KAWASAKI STEEL TECHNICAL REPORT
No.1 (September 1980)

Flatness and Profile Control in Hot and Cold Rolling of Steel Strip

Ikuo Yarita, Kunio Kitamura, Kenji Kataoka, Kichizaemon Nakagawa

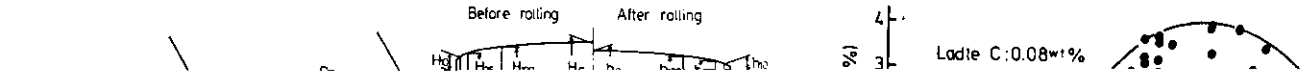
Synopsis :
One of the most important and principal qualities required of hot- and cold-rolled steel strip is good flatness and profile. Practical and theoretical studies into control systems on flatness and profile of the strip and their applications in full scale four-high mills have led to the following conclusions and to the establishment of control method. (1) A hot-rolled strip having such uniformed internal property as that from continuously cast steel is desirable to get a cold rolled strip with good flatness. And a hot-rolled strip having convex crown of 30-60 Í without surface abnormalities leading to ridge (so-called high spot) is suitable to get a good flatness and profile of cold-rolled strip. Furthermore, some cold rolling conditions are discussed in order to optimize work-roll camber, rolling schedule and roll bending force in cold rolling. (2) In hot rolling process, the crown control method using on-line draft distribution change among finishing trains and the edge drop improvement method by the use of trapezoid-cambered work roll have been developed successfully.

The body can be viewed from the next page.

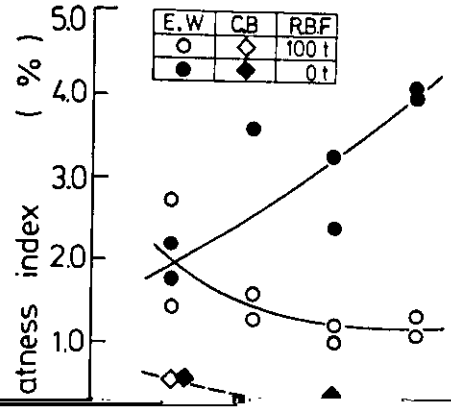
Flatness and Profile Control in Hot and Cold

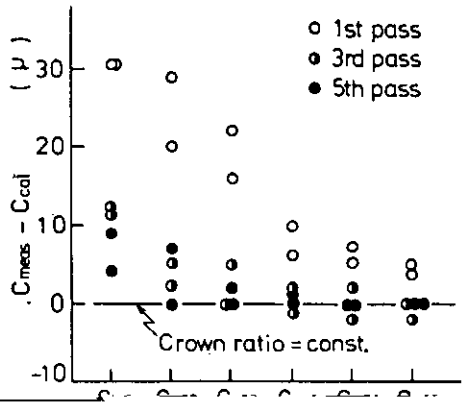
Ikuo YARITA** Kunio KITAMURA**
Kenii KATAOKA** Kichizaemon NAKAGAWA**

One of the most important and principal qualities


Before rolling
After rolling
%)
4
3
Ladle C:0.08wt%

shows the relation between the crown of a hot-rolled strip and the flatness index of a cold rolled strip. The


E.W
CB
RBF
100 t
0 t
atness index (%)
5.0
4.0
3.0
2.0
1.0


1st pass
3rd pass
5th pass
(μ)
30
20
10
0
-10
Crown ratio = const.

almost proportional to the crown of the hot-rolled strip, thereby indicating primary dependence on the crown of the hot-rolled strip. The crown after cold

is the same because the difference is also affected by work roll flattening. **Fig. 12** shows the relation between edge drops of cold-rolled strips and total

rolling is smaller as the finishing thickness and total reduction by cold rolling get smaller. As the crown ratio (H_{25}/H_C) after hot rolling approaches 1.0, the

reduction in the latter 2 stands in a four-stand tandem mill when 2.8 mm thick hot-rolled strips are cold-rolled to thickness of 0.8 mm. Edge drops of cold-

rolled thin strips is accurate grasping of flatness change brought about by temperature change in the hot rolling process. As shown in **Photo. 1**, the flatness changes depending on the process steps, such as in delivery at the final stand, entry at the coiler and after full cooling[7]. It is necessary to determine and control the flatness on the delivery side of the finishing stand so

constant crown control method and a edge drop control method are discussed.

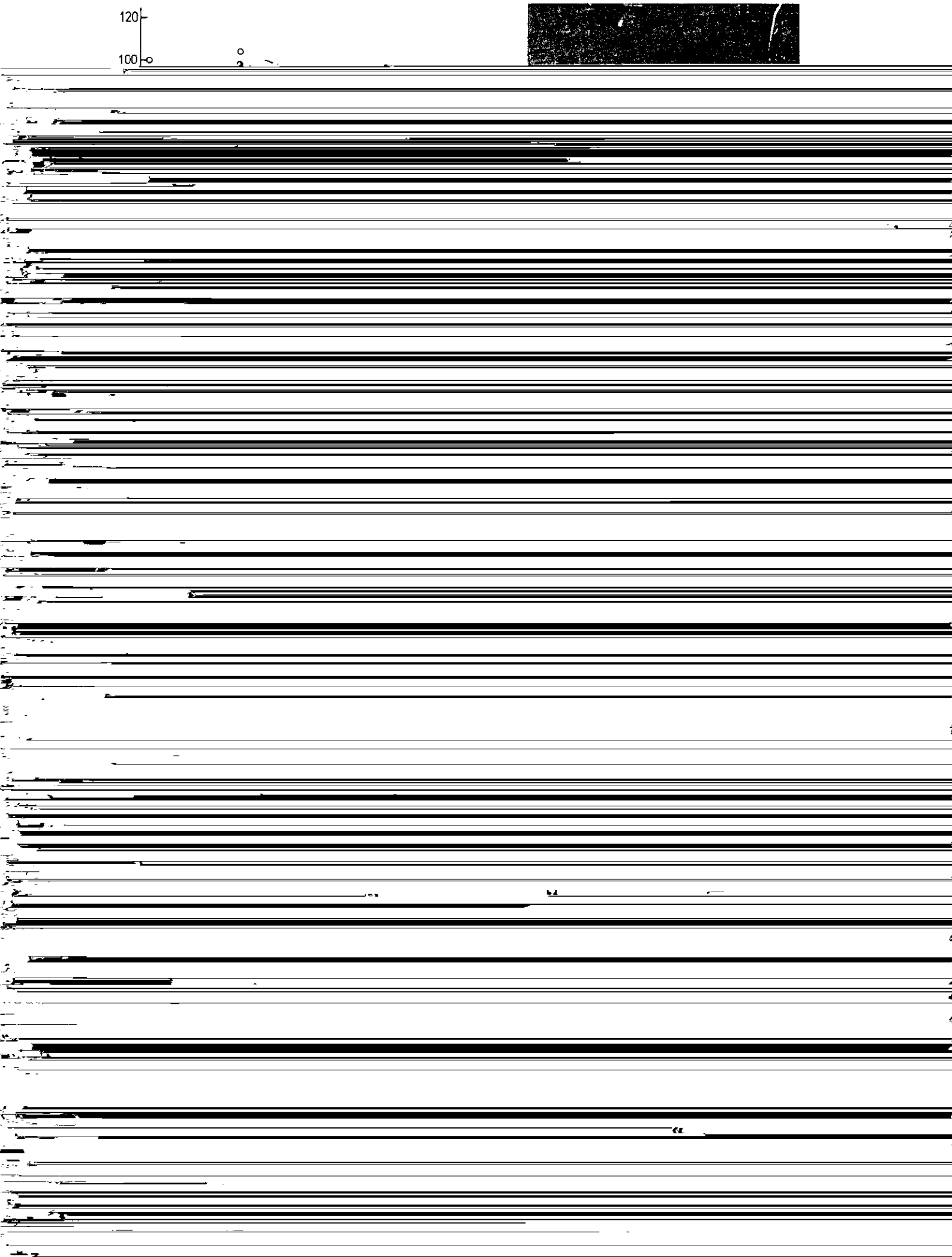
3.2.1 Roll wear and thermal crown

Generally rolling schedules for hot-rolling finishers lay stress on thickness and temperature control. Reduction is generally distributed much heavier in

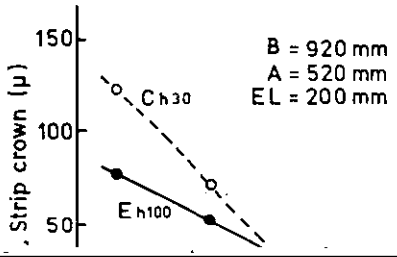
wear after rolling one cycle (80 coils) is approx. 175 μ at the F4-stand and 150 μ at the F7-stand. With regard

3.2.2 Crown control

Effective control of crowns to constant optimum

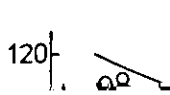

120
100

nique to control rolled strip crowns in the target range by compensating for the change of the roll thermal crowns by gradual change of reduction distribution in hot-rolling mill finisher stands which also enables us to have more flatness control.



3.2.3 Edge drop control

It has been stated that use of trapezoid-cambered



(2) Since metal flow in cold rolling occurs only within a limited distance (less than several tens millimeters) from edges, the crown of a cold-rolled