

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Development of On-line Wall Thickness Gage for Seamless Steel Tubes*

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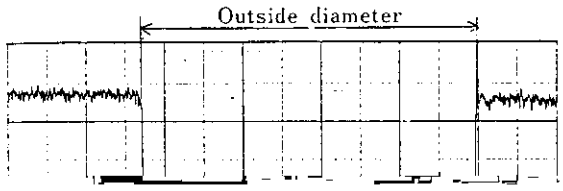
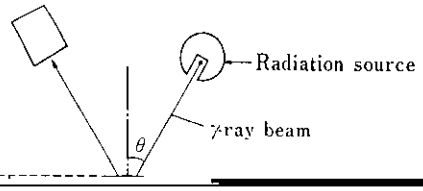
[redacted] seamless tube mill of Kawasaki Steel's Chita

Table 1 Specification of main equipments

Table 2 Process of development

Item	1978	1979	1980	1981
2. Development of scanning method (1st step)	Basic study 3	Simulation 7	12	


Outside diameter


Radiation source
γ-ray beam
θ

methods for suppressing or compensating pipe fluctuation, the authors have finally decided to con-

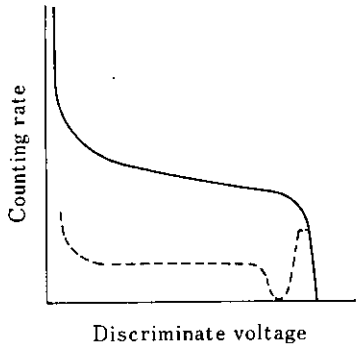
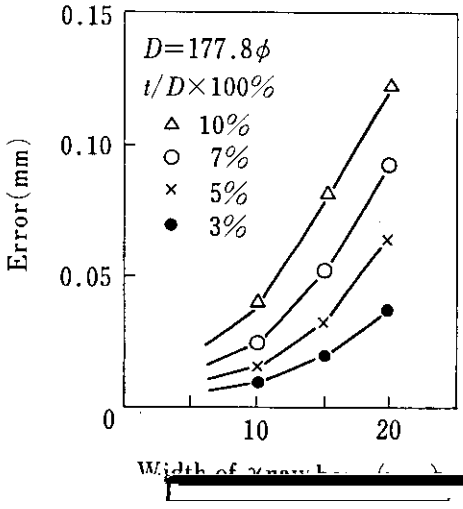


Fig. 6 Characteristics of discriminate voltage and counting rate



number of miscountings of the detector itself due to scattering can be minimized. The solid line in **Fig. 6** shows the counting rate characteristics of the detector, and if this characteristics curve is integrated by the discriminate voltage, the dotted line curve is obtained. Portion "a" of this dotted line curve shows a portion affected by Compton scattering, and portion "b" is the portion due to γ-ray energy.

4.3 γ-ray Beam Width and Measuring Accuracy

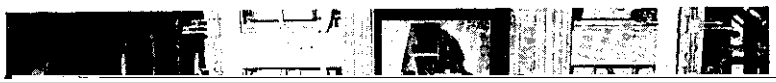
As mentioned in the preceding section, γ rays were formed into almost parallel beams by the collimeters. An experiment was made to determine whether or not there was any relation between the beam width and measuring accuracy. When the beam width

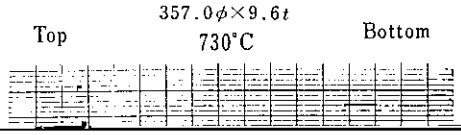
Fig. 7 Comparison of γ-ray beam width

changing the actual γ-ray beam width from 5 to 20 mm, characteristics shown in **Fig. 7** were obtained. From these characteristics, the following was observed. Namely, although a narrower beam width yielded a higher measuring accuracy, a beam width up to 20 mm was permissible, in order to achieve the measuring accuracy of 0.1 mm which had been set up as the development target by the authors. Consequently, 20 mm was adopted as the γ-ray beam width of the hot wall thickness gage to be used for making medium diameter seamless tubes.

sor C which computes the γ-ray exposure count values

source shutter and cooling water is important for




357.0φ×9.6t
Top
730°C
Bottom


1mm


A
C