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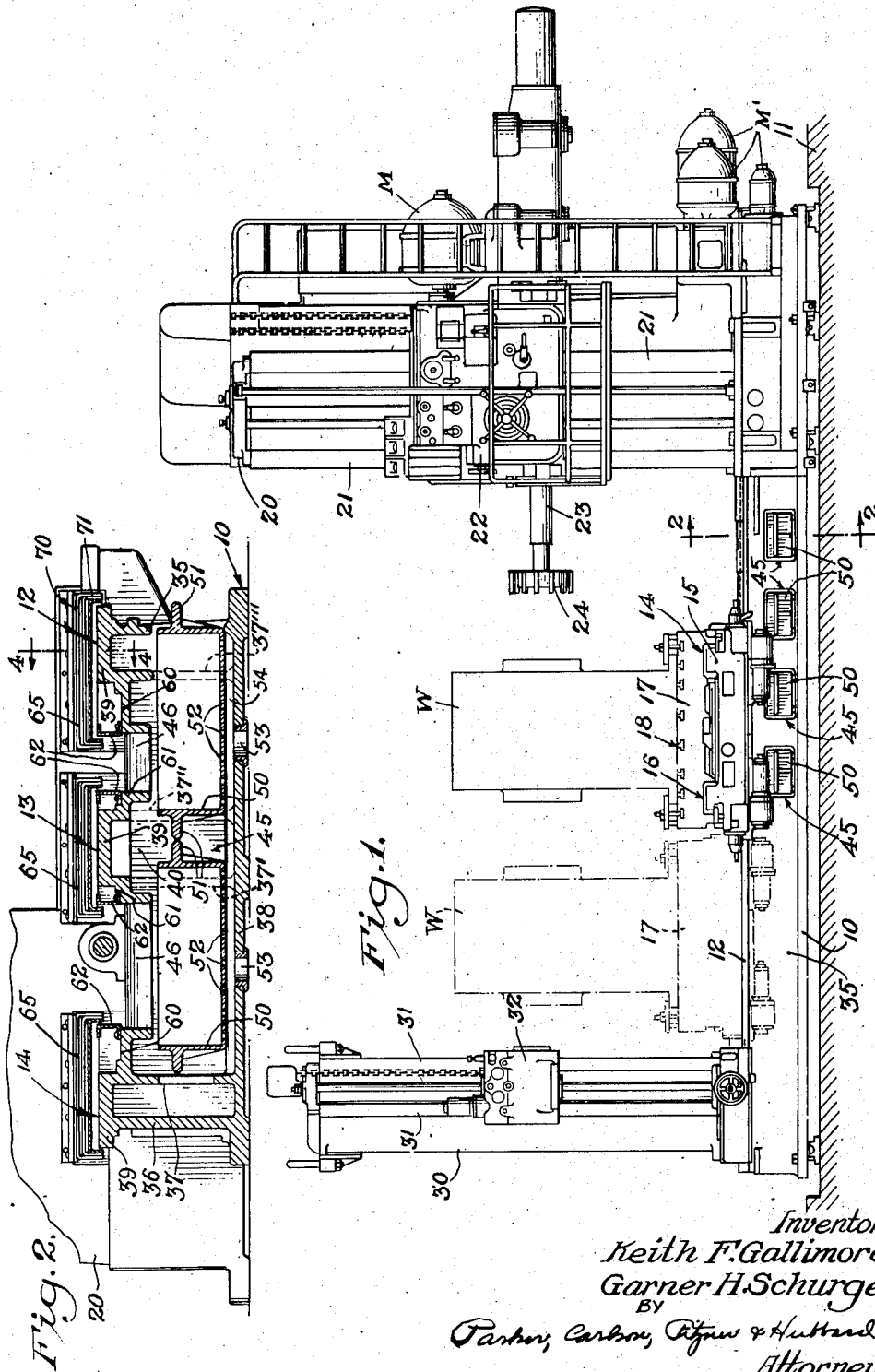
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2,375,408

MACHINE TOOL

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Fig. 3.

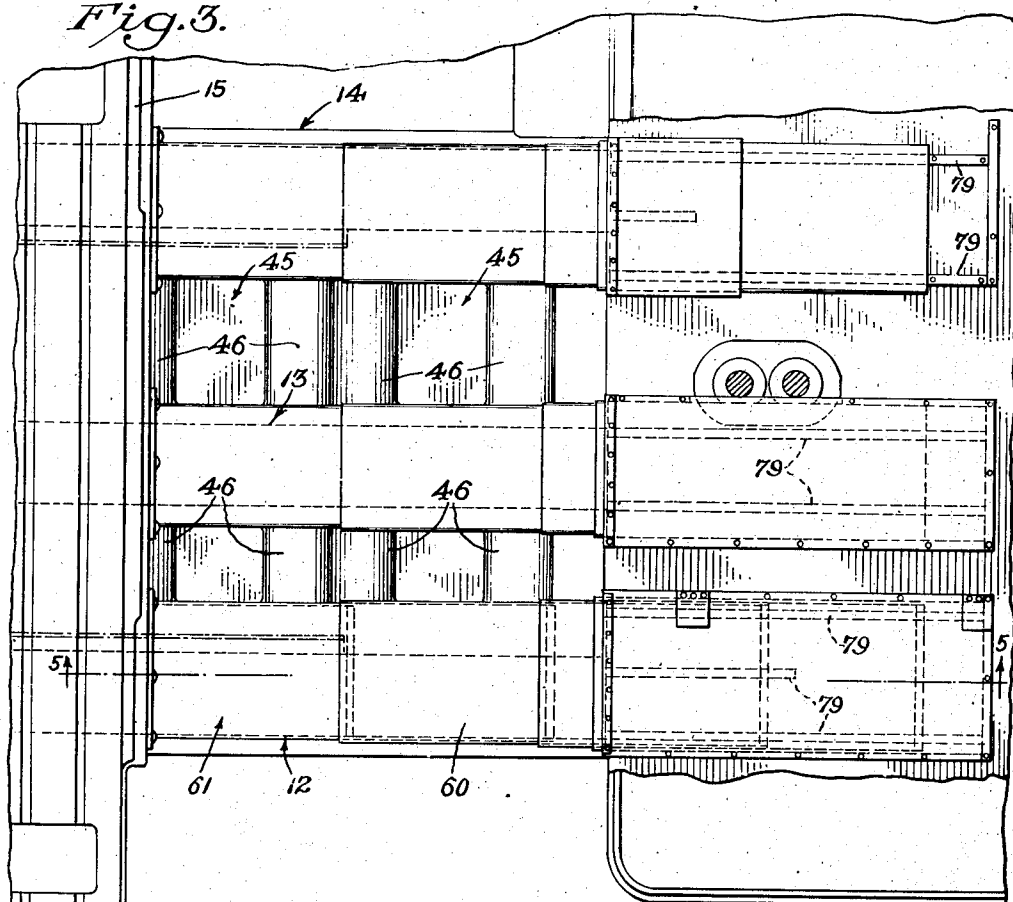
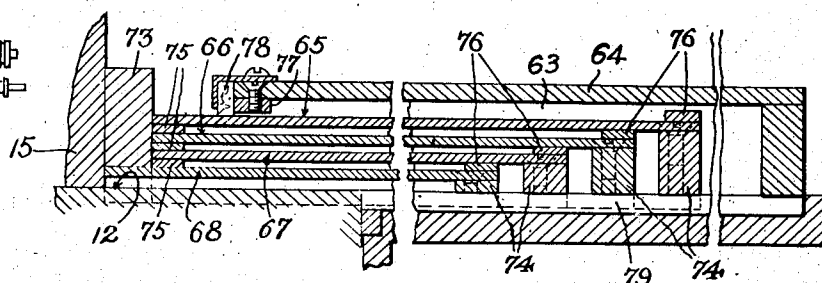


Fig. 4.



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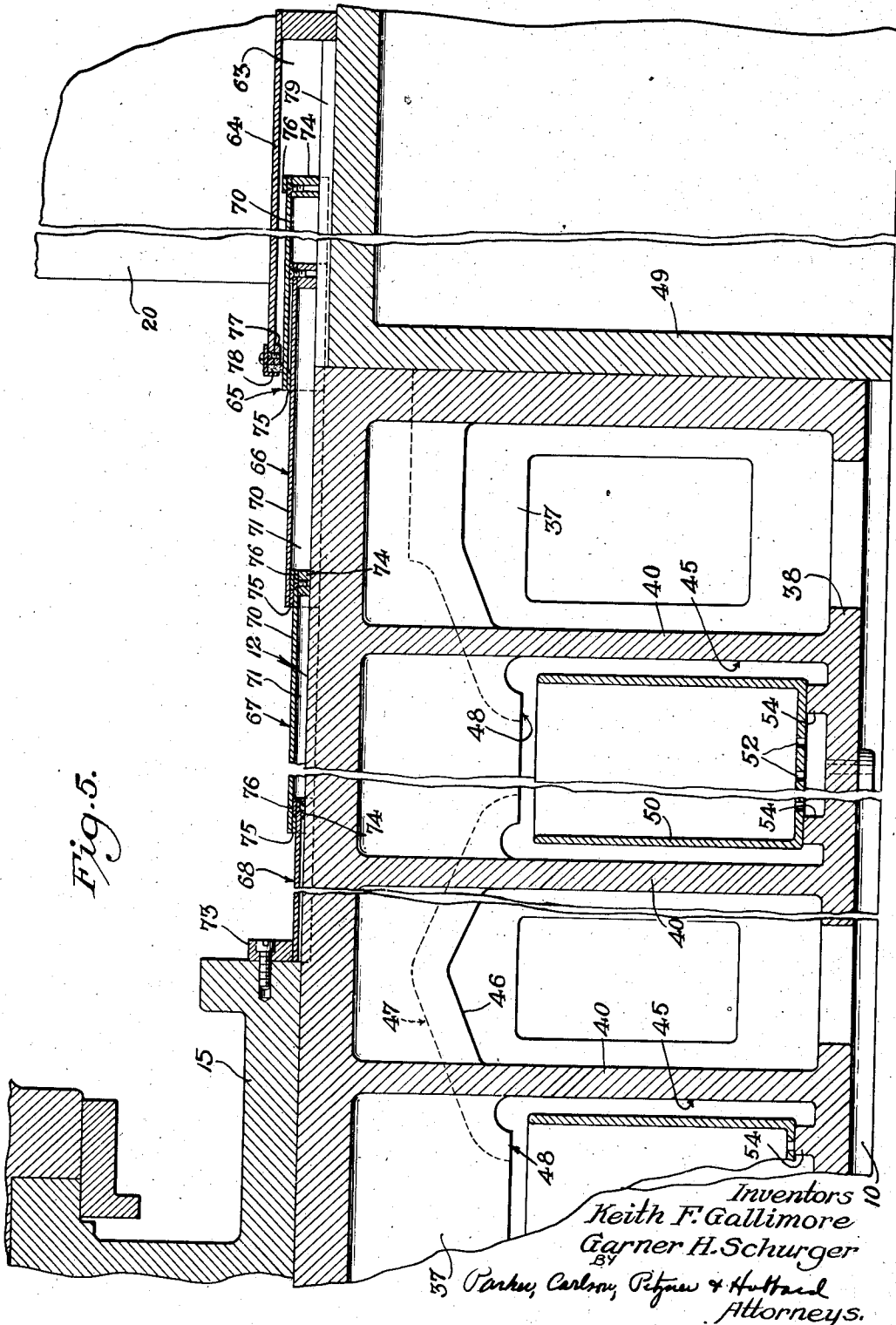
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UNITED STATES PATENT OFFICE

2,375,408

MACHINE TOOL

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7 Claims. (Cl. 77-3)

The invention relates to machine tools of the type commonly known as horizontal boring, drilling and milling machines and more particularly to improved chip disposal means for such machines.

Machines of the above general character are commonly employed for machining relatively large workpieces and, when performing certain types of operations, as for example, roughing operations, they produce substantial quantities of chips of the material removed from the work. One object of the present invention is to provide an improved bed construction for such machine embodying novel features of construction whereby the chips are collected at a point where they cannot interfere with the movement of the machine elements and from which they can be conveniently and safely removed without stopping the machine.

Another object is to provide improved guard means for protecting the ways of such machine from chips or other foreign material.

Other objects and advantages of the invention will become apparent from the following detailed description of the preferred embodiment illustrated in the accompanying drawings in which:

Figure 1 is a front elevational view of a horizontal boring, drilling and milling machine embodying the features of the invention.

Fig. 2 is a transverse vertical sectional view of the machine bed taken along the line 2-2 of Fig. 1.

Fig. 3 is a fragmentary plan view of the machine bed showing details of the section adjacent the headstock column.

Fig. 4 is a vertical sectional view taken along the line 4-4 of Fig. 2 showing the construction and interfitting relationship of the elements of the way guards.

Fig. 5 is a vertical sectional view taken longitudinally of the machine bed substantially in the plane of the line 5-5 of Fig. 3.

While the invention is susceptible of various modifications and alternative constructions, we have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that we do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications, adaptations and alternative constructions falling within the spirit and scope of the invention as defined in the appended claims.

For purposes of illustration the invention has been shown as incorporated in a horizontal boring, drilling and milling machine of the conven-

tional type. The exemplary machine comprises generally a horizontal base or bed 10 adapted to be anchored to the floor or other suitable foundation 11. The bed 10 may be in the form of a casting and the construction and arrangement of the component parts constitutes an important feature of the present invention as will be described in detail hereinafter. For a general understanding of the machine construction it is sufficient to note, at this time, that the bed is provided on its upper face with a series of longitudinally extending parallel ways. In the particular machine illustrated, three such ways are provided, namely, a front way 12, an intermediate way 13 and a rear way 14, as shown in Figs. 2 and 3. A carriage or saddle 15 (Figs. 1, 3 and 5) is mounted on the ways for translation along the bed. The saddle in turn is provided on its upper face with spaced parallel ways 16 (Fig. 1) extending transversely of the machine bed. A table 17 is slidably mounted on the ways 16, the table having its upper face formed with a series of T-slots 18 to facilitate clamping a workpiece, such as a casting W, thereon.

Rigidly mounted at one end of the bed 10 is an upstanding column 20 provided with vertical guides or ways 21 on which a spindle headstock 22 is adapted to travel. The headstock may be of any suitable construction and is equipped with a longitudinally disposed spindle 23 adapted to be rotatably driven by a motor M carried on the headstock. The spindle 23 projects from the side of the headstock adjacent the table 15 and is adapted to carry a boring tool, drill, milling cutter or other suitable tool for operating on the workpiece W carried on the table 15. As herein shown a conventional milling cutter 24 is mounted on the spindle.

Adjustably secured to the opposite end of the machine bed 10 is an upstanding column 30 having vertical ways 31 on which an end block or tailstock 32 is adapted to travel synchronously with the headstock. In operation, the tailstock is aligned axially with the spindle 23 and coacts therewith in well-known manner to support a tool bar or arbor (not shown) when such is used.

Suitable power drive means is provided for translating the various movable elements of the machine. For this purpose one or more driving motors M' are mounted at the base of the column 20 adjacent the end of the machine bed and are connected through the usual shafts, gearing and other driving instrumentalities to the machine elements. Manually operable controls are provided so that the machine attendant may readily

control the direction and rate of movement of any machine element. These movements are utilized both to position the tool and work when the machine is initially set up for operation and to effect the relative feeding movements required to traverse the tool over the work.

Referring more particularly to Figs. 2 and 5 the machine bed 10, in its preferred form, is constructed with a front wall 35, a rear wall 36 and a plurality of intermediate walls 37, 37', 37'' and 37''' arranged in parallel relation. The members forming these walls extend the full length of the bed and are integral with or rigidly secured to a horizontal bottom plate 38 and are suitably cored to reduce the weight of the bed while maintaining the necessary strength and rigidity. As herein shown, the wall members are arranged in pairs to provide support for the horizontal members 39 which have their upper and side surfaces machined to form the ways 12, 13 and 14.

Extending between the wall members are a plurality of cross-members or webs 40 which serve to impart the necessary rigidity to the bed. The walls, cross-members, way members and bottom plate may be cast integrally or suitably secured together as by welding to provide a strong, rigid machine base or bed.

It will be apparent upon reference to Fig. 1 of the drawings that the chips removed from the workpiece W by the tool 24 will fall to the table 17 and then onto the section of the machine bed between the saddle and the headstock column. One of the primary features of the present invention resides in the novel construction of the bed so as to prevent the chips from piling up in front of the saddle and to facilitate their removal from the machine. To this end the intermediate walls 37, 37' and 37'' in the section of the bed exposed upon movement of the saddle 15 to the dotted line position shown in Fig. 1, are cut away to provide a series of transverse passages or chip receiving compartments 45 the side walls of which are formed by the webs 40 (see Fig. 5). These compartments open upwardly between the ways 12, 13 and 14 as shown in Fig. 3. Preferably the compartments are provided between alternate pairs of webs. The section of each web intermediate the ways merges into a cap member 46 which extends over and covers the space between adjacent compartments. The cap members are formed with a generally convex upper surface 47 (Fig. 5) which is effective to deflect falling chips into one or the other of the adjacent compartments. The lower edge of each cap member preferably extends over the wall of the compartment as indicated at 48 whereby the chips are directed towards the center of the compartment. At the end of the bed adjacent the headstock column, the cap member 46 extends from last web 40 to a vertical wall member 49 forming a part of the column supporting section of the bed.

To facilitate chip removal, the compartments are arranged to open through the front wall of the bed as shown in Figs. 1 and 2 and suitable receptacles, such as rectangular metal pans 50 having handles 51 at each end are placed therein. The receptacles 50 are preferably dimensioned to fit relatively snugly in the compartments so that their sides underlie the projecting edges 48 of the cap members, thus insuring the deposit of all chips in the receptacles. When two such receptacles are used in a compartment, they are preferably arranged to meet below the intermediate

way 13 so that no chips can fall between the receptacles.

In most machining operations, coolant is flooded over the tool 7 and work to prevent overheating of the same and to assist in carrying away the chips. This coolant is received in the receptacles along with the chips. The bottom of each receptacle is desirably perforated as at 52 to drain the coolant from the receptacle so that it may be returned to the reservoir or sump (not shown) through suitable openings 53 in the bottom plate 38 of the bed. To facilitate drainage of the receptacles, the bottom plate may be formed to provide spaced ribs 54 extending longitudinally of each compartment and operative to support the receptacle in an elevated position.

When the machine is in operation, one or more of the compartments will be exposed for the reception of chips, depending upon the position of the saddle 15 on the bed. Falling chips are deflected into the receptacles 50 by the overhanging caps 46 between the chip compartments and the receptacles may be withdrawn from time to time for disposing of accumulated chips without necessitating stopping of the machine. A small portion of the chips produced by the tool will be deposited on the edge of the work table 15 and the exposed horizontal parts of the bed but these may be easily brushed off into the chip receiving compartments. The removal of chip deposits from such parts is greatly facilitated by guarding means arranged to cover the ways and other parts of the machine bed so that no grooves, ledges, ribs or other surface irregularities are presented in which the chips might accumulate and from which their removal would be difficult. This way guarding means additionally serves to prevent the deposit of any chips or other foreign material on the accurately machined way surfaces 40 and thus materially assists in preserving the accuracy of such parts.

Since the saddle 15 is translatable on the ways 12, 13 and 14, varying portions of the way surfaces are exposed in the zone in which the most of the chips are produced, that is, in the section of the bed between the saddle and the headstock column. The way guarding means provided by the present invention is accordingly constructed so as to completely enclose such exposed areas and effectually prevent the deposit of chips or other foreign material thereon regardless of the position of the saddle on the ways. In the particular machine illustrated, a separate guard is provided for each of the three ways 12, 13 and 14. As these guards are similar in construction a detailed description of one will suffice.

Referring to Fig. 2 of the drawings, it will be observed that the ways 12 and 14 are formed with inwardly facing vertical surfaces terminating in substantially horizontal ledges 60. The intermediate way 13 is likewise provided with vertically disposed surfaces which, in this instance, serve to guide the saddle 15 in its movements on the ways. These guide surfaces terminate at their lower edges in generally horizontal ledges 61. The improved guard means of the present invention is constructed so as to cover both the horizontal way surfaces and the ledges above mentioned to prevent the accumulation of chips or other foreign material thereon. To assist the guard means in performing this function a shield 62 of sheet metal or other suitable material is mounted on each ledge to extend upwardly to approximately the same height as the horizontal way surfaces.

Referring now to Figs. 2-5 of the drawings, each way guard has a plurality of channel-shaped sections dimensioned for interfitting telescoping relation so that the guard may be closed up or collapsed to relatively short length. When so collapsed, the guard for the way 14 is adapted to fit within a recess or pocket in the base of the column 20 when the saddle is moved into close proximity to the column as shown in Fig. 4. The guards for the ways 12 and 13, when collapsed, fit within sheet metal housings 63 carried on the column supporting section of the bed immediately below the headstock. Each of the guards, however, is capable of extension so as to cover the entire exposed area of the ways when the saddle is moved to the position shown in broken lines in Fig. 1, that is, to the extreme position at the opposite end of the machine bed. As shown in Figs. 4 and 5, the housing 63 is closed at the top by a horizontal top plate 64.

The guard provided in the exemplary machine is formed in four sections 65, 66, 67 and 68 (Fig. 5) although it will be understood that the number of sections may vary as required by the length of the machine bed and the ways to be enclosed. The several sections of the guard are generally similar in form but vary progressively in size to permit the telescoping interfit hereinbefore referred to. In the preferred form shown, each section comprises a horizontal top plate 70 of sufficient width to extend over the horizontal way surfaces and the adjacent ledge or ledges and having depending flanges 71 at each side edge of sufficient depth to extend over the side edges of the ways and the shield 62 adjacent thereto.

One terminal section of the guard, in this instance the section 68, is anchored at its forward end to the saddle 15 as by an anchoring strip 73 (Fig. 5). The rear end of this section as well as the corresponding ends of the other sections are supported and guided on the ways by guide blocks 74 suitably attached to the undersides of the respective sections. These guide blocks vary progressively in height so as to maintain the top plate 70 of the respective sections parallel with the way surface.

Since the terminal section 68 is anchored to the saddle 13, this section, of course, follows the movements of the saddle on the guide ways. In order to enable the other sections to follow such movements, suitable interlocking means is provided between adjacent sections of the series. As herein shown this interlocking means comprises a stop strip 75 mounted on the underside of the section adjacent its forward edge in position to be engaged by a stop engaging strip 76 attached to the upper surface of the plate 70 adjacent its rear edge. Thus, when the section 68 is moved to the left the strip 76 engages the stop 75 to draw the section 67 along with it. Section 67 in turn pulls along the section 66 while the latter coacts in the same manner with section 65. To prevent complete withdrawal of the latter sections from the recess or housings 63, stop members 77 are provided on the column 20 and on the plate 64 for engagement by the stop engaging strip 76 of the respective sections 65.

The stop strip 75 and stop engaging strip 76 are preferably in the form of relatively thin metal strips extending across the entire width of the top plate 70 of each section. A double sliding bearing is thus provided between the top plates of adjacent sections which forms an effective seal

against the entry of chips or other foreign material into the assembly of guide sections. As each of the stop strips 75 rides over the surface of the adjacent underlying section, it is operative in the collapsing of the sections to push the collected chips off of the same, the chips falling into the compartments provided for their reception. The recess in the column and the housings 63 are effectively sealed by a wiper 78 of felt or other suitable material arranged for coaction with the top plate 70 of the terminal section 65.

In the above construction the way guard is readily collapsed by telescoping the several sections together so that the entire assembly may be received within the column recess or housing 63 when the saddle is shifted closely adjacent the headstock column 20 as shown in Fig. 4. Tracks 79 act to guide and support the sections in their collapsed condition. As the saddle is traversed to the left (as viewed in Fig. 5) the guard section 68 is first withdrawn from the nested series of sections followed successively by sections 67, 66 and 65 thus insuring complete coverage of the ways regardless of the position of the saddle 13 thereon. Moreover, due to the efficient seal provided between the adjacent sections of the guard, entry of foreign material is positively precluded.

It will be apparent from the foregoing that the invention provides novel and useful means for facilitating the disposal of chips and for protecting the ways of large machine tools such as horizontal boring, drilling and milling machines. By reason of the novel and improved bed construction the chips are collected at a point where they cannot interfere with the movements of the machine elements and from which they can be conveniently removed while the machine is operating without endangering the attendant.

The invention also provides improved guard means which effectually prevents the deposit of chips or other foreign material on the ways regardless of the position of the machine element which is translatable on such ways. The guard means is simple in construction, efficient in operation and does not interfere in any way with the normal operation of the machine.

We claim as our invention:

1. In a horizontal boring machine, in combination, an elongated bed having horizontal guide ways on its upper face, a saddle mounted for reciprocation on said ways, a work supporting table mounted on said saddle, an upright column on said bed adjacent one end of said ways, a spindle headstock on said column adapted to carry a tool for operating on a workpiece supported on said table, said saddle being shiftable on said ways to vary the spacing of the table with reference to the headstock column, and guard means for preventing the deposit of chips removed from the work by the tool upon the section of the ways between the saddle and the column, said guard means comprising a series of inverted generally channel-shaped sections arranged in telescoping relation upon each of said ways, means operatively connecting one terminal section of each series with the saddle, and stop engaging means on each section cooperating with stop means on the next adjacent section for limiting the extent of movement of the one section with respect to the other whereby to maintain a continuous cover over the ways in any position of the saddle.

2. In a horizontal boring machine, in combination, an elongated bed having a plurality of horizontal guide ways on its upper face, a saddle

mounted for reciprocation on said ways, a work supporting table mounted on said saddle, an upright column on said bed adjacent one end of said ways, a spindle headstock on said column adapted to carry a tool for operating on a workpiece supported on said table, said saddle being shiftable on said ways to vary the spacing of the table with reference to the headstock column, and guard means associated with each of said ways for preventing the deposit of chips removed from the work by the tool upon the portion thereof between the saddle and the column, each of said guard means comprising a series of generally channel-shaped sheet metal sections of gradually decreasing width arranged in nesting relation, means anchoring one terminal section of the series to the saddle, stop engaging means on the other terminal section cooperating with a stationary stop adjacent said column, and stop engaging means on said one terminal section and the intermediate sections cooperating with stop means on the next adjacent sections for limiting the extent of movement of one section with respect to the other, said sections being movable along the ways in succession from a telescoping nested relation upon movement of the saddle away from the column so as to provide a continuous cover for the way in all positions of the saddle.

3. In a horizontal boring machine, in combination, an elongated bed having horizontal guide ways on its upper face, a saddle mounted for reciprocation on said ways, a work supporting table mounted on said saddle, an upright column on said bed adjacent one end of said ways, a spindle headstock on said column adapted to carry a tool for operating on a workpiece supported on said table, said saddle being shiftable on said ways to vary the spacing of the table with reference to the headstock column, and guard means associated with each guideway for preventing the deposit of chips removed from the work by the tool upon the portion thereof between the saddle and the column, each of said guard means comprising a series of generally channel-shaped sheet metal sections of gradually decreasing width arranged in nesting relation, means anchoring the forward end of one terminal section to the saddle, stop engaging means on the rear end of said one section and on each succeeding section adapted to cooperate with stop means on the forward end of the next adjacent section to effect movement of the sections along the ways in succession incident to the movement of the saddle away from the column, and stop engaging means on the rear end of the other terminal section of the series cooperating with stationary stop means adjacent the column for limiting the extent of movement of said other terminal member.

4. In a machine of the type described, in combination, an elongated bed having spaced horizontally disposed guideways on its upper face, said bed having front and rear longitudinal walls, a work support reciprocable on said ways, a support at one end of said bed for a tool adapted to operate on the work, rigid cross members connected to and extending between said front and rear walls and defining therewith a series of transverse compartments within and longitudinally of said bed, alternate ones of said compartments opening upwardly between said ways to receive chips removed from the work by the tool, the compartments intermediate said chip receiving compartments being closed at their upper ends

by cap members shaped to deflect falling chips into the adjacent chip receiving compartments.

5. In a machine of the type described, in combination, an elongated bed including front and rear longitudinal walls, spaced horizontally disposed ways on the upper face of said bed, a work support reciprocable on said ways, a support at one end of said bed for a tool adapted to operate on the work, rigid cross members extending between said front and rear walls and defining a longitudinal series of transverse compartments within said bed, cap members rigid with and extending between the front and rear walls of the bed and rigid with and overlying said cross members to close the alternate compartments defined by such members, the other of said compartments opening upwardly between said ways to receive chips removed from the work by the tool, said chip receiving compartments also opening through one of said walls to facilitate the removal of chips therefrom.

6. In a machine of the type described, in combination, an elongated bed including front and rear vertical longitudinally extending walls, spaced horizontally disposed ways on the upper portion of said bed, a work support reciprocable on said ways, rigid vertical walls connected to and extending crosswise in parallel spaced relation between said front and rear walls and constituting partitions defining a longitudinal series of transverse compartments entirely within said bed, rigid cap members connected to and extending between said front and rear walls and connected to and overlying said cross members to close completely alternate ones of said compartments and projecting partially over while leaving open the others of said compartments to receive chips dropping between said ways, said chip receiving compartments each having a bottom wall with parallel spaced upstanding ribs extending transversely of said bed and having access openings in at least one of said walls, and a plurality of chip pans removably inserted through said openings respectively into said open compartments and supported on said ribs, said pans being disposed to receive the chips dropping into said open compartments, and the intermediate ones of said cap members being of inverted V-shape to direct chips falling thereon into the compartments contiguous thereto.

7. In a machine of the class described, in combination, an elongated bed including front and rear longitudinal walls, horizontally disposed elevated ways extending longitudinally of the bed, a tool support at one end of said bed, a work support mounted on said ways for movement toward and from said tool support, cross members connecting said walls of said bed and defining a series of chip receiving compartments opening upwardly between the ways, chip guards protecting said ways, each guard comprising a group of inverted generally channel shaped sections arranged in nesting relation upon the associated way, means operably connecting the terminal sections of each group with the work and tool supports respectively whereby said guard sections are automatically extended and collapsed in response to the movements of said work support, and means carried by certain of the sections adapted to cooperate with the adjacent underlying sections in the collapsing of said sections for discharging the chips deposited thereon into said chip receiving compartments.

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