ABSTRACT: A protective cover for guide paths of machine tools, which comprises a plurality of overlapping and telescopically movable cover sheets, and rolling and slide means, respectively. Each of the cover sheets are supported at a front end wall by means of the rolling and slide means, respectively, on the corresponding of the guide paths and at the rear end on the next smaller of the cover sheets, and a speed-reducing braking device is disposed between the cover sheets, and becomes effective during movement from each other and into each other shortly prior to the prevailing end position.
Fig. 2
PROTECTIVE COVER FOR GUIDE PATHS OF MACHINE TOOLS

The present invention relates to a protective cover for guide paths of machine tools, in general, and to such protective cover comprising a plurality of overlapping and telescopically movable covering sheets, whereby each of the covering sheets is supported at a front end wall with running rollers, slide members or the like on the guide path and at the rear end of the next smaller covering sheet, in particular.

Protective covers of this type are known in different embodiments. In the known protective covers, the individual cover sheets are moved together in nonpredetermined succession after each other, from each other, and toward each other, respectively, whereby the moved cover sheets abut with non-reduced speed the still resting cover sheets and entrain the latter without transfer from the resting position. In order that the cover sheets are not destroyed by the acceleration forces created thereby, they must have a corresponding form stability and must be equipped with fortified abutment and entraining ledges. For this purpose, individual cover sheets of the known protective coverings have a relatively greater weight and a great moment of inertia resulting directly therefrom. Accordingly, these protective coverings can be used only up to a moving speed of about 12 to 15 m./min. In case of greater process speeds, the occurring acceleration forces cause damages upon abutment of the individual covering sheets.

It is one object of the present invention to provide a protective cover for guide paths of machine tools, wherein the protective covering for straight guide paths of machine tools are formed such, that they are suitable also without increase of the weight for higher process speeds beyond 20 m./min.

It is another object of the present invention to provide a protective covering for guide paths of machine tools, wherein the individual cover sheets are coupled together such, that they abut nearly noiseless on each other. Finally, the individual cover sheets of the protective cover should no more be pulled from each other and into each other in a merely coincidental succession, but rather always from the end in a predetermined and equalized succession.

It is still another object of the present invention to provide a protective covering for guide paths of machine tools, wherein the drawbacks of the known structures are avoided.

Starting from the known protective guiding paths of machine tools, consisting of a plurality of overlapping and telescopically covering sheets moving into each other, whereby each cover sheet is supported on a front end wall with running rollers, slide members or the like on the guide path and at the rear end on the next smaller cover sheet, the object of the present invention is achieved by a breaking device disposed between the cover sheets becoming effective during moving apart or moving together of the cover sheets short prior to the prevailing end position and reducing the maximum speed.

The protective covering formed in accordance with the present invention has the advantage that the starting path up to reaching the end speed is increased. By this arrangement, the maximum occurring acceleration force is reduced, so that the individual covering sheets not only endure greater passing speeds in permanent operation, but also can be designed of lighter weight. Furthermore, the braking device disposed between the individual covering sheets removes also, in accordance with the present invention, the noise caused until now at the point of abutment.

In a preferred embodiment, the braking device is suitably disposed on the front or rear side of the end wall and comprises at least a pneumatic or hydraulically operating buffer. In the practice, it has been found suitable to provide two buffers on each end wall, whereby always one is disposed adjacent the sidewalk. The pneumatic operating buffer can comprise, thereby, a cylinder with two return valves disposed in an end portion thereof operating in opposite directions and biased by pressure springs, a bleeding bore disposed in the cover and a piston with piston rod and headplate standing under the effect of a return spring. In order to dampen the abutment noise, the headplate is thereby suitably resiliently supported with an elastic pillow of synthetic material or rubber.

In a further preferred embodiment, the braking device can be disposed also between the sidewalls of the cover sheets and can comprise two brake wedges secured rigidly adjacent the end wall on the inner cover sheet on the outside and also four corresponding brakeshoes secured in pairs at the outer cover sheet on the inside thereof and mounted resiliently perpendicularly to the direction of movement. The brakeshoes are thereby suitably guided by means of slots on bolts and mounted with their back to the cover sheet and to the guide ledge of the cover sheet against spring blades. In order to improve further the elasticity of the friction brake consisting of brake wedges and brake basins, the slots in the brakeshoes can be disposed at an angle to the direction of movement, preferably at an acute angle. By this arrangement, simultaneously also the advantage is brought about, that the brake wedge can be released easily again from the brake split defined by the two brakeshoes.

Another braking device disposed likewise between the sidewalls of the covering sheets comprises, in a preferred embodiment, two braking rods rigidly secured adjacent the end wall on the outside of the inner cover sheet and also four corresponding brake tongs disposed on the outer cover sheet at both ends of the inner side. By this arrangement, the brake rod is suitably conically formed toward both ends and each brake tong comprises two levers swingingly mounted relative to each other on an axle against pressure springs. In order that the brake rod can close the brake tong and can run into the latter without any noise, it is suitable to mount eccentrically a pressure roller on each lever, whereby the smaller is its unloaded state toward the brake rod. For this reason, the center of gravity of the upper pressure roller is shifted by a recess to the smallest radius, so that the latter hangs always automatically downwardly.

Finally, the braking device can comprise, in a further preferred embodiment, also permanent magnets or electromagnets. For this purpose, suitably two soft iron pieces are measured spaced apart from each other at the forward and rearward ends below the outer cover sheet and a permanent magnet in between on the end wall and a console of the inner cover, respectively, whereby the South Poles of the permanent magnet points to the soft iron pieces. In order that the soft iron pieces are disposed space saving and can be rolled towards each other without any noise, they are ledgelike formed and have inclined contact faces. This arrangement has the advantage that the succession in which the individual cover sheets are drawn away from each other and are moved into each other, respectively, are exactly determinable by the length of the soft iron pieces and of the permanent magnet. If the length of the soft iron pieces and of the soft iron pieces diminishes from the largest and the smallest cover sheet, the latter are moved from each other and into each other, respectively, starting with the smallest always in the succession of their size.

A further preferred embodiment of the braking device of the present invention with permanent magnets resides in the fact, that at least one permanent magnet is inserted in each end wall, whereby the poles are alternately exchanged and, under circumstances, equal poles are pointing towards each other. Additionally, in this embodiment, still at least one permanent magnet can be disposed and with unequal poles can be secured in front of each end wall on a console and at the rear end below the cover sheet. If the number of these permanent magnets from the largest to the smallest cover sheet diminishes, again the advantage is brought about, that the cover sheets are moved from each other and towards each other, respectively, in a predetermined succession.
3

With these and other objects in view, which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawings, in which:

FIG. 1 is a perspective view of the completely pulled out protective covering on a guide path for demonstration of the different braking devices with partly broken cover sheets;

FIG. 2 is an axial section of a pneumatically operating buffer;

FIG. 3 is a perspective view of two covering sheets moved into each other, whereby the sidewall of the larger cover sheet, for demonstration of a tong brake disposed between the sidewalls is partly broken away;

FIGS. 4b and 4c are schematic elevation of two pressure rollers of the tong brake in accordance with FIG. 4a;

FIGS. 5a and 5b are longitudinal sections of a plurality of cover sheets moved into each other and out of each other, respectively, with a braking device consisting of soft iron pieces and permanent magnets;

FIGS. 6a is a top plan view of a protective cover with a braking device comprising permanent magnets; and

FIGS. 6b and 6c are longitudinal sections of a protective covering with a braking device consisting of permanent magnets and in a position moved into each other and moved out of each other, respectively.

Referring now to the drawings, and in particular to FIG. 1, on guide paths of a bed 1 of a machine tool (not shown) a protective covering 2 completely pulled out and consisting of five cover sheets A, B, C, D and E is shown. The cover sheets A, B, C, D and E overlap relative to each other and comprise the cover sheet 3, sidewalks 4, with guides 5 angularly bent for 90° in the lower range, and a front end wall 6, 6° and 6°. The front end wall 6 extends at both ends slightly over the cover sheet 3 and forms there abutment 7. In the center between the abutment 7, the front end wall 6 has a recess 8, so that during movement of the cover sheets A, B, C, D and E so suction effect is created. Between the cover sheets 3 sliding and stripping 9 are arranged, with which the cover sheets A, B, C, D and E abut on the abutment 7. In the end walls 6 running rollers 10 are mounted in the end walls 6, with which the cover sheets B, C and D support themselves on the guide wall 6. With the front end wall 6' of the cover sheet A the protective covering 2 can be secured to a support 11, for instance, schematically shown in FIGS. 6a to 6c of a machine tool (not shown). At the end of the guide path 1 is secured a supporting console 12, on which the last cover sheet E is arranged and over which the total protective covering 2 can be moved together.

Braking devices 20, 30, 40 or 50 can be provided between the cover sheets A, B, C, D and E, as it has been disclosed in connection with FIG. 1, or a braking device in accordance with FIGS. 6a, 6b and 6c. In a practical embodiment, always only similar braking devices are disposed between the covering sheets of a protective cover 2. It is possible, however, also to combine together from case to case different braking devices.

The braking device 20 shown in FIG. 2 is designed as a pneumatic buffer, it comprises a cylinder 21 with a division wall 21a and a cover 21b, return valves 23 and 24 biased by pressure springs 22 and disposed adjacent the wall 21a, a piston 25 with respective 25a and 24a, opening with their wider portions towards the valve chamber 20b and the piston chamber 20a, respectively, are formed in the wall 21a and the return valves 23 and 24 are formed frustoconically to cooperate with the openings 23a and 24a. Valve shanks 23b and 24b extend from the valves 23 and 24, respectively, inclined disposed in the valve chamber 20b and through the cylinder end wall 20d. An abutment 24c is disposed on the valve shank 24c cooperating with the corresponding pressure spring 22 to bias the valve 24 cooperatively against the frustoconical opening 24a adjacent the piston chamber 20a. The other pressure spring 22 is disposed about the valve shank 23b and biases the valve 23 cooperatively against the frustoconical opening 23a adjacent the valve chamber 20b.

The cylinder 21 has two openings 20c communicating with the valve chamber 20b.

The braking devices 20 are provided, as can be ascertained from FIG. 1, on the rear end of the wall 6 below the cover sheet 3 at a distance from each other. Two further braking devices 20 are secured outside of the running rollers 10 on top, in front of the abutment 7. During moving together of the cover sheets A, B, C, D and E of the protective covering 2, the moved cover sheets A, B, C, D and E engage the braking devices 20 on the back side of the end walls to the front side of the end wall 6 of the still resting cover sheets A, B, C, D and E. During moving out of the protective cover 2, the moved cover sheets A, B, C, D and E move with their slide and stripping leds 9, which can be fortified for this purpose toward the braking devices 20. In the braking devices 20 during engagement of the cover sheets A, B, C, D and E, on the one hand, one part of the kinetic energy is transformed, and, on the other hand, the cover sheets B, C and D which are still at rest, are smoothly moved up. During the operation of the braking device 20 the air compressed in the cylinder 21 by the piston 25 is moved out by the return valve 23, whereby air can follow due to the bleeding bores 28. As soon as the braking device 20 is discharged again, the return spring 26 moves back the piston 25, whereby air is again sucked through in the return valve 24.

The braking device 30, shown in FIG. 3, is arranged between the sidewalks 4 of the cover sheets B and C. It consists of a double-sided brake wedge 31 rigidly secured on the sidewalk 4 of the inner cover sheet C on the outside within the range of the end wall 6 at the height of the centerline and four corresponding brakeshoes 34 guided in pairs on the sidewalk 4 of the outer cover sheet B of the inside on bolts 32 with slots 33. Between the back of the brakeshoes 34 and the cover sheet 3 and the guide ledge 5, respectively, springs 35 are arranged. The slots 33 in the brakeshoes 34 are normally disposed with their longitudinal direction perpendicularly to the direction of movement. In order to reduce the slamming effect during pulling out of the brake wedges 31 from the brake split formed by the two brakeshoes 34, the longitudinal direction of the slots 33 can be disposed also at an acute angle to the direction of movement.

The braking device 40 disclosed in FIGS. 4a, 4b and 4c is likewise arranged again between the sidewalks 4 of the cover sheets C and D. It consists of a brake rod 41 rigidly secured close to the end wall 6 on the outside of the sidewalk 4 of the inner cover sheet D on the centerline and two corresponding brake tongs 42 secured at the forward and rearward end on the inside of the sidewalk of the outer cover sheet C. Each of the brake tongs 42 is formed of two levers 45 swingably mounted on axles 43 against pressure springs 44. At the longer lever arm, pressure rollers 46a and 46b are eccentrically mounted above and below, respectively, the pressure springs 44. The short radius of the pressure rollers 46a and 46b extends thereby into the brake split formed by the levers 45, so that both pressure rollers 46a and 46b can run on the brake rod 41. In order that a short radius r of the upper pressure roller 46c points likewise downwardly into the brake split, the center of gravity of this upper pressure roller 46c is displaced by a recess 47 into the short radius. In the case that the levers 45 stand with the pressure rollers 46a and 46b over each other, so that the brake rod can be inserted into the wide-open tong mouth on the shorter lever arms. The tong mouth is
closed by the eccentrically mounted pressure rollers 46a and 46b, which are rotated by friction by the brake rod 41, at the forward end by means of the brake rod 41. Upon reversal of the movement, the tong mouth opens under the effect of the pressure springs 44 and the pressure rollers 46a and 46b oscillate due to the arrangement of the center of gravity again into their original position.

The braking device 50 disclosed in FIGS. 5a and 5b comprises ledgelike soft iron pieces 51 and 52 and a ledge-shaped permanent magnet 53. The soft iron pieces 51 and 52 are disposed spaced apart from each other at the forward and rear end under the cover sheet 3 of the outer cover sheet C. The permanent magnet 53 formed in rooftile cross section is secured on the cover sheet 3 and a console 54, respectively, of the inner cover sheet B, whereby the poles are designed such that the South Pole is disposed on top and is arranged opposite to the soft iron pieces 51 and 52. By this arrangement, the cover sheets C and D are braked upon approaching of the permanent magnet 53 to one of the two soft iron pieces 51 and 52, whereby the braking effect is produced in dependency upon the relative speed with which the soft iron pieces and the permanent magnet approach each other, by magnetic forces and by eddy currents. In order to bring about a progressive braking effect, the soft iron pieces 51 and the permanent magnets 53 are equipped with inclined faces 55.

Referring now to FIGS. 6a, 6b and 6c of the drawings, a braking device 60 is disclosed, which comprises substantially permanent magnets secured to the end walls 6, whereby the arrangement is chosen such that equal poles are pointing towards each other. By this arrangement, the cover sheets A, B, C, D and E, which run towards each other, are braked. In this braking device 60, further permanent magnets 63 and 64 are secured in front of the end walls 6 on consoles 62 and closely behind the stripping ledges 9 below the cover sheets 3, whereby the arrangement is chosen such that unequal poles point towards each other. If, in addition, as it appears from the top plan view in FIG. 6a, the number of permanent magnets 63 and 64, starting with the next to the last cover sheet D up to the first cover sheet A, is increased, the individual cover sheets A, B, C, D and E are pulled towards each other and from cover sheet D respectively, in a predetermined succession and in particular starting with the smallest cover sheet E. The same effect can also be brought about in connection with the braking device 50 shown in FIGS. 5a and 5b, by an arrangement according to which the soft iron pieces 51 and 52 and the permanent magnets 53 starting from the smallest cover sheet E towards the greatest cover sheet A become always longer.

All new features mentioned in the specification and shown in the drawings are essential for the present invention and even to the extent as they are not expressly claimed in the following claims.

While we have disclosed several embodiments of the present invention, it is to be understood that these embodiments are given by example only and not in a limiting sense, the scope of the present invention being determined by the objects and the claims.

We claim:

1. A protective cover for guide paths of machine tools comprising a plurality of overlapping and telescopically movable cover sheets, rolling and slide means, respectively, each of said cover sheets being supported at a front cover sheet end wall by means of said rolling and slide means, respectively, on the corresponding of said guide paths and at the rear end on the next smaller of said cover sheets, a speed-reducing braking device disposed between said cover sheets and becoming effective during movement from each other and into each other shortly prior to the prevailing end position.

2. A braking device is disposed operatively on said cover sheet end wall and comprises at least one buffer member, said buffer member is pneumatically operated, and comprises a cylinder having two return valves disposed in said cylinder, operating in opposite directions and biased by pressure springs, said cylinder having a cover and at least one bleeding bore disposed in its cover, said buffer member comprises further a piston including a return spring and having a piston rod, a headplate secured to the free end of said piston rod, said headplate is covered by an elastic pillow, a division wall in said cylinder dividing said cylinder into a cylindrical piston chamber and a cylindrical valve chamber, a cylinder end wall spaced from said division wall, a first opening in said division wall communicating said piston chamber with said valve chamber, a second opening in said division wall communicating said piston chamber with said valve chamber, one of said two return valves comprises a first valve operatively disposed adjacent said piston chamber cooperating with said first opening and includes a first valve shank extending through said valve chamber and displaceably through said cylinder end wall, and includes an abutment secured to said valve shank disposed in said valve chamber, a first of said pressure springs disposed about said first valve shank and disposed operatively against said abutment for biasing said first valve operatively relative to said first opening, the other of said two return valves comprises a second valve operatively disposed adjacent said valve chamber cooperating with said second opening and includes a second valve shank extending through said valve chamber and displaceably through said cylinder end wall, a second of said pressure springs disposed about said second valve shank and between said cylinder end wall and said second valve, said cylinder being formed with at least one opening, and said return spring being disposed about said piston rod outside of said cylinder and between said cover and said free end of said piston rod.

2. The protective cover, as set forth in claim 1, wherein said braking device is disposed on the front and back sides of said cover sheet end wall.

3. The protective cover, as set forth in claim 1, wherein said first opening includes a first frustoconical opening with its larger part facing said piston chamber, said second opening includes a second frustoconical opening with its smaller part facing said piston chamber, said first valve is frustoconical in shape and is operatively disposed in said first frustoconical opening, and said second valve is frustoconical in shape and is operatively disposed in said second frustoconical opening.

4. The protective cover, as set forth in claim 3, wherein said abutment is adjacent said cylinder end wall, said first pressure spring is compressed between said abutment and said division wall, said second pressure spring is compressed between said cylinder end wall and said second valve, and said at least one opening constitutes two oppositely disposed openings communicating with said valve chamber.