AN IMPROVEMENT ON MECHANISM OF MOTORCYCLE RIM ADJUSTING JIG

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ABSTRACT

Motorcycle Rim Adjusting Jig has been widely used as an instrument for wheel alignment of motorcycle's tires, which is between rims and its hub. By using this jig, it may help the mechanic to do the adjustment of "high-low" and "side-run-out" problems which is normally related to the alignment of the motorcycle rim. However, the existing motorcycle rim adjusting jig which is already in the market, is not really user friendly. It is very difficult to operate and it takes longer time to complete the alignment. Furthermore, the measurement of the "run-out" is not very precise and this may affect time during the adjustment process.To overcome this problem, the improvement and enhancement of the existing jig's design mechanism must be done in order to reduce the operating time and facilitate the rim adjustment techniques. The concept of using the dial gauge to adjust the rim tolerance ("high-low" and "side-run-out" problems) as well as the presence of the driven motor which is connected to the hub's holders can make the product function effectively.The alignment process can be done automatically hence the detection of the run out problems become more easily and the alignment process will become faster with the existence of "present sensor" which will be located near to the hub's holder.

KEYWORDS*: Mechanism improvement, motorcycle rim, adjusting jig.*

1.0 INTRODUCTION

A motorcycle rim adjusting jig or also known as truing jig, is a specialized tool or equipment for the purpose of straightening the wheels. The jig consists of an axle stand on which the wheel can be rotated. The other component, calipers which act as an indicator, is used to measure the deviations of the wheel's rim from ideal alignment. Figure 1 shows the common motorcycle rim adjusting jig which widely used in the market. The stand is used in conjuction with an appropriately sized spoke wrench to loosen and tighten the spokes that hold the rim in its own position.

Common rim consist of frame, hub, spokes and nipples (Hoeppner, 2006) as shown in Figure 2. A good wheel alignment will ensure that the wheel is ideal in two ways which are high-low (roundness of the rim) and side-run-out (sideways wobble). Ideally, spokes have equal tension although the two sides will be different if a wheel facing uneven bracing angle of spokes on some multi speed wheels with tension high enough to give a rigid wheel and retain some tension under all loads but not so high as to lead the failure of spokes or the rim. Spokes should have no residual twist from tightening the nipples.

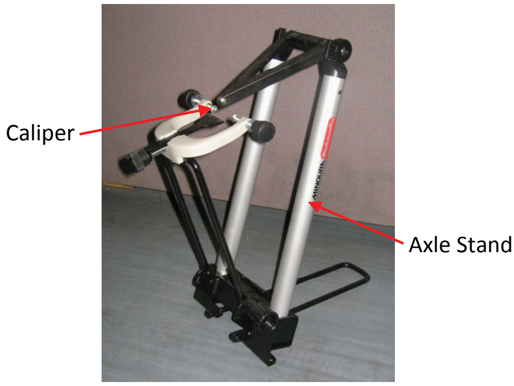

FIGURE 1
Motorcycle Rim Adjusting Jig.

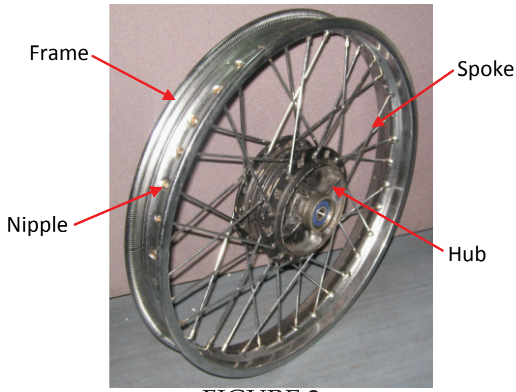

FIGURE 2
Common parts of motorcycle rim

Current motorcycle rim adjusting jig which widely used in the market nowadays, are difficult to operate. Operating time, and alignment accuracy are the main concerned factors in order to complete the alignment process. The operator skills who handle these particular jig and their concentration are very essential as well. Based on the current scenario, required time to finish up the alignment for a wheel is within 30 minutes to 40 minutes. In addition, these alignment operation is totally depends on the operator skills, and this lead to poor accuracy of the overall alignment process. Full concentration is required in handling this jig, and this causes the operator not being able to perform other tasks until the alignment process is done completely.

Therefore, the existing design mechanism need to be reviewed to overcome those problems that heve been raised as to ensure that the jig can be optimized for more effective use. The concept of the using dial gauges, sensors, and driven motor which can be intergrated together with the jig, will enable the process alignment implemented automatically, where by the run-out problems can be detected more easily and quickly.

The purpose of this paper is to discuss about the conceptual idea of how to improve and overcome the problems especially those which are related to the difficulties faced by the end users as stated earlier. Improvement in terms of mechanism design will be emphasized in this work.

2.0 RUN-OUT ALIGNMENT PROBLEMS

In the process of wheel alignment and balancing, there are two types of alignment which should be concerned with; high-low and side run-out problems. Typically, the side run-out problem is more common compared with the high-low problem.

2.1 Side Run-Out Alignment Problem

The calipers which act as a gauge for side shaking are located on both side of the U-shaped frame. Rim's position should be in the middle between the calipers. When rim is rotated slowly, observe the clearance between the tip of the calipers and the rim surface (www.cyclingnews.com). Sometimes, the tip of the caliper will touch the rim or will away from the rim. This is called side run-out alignment problem. Figure 3 shows the side run-out alignment problem, where the side to side wobble of the rim can be seen as the wheel spins.

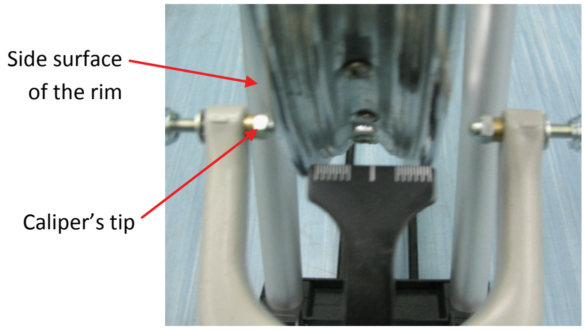

FIGURE 3
Side run-out alignment problem

2.2 High-Low Alignment Problem

High-low alignment problem is the amount of up and down wobble. If the wheel becomes out-of-round, it wobbles up and down with each revolution. This high-low alignment prolem can be affected by spoke tension (www.cyclingnews.com). Sections of rim can be moved toward the hub by tightening spokes. Alternatively, sections of rim can move slightly outward by loosening spokes. Figure 4 shows the high-low alignment problem of the rim. Similarly like side run-out alignment prolem, when rotating the rim slowly, the clearance between the gauge plate and the rim surface should be given full attention. Sometimes the gauge plate will touch the rim, and will away from the rim. When this scenario appeared, the high-low alignment problem need to be addressed.

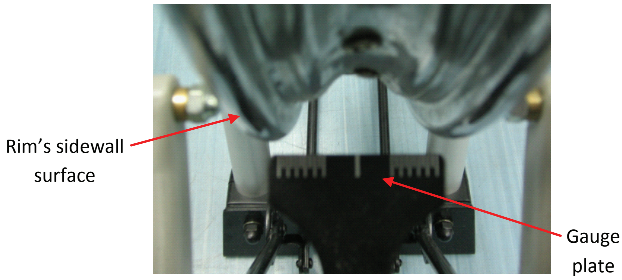

FIGURE 4
High-low alignment problem

2.3 How to Fix The Run-Out Alignment Problems?

Prior to discuss further about this particular matter, it is better to know the position of the spokes on the motorcycle rim. Figure 5 shows the location of spokes on the common motorcycle rim. The spoke nipples labelled A, C, and E are on the left side of the rim, actually come from the right side flange. Spoke nipples B, D, and F are on the right, actually come from the right side of the flange. Left side spokes tend to pull the rim toward the left. Their pulling is offset by the pull of spokes on the right (www.cyclingnews.com).

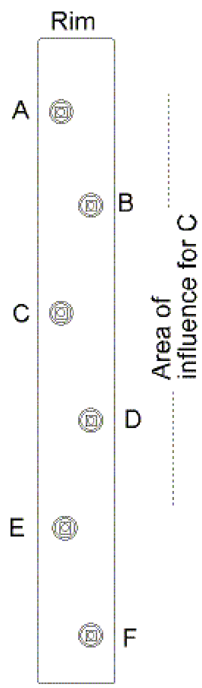

FIGURE 5
Location of spokes (Seen from the top view) (www.cyclingnews.com).

Each nipple affects a relatively wide area of the rim. Spoke C will pulls area mainly adjacent to its location, but will also effect the rim up to and even past A and F. Tightening nipple C will increases spoke tension and tend to move that section of rim to the left. Tightening nipple D will tend to move the rim to the right. Loosening nipple C, will also tend to move the rim to the right, due to the constant pull of D (www.cyclingnews.com).

In case for side run-out alignment problem, if rim touches left side of the caliper (reference point), find out the closest nipple to the center deviation coming from right side of hub flange. On the other hand, if rim touches right side of the caliper, find out the closest nipple to the center deviation coming from left side of hub flange. This can be done by tightening the nipple half turn and rotate the rim back and forth in this area and check the deviation again. Repeat the steps for both situations until rim position is in aligned position. That means the right and left side of rim will never touch the caliper. In order to get good adjustment, both side of rim must always in center location from right and left calipers (www.cyclingnews.com).

For the high-low alignment problem, if the gauge touching the rim sidewall, tighten the two spokes in the middle of the hub with same amount, beginning with half turn. Rotate the rim again back and forth in this particular areas and check the deviation once again. Repeat the steps until rim become completely true (www.cyclingnews.com).

3.0 METHODOLOGY

As has been discussed before, the problems faced when carrying out wheel alignment and balancing are the time consumption, ease of operating the jig, requires skilled labour to handle as well as his full concentration when doing the alignment. Therefore, to overcome or at least to reduce the problems faced by this situations, few suggested solutions to replace this conventional method has been made, where the jig's mechanism design itself need to be changed and improved. The proposed methods including the use of dial gauges which are connected with sensors (Korth, 1983), intended to detect "high-low" or "side run-out" automatically; involving the use of a motor which placed at the rim holder – to rotates the rim, and stop automatically whenever the sensors detect the presence of the misalignment problems. The current motorcycle rim adjusting jigs do not have features as proposed.

3.1 The Implementation of Dial Gauge, Limit Switch Sensor, and Driven Motor.

Dial gauge is used to replace the caliper where its main function is to detect the existance of "high-low" or "side run-out" problems. On the other hand, limit switch sensor acts as a flagman for the driving motor to stop rotating when the dial gauge detect a problem. Meanwhile, the function of the driving motor is to automatically rotate the rim. In the proposed method, the position of dial gauge and sensor on the adjusting jig stand is as shown in Figure 6. This method is to do adjustment for the "side run-out" alignment problem. As indicated in the Figure 6, the sensor is located at the upper part of the dial gauge.

When the tip of the dial gauge touches the rim, the needle of the dial gauge moving from zero reference, and this shows that the rim is facing "side run-out" alignment problem. When this scenario occurs, the cap of the dial gauge will be in contact with the sensor and this sensor will give command to the driving motor to stop the rim from rotate. In this particular case, observations should be done either the rim touches the left or right hand side of the dial guage's tip. Therefore, from the observation, the spoke's adjustment need to be done as described in Subsection 2.2. Nipple of the spoke will be adjusted until the dial gauge needle back to zero reference. The same method will be used for "high-low" alignment problem.

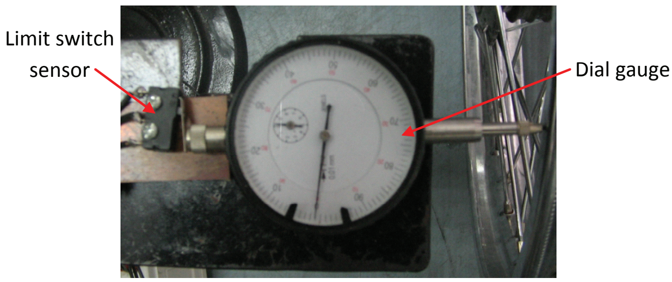

FIGURE 6
The location of the sensor and dial gauge

4.0 RESULTS AND DISCUSSION

Before producing the prototype, all components which are related to the jig, will bw graphically constructed in three dimensional view by using SolidWorks® software. The aim is to ensure that all components are free of any problem such as dimension problem, before the assembly process can be done. Figure 7 shows the new jig after modification has been made.

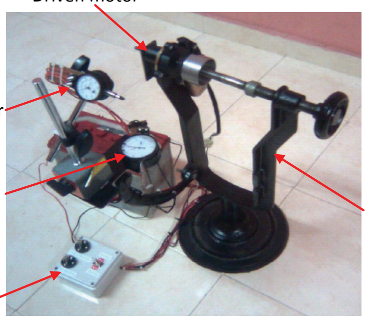

FIGURE 7
Modification jig

After the fabrication as well as installation process has been completed, the next step is to perform some experiments on a prototype produced. Experiments to be conducted will involve the existing jig as well as the modification jig (prototype) based on proposed methods. Two parameters have been taken into account to implement this particular experiment which are the operating time and ease of handling the jig.

TABLE 1
Comparison on operating time for both types of jig (Abdul Ghani, 2009)

Rim	Operating time for existing jig (minutes)	Operating time for new jig (minutes)
1	45	15
2	40	14
3	42	14
4	45	13
5	38	12
6	40	14
Average time (minutes)	42	14

To conduct this experiment, six units of motorcycle rims have been used, and before the operation starts, all spokes on the rims will be loosened. First of all, the experiment will be done on existing jig (jig without modification), and operating time will be taken from start until end of the alignment process. The same steps will be repeated again for the new jig (Abdul Ghani, 2009). Table 1 shows the comparison of the experimental results for six units of motorcycle rim.

From Table 1, we can conclude that:

Time saving for modification jig: 42 – 14 = 28 minutes
Percentage of time saving: (28/42) X 100% = 67%

Based from the data collection in Table 1, approximately 67 per cent of operating time can be saved by using new jig. For the existing jig, the average operating time is approximately 42 minutes, and on the other hand for new jig, time taken is 14 minutes (Abdul Ghani, 2009).

During the alignment operation for the new jig, the operator can perform other tasks, without having to wait and give full attention to the operation of the alignment. The reason is because the rim is controlled by the driving motor and it is rotated automatically. In addition, the presence of dial gauges and limit switch sensors can detect the alignment problems by itself. Using the old jig the operator must give full attention when doing the alignment process. This is because, the rim should manually be rotated, while the alignment problems should be detected by operator himself (Abdul Ghani, 2009).

From the observations on the handling activities for both jigs, it is clearly shown that the existing jig somehow is difficult to operate, while for the new jig, the handling activities is much more easier due to the implementation of the dial gauges, limit switch sensors and driving motor. Indirectly it can reduce the use of operator’s skill and allows the jig to function more effectively.

5.0 CONCLUSION

The performance of the mechanism suggested for the motorcycle rim adjusting jig has been evaluated. Comparison between the existing jig and new modification jig (after improvement has been made) has been carried out. Based on the experiment’s result, clearly shows that the implementation of dial gauges, limit switch sensors, and driving motor has great influenced on the operating time as well as facilitate the handling activities. For future works, more various other types of mechanism can be proposed and studied in order to find out the best solution to facilitate and expedite the process of using the existing jig.

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