March 18, 1947. J. B. ARMITAGE 2,417,671

MACHINE TOOL WAY GUARD

Filed Aug. 2, 1943 2 Sheets-Sheet 1

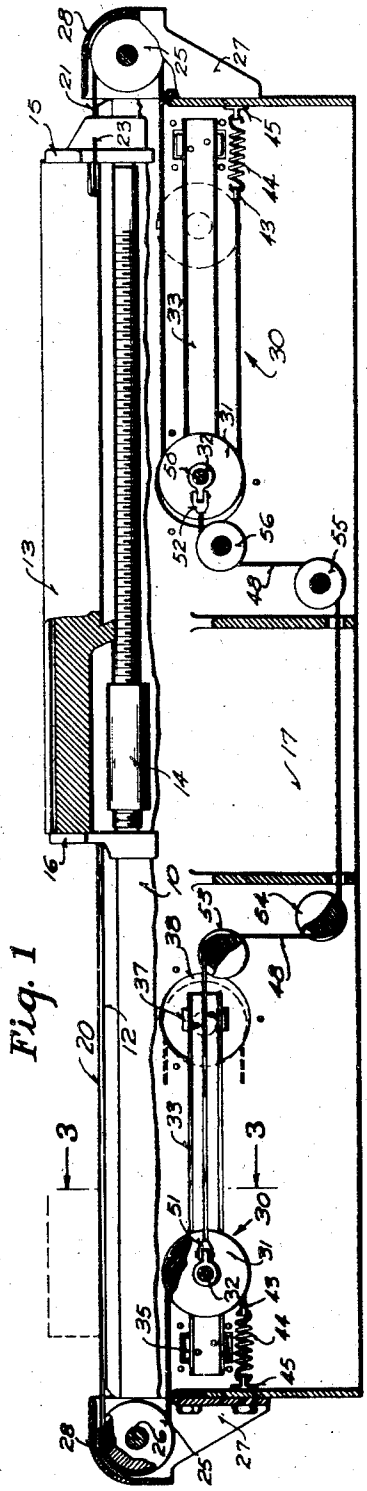

Fig. 1

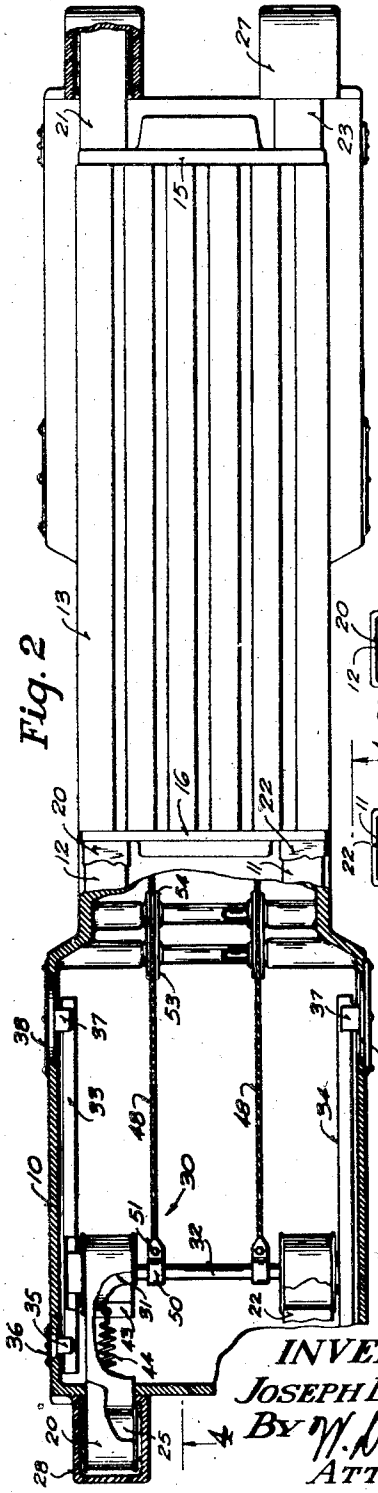

Fig. 2

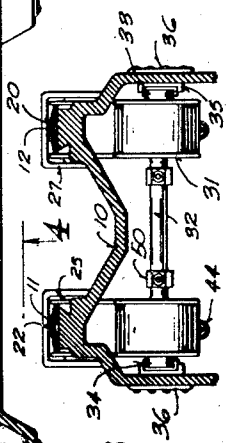

Fig. 3

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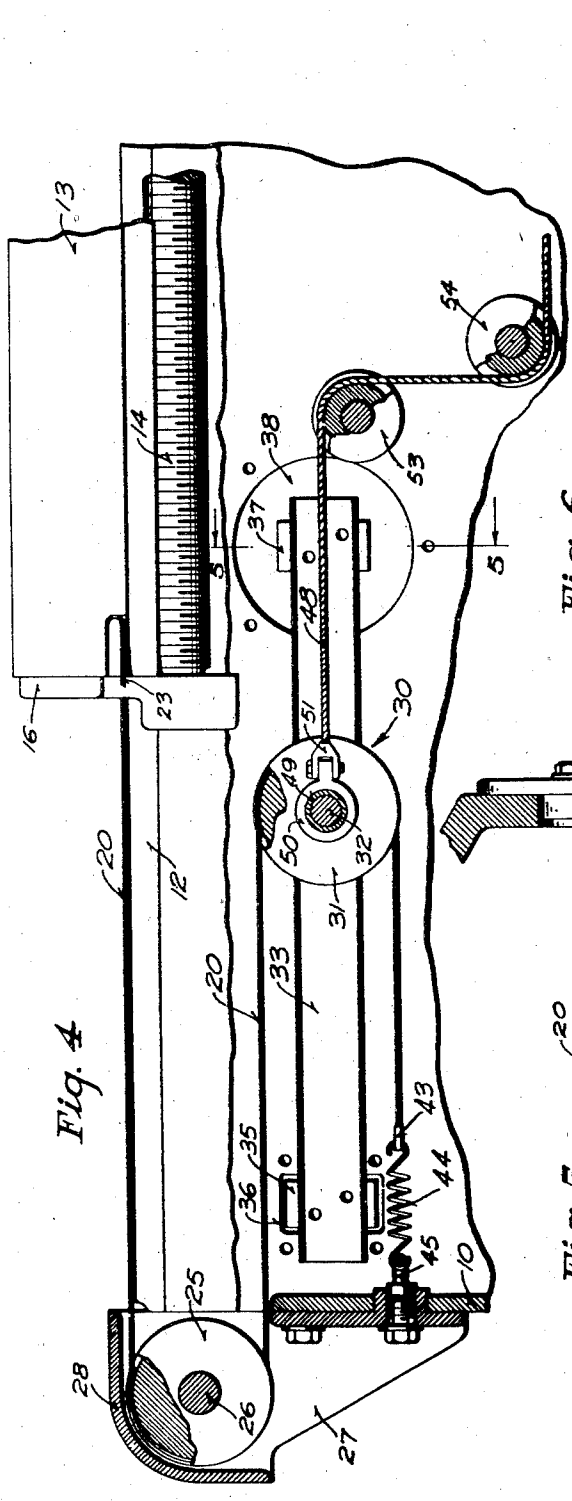

Fig. 4

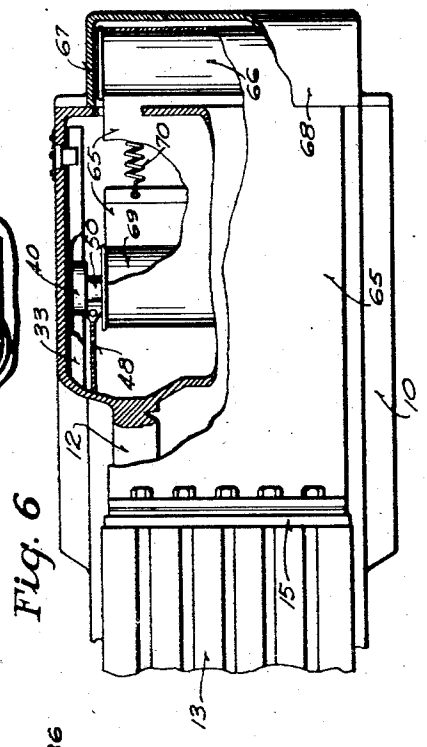

Fig. 6

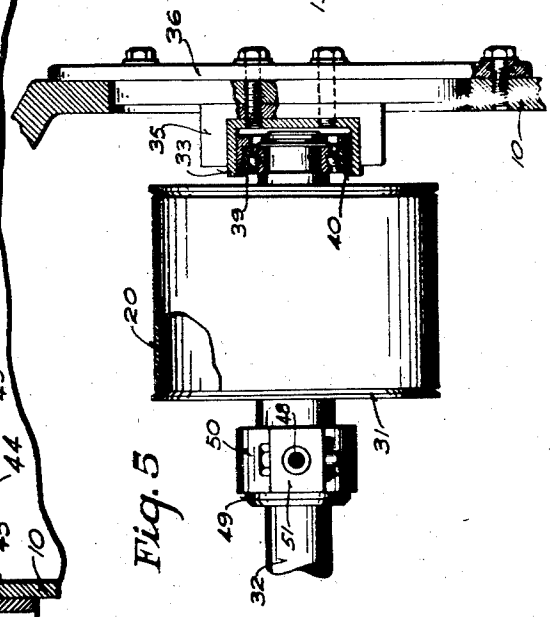

Fig. 5

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MACHINE TOOL WAY GUARD

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16 Claims. (Cl. 308—3.5)

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This invention relates, generally, to improvements in way guards and more particularly to an improved way guard especially adapted to protect the bearing ways of a machine tool.

A general object of the invention is to provide an improved machine tool way guard.

Another object of the invention is to provide an improved compensating mechanism for way guards so arranged that one guard is made to retract while a second guard is made to advance along the way surface in accordance with movement of the carriage traveling thereon.

Another object of the invention is to provide a way guard supporting means so arranged that chips and debris deposited on the top of the guard strip cannot be transferred to the opposite face of the guard and subsequently deposited on the way surfaces of the machine.

Another object of the invention is to provide a way guard retracting mechanism arranged to operably support the guard within the interior of a machine structure without interfering with the driving mechanism therein.

A further object of this invention is to provide a way guard mechanism having improved tensioning means for retaining the guard in a taut condition.

A still further object of the invention is to provide a way guard arranged to protect a plurality of parallelly disposed way surfaces.

According to this invention, the way surfaces of a machine tool are protected by means of flexible guard strips arranged to be drawn onto and retracted from the ways in accordance with movement of the traveling carriage. As the guard strips are retracted, they are drawn into the ends of the machine bed and looped around idler rollers therein in such manner that the surfaces which pass over the ways are protected from contamination. To effect the retracting action, the idler pulleys are arranged for movement within the bed, the pulleys at one end of the bed being connected to those at the other end by cables arranged in such manner that as the guard strips are paid out to follow the carriage along the ways, the cables exert forces upon the idler pulleys at the other end of the bed to retract the associated guards from in front of the carriage. The ends of the guard strips are secured by springs to maintain them under tension and the parts of the strips within the bed are looped around the idler pulleys in such manner that debris falling from the upper inverted runs of the strips will drop upon the top of the lower runs without coming in contact with the way engaging surfaces.

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The foregoing and other objects of this invention, which will become more fully apparent from the following detailed description, may be achieved by means of the exemplifying apparatus depicted in and set forth in this specification in connection with the accompanying drawing, in which:

Figure 1 is a longitudinal vertical sectional view through the base of a milling machine showing the way guard mechanism arranged to protect the way surfaces for supporting the table;

Fig. 2 is a top plan view partially in horizontal section showing the way guard mechanism and its relationship to the machine base and table;

Fig. 3 is a vertical transverse sectional view taken substantially along the line 3—3 in Fig. 1 and showing the ways, way guards and guard retaining mechanism;

Fig. 4 is an enlarged fragmentary view in longitudinal vertical section taken substantially along the line 4—4 in Fig. 2 and showing the way guard mechanism in greater detail;

Fig. 5 is an enlarged view in transverse vertical section taken substantially along the line 5—5 in Fig. 4 and showing the detailed mounting of the guard retaining harness; and

Fig. 6 is a fragmentary top plan view, with parts broken away, showing a modified version of the way guard wherein a single wide guard strip serves to protect a plurality of parallelly disposed ways.

Referring more specifically to the drawings, and particularly to Figs. 1 and 2 thereof constituting general views of parts of a machine tool embodying the present invention, it will be seen that the machine structure there shown comprises essentially a relatively long base or bed 10 having two horizontally disposed parallel way surfaces 11 and 12 upon which is slidably supported a work table or carriage 13. The table 13 may be moved horizontally along the way surfaces by means of a table screw and nut assembly 14 that may be operated either manually or by power. As shown in Fig. 1, the table screw is rotatably journalled in two end brackets 15 and 16 bolted to the right and left ends of the table 13 respectively, and the nut is fixed to the base or bed 10. Relative rotation between the screw and the nut in effecting power feeding movement of the table is accomplished by driving the table screw in the usual manner by means of a transmission drive mechanism (not shown) located in a central compartment 17 within the base 10.

In any machine tool having way surfaces, the continuing accuracy of the machine is depend-

ent upon the maintenance of the way surfaces in perfect condition without scratches or marks. The accumulation of chips and other debris on the way surfaces brings about damage to these surfaces since movement of the table causes chips to become wedged between the bed 10 and the table 13 on the way surface and consequently causes scratches and ultimate wearing away of the surfaces. The invention herein set forth presents an improved means for guarding the way surfaces of a machine tool.

As shown in Fig. 2, it is evident that when the carriage or table 13 is wholly supported on the parallel ways 11 and 12, there are ordinarily four portions of the ways which are exposed and upon which damaging foreign elements may collect. To afford protection to these four surfaces, the way guard mechanism embodying the present invention includes four flat or pre-formed strips or guard elements 20, 21, 22 and 23, one arranged to overlie each of the four exposed portions of the two way surfaces 11 and 12. Thus the guard 20 is disposed to cover the exposed left end of the way 12 while guard 21 serves to cover the exposed right end of the same way. Similarly, guard 22 is positioned to protect the exposed left end of way 11 and guard 23 is positioned to protect the exposed right end of this way. The length of the exposed portion of any way surface at a given instant is, of course, dependent upon the position of the table. Thus, as shown in Figs. 1 and 2, when the table 13 is positioned at the extreme right end of the base 10, the maximum area of the way surfaces 11 and 12 at the left end of the base will then be exposed while a minimum area of the same way surfaces will be exposed at the right end of the base.

One end of each of the way guards is fastened to the end of the table or carriage 13 directly over the respective way surface in position to lie longitudinally along the top of the surface it is to protect. The guard retaining and guiding mechanisms for each of the four way guards 20, 21, 22 and 23 are similar in construction although differently arranged to assume different positions within the machine base 10. By way of example, the mechanism associated with the guard 20 protecting the left end of the way surface 12, as shown in Fig. 4, includes a flat-faced pulley or roller 25 rotatably mounted on a short shaft 26 which is carried in a frame or bracket member 27. The bracket 27 is bolted to the vertical end wall of the base 10 in such manner that the top peripheral surface of the roller 25 is slightly above the way surface. The width of the roller 25 between its flanged edges is slightly greater than the width of the way strip or guard necessary to fully cover the way. A shield 28 of generally arcuate shape is integrally formed with the frame member 27 and positioned to prevent accidental engagement with the rotating roller while permitting any debris deposited on the way guard 20 to pass through and drop from the guard as it moves downwardly over the periphery of the roller.

An automatic compensating harness mechanism 30 is contained within the hollow interior of the base 10 to maintain the guards or strips taut regardless of the position assumed by the carriage or table 13. This mechanism effects the retraction of the guard from the way surface in front of the advancing table and permits a corresponding advance of the complementary guard onto the way surface behind the advancing table. The harness mechanism 30 for the guard strip 20 for example includes a movable flanged pulley 31 mounted on a shaft 32 for rotation and for bodily movement in a horizontal plane longitudinally of the base parallel to and beneath the way surface 12.

Horizontal movement of the pulley 31 and shaft 32 occurs along a pair of channel shaped tracks 33 and 34, as generally shown in Figs. 2 and 3. These tracks are parallelly disposed on the opposite inner faces of the vertical longitudinal walls of the base 10. The left or outer end of the track 33 is bolted to a channel shaped block 35 integrally formed with a rectangular cover plate 36 which is bolted in a recess in the base 10 (see Figs. 4 and 5). The right or inner end of the track as seen in Figs. 1 and 4, is bolted to a channel shaped block 37 attached to a circular cover plate 38. The cover plate fits into a correspondingly shaped recess in the vertical wall of the base and is bolted thereto. The track 34 is mounted in the same manner on the opposite vertical wall of the base. The shaft 32 of the mechanism 30 is of sufficient length to fit between the upright walls of the tracks 33 and 34 and to ride on the extending flanges of the said tracks. This is accomplished by means of a roller-bearing 39 (see Fig. 5) pressed on each end of the shaft 32 and presenting a steel rim 40 carried by the outer race of the bearing. Thus with each end of the shaft disposed to ride on its respective track, the shaft is restricted to travel in a horizontal plane parallel to the way surface 12.

The way guard 20, after passing half way around the pulley 25, leaves the bottom peripheral surface of the pulley and extends in reversed direction through an opening in the vertical end wall of the base 10 and is looped back upon itself in manner to pass half way around the pulley 31. The other end of the guard is resiliently anchored on the frame member 27, as shown in Figs. 1 and 4. For this purpose, the end of the guard is attached to a retaining plate 43 and a coil tension spring 44 is disposed between the plate 43 and an axially adjustable hook member 45 that extends through the end wall and serves to retain the entire length of the guard in a taut condition at all times, regardless of the position of the table 13 on the way surface 12. The hook member 45 is axially adjustable from the outside of the base in order to afford a convenient means for varying the degree of tautness or for compensating for any elongation of the guard which may occur after continued use.

Since the compensating harness mechanism 30 retaining the way guard 21 at the right end of the base, as shown in Fig. 1, is similar to though oppositely arranged from the mechanism just described in connection with the guard 20, it becomes evident that a unified response from both mechanisms occurring upon any movement of the table or carriage 13 will effect compensating action upon both way guards 20 and 21. The unified action of both mechanisms is made possible through an interconnecting flexible cable 48. A sleeve bearing 49 (see Fig. 4) permits a flange member 50 to float on the shaft 32 adjacent to the pulley 31 without rotating therewith. One end of the cable 48 is anchored to a clevis 51 which is pinned to the member 50 associated with the mechanism 30 supporting way guard 20 while the other end of the cable is similarly fastened to a clevis 52 which is pinned to a flange member associated with the mechanism 30 supporting way guard 21.

A sheave 53 mounted for free rotation within

the base 10 carries the cable 48 and leads it downwardly to a sheave 54 likewise mounted for free rotation near the bottom of the base. The sheave 54 together with a sheave 55 similarly mounted on the right side of the table drive mechanism compartment 17 serves to carry the cable 48 beneath the mechanism in the center compartment 17. Another sheave 56 carries the cable 48 for a corresponding horizontal connection with the mechanism 30 in the right end of the base. Thus the way guard harness mechanisms 30 are individually disposed in the two ends of the base 10 without interfering with any of the table drive mechanism contained in the middle compartment. It is evident that the force exerted upon either of the compensatory mechanisms 30 by the cable 48 effects a horizontal movement of the mechanism and retracting movement of the associated way guard.

Thus referring again to Fig. 1, the complete cycle of operation of the way guard mechanism is readily apparent. With the table 13 in the extreme right hand position as shown, the way guard 21 is completely retracted, with the carrier shaft 32 and pulley 31 associated therewith positioned at the extreme innermost position on the tracks. The way guard 20 is then fully extended upon the way surface with compensatory mechanism 30 associated therewith positioned at the extreme outermost station on the tracks. If it is assumed that power is applied to the table screw and nut assembly 14 so as to effect a table movement to the left, the guard 20 must be retracted and the guard 21 must be advanced on the way surface 12. As the table moves to the left, the guard 21 is drawn with the table onto the way surface. The increased tension on the guard 21 causes a rightward movement of the movable shaft and pulley retaining the guard. This movement tends to relieve the tension on the guard and to impart tension to the cable 48.

The pulling force thus applied to the right end of the cable 48 is transmitted to the movable shaft 32 and pulley 31 retaining the way guard 20. Thus the harness mechanism 30 is made to operate in a rightwardly direction and in doing so retracts the guard 20 from the way surface at the same rate of speed as that of the table 13. Since the purpose of the coil spring 44 is to place a slight tension on the guard at all times, the guard will not buckle or bend during a retracting or advancing movement and consequently the guard cannot be damaged through excessive flexing. No matter where the table is stopped on the way surface, both guards will remain taut and under an even tension since the compensating mechanisms 30 retaining the guards are both retentatively positioned on the tracks in a given position until the table is again moved.

When the table 13 has reached the extreme lefthand position, as indicated by the dotted lines in Fig. 1, the tensioning mechanism 30 in the left end of the base 10 for the way guard 20 will be in an extreme innermost position on the tracks, as indicated by the dotted lines, so that the guard will be completely withdrawn from the way surface 12. At the same time, the way guard 21 will be fully advanced on the exposed left end of the same way surface and the harness mechanism for this guard will then reach the extreme outermost position, as indicated by the dotted lines. Reversed movement of the table to the right will cause the initial tension to be placed on the way guard 20 which in turn will effect a leftward movement of the carrier pulley 31 and

shaft 32 associated therewith on the tracks. A corresponding movement of the carrier pulley and shaft in the right end of the base 10 and associated with the guard 21 will occur and accomplish a retraction of the guard 21 from the way surface 12 in front of the advancing table 13.

Although the explanation of the operation of the way guard compensatory mechanism has been made with reference to the guards 20 and 21 protecting the way surface 12, it will be apparent from Fig. 2 that a duplicate arrangement of the harness mechanism is provided for the guards 22 and 23 associated with the other way surface 11. As previously explained, the shafts 32 of the harness mechanism 30 for the two ends of the machine are supported at their ends in track-ways mounted on the respective inner walls of the base. As shown, each shaft 32 carries a flanged pulley 31 near each end and likewise carries a flange member 50 near each pulley, there being two cables 48 connected at their ends to the flanges of each shaft and arranged in spaced relationship within the base. By this arrangement, both ends of the shafts 32 are arranged to be moved simultaneously by the two cables and both guard strips at each end of the machine are maintained in taut condition.

The particular embodiment of the invention herein set forth has been shown in association with a typical machine tool structure having the usual pair of slide supporting ways, although it is to be understood that the protective apparatus may be modified readily to provide for protecting a single way surface or any number of adjacent way surfaces arranged in parallel relationship.

In Fig. 6 a modified version of the way guard invention is shown, in which a single way guard or strip 65 is adapted to cover two or more way surfaces, the principle of operation being identical to that previously described. In this modification, a comparatively wide flexible guard 65 is attached to the table bracket 15 on the end of the table 13, in manner to extend over both of the way surfaces 11 and 12 on the base 10. The guard 65 is operatively supported in alignment over the way surfaces by a flanged drum-type pulley 66 rotatably mounted in a bracket member 67 bolted on the vertical end wall of the base and extending the full width thereof. A wide shield 68 integrally cast with the member 67 and generally similar to the narrow shields 28 shown in Fig. 2, serves as a protective means over the top of the guard 65 and pulley 66. Beneath the pulley 66, the way guard 65 extends into the interior of the base and over a wide faced, drum-type pulley 69 rotatably disposed on the shaft 32 that is arranged to travel along the pair of tracks 33 and 34, parallelly bolted within the opposite longitudinal sidewalls of the base, as previously described. The wide flexible guard 65 extends halfway around the pulley 69 and is fastened to the vertical endwall of the base by means of a series of coil springs 70. Thus the guard is retained under a slight tension at all times. A second flexible guard (not shown) is likewise fastened to the other end of the table 13 and operatively mounted for compensating movement over the same way surfaces in a manner identical to that previously described. Since a single wide pulley 69 was used to support the full width of the guard within the base, the flange members 50 are now positioned intermediate the ends of the pulley 69 and the rims 40 rotatably mounted to ride on their respective tracks 33 and 34. Like-

wise, the two cables 48, only one of which is shown in Fig. 6, and their supporting sheaves are shifted to a position alongside the longitudinal sidewalls of the base. As the table 13 advances to the right, a pulling force applied to the cables 48 by the movement of the second guard harness mechanism in the left end of the base will effect a leftward movement of the pulley 69 and consequently cause a retraction of the guard 65 from the way surfaces in front of the advancing table. If the table 13 is moved to the left, it draws the way guard 65 onto the way surfaces and in doing so, the pulley assembly 69 is forced to move toward the right end of the base. This movement results in the transmission of a pulling force through the cables 48 to the guard retaining mechanism within the left end of the base, as previously explained, and in the retractive movement of the guard from the way surfaces at the other end of the base.

An important feature of this invention lies in the fact that chips and other debris deposited on the top surface of the way guard cannot be transferred to the bottom surface of the guard and thence to the way surface, since if this should occur, the entire purpose of the guard would be defeated. With the present arrangement, the greater part of the dust, chips and debris which are deposited on the top surface of the guard strip will fall off the guard as it is retracted over the roller 25 at the end of the base. Even if the top surface of the guard is oily and the foreign particles deposited thereon adhere to it and fail to drop off, they will not be transmitted to the other side of the guard. As the guard is withdrawn into the base after leaving the roller 25, it is retained in a horizontal inverted position and if the oily chips or dust particles drop away from the guard while it is in an inverted position, they will merely fall onto the top surface of the portion of the guard horizontally suspended thereunder. With this arrangement of the guard, the bottom face thereof which extends above the way surface never is exposed to chips, debris or dust particles.

This invention is applicable to any type of machine way, various minor constructional changes being necessary in order to adapt the invention to various types of horizontally or vertically disposed way surfaces. It is also evident that this invention is applicable to a machine tool base having only a single way and equally as well as a machine having a plurality of ways.

The aforedescribed invention is herein shown as applied to protect the ways of a large bed type milling machine. However, it is to be understood that this particular embodiment of the invention is intended to be illustrative only and that various other embodiments, all within the scope of equivalents of the characteristics defined in the subjoined claims, may be utilized by those skilled in the art in practicing various features of the invention without departing from its spirit.

The principles of the invention having now been fully explained in connection with the exemplifying apparatus herein set forth, I hereby claim as my invention and discovery:

1. In a machine tool, a base presenting a horizontally disposed bearing way, a carriage slidably mounted for movement along said bearing way, a guard for said bearing way comprising a flexible strip of protective material attached at one end to said carriage and disposed to overlie said bearing way, guide means on said base at the end of said way arranged to guide said guard strip into the end of said base in inverted position, an idler pulley movably mounted within said base beneath said way and disposed to receive and reverse said guard strip, resilient means arranged to attach the reversed end of said guard strip to the end of said base, and means disposed to exert force upon said idler pulley to maintain said guard strip taut and to provide for retracting or paying out said strip in accordance with movement of said carriage along said way while protecting the way engaging surface of said strip from contamination.

2. In a machine tool, the combination with a frame presenting parallel ways and a carriage slidably mounted on said ways, of way guard mechanism including a guide pulley mounted at each end of each way, flexible protective strips connected to said carriage and extending therefrom along said ways and over said guide pulleys said strips being looped within said frame beneath said ways, resilient means arranged to connect the looped ends of said strips to said frame, movable idler pulleys disposed within the loops of said strips within said frame, and motion transmitting means interconnecting said movable idler pulleys in manner to maintain tension upon said strips while permitting movement thereof in accordance with movement of said carriage.

3. In a machine tool structure, a frame presenting bearing ways, a carriage slidably mounted on said bearing ways for reciprocatory movement therealong, a roller mounted on said frame at each end of said bearing ways, an idler pulley mounted for bodily movement within said frame beneath said ways at each end thereof, a flexible protective strip associated with each end of said ways said strips each being fastened at one end to said frame looped around the corresponding bodily movable idler pulley in extended condition passed over the corresponding end roller and along the surface of said way and then fastened at its other end to said carriage, and means exerting force upon said movably mounted idler pulleys for moving them bodily to maintain said protective strips in extended taut condition while permitting play thereof around said pulleys and rollers in accommodating movement of said carriage along said ways.

4. In a machine tool having a frame presenting ways upon which a movable carriage is slidably mounted, means for protecting one of said ways comprising a flexible strip attached to said carriage directly above said way and arranged to extend along said way, a pulley rotatably attached to said frame and positioned at the end of said way to deflect said strip therefrom, a movably mounted harness mechanism operably disposed to retain said strip in an extended position within said frame, tensioning means attached to the other end of said strip to retain said strip taut at all times, a second strip attached to the other end of said carriage to extend along and protect said way surface said strip being deflected therefrom in a similar manner, a second movably mounted harness mechanism operably disposed to retain said second strip in an extended position within said frame, motion transmitting mechanism interconnecting said harness mechanisms for moving them bodily in unified operation, and a second tensioning means operatively connected to retain said second strip taut, whereby one of said strips is advanced while the other of said strips is retracted from said way

depending upon the direction of travel of said carriage on said ways.

5. In a machine tool, the combination with a frame presenting ways and a carriage slidably mounted on said ways, of means for guarding said ways comprising strips of flexible protective material secured to said carriage and extending therefrom along said ways throughout their length, rollers at the ends of said ways disposed to receive said guard strips and guide them into said frame beneath said ways, idler rollers mounted for bodily movement within said frame in position to receive loops of said strips in extended condition, means securing the ends of said strips to said frame, and means exerting force on said idler rollers for moving them bodily to maintain tension in said guard strips while holding them extended within said frame, whereby said strips may be caused to move over said ways in accordance with movement of said carriage while maintained under predetermined tension.

6. A way guard reciprocating mechanism adaptable to a machine tool having a base with ways thereon and a carriage slidably mounted on said ways comprising a pair of flexible strips adapted to protect said ways and fastened on each end of said carriage, guide rollers mounted on said base adjacent each end of said ways over which said strips pass into said base, tracks disposed parallel to said ways within said base, retaining frames mounted on said tracks, interconnecting means between said frames to effect an equally tensioned converse movement of said strips, intermediate rollers rotatably mounted in said frames to carry said strips, and resilient clamps to fasten the other ends of said strips within said base.

7. In a machine tool with a base having way surfaces upon which a traveling carriage is slidably mounted, a guard mechanism for said way surfaces comprising a way guard for each exposed way surface on both ends of said carriage, a pulley rotatably mounted on said base at each end of said surfaces to operably support said guard. a bodily movable harness mechanism operably disposed to engage the guards on one end of said carriage and mounted within one end of said base, a second bodily movable harness mechanism operably disposed to engage the guards on the other end of said carriage and mounted within the other end of said base, and cable means interconnecting said harness mechanisms and serving to move them bodily in unison to provide for advancement of said guards at one end of said carriage and retraction of said guards at the other end of said carriage at a rate in accordance with the feed rate of said carriage while maintaining them in extended taut condition.

8. In a machine tool having a base presenting a way surface and a carriage movably mounted on said way surface, a flexible way guard attached to one end of said carriage and protectively disposed over the exposed portion of said way surface, a second flexible way guard attached to the other end of said carriage and disposed over the other exposed portion of said way surface, a pulley rotatably mounted on each end of said base to operably support said guards, and a pair of bodily movable interconnected idler pulley harness mechanisms individually disposed within each end of said base in position to engage and retain said guards in extended taut condition and operatively interconnected to provide for unitary bodily movement to effect advancement or retraction of the said guards as said carriage travels on said way surfaces.

9. In a machine tool having a frame presenting a multiplicity of ways upon which a movable carriage is slidably mounted, means for protecting said ways comprising a pair of sufficiently wide flexible way guards to cover all of said ways and each operably attached to opposite ends of said carriage for unified movement therewith, a pair of pulleys rotatably mounted adjacent to the ends of said ways to operably support said guards, a bodily movable compensating harness means operatively engaging each of said guards, mechanism interconnecting said harness means in manner to provide for compensated advancement or retraction of said guards on said ways in accordance with movement of said carriage and resilient anchoring means for said guards, whereby said guards are constantly retained in extended taut position to render the way engaging face thereof and the way free of dust, chips or other foreign matter.

10. A way guard reciprocating mechanism applicable to any machine having way surfaces and a traveling carriage thereon comprising a pair of flexible way guards longitudinally disposed to overlie said way with one end of each guard fixedly attached to opposite ends of said carriage, a guide means at each end of said way disposed to deflect said guard from said way surface, a pair of tracks parallelly disposed to said way, a compensating harness mechanism operably mounted on each of said tracks and serving as supporting means for each of said guards, resilient means to secure the other end of said guards and interconnecting motion transmitting means between said harness mechanisms for effecting cooperative action thereof, whereby said guards are advanced on or retracted from said way surfaces in accordance with movements of said carriage.

11. In a way guard system for protecting a machine tool way, a strip of flexible protective material disposed to overlie the way and to be movable therealong in accordance with the movement of a machine element along said way, a pulley at the end of said way disposed to receive said protective strip and guide a portion of it beneath said way, a movable ider pulley disposed to engage a loop of said strip beneath said way, resilient means arranged to secure the end of said strip, and means to exert force upon said movable idler pulley to take up slack in said strip to compensate for movement thereof along said way.

12. In a machine tool, the combination with a frame presenting bearing ways and a carriage slidably mounted on said ways, of a way guard system comprising a strip of flexible protective material extending in each direction from said carriage along said ways, a guide at each end of said ways disposed to receive said strip and to guide it into said frame beneath said ways, means securing the ends of said strips to said frame, bodily movable idler rollers engaging loops in said strips beneath said ways in manner to maintain said strips extended, and means interconnecting said idler rollers in manner to provide for complementary movement thereof to maintain tension in said strips.

13. In a machine tool comprising a base presenting slide ways and a carriage slidably mounted on said ways, means to protect said ways from injury through contamination by foreign matter including a flexible band of protective material

extending over each exposed portion of said ways, means attaching one end of each protective band to said carriage to provide for movement of said bands with said carriage, means attaching the other end of each band to said base in manner providing slack for permitting full movement of said carriage, and an interconnected bodily movable idler pulley compensating arrangement cooperating with said bands in manner to take up and pay out the slack in said bands while maintaining them in extended taut condition with the way contacting surfaces thereof free from contamination by foreign matter.

14. In a machine tool, a base provided with slide ways, a carriage slidably mounted on said ways for reciprocating movement therealong, means to protect said ways from damage including a flexible strip overlying each exposed portion of said ways, means connecting one end of each strip to said carriage for movement with it, an idler wheel rotatably mounted on said base at each end of each slide way for receiving the way engaging surface of each of said strips, an idler wheel rotatably and movably mounted for bodily movement beneath each of said ways for receiving the back of each of said strips, means securing the ends of said strips to said base, and means interconnecting said movably mounted idler wheels for bodily movement in unison in manner to provide for maintaining said strips in extended taut condition and paying out said strips at one end of said base while taking in said strips at the other end of said base, the arrangement being such that the way engaging surfaces of said strips are protected from contamination by foreign matter.

15. In a machine tool, the combination with a frame presenting parallel ways and a carriage slidably mounted on said ways, of guard mechanism for said ways including a guide pulley rotatably mounted at each end of each way, flexible protective strips each connected at one end to said carriage and extending therefrom along said ways and over said guide pulleys, said strips being looped within said frame beneath said ways,

resilient means arranged to connect the other end of each of said strips to said frame, bodily movable idler pulleys engaging and supporting the loops of said strips within said frame, and motion transmitting means interconnecting said bodily movable idler pulleys for cooperative action in manner to maintain tension upon said strips while permitting movement thereof in accordance with movement of said carriage.

16. In a machine tool having a hollow frame presenting bearing ways and a carriage slidably mounted on said ways, guard mechanism for said ways comprising a guide pulley rotatably mounted at each end of each way, a flexible protective strip extending over each end of each way and connected at one end to said carriage, said strips running over said pulleys and being looped within said hollow frame, means connecting the other end of each looped strip to said frame, a pulley engaged within the loop of each strip and movably mounted within said frame, and motion transmitting mechanism interconnecting the movable pulleys within one end of said frame with those within the other end thereof in manner to exert force between them for maintaining said strips taut while permitting movement of said pulleys to take in and pay out said strips alternately in accordance with movements of said carriage along said ways.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,246,199	Caldwell	June 17, 1941
1,937,985	Schnuck	Dec. 5, 1933
1,895,122	Benedict	Jan. 24, 1933
1,679,912	Mondlock	Aug. 7, 1928
2,033,141	Kraut et al.	Mar. 10, 1936
848,578	Thelin	Mar. 26, 1907
2,190,213	Meyer	Feb. 13, 1940