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"Straightening machine: A Review"

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ABSTRACT

In the Era of industries flatness in required component increases.to achieve flatness industries are mostly used hammer method but this method is time consuming, less accuracy as well as produce unwanted noise to meet this requirement and also to overcome from the problem and to increase production rate straightening machines are available in market, but in this machine many factors plays an important role just like working roller diameter, thickness of component, material of component, pressure acting on roller etc. This paper discuss about important parameter of straightening machine like roller diameter, pitch, forces and moment acting on sheet. These paper helps to saving time for developing such type of machine.

KEYWORD *straightening machine, flatness, strip straightening machine, rollers, and sheet defects,strip.*

I. INTRODUCTION

Flatness required in product is increases day by day to fulfill this requirement straightening machine is used. Straightening machine uses to removed curl, gutter, and unwanted bend in product. Straightening machine has been built with number of roller. Some machine having individual drive motor to each roller but important point is velocity of roller required same. Few important factor which is really affect flatness are roller size, pitch of the roller, residual stresses, speed, feed of the material, proper alignment of roller etc. To achieve flatness in the product we have to consider all the factor and work accordingly.

II.LITERATURE REVIEW

V.N.Shinkin [1] in this paper present that reduction of curvature and bend is also depend on working roller diameter, distance between two roller named as pitch of roller as well as number of roller. This paper consider detail methodology about determining forces shaft support reaction, bending moment as well residual stresses acting on steel sheet. Arithmetical method for calculating bending moment, curvature as well as reaction of

working roller of straightening machine is proposed and it shown that arithmetical method is better than korolev method. Below figure 3.1 shows forces as well a moment acting on sheet in 12 roller straightening system.

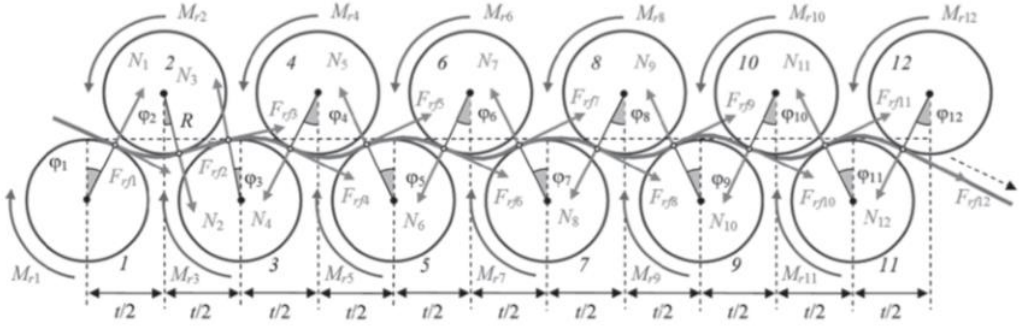

Fig.3.1 shows forces and moment acting on steel sheet

[Fig.3.1 reference- "arithmetical method of calculation of power parameters of twelve roller straightening machine" CIS Iron and Steel Review — Vol. 12 (2016), pp. 40–44]

Krishna jadhav et.al [2] in this paper presented methodology for calculation of roller as well as gear. This calculation help to determine roller diameter. In this calculating forces from area and tensile strength as shown below:

$\sigma_t = F/A$

Where,

σ_t = Tensile strength of component

F = force

A= (l×b), Area of component to be straighten and then used calculated force to determine roller diameter $\sigma_t = F/A$

Where,

σ_t = Tensile strength of roller material

F= Force applied on roller

A= Area of roller

Markus gruber et.al [3] in this paper relation between working roller intermesh and residual stresses is evaluated to achieve constant flatness. The study are attention on seven roller machine with three load triangle named as plastification, residual stresses and flatness with feed forward system as shown in below figure. This figure shows a roller 2 is applying forces on strip till reach in plastification region, a middle triangle at roller 4 affect to residual stress distribution and at roller 6 ensure flatness of strip at outlet. The numerical study conducted and validate with experimental data and Concluded using different intermesh achieve different residual stresses for sheet flattening and achieve stress distribution by increasing number of bending operation.

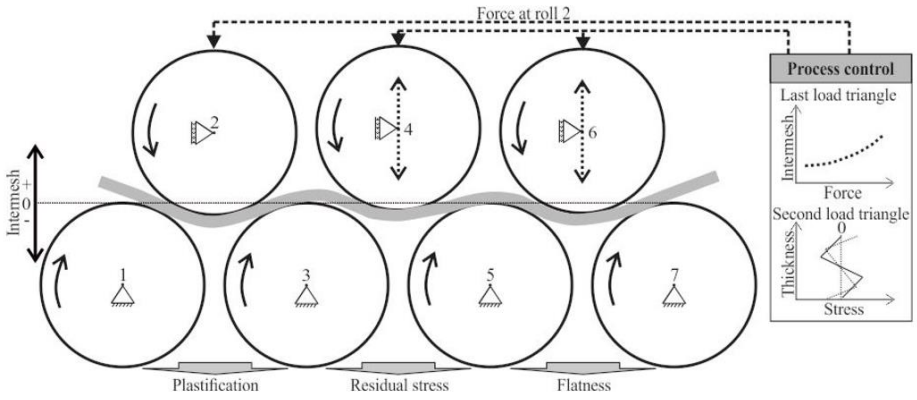

Fig.3.2 shows seven roller leveler with feed forward system

[Fig.3.2 reference- A strategy for controlled setting of flatness and residual stress distribution in sheet metal via roller levelling", ICTP 2017, procedia Engineering 207]

WANG Yongqin et.al [4] model was evaluated by comparative study presented that capacity of straightening machine is generally affected by material properties, shape of plate (incoming) and plastic ratio along with that researcher concluded that straightening speed, elastic module and width of plate affect straightening capacity. As greater the straightening speed, width of plate smaller straightening capacity.

Ibiye Roberts [5] in this paper develop an idea to make a predictive model by using a concept of energy minimization of bending path of strip. This paper main focus on importance of correct leveler setting. Shape correction is very important in industries for achieving more flatness use lesser diameter of roller. In this study using industrial data and validate data with mathematical modal. This paper focus on importance of correct leveler setting.

V.B.Sarode et.al [6] in this paper presented a modification in straightening machine to overcome from the problem of tube not being straightened below 88.9mm due to less contact area because of misalignment and eccentricity of roller and pin. This paper gives importance of alignment in roller and pin because misalignment leads to uneven distribution of pressure applying on roller leads to produce unwanted bend in the tube. To overcome from this problem in place of changing component author design a pin which is match the centre of upper roller and lower roller. Designing of pin contain calculation of pin, selection of material, calculating stresses acting on pin by usingANSYS. This paper concluded that misalignment of roller creating a problem in straightening.

Xue-ying huang [7] this paper present a multi-point flexible straightening process which is verified by numerical simulation and experimental analysis of different material and initial shape. In this system.Upper die and lower die having individual punch, to achieve different curvature adjusting the position of each punch. It has two step in first unified the curvature of plate and in second step uniform curvature is straightened by over bent. Experiment carried out over three different material and profile and the result shows that this method remove difference of initial curvature, as we decrease bending radius the uniform. Curvature is also decreases so this process is suitable for different material metal profile.

III. SUMMARY OF RESEARCH PAPER

Author	Title	Journal	Methodology	Remark
J. Mischke (8)	Simulation of the roller straightening process	JMPT, ELSEVIER Publisher	Computer simulation	Elaborated model is compatible with straightening system
B.-A. Behrens et.al (9)	Development of an analytical 3D – simulation model of the levelling process	Journal of material processing technology	3D Simulation using MATLAB, Experimental	Proposed model is validate with experimental data
A. Krasovskyy et.al(10)	Material Characterization for Reliable and Efficient Spring back Prediction in Sheet Metal Forming	Steel Res. Int. 77	Experimental-numerical approach	spring back in forming simulation improved By using advanced material models
G. schleinzer et.al(11)	Residual stress formation during the roller straightening of railway rails	IJMS	Chaboche's multiple component non – linear kinematic hardening model and FEM	Improvement in numerical model as compare to previous model

Yongseok CHO (12)	A new model for the prediction of evolution of the residual stresses in tension levelling	ISIJ	Numerical method, FEM	Predictive model accuracy is comparable to FEM
Kee - cheol PARK (13)	Development of a Finite Element Analysis Program for Roller Leveling and Application for Removing Blanking Bow Defects of Thin Steel Sheet	ISIJ	FEM	FEM result were 20% of experimental range.
E. Silvestre et.al(14)	Roll levelling semi-analytical model for process optimization	Journal of Physics	Semi analytical, FEM	Semi analytical model is able to predict basic levelling variable
V. N. Shinkin (15)	Asymmetric Three-Roller Sheet-Bending Systems in Steel-Pipe Production	Steel in Translation	Analytical method	Proposed system is useful in metallurgical plant

IV. CONCLUSION

After referred lot of research paper it is concluded that a number of methodology are available but above paper gives an idea about determining roller diameter. Clear concept related topitch of the roller, roller speed and also material selection. Above papers explain importance of roller intermesh and pressure setting for straightness &many key point which is helpful for developing a straightener machine easily as well as time consuming.

REFERENCES

[1] V. N. Shinkin, “arithmetical method of calculation of power parameters of twelve roller straightening machine” CIS Iron and Steel Review — Vol. 12 (2016), pp. 40–44

[2] Krishna jadhav et.al, “Design and Development of Strip Straightening Machine”, IJRESM Volume-2, Issue-6, June-2019, pp. no- 164-165

[3] Markus gruber et.al, “ A strategy for controlled setting of flatness and residual stress distribution in sheet metal via roller levelling”, ICTP 2017, Procedia Engineering 207, pp. 1332-1337

[4] Wang yong- qin, “evaluation of straightening capacity of plate roll straightener”,J.Cent. South University. (2012) 19: 2477−2481

[5] Ibiye Roberts’s et.al, “optimal selection of machine parameters in tension levelling of sheet metals”, semantic scholar.org, (2012) pp.1-6.

[6] V.b.sarode et.al, “ modification of tube straightening machine” , International Journal of modern trend in Engineering and Research, volume-04, pp. no: 22-29

[7] Xue-ying huang et.al, "multi-point flexible straightening process by reciprocating bending for metal profile", nonferrous metals society of china, published by Elsevier Ltd & science press pp. no – 2039-2050.

[8] J. Mischke and J. Jonca "Simulation of the roller straightening process," Journal of Materials Processing Technology Journal of Material Processing Technology, 34, (1992), 265-272.

[9] B.A. Behrens, R. Krimm, T.EI Nadi, **"**Development of an analytical 3D – simulation model of the levelling process", Journal of Material processing Technology,2011, pp.1060-1068

[10] A. Krasovskyy, W. Schmitt, H. Riedel, Material Characterization for Reliable and Efficient Spring back Prediction in Sheet Metal Forming, Steel Res. Int. 77 (2006) 747-753.

[11] G. Schleinzer, F.D. Fischer, "Residual stress formation during the roller straightening of railway rails", International Journal of Mechanical Science,2001,vol. 43 pp.no 2281-2295.

[12] Yongseok CHO, hosung YE, Sangmoo HWANG, "A New model for the prediction of Evolution of the residual stresses in tension levelling", ISIJ International , 2003, vol.53, pp. 1436-1442

[13] Kee - cheol PARK et.al, "Development of a Finite Element Analysis Program for Roller Leveling and Application for Removing Blanking Bow Defects of Thin Steel Sheet" , ISIJ International, Vol. 42 (2002), No. 9, pp. 990–999

[14] E. Silvestre et.al, "Roll levelling semi-analytical model for process optimization", Journal of Physics Conference Series 734 (2016) pp.1-5

[15] V. N. Shinkin, "Asymmetric Three-Roller Sheet-Bending Systems in Steel-Pipe Production", Steel in Translation, 2017, Vol. 47, No. 4, pp. 235–240

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