

TRENDS FOR APPLICATION OF THE WEDGE AND RIBBED BELTS IN MODERN WOODWORKING MACHINERY

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ABSTRACT

The current paper makes an overview of trends in the use of V-belts and ribbed belts in modern woodworking machines. Driving of different types of mechanisms in machines is most often accomplished by using belt drives. They have many advantages and some of the most important are: simple construction, quiet operation, large towing capacity, the possibility of simultaneous operation of several belts and further more. Widely spreads are both the V-belts and ribbed belts. Improved construction and use of high quality materials for their production leads to betterment their performance.

Key words: woodworking machines, V-belts, ribbed belts

INTRODUCTION

Belt drives are used as the preferred method to drive cutting, filing and other mechanisms in woodworking machines. This undeniable is due to their advantages over other types of gears. Compared with the chain and teeth gears, which are also widespread, belt drives operate more quietly and smoothly owing to the elasticity of the belt, reduce the shocks of the emerging rapid changes in load during operation of the mechanism, transmitting power over long distances. The belt slides on the pulleys protect the mechanism from overload. Also sudden loads in the drive units of the machine and its other element are avoided (Lefterov et al. 1994, Popov 1985). Belt drives do not require special efforts to maintain. They are easy to operate; replacement of the old belt with a new one is faster and cheaper. Their simple construction means reducing costs, increasing security and durability. At the same time they enable the reduction in the level of vibration and noise (Vukov 2005, Vukov et al. 2012). In woodworking and furniture machinery, energy is transferred from the motor to the executive

parts through the belt drives. There the motion is transformed in one required for the operation element of the machine (Filipov 1977, 1979). Belt drives operate at high speeds – most often from 5 m/s to 30 m/s. There are also rapidly-operating ones which can run at speed above 60 m/s (Popov 1985, Sokolovski 2007).

The purpose of this work is an overview of trends on the use of V-belts and ribbed belts as part of actuators in modern woodworking machines.

1. APPLICATION OF THE WEDGE AND RIBBED BELTS

The most commonly used belts for driving the cutting mechanisms of modern band saws, circular saws, wood shapers, planers, thickness planers and other machines are V-belts and ribbed belts. Fig. 1 shows a planer driven by a V-belt.



Figure 1: A planer driven by a V-belt

Fig. 2 shows a circular saw driven by a ribbed belt.

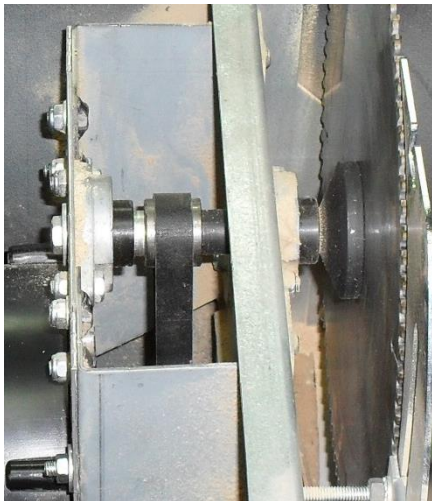


Figure 2: Circular saw driven by a ribbed belt

This trend was established as a result of their primary advantages over flat belts, which were widely used in the past. Some of their qualities are:

- They work lightly, quietly without vibration;
- They have more quality grip with pulley;
- Large traction capacity;
- They perform evenly well both at horizontal and vertical placement of the gear;

- The pressure exerted over shafts and bearings is smaller than from flat belts;
- A tension roller is not required in order to set in motion a V-belt.

V-belts and ribbed belts are produced closed. This avoids unnecessary oscillations in the operation of the gear, generated by concentrating more mass at the joint at both ends if the belt is not closed.

V-belts and ribbed belts operate by moving repeatedly around the pulleys. During operation of the gear, pressure is exerted in a different way on the different parts of which a belt is made. They can be divided in three main directions: operating on stretching, operating on pressure and neutral ones. This requires using different materials when manufacturing the different parts of the structure. For a belt to be able to function optimally, it is desirable belt layers that operate on stretching and contraction to be made of materials with low modulus of elasticity. For the development of the middle layer, products with high strength and high modulus of elasticity should be used. If these conditions are observed, the result will be quality belts that work reliably. This will reduce the time lost in frequent replacement caused by its rapid amortization or destruction of arising defects. The materials and construction have a significant impact on the performance of the belt, its operating hours, the opportunity to transmit torque from one shaft to another, its traction power, efficiency of the gear and more. Large residual stresses in the belts are undesirable effects. When V-belts or ribbed belts don't demonstrate the desired performance according to the accepted standards (BDS 8718:1989), some of the reasons for this is due to the failure of any of the requirements for them.

2. BASIC CONSTRUCTIONS OF THE WEDGE AND RIBBED BELTS

Classical V-belts are widely used in order to drive the cuttings, fillings and other mechanisms in band saws, circular saws, planers, wood shapers and other woodworking and furniture machinery. They work by two sloping sides and allow the transmission of high power. V-belt with different sections demand the appropriate minimum diameter of the pulley. For optimal performance, this condition must be observed. Constructive V-belts are divided on two groups. Some of them are made with cord stuff and the other with cable cord (Lefterov et al. 1994, Popov 1985, Sokolovski 2007). The cord matter is a carrying material and placed in a middle layer of the product. It is made of synthetic materials such as polyamide, viscose (Lefterov et al. 1994, Popov 1985). Trapezium is made of rubber, the outer layers are treated with rubberized fabric and rubber coating to increase its durability (Optibelt – Product Range, SKF – belt catalog).

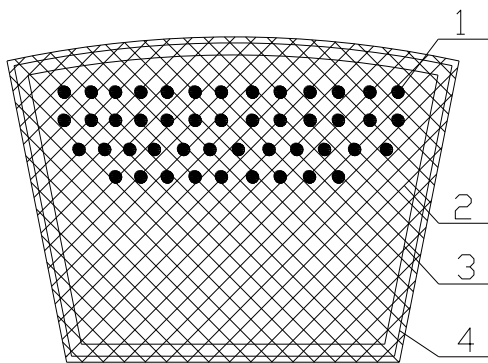


Figure 3: A V-belt cut made from cord stuff

Fig. 3 shows a detailed section of the V-belt made of cord stuff, which consists of 1 – synthetic ropes, 2 – layer of hard rubber, 3 – rubber coated, 4 – rubberized fabric which wraps several times around the section and protects it from wear.

The construction of the belt made from cable cords can be seen in fig. 4. It repre-

sents several spirally tied cords in the neutral line of section of the belt – 1. They take the main pressure during the operation. The base of the trapezium is made of rubber – 2 and is additionally treated with a rubber coating – 3 and rubberized fabric – 4, which protect it.

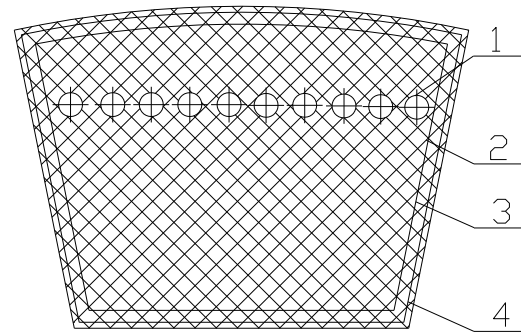


Figure 4: A V-belt cut made from cable cord

Narrow V-belts are used in cases when it is necessary to gear to increase the towing capacity (Popov 1985). These belts are most widespread in the automobile industry. They can easily be used in the woodworking machinery. Their construction can be both from cord stuff and cable cord. Cross fiber from polychloroprene is added to the rubber base of the product. When classic belts are changed for narrow V-belts the distance from the top to the bottom of the pulley channel should be carefully measured with caliper. Typical for them is that they are narrower but deeper than the classic ones. They must not fall to the bottom of the channels – fig. 5 and operate as flat ones. In this situation the gear operation is upset.

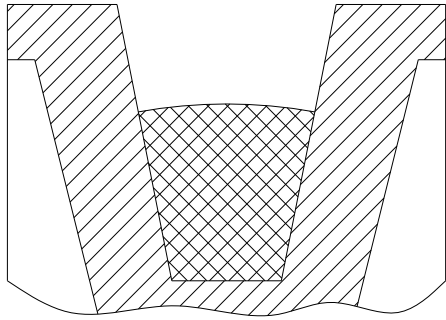


Figure 5: Incorrect belt placement in the channel of the pulley

Other advantages of this type of belts are also improved towing capacity, sometimes it can be up to 50 %, easy maintainability, improved work efficiency of the gear, good performance during operation which reduces vibration and resistance to shock loads (Optibelt –Product Range, SKF – belt catalog).

Many producers of woodworking machinery have recently been using ribbed belts to drive their actuators. Most often this trend can be seen in circular and some amateur wood machines. They combine the advantages of flat and V-belts. They can be placed on pulleys with much smaller diameter than V-belts. The result is smaller dimensions of the gear and a more compacted machine. They have increased towing capacity. There must be strict parallelism between the main shaft of the machine and that of the electric motor so that the gear with the ribbed belt can operate properly; precise produce of the grooves of the pulley in accordance with the belt profile; accurate assembly and more. Fig. 6 illustrates the structure of the belt. It consists of a flat rubber part 1, where cable cords are arranged 2. Wedges are arranged in length and made of the same material as the base (Popov 1985).

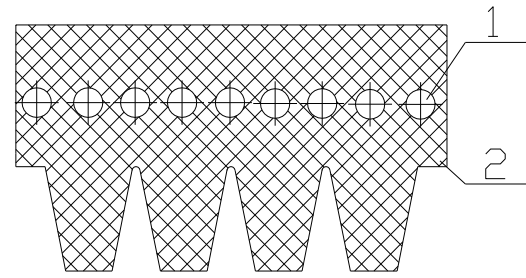


Figure 6: A ribbed belt cut

The examined types and structures of V-belts and ribbed belts are for the most part used in woodworking and furniture machinery. This is due to their quality and the reliable and efficient operation of the gear. This reduces damages that would result from the gear. Also unnecessary idle time associated with repairs and machine setting is prevented – which is directly related to their performance. Each of the belts shown in this article has its individual characteristics. For optimal operation of the gear they must be observed strictly.

CONCLUSION

The article review studies the application of V-belts and ribbed belts in modern woodworking machines. It describes the basic structure from which they are made as well as the advantages and disadvantages of different types of belts. In the future, practical research is going to be made about the behavior of classical V-belts, narrow V-belts and ribbed belts, used mostly to drive cutting mechanisms in woodworking machines. Oscillation caused by the belt will be carefully analyzed as well as the influence of these vibrations over the elements and machine knots.

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