Belt Tension Demonstration Device
PA NOTE

In the recent past we've had a few questions concerning the new belt tension demonstration device (mousetrap) which is part of the belt demonstration kit. This device demonstrates the relationship between the amount of torque which a belt can transmit and the shaft separation force (total belt tension). A few people have noticed a difference in torque readings when 40 lbs. of shaft separation force is applied with only one belt vs. three belts.

This is due to the fact that we are demonstrating a dynamic principle with a static device. A well-known principle of physics explains that static friction is usually higher than dynamic friction. Also, elastic nature and wedging principles greatly complicate the frictional characteristics of the common V-belt. When these varying frictional forces are applied to the sheave, it introduces the inconsistent torque readings on the driveN sheave. The higher the load, the higher the variation of torque readings. The worst variation would happen when there is 40 lbs. shaft separation force and only one belt on the pulleys. A check of the "old mousetrap" revealed it exhibits a similar characteristic.

Could these variations prevent us from demonstrating a tension lip characteristic of V-belts with this demonstration device? Not really. When measuring torque under constant tension, most people think three belts would transmit three times more torque than one belt. In theory, there should be no difference, but in reality with the mousetrap the variation in torque reading is minimal.

How can we minimize this affect when demonstrating the mousetrap? The best way would be to avoid the worst variation, or step 8, of the instructions. Let's review the entire instructions for the tension demonstration device.

Steps 1,2, 3 and 4 simply introduce the different mechanisms of this drive. Steps 5 and 6 demonstrate that three belts do not transmit three times more torque than one belt when tensioned at 20 lbs. shaft separation force. Notice there is a little variation between one and three belts, but certainly not three times.

A comparison between steps 6 and 7 demonstrate that the total shaft separation force, not the number of belts, control the amount of torque which can be transmitted. When total shaft separation force is doubled, the torque doubles. Step 8 is simply a double-check, at the higher tension value, which is really not needed to demonstrate that the number of belts do not increase the amount of torque which can be transmitted, assuming shaft separation force does not change. Therefore, we recommend Step 8 be omitted when demonstrating the mousetrap.

There are a few other ways to reduce the variation in torque:

1. When only one belt is on the pulleys, use the inboard groove. This reduces the bearing loads and any binding of the carriage which holds the driveN sheave. Again, this is more important at the higher 40 lb. shaft separation force.

2. When setting the shaft separation force to 20 or 40 lbs, be sure to adjust the fine-tuning thumbscrew on the left hand side to make sure the spring scale reads the correct value. Do not simply use the tension handle on the right-hand side since it is not calibrated to exact loads. This device demonstrates the torque vs. tension relationship; therefore, it is very important to set the spring scale to the correct value using the thumbscrew.

For those of you who have not used the tension demonstration device, we suggest you take some time to go through the procedure and familiarize yourself with the device.