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The main combing organs of the carding machine

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ABSTRACT: This article discusses the improvement of the technological process for the production of threads, through the process of scratching, solving optimization issues and developing the necessary recommendations. The main purpose of the combing organs of the carding machine is the further separation of individual small groups of fibers into even smaller groups and individual fibers, straightening and parallelizing the fibers, mixing and purifying them from impurities.

KEY WORDS: Main drum, headset, raw materials, carding, head drum, comb, combing machine, wool, fiber, receiving drum, speed, research, spinning yarns, spinning.

I. INTRODUCTION

In world production, spinning of raw materials in order to reduce the consumption of natural materials, expanding the range of spinning yarns, conducted large-scale research aimed at improving technological processes. In particular, in this direction, it is aimed at improving the properties of spinning yarns, its quality indicators and competitiveness by improving the technological process for the production of yarns, through the process of carding, solving optimization issues and developing the necessary recommendations. (1).

II. SIGNIFICANCE OF THE SYSTEM

Knot of the main drum of carding machines. In cash carding machines, the main working bodies performing these operations are: the main drum, working and removable rollers, distillation roller, runner and runner.

On machines, both in woolen and combed spinning systems, the number of lines increases with an increase in the number of webs, as well as with an increase in the number of pairs of working and removable rollers in each weave.

For the normal course of carding, the surfaces of the working bodies equipped with a headset should be at a certain distance from each other. As the fiber transitions from one working body to another (subsequent) as the degree of its loosening. Separation into small groups and individual fibers, the distance (wiring) between the working bodies should be reduced.

For this purpose, the bearings of the working bodies associated with the main drum are mounted on a frame - an arc fixed to the main frame of the machine. The gap between the arcs and the main drum is from 0.5 to 1.0. For proper fixation, the arcs are pinned to the frame.

The bearings of the removable rollers, working rollers, runners and runners, respectively, can be moved in the radial direction (to set the wiring between them and the main drum) and in a circular arc (to set the wiring between the working and removable roller, runner and runner). The bearings of the removable drum are mounted on the frame; they can be moved horizontally (frame).

Mountings of bearings mounted on an arc - frame are the same for all working bodies.

The bearings are firmly attached to the arc with a stud and nut. The lower part of the bearing has a screw that passes through the longitudinal hole of the side of the arc, and is fixed with nuts (to move the bearing in the radial direction). To move the bearings along the arc, there are bolts that pass through the inner walls of the bearing and abut against the rectangular sides of the arc. (2, 3)

Moving bearings should provide the following recommended wiring: drum and work rolls 0.5-1 mm; drum and removable rollers 0.5-1 mm; working and removable rollers 0.5-0.6 mm; drum and runners 0.5-0.7 mm; runner and runner 0.5-0.75 mm; drum and removable drum 0.3-0.6 mm; removable drum and comb 0.2-0.35 mm.

The efficiency of the process of processing fibrous material on carding units depends on many closely related factors.

One of these factors is the ratio of the speeds of the working bodies.

III. METHODOLOGY

When choosing the speed mode of the carding machines, it is necessary to avoid excessive stretching and loosening at the first stage of combing to avoid fiber breakage. The speeds of the working bodies of the pre-combing machine should be significantly lower than the speeds of the working bodies of the subsequent combing. As the fiber mass is divided into separate groups and individual fibers, the peripheral speeds of the working bodies during the process gradually increase.

Initial in determining the ratio of speeds are the safety of the fiber along the length, the efficiency of separation (combing) of the fibers, the leveling and mixing ability of the carding machine.

When choosing the speed of the main drum covered with a needle tape, it should be borne in mind that the strongest tape can move away from the surface of the drum with an all-metal serrated tape, the speed of the drum can be significantly increased.

The speed of the main drum of the carding machine for wool can be determined from the conditions of equal mass coming down from the fleece drum per minute, to the mass of roving threads wound with knurled rollers over the same time:

$$qlv_6 = \frac{n_p v_h}{N_{pob}};$$

where q -the load on the headset in g / m^2 ;

l – working width of the main drum in m;

v_6 - peripheral speed of the main drum in m / s;

n_p – the number of straps;

v_h - peripheral speed of knurling rollers in m / s;

N_{pob} - roving number in m / g.

The load q depends on the quality and nature of the processed wool blends and ranges from 0.36 to 1 g / m^2 . The roving number also depends on the nature and quality of the processed wool blends and on the hood that can be given to it on the spinning machine from the number of yarn.

At $q = 0,36-1,0 \text{ g/m}^2$; $N_{pob} = 4-16$;

$v_h = 0,3-0,75 \text{ m/s}$; $n_p = 120$; $l = 1800 \text{ mm}$;

The peripheral speed of the drum will vary within.

$$v_6 = \frac{120(0,3-0,75)}{1,8(0,36-1,0)(4-16)} = 1,25 - 34,7 \text{ m/s},$$

With the diameter of the drum $d = 1372 \text{ mm}$, the rotation speed

$$n_6 = \frac{(1,25 - 34,7) * 60}{3,14 * 1,372} = 17 - 484 \text{ rev/min}$$

Assuming for the existing structures $n_{max} = 160 \text{ rev/min}$ and $n_{min} = 80 \text{ rev/min}$, we obtain the necessary adjustment range $D = 160 \div 80 = 2$. The above calculation of the speed of the main drum was made for the third process. The speeds of the first and second checks of the machine are calculated in a similar way. The drums are not on a par with the technological cycle one after the other: in practice, the subsequent drum has a higher speed than the previous one.

The speed of rotation of the working rollers depends on the nature of the mixture, the quality of the processed fiber and the produced roving number. The speed of rotation of the rollers must be adjusted easily and quickly, without stopping the machine.

Work rolls usually rotate at a peripheral speed of 0.033-0.091 m / s. With a diameter of working rollers of 210 mm (the first working roller has a diameter of 185 mm), their rotation speed varies from 2.5 to 8 rev/min.

Usually, the speeds of the working rollers (from the first to the fifth) are somewhat reduced; the number of sprocket teeth is as follows; $z_1 = 32$; $z_2 = 34$; $z_3 = 36$; $z_4 = 38$; $z_5 = 40$; in some machine rollers, the number of teeth in each subsequent sprocket increases by five.



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Removable rollers (diameter 102 mm) are driven by a belt from the main drum shaft. The rotation speed of the removable rollers is about 500 rpm.

The purpose of the runner is to raise the fibers in his headset to the surface of the drum. The diameter of the runner is 310-350 mm, the peripheral speed is about 12 m / s (on the first pass). The district runner slightly exceeds the speed of the main drum.

In hat-type carding machines, the final separation of fiber bundles into individual fibers and the separation of small weed impurities and individual fibers with defects is carried out in the drum-cap area.

The main drum of the machine is covered with an all-metal serrated ribbon, and in some machines - with a needle ribbon. Hats are fitted with a needle ribbon. Hats with semi-rigid and all-metal serrated tape are being developed.

Under the main drum there is a grill of two parts 24 and 25, each of which is independently adjusted relative to the working surface of the drum. (4, 3).

The number of loosening-scratching lines providing separation of the fiber bundles is determined by the number of hats in the scratching zone. In modern machines, from 24 to 40 caps are in the scratching zone.

Screws for fastening the chain links with the sleeve are screwed into the protrusions at the ends of the caps. Hats and a chain represent an endless bonnet. To ensure free relative rotational movement of the hats when they pass along the arc, it is necessary that the outer diameter of the chain sleeve is slightly smaller than the diameter of the opening of the chain link (landing fit). For the same purpose, the inner diameter of the hole of the chain link for the screw should be slightly larger than the diameter of the screw (running landing). Of great importance to the quality of the weave is the wiring, the distance between the headset of the main drum and the caps. The wiring between the drum and the hats (about 0.20-0.25 mm is recommended) is installed using a special device. An arched arc is installed on the machine frame, on the protrusion of which a movable arc is installed. To prevent distortion between the movable arc and the nut there is a spherical washer. A flexible arc is installed on the beveled part of the movable arc, which abuts against the protrusion of the edge of the arched arc with the side wall.

The ends of the caps rest on flexible arcs and are concentric with the working surface of the main drum. The cylindrical surface of the flexible arc serves as a support for hats; during the operation of the machine, the caps glide over this surface.

Upon leaving the working area, the hats are cleaned with a comb comb or roller, and finally with a round brush.

The direction of movement of the caps usually coincides with the direction of rotation of the drum. If the direction of movement of the caps does not coincide with the direction of rotation of the drum, then the quality of the weave and the purity of the yarn are increased; this method of processing is the most progressive. However, with this method, the loss of full-length long fibers carried away with tow is increased.

Combing machines for wool and cotton fumes have a separate electric motor for each comb. Caps are usually equipped with one electric motor. The drive of the scratching machine must ensure the synchronous rotation of all engines during start-up and shutdown; synchronous rotation of all engines in stationary mode and the possibility of reversing the electric motor of each process.

The large moments of inertia of the rotating parts of the carding machines, especially the main drums, determine the choice of electric motors for which the starting torque is 2.8-3 times greater than the rated one. Engines of carding machines previously, as a rule, were installed outside the machine, the dimensions of the apparatus with this arrangement increased sharply. Currently, the design trend is the desire to place the engine in the dimensions of the machine, and the machine to run completely closed.

The drive of the carding hat machine includes a friction clutch, shoe brake, control mechanism and other mechanisms.

Consider a friction clutch device. The drive V-belt pulley is freely seated on the sleeve of the main shaft of the drum. The driven pulley hub with dowels is rigidly fixed to the drum shaft. On the hub of the driven hub, a hub is freely set to which a steel disk is mounted with rivets on both sides of which are freely floating copper-asbestos friction rings. Bolts secured around the circumference of the pulley and passing through the holes of the pressure disk carry springs on them that clamp the disk together with the friction rings between the wall of the drive pulley and the disk.

The movement of the main drum is transmitted from the pulley through a disk with friction rings and then through the fingers of the driven hub.

The coupling is switched off by moving the thrust ball bearing housing along the axis of the shaft (towards the end of the shaft). Two pins are included in the bearing housing, which are included in the bevels of the housing. The upper tide of the housing is pivotally connected by a rod with a handle. When the handle is moved to the leftmost position, the housing rotates and, sliding along the bushings of the fixed pins, moves along the shaft, pushing the ends of the levers through the thrust bearing and the movable housing. The levers push the bolts located around the circumference of the pressure plate, squeeze it and turn off the friction clutch.

The features of the drive of a carding hat machine are a friction clutch and a shoe brake, which ensure a smooth start of the machine (unloading the electric motor and V-belt transmission from high starting loads) and a quick stop of the machine in 10-20 seconds.

At the same time as the clutch is turned off, the shoe brake mounted on the right frame of the machine is engaged.

A brake shoe fitted with asbestos tape sits loosely on an axle mounted in the frame of the machine, inside the rim of the main drum. Between the brake pad and the inner part of the rim there is a gap that provides free rotation of the main drum.

When the friction clutch is turned off, when turning the ear of the housing and the finger, the rod turns the lever mounted on the roller. In this case, the cam presses the brake pad against the inside of the rim of the main drum; the drum slows down and stops.

When the clutch is engaged, the cam releases the brake pad, which, under the action of the spring, moves away from the drum rim.

Inclusion in work of a brake and switching off of the coupling is carried out by means of draft and the handle. On the link is located under the locking lever locking the folding knife, not allowing it to open when the main drum rotates.

The coupling to protect it from dust and service safety is closed with an end cap.

With the existing technological mode of operation of the machine, the speed of rotation of the main drum with a diameter of 1280 mm is 185-195 rpm and more quality is improved, there is a complete possibility of operating the machine. It should be borne in mind that increasing the speed of the main drum requires increasing the accuracy of the manufacture of the machine, and especially its main working bodies.

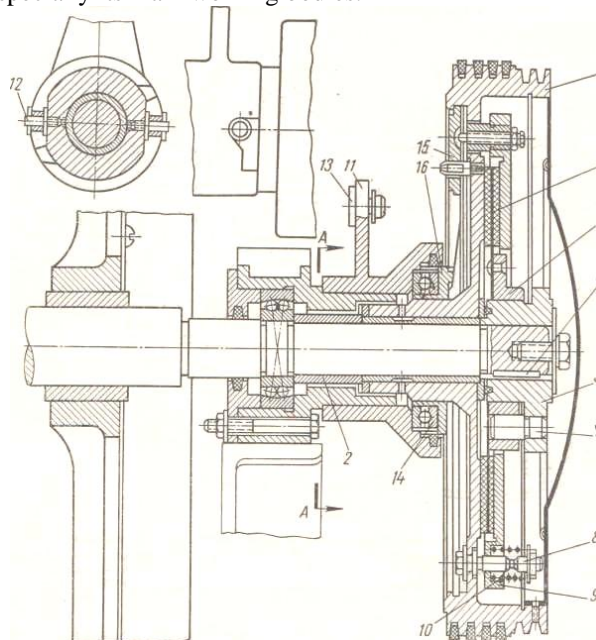


Fig. 1. Friction clutch:

1-pulley; 2- sleeve; 3-driven pulley hub; 4- dowel; 5-nave, 6-disk; 7- finger; 8- bolt; 9- clamping disk; 10-spring; 11- thrust ball bearing housing; 12-pin; 13- thrust; 14 - thrust bearing; 15- lever; 16-movable housing.

Combing machines for wool and cotton fumes have a separate electric motor for each comb. Caps are usually equipped with one electric motor. The drive of the scratching machine must ensure the synchronous rotation of all engines during start-up and shutdown; synchronous rotation of all engines in stationary mode and the ability to stop and reverse the electric motor of each comb.

The large moments of inertia of the rotating parts of the carding machines, especially the main drums, determine the choice of electric motors for which the starting torque is 2.8-3 times greater than the rated one. Engines of carding machines previously, as a rule, were installed outside the machine, the dimensions of the apparatus with this arrangement increased sharply. Currently, the design trend is the desire to place the engine in the dimensions of the machine, and the machine to run completely closed. The features of the drive of a carding hat machine are a friction clutch and a shoe brake, which ensure a smooth start of the machine (unloading the electric motor and V-belt



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transmission from high starting loads) and a quick stop of the machine in 10-20 seconds. At the same time as the clutch is turned off, the shoe brake mounted on the right frame of the machine is engaged.

A brake shoe fitted with asbestos tape sits loosely on an axle mounted in the frame of the machine, inside the rim of the main drum. Between the brake pad and the inner part of the rim there is a gap that provides free rotation of the main drum.

When the friction clutch is turned off, when turning the ear of the housing and the finger, the rod turns the lever mounted on the roller. In this case, the cam tightly presses the brake pad to the inner part of the rim of the main drum, the drum slows down the rotation and stops.

When the clutch is engaged, the cam releases the brake pad, which, under the action of the spring, moves away from the drum rim.

Inclusion in work of a brake and switching off of the coupling is carried out by means of draft and the handle. There is a locking finger on the link, which, when the machine is turned on, is located under the locking lever that locks the folding knife, not allowing it to open when the main drum rotates.

When choosing the speed of the main drum, and therefore the kinematic mode of operation of the entire machine, it is necessary to take into account the speed of the receiving drum, the speed and direction of movement of the flat head.

The conditions for the transition of the fiber from the receiving drum to the main drum depend on the advancing of the receiving drum by the main drum, the action of the centrifugal force of the fiber complex, the wiring between the drums, the angle of inclination of the teeth of the receiving and main drums and the air flows formed by the rotation of the main drum directed to the occipital part of the teeth of the receiving drum at the transition point fiber to the main drum.

With the existing technological mode of operation of the machine, the rotation speed of the main drum with a diameter of 1280 mm is 185-195 rpm. However, research shows that with an increase in speed of up to 300 rpm and more, the quality of the weave improves, there is a complete possibility of operating the machine. It should be borne in mind that increasing the speed of the main drum requires increasing the accuracy of the manufacture of the machine, and especially its main working bodies.

The main drum is one of the main working organs of the carding machine. It is a thin-walled cylinder with a thickness of 10-12 mm, mounted on the shaft with two crosses located at the ends of the drum. The shell is usually made of gray cast iron grade SCH 18-36. On the inner surface of the middle part, the shell has stiffening ribs. The spider joins the shell with bolts. Between the crosses and the shaft are split sleeves with an external conical surface, which facilitates the assembly of the drum assembly and provides centering and fastening of parts on the shaft. To prevent the ingress of fibers and fluff inside the drums from the ends are closed by shields. The surface (cylindrical) of the main drum is fitted with an all-metal serrated tape or needle ribbon. To fix the needle tape on the surface of the drum, holes are drilled for wooden plugs. Early on roller carding machines, gypsum drums were used. In modern machines, only metal drums are used, which provide sufficient strength at high speeds of rotation and accuracy of wiring. During rotation, the centrifugal force of the mass of fibers located on the drum is several times higher than their gravity.

The maximum radial deformation of the drum is determined by the allowable value of the maximum tooth edge of the serrated tape during its operation.

To determine the loads acting on the shaft of the main drum, you can use the data on the distribution of power among the individual nodes of the machine (according to the test results).

V. EXPERIMENTAL RESULTS

Studies show that the high quality of the comb depends not only on the number of hats, but also on the choice of the type of combing headset, on the increase in activity of each hat, which, in turn, depends on the design of the drum head assembly. The angle between the needle surface of the caps and the needle surface of the drum is about 1.50. To do this, one hat plate is thicker than another. At the entry point of the fiber under the cap, the gap is greater at the exit point of the fiber - less. Recent studies have shown that the main drum of the hat-combing machine for cotton, covered with an all-metal tape, works quite satisfactorily at a speed of 23.5 m / s (the diameter of the main drum is 1272 mm).

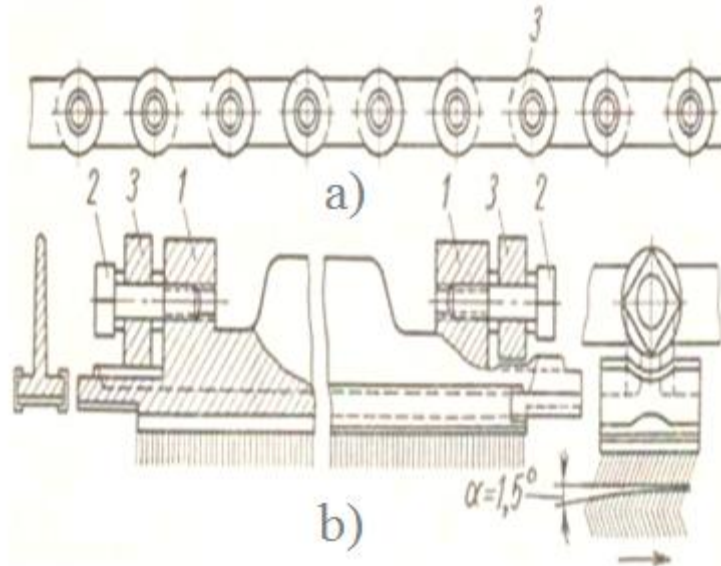


Fig. 2. Hats:

a - general view; b- nodes (1- tabs on the grates of the hats; 2- screws; 3- chain).

Researchers' experiments showed that the speed of the flat head should be set taking into account the performance of the machine and the speed of the main drum

VI. CONCLUSION AND FUTURE WORK

When choosing the speed of the main drum, and therefore the kinematic mode of operation of the entire machine, it is necessary to take into account the speed of the receiving drum, the speed and direction of movement of the bonnet.

The conditions for the transition of the fiber from the receiving drum to the main drum depend on the advancing of the receiving drum by the main drum, the action of the centrifugal force of the fiber complex, the wiring between the drums, the angle of inclination of the teeth of the receiving and main drums and the air flows formed by the rotation of the main drum directed to the occipital part of the teeth of the receiving drum at the transition point fiber to the main drum.

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