Productivity Improvement Using Auto Weight Grading For Connecting Rod

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Abstract: *Manual Weight Grading is a method that is being used in industry for grading the connecting rod especially in automobile industry. This cycle time of Manual Weight Grading is more which affect the productivity and results in less production. Manual Weight Grading requires more labors to carry out the process which results to high labor cost for production. This paper presents an alternative method for Manual Weight Grading which is Auto Weight Grading. This method is totally based on automation and requires single person can do the complete work activity on work piece. It reduced the cycle time effectively which helped to improve the productivity in low labor cost. Auto Weight Grading is accurate and fast method. The result shows that the productivity improved by 20%, labour cost saving 50% and cycle time reduced 20.63 % compared to manual weight grading method. The suggested method can be effectively applied in industry for grading purpose.*
Keywords: *Automation, Cost saving, Cycle time, Grading, Productivity.*

I   Introduction

The weight of connecting rod is a crucial factor in the engine assembly. The variation in the weight of connecting rod imbalances the engine and affects its efficiency. To know the weight of connecting rod grading is done which is an important factor for that reason manual weight grading is done. The manual weight grading method is used in Automotive Industry for grading purpose. In manual weight grading the grading is done manually, so it is a time consuming method. For Manual Weight Grading there was need of two labors to carry out the process. As method is time consuming it use to affects the productivity of connecting rod. There are chances of miss grading due to the fatigue to the operator. To overcome this problems mentioned above we introduced an alternative method named as Auto Weight Grading. Auto Weight Grading Method is fully based on Automation. This method improves the productivity of the connecting rod by reducing the cycle time. As method is automated there is only need of a single labor to carry out the process which reduces the labor cost. Auto Weight Grading is quick and fast method.

II   Grading Techniques

The Manual and Auto weight grading techniques of grading the part of connecting rod is suggested in this paper to overcome the grading problems and limitations of manual weight grading technique. The industry faced the problem like accuracy, scrap; productivity and labor cost which is minimized by Auto weight grading technique in which more automation are performed using automated parts.

2. 1 Manual Weight Grading

The Manual operation carried for weighing grading system is measuring the weight of connecting rod with the help of load cell. Then according to the weight of the connecting rod, the connecting rod are separated or sorted with the help of grading table. After sorting the connecting rod, according to their weight, they are placed in the fixture machine where the connecting rod are been graded. As per their grading they are fixed further to the engine assembly. This process is time consuming which affects the productivity of the company. As it is a time consuming process, it also affects the operator.

Fig. 1 Weighing Machine

Fig. 2 Fixture

2.2. Auto Weight Grading

The above figure is the complete set-up of the auto weight grading .In this technique we have assembled all the components as explained below. This technique is fully automatic which can be operated with the help of computer unit as there is less manual handling of component, operator has to only clamp and unclamp the connecting rod from the fixture.
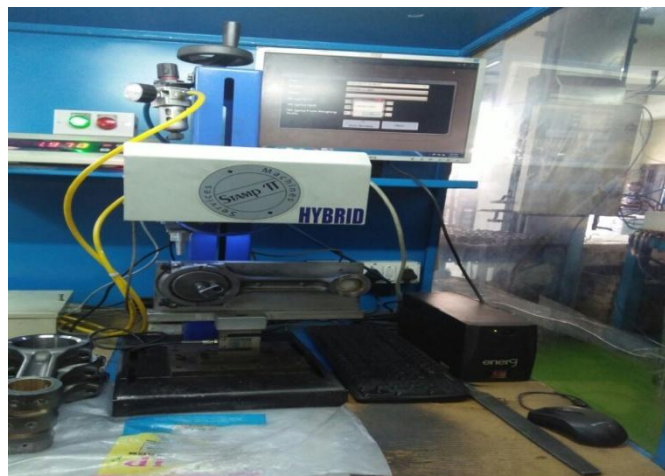

Fig.3 Auto Weight Grading

In this technique we used the sensors like proximity sensor which recognizes whether the connecting rod is fitted properly on the fixture, if the connecting rod is fitted exactly the way it want to be then the air pressure supply is given to the marking machine with help of air filter regulator and finally the marking process is taken place by the marking machine on the connecting rod and if the connecting rod is not fitted exactly the way it is to be on the fixture then the air supply is not supplied by the air filter regulator to the marking machine with the help of proximity sensor. We used S-type load cell in this technique whose capacity is 20 kg. Load cell of capacity 20 kg is chosen by overlooking the combined weight of connecting rod and fixture. The fixture used here is made of aluminum material rather than mild steel as it is light in weight. The load cell of capacity 20 kg is used to maintain 1 gram of variation. Computer unit in this technique is used to store the grading data to be graded on the logical form. The listed parts of automatic grading system are fixture, marking machine, and computer unit and air regulator. The importances of each part are stated here:

2.2.1 Load cell
It is an integral part of a weighing system. The load cell used here is of 20 kg capacity.

2.2.2 Fixture
Fixture is a work holding or a support device used in manufacturing industries. The fixture for Auto Weight Grading has used is made of aluminum material rather than mild steel as it is much lighter in weight.

2.2.3 Marking Machine
Marking machine used for the marking of grade on connecting rod. If the connecting rod is not fitted properly then the grading is not done.

2.2.4 Computer Unit
Computer unit used to carry out logical operation. It is as a control system. A program is stored in the system on the basis of grading logical form.

2.2.5 Air Regulator
Air pressure regulator is a control valve that is used for controlling the marking machine.

III   Results And Discussions

The standard grading chart for connecting rod component is shown in Table1. This is a standard chart used for grading purpose in company to carry out the grading according to their weight. In this section the results of productivity, average cycle time and labor cost saving are shown graphically which is obtained using auto weight grading technique. The results of these are shown in Fig. 4-6. The Fig. 4 shows the graph of techniques in which the manual technique is having the productivity 750 units whereas in automated grading technique, the productivity value found 950. Thus improvement in productivity of 20% is observed using auto weight grading technique. Similarly from Fig. 5, the cycle time is observed 0.63 min and 0.50 min which indicated the reduction in average cycle time by 20.63%. In the same way the analysis for labor cost saving shows in Fig.6. The monthly labor cost saving from manual grading technique was Rs. 17100 while using auto weight grading technique, it was found Rs. 8550. Thus improvement in 50% labor cost

Table 1 : Standard grading chart

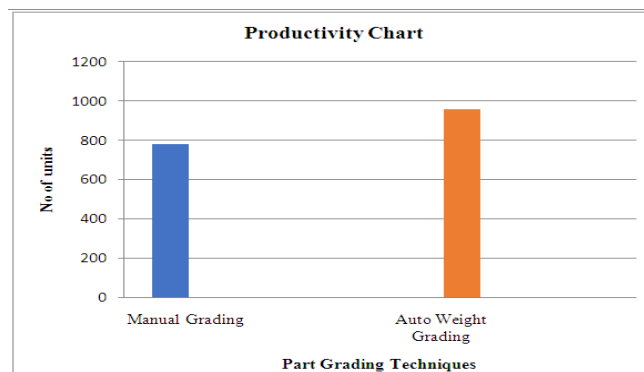| Weight(grams)	Grade
1790 to 1830	A
1830 to 1870	B
1870 to 1910	C
1910 to 1950	D
1950 to 1990	E
1990 to 2020	F

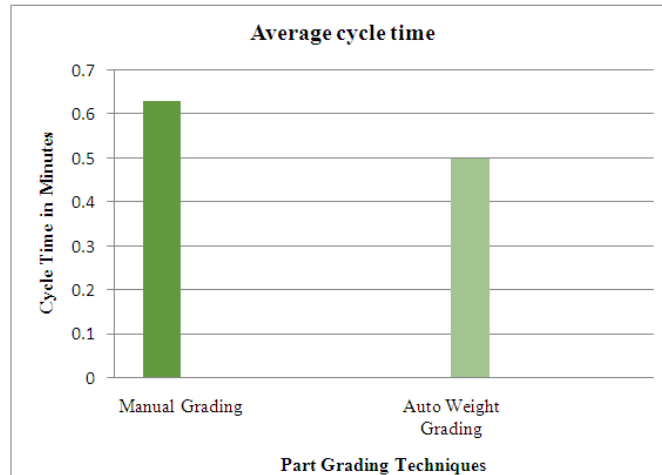**Fig. 4 Productivity graph**

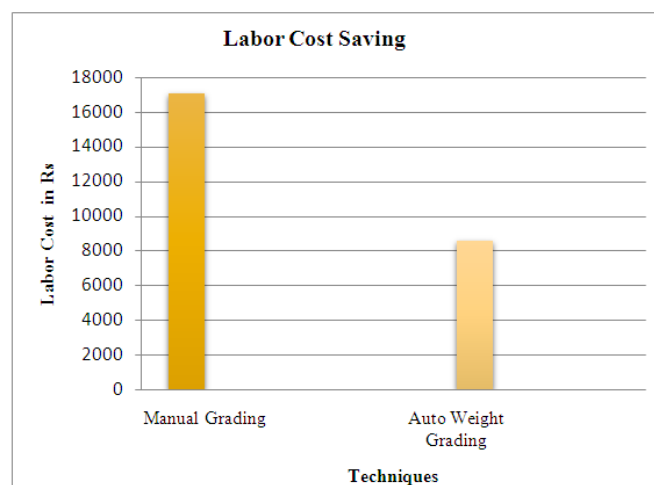**Fig. 5 Average cycle time graph**

Fig. 6 Labor cost saving

IV   Conclusion

After the comparative study of Manual Weight Grading and Auto Weight Grading method, following results were found:

1. Manual time consuming method was carried out manually, so it affects on productivity. The suggested method of Auto Weight Grading is more effective as it improves the productivity by 20%.
2. The cycle time reduced by Auto Weight Grading method by 20.63% as the operation was based on automation.
3. The Auto Weight Grading eliminates the unnecessary sorting time. Therefore labor cost reduces by 50% as the complete activities were carried by single operator.

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