Dynamic Balancing of Flange Sets

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General

Any round object that rotates at any given speed per minute causes some vibrations due to asymmetric mass distribution. At higher speed, the vibration phenomenon is being accelerated.
The vibration issue is very critical on a dicing system, as parts are rotating at relatively high speed.
The main reason for vibrations on a dicing system is multiple parts assembled together on the spindle, such as:

- The spindle itself
- The wheel mount
- Flange assembly with blade.

Although the spindle and wheel mount are balanced, the flange & blade assembly are the main reason for more vibrations. In most applications the existing vibrations of the flange & blade assembly can be tolerated without any balancing requirements.
However, some delicate applications require an extra dynamical balancing to achieve better cut quality.
Following are some applications requiring perfect balancing to achieve better cut quality requirements:

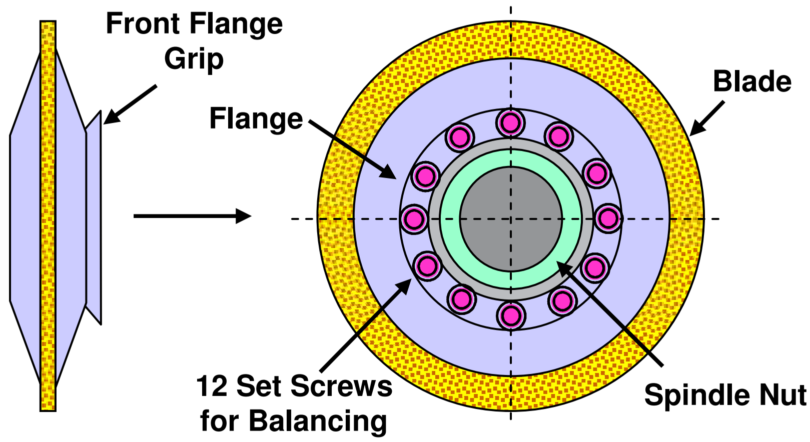
- Ultrasound sensors dicing PZT for the medical industry
- Magnetic heads for the storage industry.

Principle of Dynamic Balancing on Dicing Saws

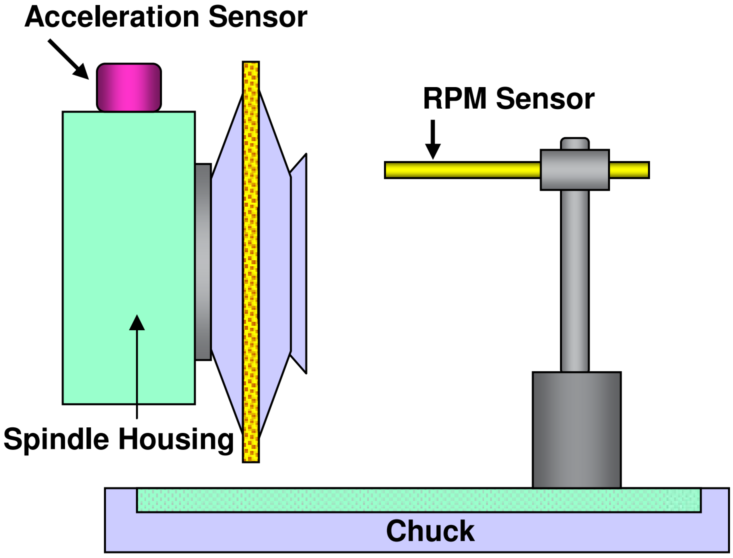
Balancing a flange / blade assembly needs to be performed **on** the saw. A balanced flange out of the saw may help but is not a perfect solution as the flange and the blade can be mounted in different orientation and will result in different unbalanced characteristics.
Balancing the flange set on the saw is actually called dynamical balancing.
This is a well-known process and a common practice on balancing, for example, car wheels.
A sensor is monitoring the vibrations and calculating the mass to be added to a specific location to perfect the mass distribution while the wheel is rotating. This process is repeated till the wheel is in the vibration tolerance.

Dynamical Balancing of Flange Sets on Dicing Saws

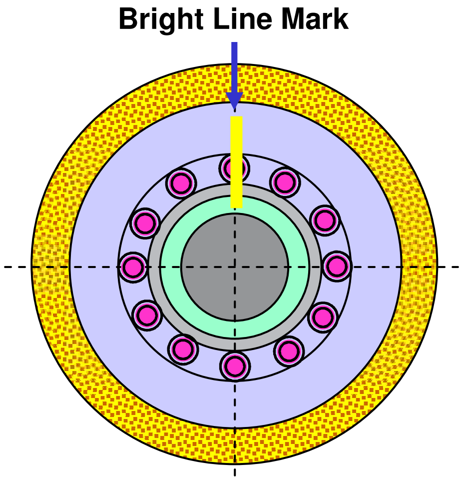
The most common system for dynamic balancing of flange sets is the Schenck system, although any other similar system can be used as well.
To perform a dynamic balancing process, 8–12 set screws are needed on the flange front grip or on the spindle nut:



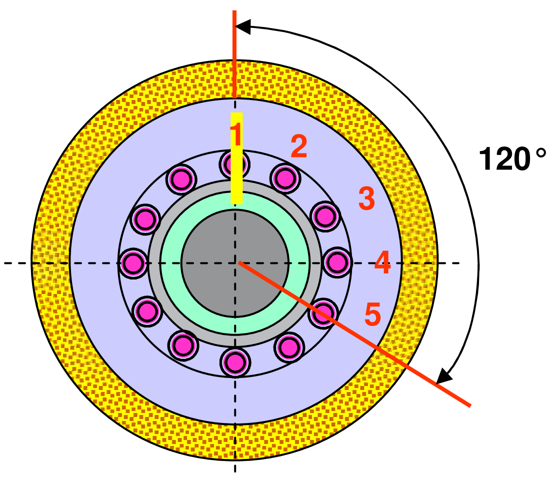
An acceleration sensor is mounted to the spindle housing area and an RPM sensor is mounted to the chuck area. Both the acceleration and the RPM sensors are connected to a microprocessor:



On the front flange where the set screws are located, a bright line is marked.
This is needed for the RPM sensor:

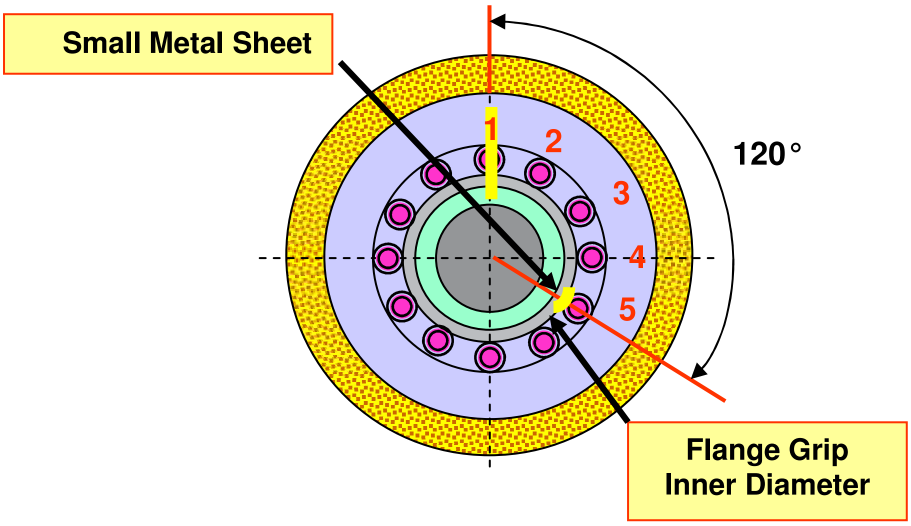


After setting up all the sensors on the saw, the spindle is being rotated to the same production RPM and the microprocessor is monitoring the vibrations in **mm/sec².**
The vibration reading is digitally displayed or printed, depending on the system options.
The instrument also displays the mass (weight) needed for correction of the vibration and the location the mass needs to be added. The location can be either a set screw no. or the angle from the bright reference mark on the flange set. For example, hole no.5 or 120º.
(360 : 12 = 30 x 4 = 120º). See the below sketch.



There are 2 options for mass correction:

1. A set screw with a specific mass is being weighted on an accurate scale with an accuracy of milligrams and screwed to the right location. The set screws are taken from a set of screws including many small nylon set screws with different length, each with a different mass (weight).
2. Another option is to use a thin metal sheet with an adhesive on one side. A small piece of the metal sheet is cut with scissors and being weighted on an accurate scale with an accuracy of milligrams. The small metal sheet piece is then glued to the inner diameter of the flange grip (see the below sketch):



A second spindle rotation is conducted to the production RPM and a second vibration check is monitored. This process is repeated till the flange set is meeting the vibration goal. A normal acceptable vibration value is in the range of **0.02mm / sec²** but this value may change per each application requirement.

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