

**KAWASAKI STEEL TECHNICAL REPORT**

No.37 ( October 1997 )

*Rolling Technology and Modernization of Chiba Works*

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# Development of Size-Free Rolling Technology for Wire Rod and Bar Using 4-Roll Mill\*

## Synopsis:

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shape. Kawasaki Steel succeeded in developing size-free rolling technology by the 4-roll method that has such excellent features and introduced this technology in the wire rod and bar mill of its Mizushima Works in April 1994.

This report describes the features of this new rolling technology and the equipment with which this technology was put into practical application.

## 2.2 Kinds of Rolling Methods and Comparison

There are three kinds of size-free rolling as shown in Fig. 2. The 2-roll method shown in Fig. 2 (a) and the 3-roll method shown in Fig. 2 (b) have already been put into practical use, and the 4-roll method shown in Fig. 2 (c) is a newly developed technology which will be described in this report. As shown in the figure, form rolling is conducted using two passes under the 4-roll method, which has one less forming passes than the

Rolling train

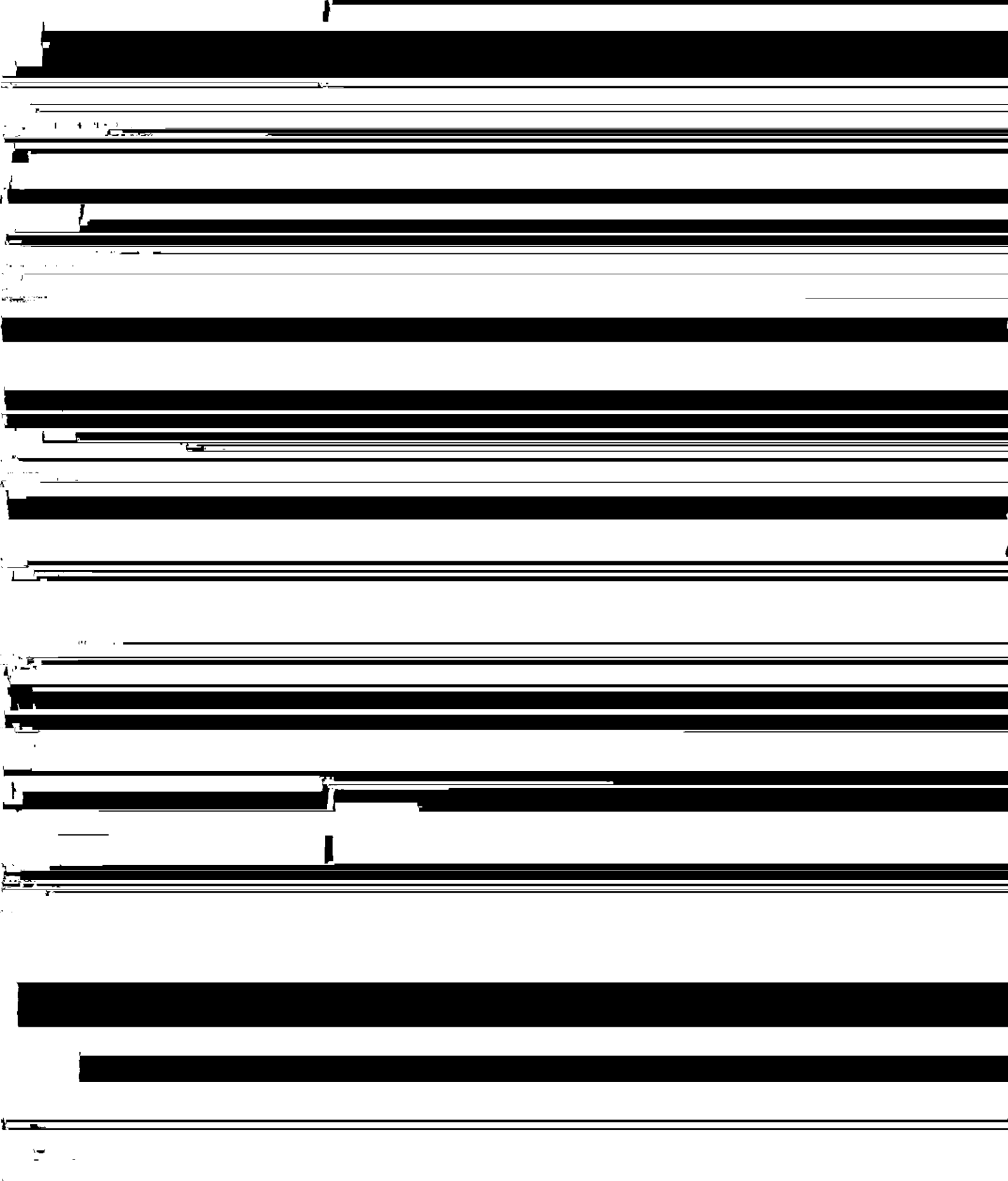
Application technologies

Advantages

Roughing mill

On-line setup changing  
1. Automation of millstand exchange

Rolling chance free  
On-line  
1. Reduced setup time and frequency



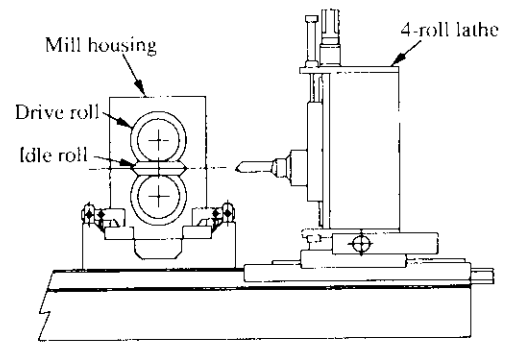
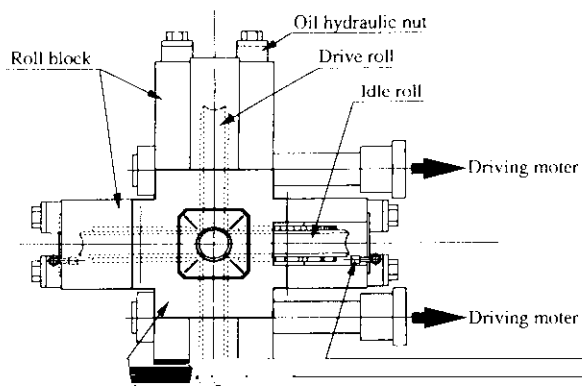


Fig. 6 Construction of 4-roll mill housing

ven by motors as in the 2-roll mill was adopted as shown in Fig. 6 and the mill was given a simple housing structure so that the 4-roll method can be put into practical use. However, the other two rolls are rotated

rolls can be separately adjusted by remote control using a set of hydraulic motors and encoders for control installed for a pair of rolls.

### 3.1.2 Off-line equipment

Preparations for the succeeding rolling, such as the changing of rolls and guides of the mill and dressing of worn rolls, are conducted off-line.

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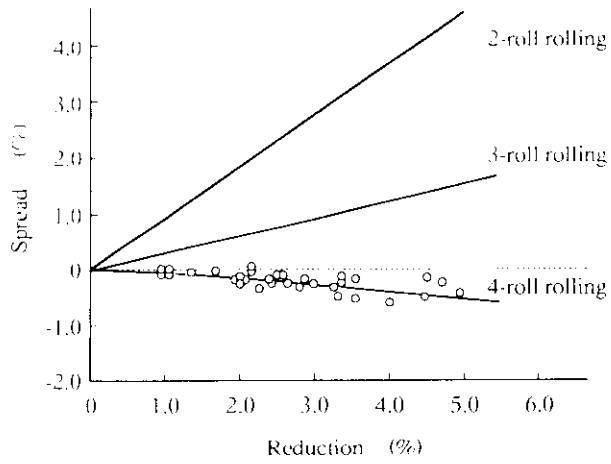
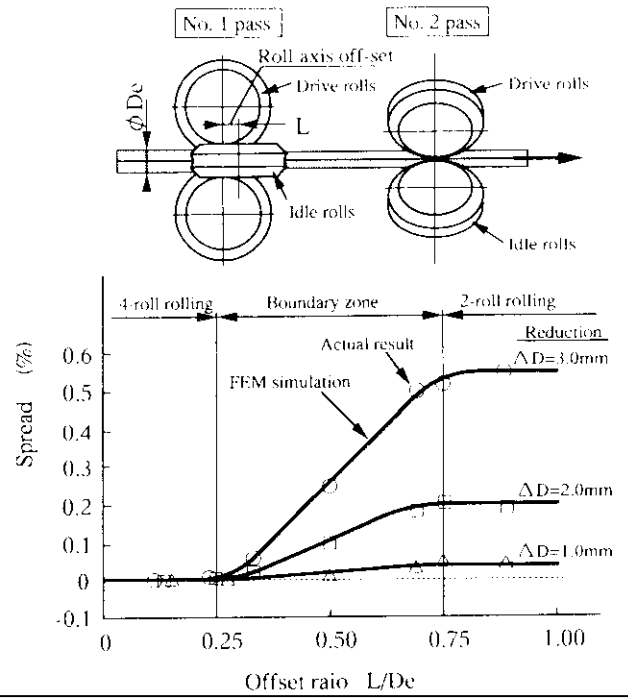


Fig. 8 Comparison of spread by each rolling method

ment of parts. These operations were also thoroughly mechanized in order to increase efficiency. The main equipment developed for this purpose includes a mill-housing dismantling and assembling device and a



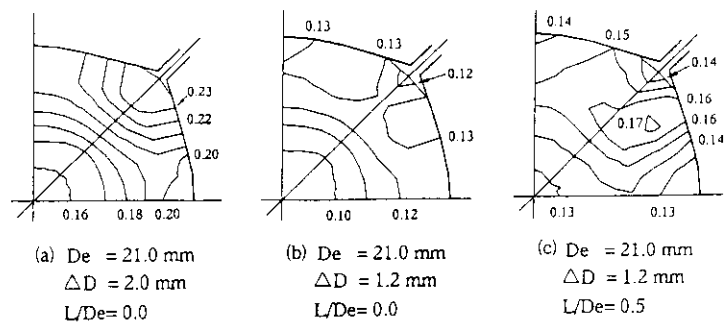


Fig. 10 FEM simulation results of sectional strain distribution of the stock rolled by 4-roll mill

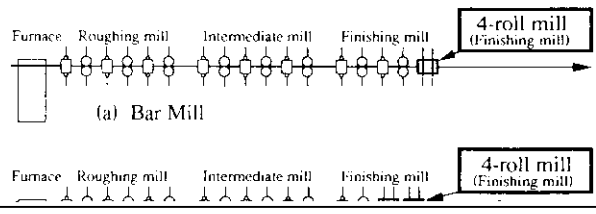
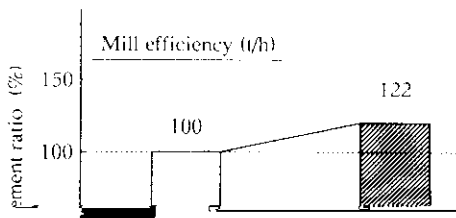
ratio ranges from 0.25 to 0.75 when rolling is conducted under conditions between the 4-roll method and the 2-roll method. Thus the offset ratio is set depending on the

of wire rod in a wire rod and bar mill. Square billets of 150 mm square are used as the material and products 16 to 85 mm in diameter are produced by size-free rolling

Table 1 Specifications of 4-roll size-free mill for bar and rod at Mizushima Works

Items		Specifications
Mill capacity	Product size range (mm)	$\phi 16 \sim \phi 85$ $\phi 9 \sim \phi 12.5$





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