REPORT OF RESEARCH PROJECT UNDER SEED GRANT.

"Utilization of experimental setup (load cell, digital indicator, etc.) sanctioned vide application no. ME/31/7600 dated 3.7.2020 "

The subject testing equipment has been used to measure Roll Separating Force during hot rolling of metal bars

The rolled steel bars are widely used for production of gears, spindles, camshafts, axles, fasteners, and gudgeon pins etc. Basic production process of the metal bar involves heating the billet in reheating furnace up to 1200°C-1210°C followed by passing it through a pair of grooved rolls in a rolling mill. These grooved steel hot rolling mills are energy intensive and consume lot of resourcesin terms of costly raw material, fossil fuels such as furnace oil (HPS, LDO) or coal for preheating the billets prior to the rolling operation. The rolling mills involve heavy load enduring rolling stands and tremendous electric power consumption.

Steel industries are striving for productivity and better yield of hot rolled bar products. The roll separating force (RSF), driving torque (DT) and end crop length (ECL) are the important issues that need to be controlled for quality production, maximization of yield, minimization of rolled bar process scrap, safety of mill and reduction in energy consumption. The response parameters depend on several process parameters – rolling speed, billet temperature, reduction ratio (strain), billet size, roll diameter, etc.

Experimental Measurement of Roll Separating Force (RSF)

The experimental value of RSF has been estimated with the help of strain gage mounted load cell installed on the rolling stand (Figure 1). A single load cell was placed in between the top surface of roll chock and beneath the screw down mechanism. The RSF value has been obtained using the principle of lever. The RSF variation with respect to time has been captured using the data acquisition system (DAQ-16) and stored in the PC attached with display unit.

Taking moments about left column, $\quad F * (X_d - X_p) \quad = D * X_d$

Which gives $\qquad\qquad F \qquad\qquad = (D * X_d) / (X_d - X_p)$

$\quad$ F $\qquad$ = Roll Separating Force
$\quad$ D $\qquad$ = Load Cell Display
$\quad$ X_d $\qquad$ = Horizontal distance between columns of rolling stand (span)
$\quad$ X_p $\qquad$ =Horizontal distance between stand column where load cell has been placed and centre of operational groove i.e., from where the hot billet passes.
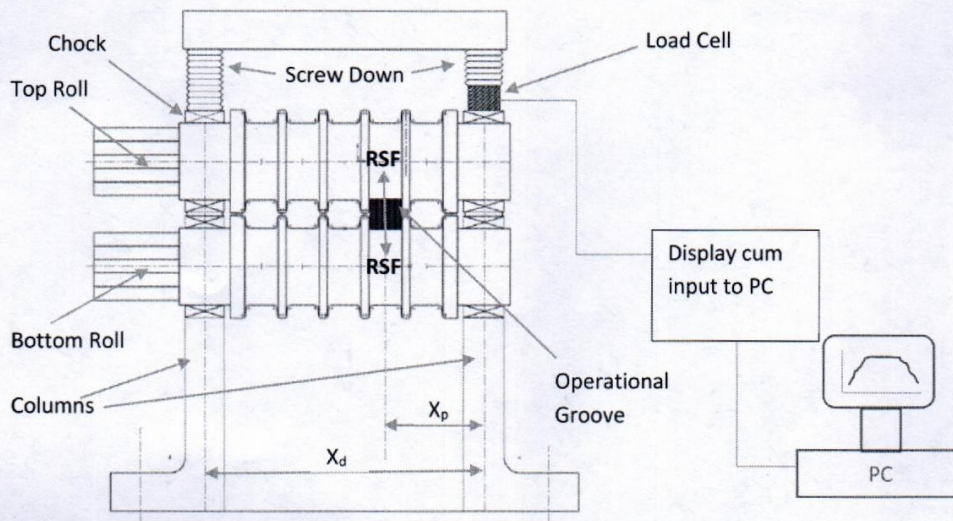

Figure 1. Setup for estimation of RSF installed at 26-inch rolling mill

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