Sept. 17, 1940. H. W. FOX ET AL 2,215,287

BED AND COLUMN CONSTRUCTION

Filed March 25, 1937 2 Sheets-Sheet 1

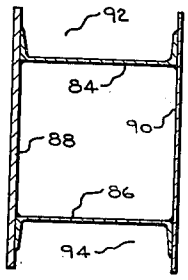


Fig. 4

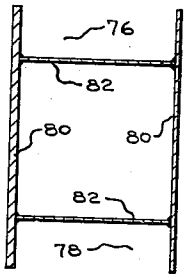


Fig. 3

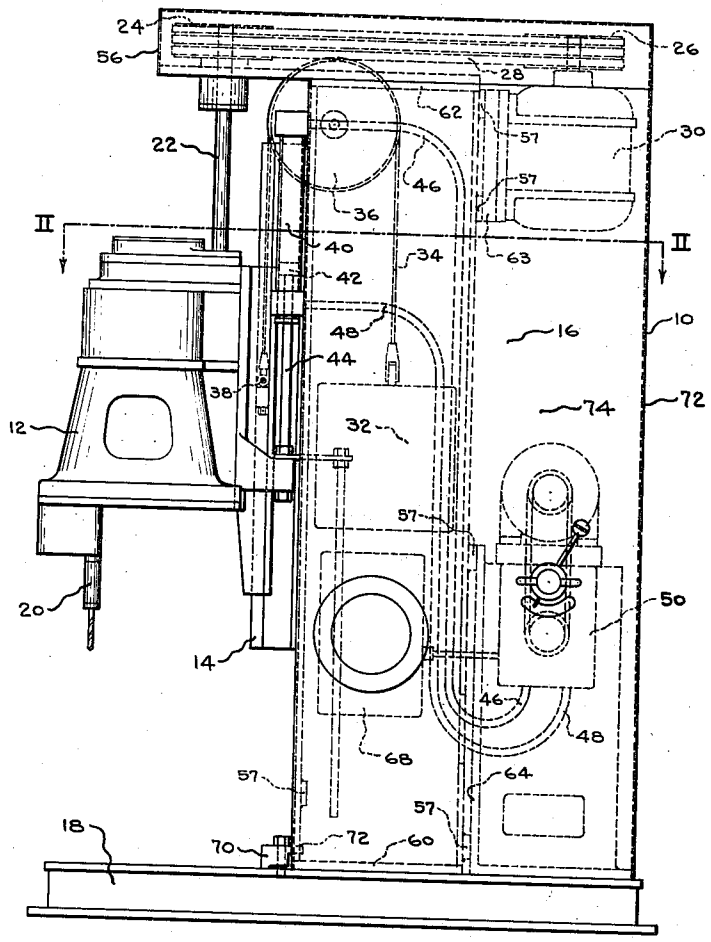


Fig. 1

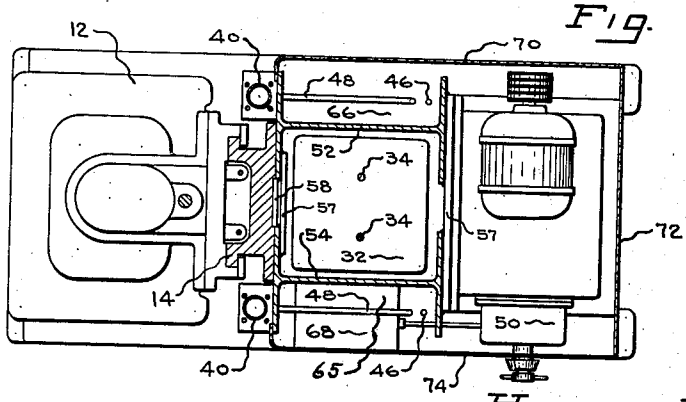


Fig. 2

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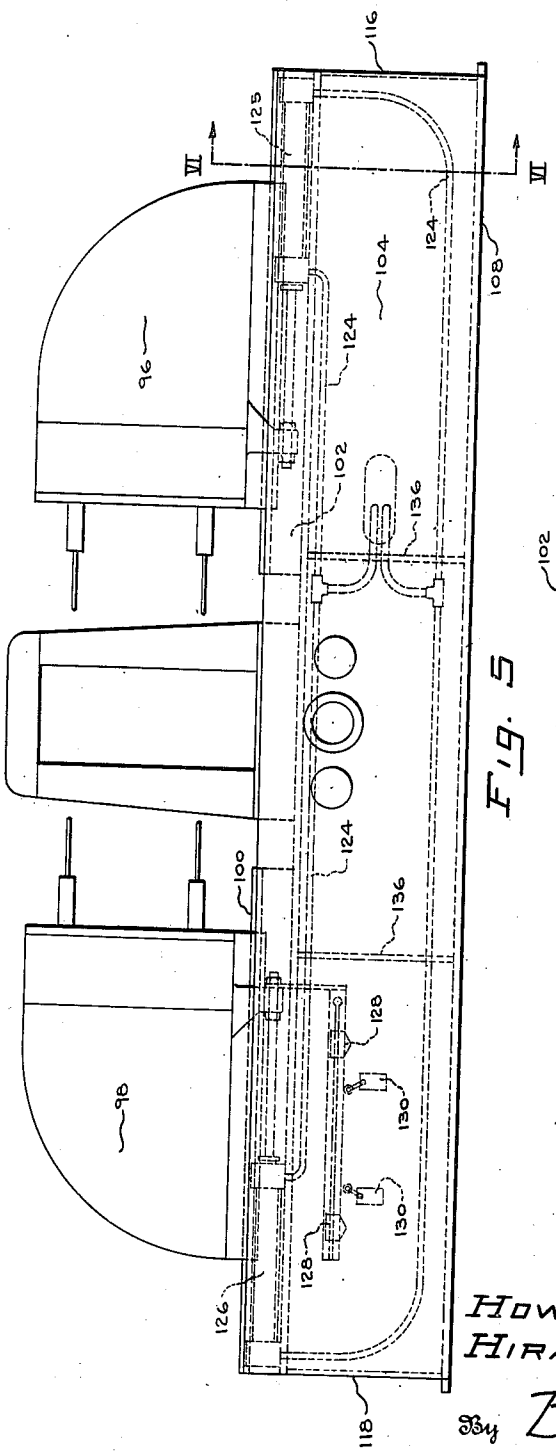


Fig. 5

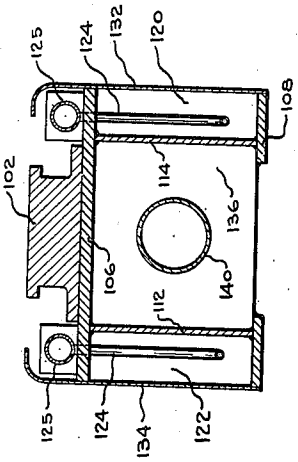


Fig. 6

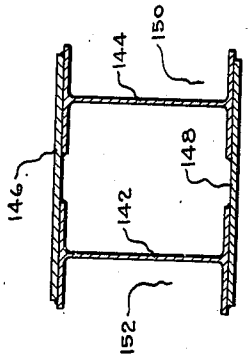


Fig. 7

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Patented Sept. 17, 1940 2,215,287

UNITED STATES PATENT OFFICE

2,215,287

BED AND COLUMN CONSTRUCTION

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Application March 25, 1937, Serial No. 132,948

3 Claims. (Cl. 77—5)

The present invention relates to improvements in bed and column construction, having particular reference to the bed and column construction of machine tools.

In the manufacture of machine tools, with the exception of low production and tool room models which are of standard sizes and construction and permit manufacture in quantities, a high percentage of machine tools are of special construction made upon order and for the purpose of performing upon a specific work piece or class of work piece. This is particularly true in the automobile industry in which yearly models are brought out involving changes in construction and method of manufacture. Usually only a few such special machine tools are required.

It is one of the objects of the present invention to depart from prior practices in bed and column construction in order to reduce the cost of manufacture of both standard and special machine tools and add flexibility to the designing of such tools.

Another object is to improve the arrangement of the control and operating parts associated with the bed and/or column construction of machine tools enhancing the appearance and providing adequate housing desirable from the standpoint of maintenance and servicing.

Further objects and advantages of the invention residing in the arrangement, combination and construction of parts will be more fully treated hereinafter and will appear from the appended claims.

The practice prior to this invention has been to employ cast metal beds and columns in machine tools. While providing adequate strength and rigidity such practice is relatively expensive as it necessitates the making of a pattern which often times will only be used for a few castings in the case of special machines built on order. It is also the case that many manufacturers of machine tools have their castings made outside of their own plant which necessitates considerable expense in connection with the shipping and handling of heavy, bulky castings in addition to the inability to always obtain satisfactory castings when desired.

According to the present invention it is proposed that the bed and/or column constructions for machine tools be fabricated from rolled metal sheets, or bars, or a combination of rolled, metal sheets and bars. Preferably, the constructions are fabricated from standard rolled sheet and bar sections which are readily available at all times and are of uniform dimensions and properties. In one of the illustrated forms of the invention standard H-sections are employed in the fabrication of the construction. Another form embodies standard channel sections, while a third form illustrates the manner in which the construction is entirely fabricated from welded sheets. It is to be understood that the illustrated forms of the invention are only exemplary of the principles of the invention. As will be described more fully, hereinafter, our improved bed and column construction might be called generally as of box cross-section; there being a centrally closed or partly closed box-like section and preferably open channels upon the opposite sides of the central box section. The number of open channels, however, may be varied by selection and arrangement of the rolled metal section used in making up the bed or column construction. In the case of machine tools having a vertical column and vertical ways for the working head, the central box-like section may serve as a housing and guideway for a counterweight. The open channels serve as a convenient conduit for various pipes, wires and mechanical structures embodied in the operation and control of the machine tool.

In the drawings,

Fig. 1 is a side elevational view of a multiple spindle drill press with a column structure thereof conforming to the present invention.

Fig. 2 is a cross-sectional view taken on the section II—II of Fig. 1,

Fig. 3 is a cross-sectional view of a modified form of the column framework made up of welded rolled sheet sections,

Fig. 4 shows a cross-sectional view of a further modified column framework structure made up from rolled metal bars and sheets,

Fig. 5 is a side elevational view of a boring mill having the bed thereof constructed in accordance with the principles of the present invention,

Fig. 6 is a cross-sectional view taken on line VI—VI of Fig. 5, and

Fig. 7 is an end view of a modified form of the bed framework fabricated from rolled metal bars and sheets.

Referring to Fig. 1, the principles of the invention are illustrated in connection with a multiple spindle drilling machine 10 having a head 12 supported for vertical movement upon guideways 14 carried by the vertical column 16

resting upon a base 18. The spindles 20 of the head 12 are driven through a power takeoff shaft 22 which has suitably splined driving relation with the head 12; the shaft 22 being driven by the arrangement of the pulleys 24 and 26, belt 28 and motor 30. A counterweight 32 through flexible cables 34 running over pulleys 36 and connected to the head 12 at 38 functions in a well known manner to counterbalance the weight of the head 12 to facilitate feeding movement of the latter through suitable hydraulic feed mechanism. As shown, a pair of cylinders 40 carried by the column 16 have operating pistons 42 with connecting rods 44 attached to the head 12. Suitable conduits 46 and 48 for the operating fluid connect opposite ends of the cylinders 40 and extend to the hydraulic control mechanism generally designated at 50.

With the exception of the construction of the column 16, the foregoing described mechanism forms no part of the present invention except as it may be claimed in combination with our column construction.

In Figs. 1 and 2 of the drawings, the column 16 is illustrated as comprising a pair of standard rolled steel H-beam sections 52 and 54. These sections are co-extensive in length and extend between the base 18 and the top structure 56 within which the driving mechanism for the shaft 22 is housed. The H-beam sections 52 and 54 are spaced by suitable upper and lower tie plates 60 and 62 welded to opposite ends of the sections 52 and 54 as well as by transverse tie plates 57. The tie plates 57 are shown vertically spaced along the column 16 and in sufficient number to give the desired rigidity. Rolled sheet steel of the required gauge is used in the fabrication of the plates 57, 60 and 62. Further stiffening and rigidity is obtained through the bolting of the base 63 of the motor 30 and the flange 64 of the hydraulic mechanism 50 to the right hand ends of the sections 52 and 54. Similarly, the guideways 14 attached to the left hand ends of the sections 52 and 54, reinforce and stiffen the column construction. As shown, the guideways 14 have a key 58 which is received between opposed machined edges of the flanged ends of the sections 52 and 54 to locate the guideways.

As more clearly appearing from Fig. 2, the H-beams 52 and 54 as arranged provide oppositely opening vertical channels 65 and 66 within which the hydraulic piping is housed and extends. These channels may receive numerous operating and control parts and conduits not specifically shown as for example the control box 68 of the hydraulic mechanism 50. Sheet metal panels 70, 72 and 74 removably secured to three sides of the column impart to the same a finished and attractive appearance yet may be readily removed for inspection and servicing of the machine tool. In the particular form of the machine illustrated the central vertical chamber defined by the H-beams 52 and 54 houses and acts as a guideway for the counterweight 32.

In practice rolled H-beams from which the sections 52 and 54 are cut may be carried in stock and the sections 52 and 54 cut to proper lengths to give the height of vertical column 16 desired. This may vary with each machine tool manufactured without any appreciable increase in cost of manufacture as compared with a cast column requiring new pattern for each change and in most cases reproportioning of the design. To increase or decrease the width of column 16 it is only necessary to move the sections 52 and 54 closer together or farther apart before fixing the same in spaced relation with the tie bar 58 and the tie plates 60 and 62. Under varying requirements of strength and rigidity in various sized machine tools, standard H-beams meeting such requirement if not in stock can always be promptly obtained from the rolling mills. The column 16 may be secured to the base 18 by bolting or welding the tie plate 60 to the base 18. For additional rigidity, toe clamp 70 extends through openings 72 in the flanges of the sections 52 and 54 and directly anchors the sections to the base 18 to relieve the tie plate 60 from any excess strain during the operation of the machine tool.

As we wish to broadly claim as our invention bed and column construction fabricated from standard rolled bars and/or sheets, we have illustrated in Fig. 3 a modified form of the invention which is similar in cross-section to the column structure of Fig. 2 yet is entirely fabricated from sheet stock. As shown, a box-like section with oppositely opening channels 76 and 78 has been obtained by welding together elongated sheets 80 and 82 of required lengths and gauge. With this construction it is only necessary to stock flat rolled sheets and cut them to the proper width and length to obtain any desired column or base construction. In most cases, however, the use of standard rolled bar sections is preferably as shown in Fig. 2 as the welding operation required during fabrication is materially reduced.

In Fig. 4 a further modification is illustrated showing a section made up from a combination of rolled bar and sheet stock. Standard channel sections 84 and 86 are spaced by end plates 88 and 90 which may overlap as shown to vary the depth of the oppositely opening channels 92 and 94.

Referring to Fig. 5 is shown a boring mill having a pair of working heads 96 and 98 supported for horizontal movement upon suitable ways 100 and 102 located upon the bed 104. As more clearly shown in Fig. 6, the bed 104 is fabricated from rolled sheet metal stock comprising an upper plate 106, lower base plates 108 and 110, spaced vertical side plates 112 and 114, and end plates 116 and 118. Preferably all of the aforesaid plates are welded together along their abutting portions. The side plates 112 and 114 are set inwardly to provide side opening channels 120 and 122 for the locating of conduits or pipes generally designated 124 leading to the operating cylinders generally designated 126. Electrical conduits (not shown), and control mechanism, both electrical and mechanical, such as for example cams 128 and limit switches 130, may also be conveniently located within the channels 120 and 122. To complete the housing of the mechanism located in the channels 120 and 122 and to enhance the appearance of the machine, light sheet metal plates 132 and 134 are removably secured to the edges of the upper and lower plates in any suitable manner.

For obtaining maximum rigidity where required, cross plates 136 spaced longitudinally of the bed 104 are welded between the side plates 112 and 114. If desired these plates 136 may be apertured to receive an elongated tube 140 for further rigidity.

In Fig. 7 a modification in bed frame structure is shown corresponding to the structure of Fig. 6 fabricated from the plates 106, 108, 110, 112, and 114. Two standard rolled H-beam sections 142 and 144 are used of lengths equal to that of the bed of the machine. These sections are

spaced by upper and lower plates 146 and 148 either or both of which may be coextensive with the sections 142 and 144 or in shorter lengths spaced along the sections 142 and 144. The oppositely opening channels 150 and 152 correspond to the channels 120 and 122 of Fig. 6 and serve a similar function. The plates 146 and 148 may be welded, bolted or otherwise secured to the H-beam sections 142 and 144. It will be readily appreciated that the length and width of the bed structure may be varied at will by securing standard H-beams of the desired length and varying the spacing of the same. Likewise, desired height, width and degree of rigidity may be obtained through selection of standard rolled sections of proper dimension and shapes.

We consider that the present invention constitutes a decided advancement in column and bed construction and wish to claim the invention broadly without limitations as to type or use of machine. Moreover, we do not wish to limit the invention to the specific constructions illustrated in the accompanying drawings as they are only exemplary of the principles of the invention and other shapes and forms will readily suggest themselves to those skilled in the art. The invention resides in the construction of the bed or column framework, the arrangement of parts in combination with the bed or column framework and the housing of operating and control parts by the column or bed framework and the sheet metal outer covering plate which enhances the appearance of the structure and facilitates construction and servicing.

Having described our invention what we desire to protect by Letters Patent and claim is:

1. In a machine tool, a supporting structure for the working head comprising a pair of standard rolled steel beam sections disposed in spaced relation with the webs thereof in parallelism, plates connecting said beams in fixed spaced relation to form a rigid unitary structure, outer sheet metal casing members housing said beams, said casing members forming elongated chambers with said webs, and operating and control means for the working head housed in said elongated chambers.

2. A machine tool comprising a base, a column supported upon said base, said column being fabricated from a plurality of standard rolled steel beam sections vertically disposed in spaced relation, a working head, guideways for said working head, said guideways acting as a common connector for said beams, the webs of said beams being opposed in spaced relation and defining a vertical chamber, a counterweight for said working head disposed in said chamber for vertical movement, vertical channels defined upon said opposite sides of said central chamber, operating and control means for said working head housed in said channels, and outer sheet metal members overlying said channels and completing the housing of said means.

3. In a machine tool, a bed comprising a plurality of standard rolled steel beam sections disposed in spaced relation, a working head, a tie plate for fixing said sections in rigid spaced relation, guideways for said working head, said guideways also acting as a connector member for said beams for imparting further rigidity thereto in their spaced relation, the webs of said beams being disposed in spaced relation defining a central chamber, said beams defining outwardly open channels on opposite sides of said bed, operating and control means located in said channels, and outer sheet metal members overlying said channels and completing the housing of said means.

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