Nov. 21, 1933. C. J. DAVIS 1,936,384

METAL WORKING MACHINERY

Filed April 18, 1932 3 Sheets-Sheet 1

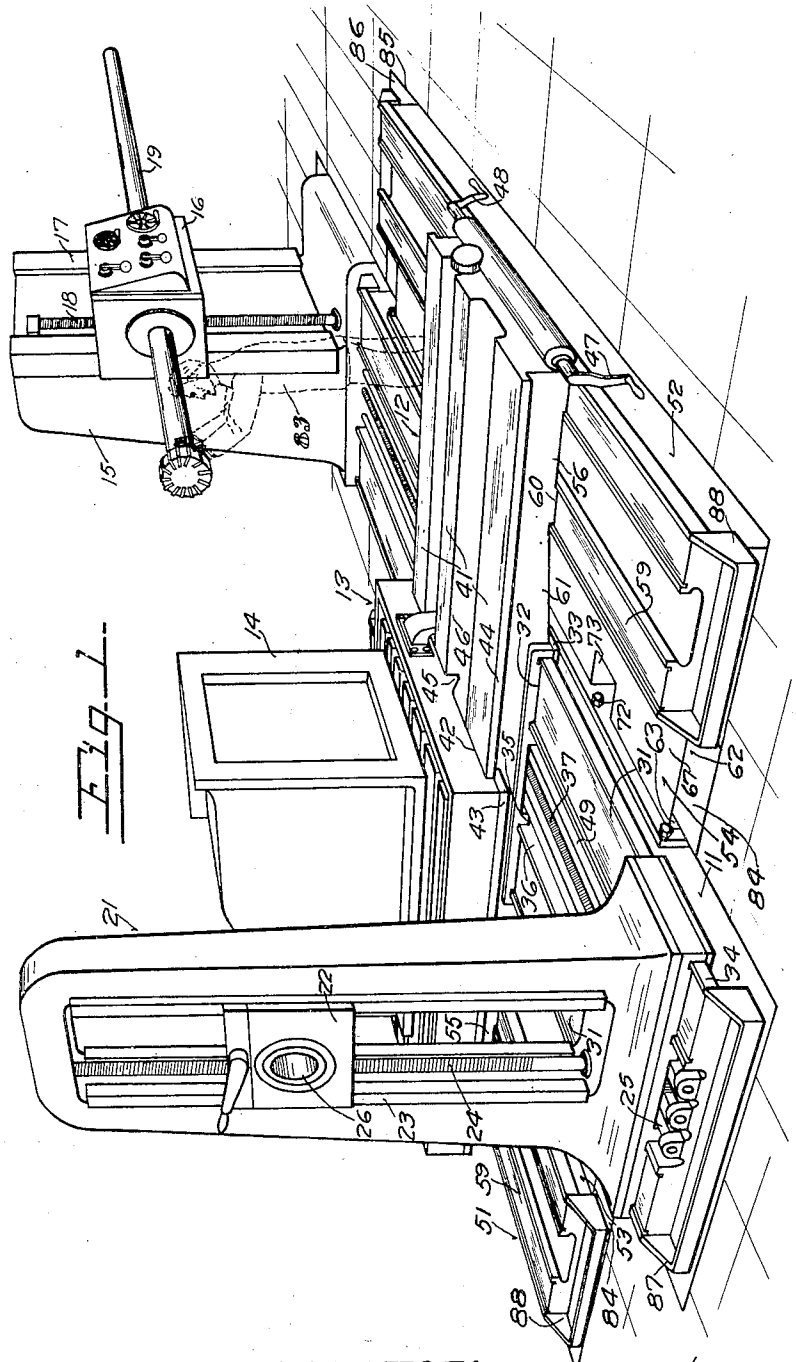


Fig. 1.

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Nov. 21, 1933. C. J. DAVIS 1,936,384

METAL WORKING MACHINERY

Filed April 18, 1932 3 Sheets-Sheet 2

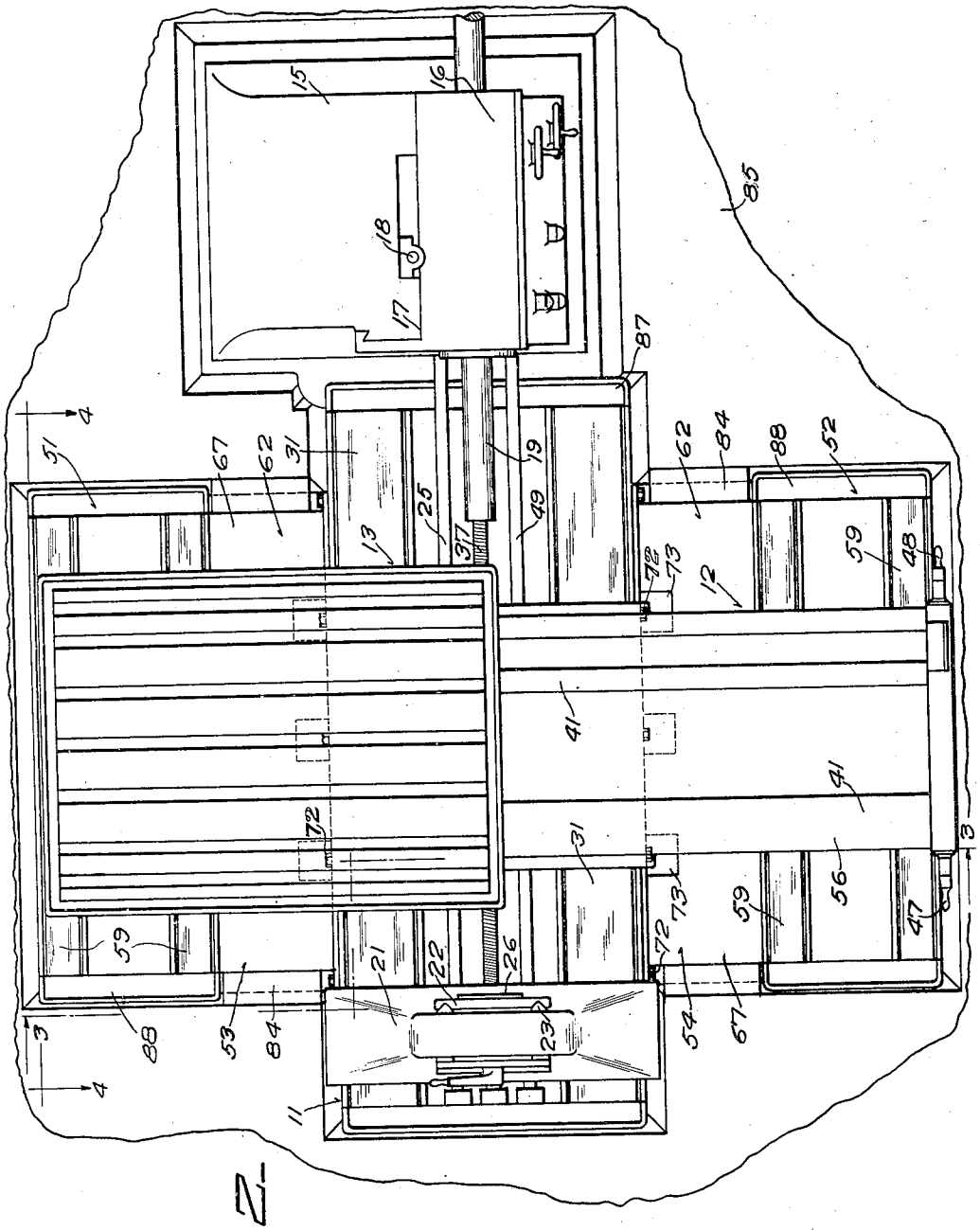


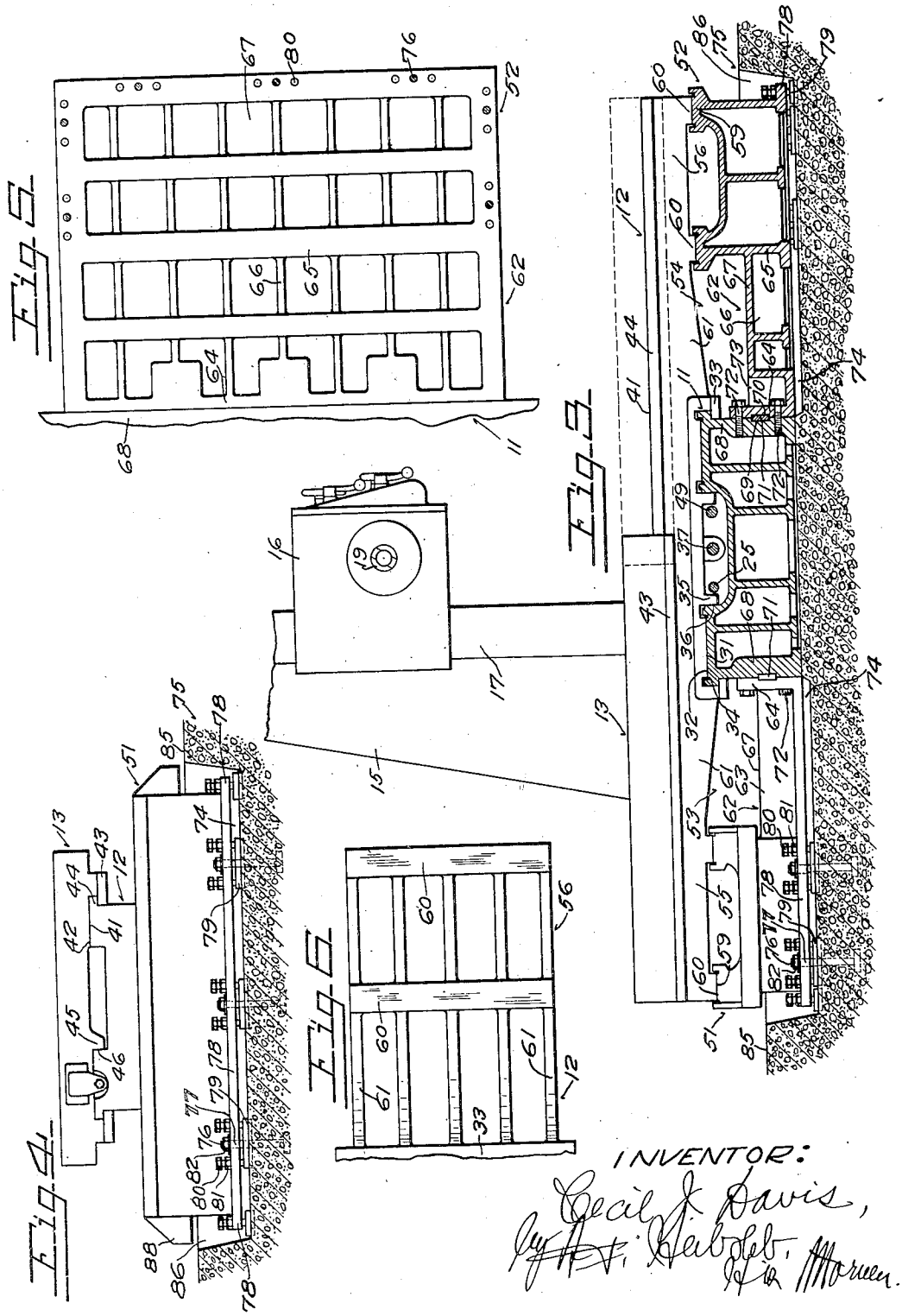
Fig. 2.

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Nov. 21, 1933. C. J. DAVIS 1,936,384

METAL WORKING MACHINERY

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UNITED STATES PATENT OFFICE

1,936,384

METAL WORKING MACHINERY

Cecil J. Davis, Kenton, Ohio, assignor to The Ohio Machine Tool Company, Kenton, Ohio, a corporation of Ohio

Application April 18, 1932. Serial No. 605,933

8 Claims. (Cl. 29—26)

My invention relates to metal working machinery, and is exemplified as applied to a metal boring, milling and drilling machine of large size.

Machinery to which my invention is applicable employs a bed, a carriage movable lengthwise of the bed, and a work-supporting table movable on the carriage transversely of the bed. There is usually a tool spindle at higher elevation than the table carrying a tool for operating on the work, the carriage and the table being shiftable for placing the work in various positions, or for feeding the work lengthwise or crosswise of the bed, so that the tool may operate upon various portions of the work, the tool-spindle being shiftable axially, as in drilling and boring operations.

The work is usually very heavy, consisting for instance of very heavy iron, steel or bronze castings.

It has been the practice heretofore to permit the carriage to overhang the bed laterally, or to permit the table to overhang the carriage laterally, or to permit both of these relations, during shifting of and operation upon the work, as when the lateral portions of the work was being operated upon by the tool, with the result that the carriage, the table and the work would tilt or sag on account of the overweight of the overhanging portions, resulting in placing the work out of true positions, in inaccuracy of the tool operations upon the work, and in binding stresses upon the parts.

It is the object of my invention to avoid these objections, and to extend the carriage in lateral directions so that the work supporting table is supported thereon substantially throughout its area throughout all lateral positions of the table, and to provide auxiliary beds for the main bed of the machine upon which the outer ends of the carriage have supported movements.

It is the object of my invention further to provide such auxiliary beds in spaced relation from the main bed for providing an operator's space between the beds into which the operator may walk or in which he may stand and move when giving attention to the various parts of the machine, or in examining the work or tools or the operation being performed by the tools on the work; and, further, to provide a floor for this operator's space which is substantially level with the floor of the space surrounding the machine.

It is the object of my invention further to connect such auxiliary beds with the main bed; and, further, to provide such auxiliary beds with leveling means for leveling the guideways thereon with relation to the guideways on the main bed.

It is the object of my invention further to provide complemental guideways on the main bed and on the auxiliary beds for guidingly supporting the intermediate portion of the carriage and the respective end portions thereof, so that the carriage has supporting connection throughout substantially its entire area, in order to give supporting connection to the table substantially throughout the entire area of the latter; and, further, to so arrange the parts that each end portion of the table may be placed on the carriage substantially in the vertical plane in which the axis of the tool spindle is located, and at the same time have support for the other end of the table on one of the outer ends of the carriage, which in turn is supported on one of the auxiliary beds, thereby removing substantially all overhanging relations of the table and the carriage, and, further, permitting large pieces of work which are sometimes of immense weight to occupy the entire table without overhanging stresses upon the table or carriage.

The invention will be further readily understood from the following description and claims and from the drawings, in which latter:

Fig. 1 is a perspective view of an exemplifying metal working machine embodying my invention, and illustrating an operator in dotted lines for exemplifying the sizes of machinery to which my invention may be applied, although it is to be understood that the size of the machine does not limit the scope of the invention.

Fig. 2 is a plan view of the same, partly broken away.

Fig. 3 is a vertical cross-section of the same, taken on the irregular line 3—3 of Fig. 2, and partly broken away, showing the work supporting table in one limit of movement in full lines and in the other limit of movement in dotted lines.

Fig. 4 is a vertical section of the same, taken on the line 4—4 of Fig. 2, and partly broken away.

Fig. 5 is a bottom view of the auxiliary frame and its relation to the main frame, partly broken away; and,

Fig. 6 is a bottom view of one end of the carriage, partly broken away.

The exemplified machine comprises a main bed 11, on which there is a carriage 12. On the latter there is a work supporting table 13, exemplified as supporting a piece of work 14. A column 15 extends upwardly at one end of the bed, a head 16 being adjustable and feedable manually or by power up and down on the column on ways 17

in any usual or well known manner, employing for instance a vertical screw 18 which is threaded in a suitable nut fixed in the head.

A tool supporting spindle 19 is axially movable and feedable manually or by power in its bearings on the head in any ordinary or usual manner. Various tools, as for boring, drilling and milling, may be suitably secured to rotate with the spindle, and a boring bar may also be suitably secured to the spindle in usual manner.

At the other end of the main bed a standard 21 is shown, in which a slide 22 is adjustable and feedable manually or by power up and down on guideways 23 in ordinary or usual manner, employing for instance a vertical screw 24 threaded in a suitable nut fixed in the slide. The vertical screw has operative connection with a shaft 25 extending lengthwise in the bed.

The slide supports a bearing 26 provided for instance for the outer end of a boring bar, which is an extension of the tool spindle 19 in usual manner, when performing a boring operation upon the work. When such boring bar is used the vertical screw 18 of the head 16 and the vertical screw 24 of the slide 22 are operatively connected in suitable or usual manner for vertically shifting or feeding the head and the slide in unison.

The carriage is slidable lengthwise of the main bed 11, on guideways 31, being supported thereon by means of guides 32 on the lower face of the carriage, the carriage being shown as having gibs 33, reaching under the laterally projecting ledge 34 of the bed, and lugs 35 guided on the lateral guides 36 on the bed. The carriage is feedable manually or by power lengthwise of the bed by means of a screw rod 37 extending lengthwise in the bed having screw connection with a usual nut in the carriage. The screw rod is rotated and controlled in any ordinary or usual manner.

The standard 21 is adjustable lengthwise of the bed by suitable or usual means and is suitably clamped in adjusted positions. It has guides which coact with the guides on the bed.

The table 13 is slidable along the carriage transversely of the bed on guideways 41 on the carriage, the table being provided with complemental guides 42 at its bottom. The table has bibs 43, reaching under projecting ledges 44 of the guideways on the table and lugs 45 guided by lateral guides 46 on the carriage.

Travering movement of the table crosswise of the tool spindle may be manually obtained in respective directions by operating handles 47, 48, or such traversing movement may be accomplished by power in usual manner by a screw rod extending laterally in the table and a usual coacting nut threaded thereto and held endwise in the saddle, and operated by usual or ordinary means, part of which may be a shaft 49 extending lengthwise in the bed.

Usually an ordinary power driving means, as an electric motor, is provided for the machine at the head end of the machine, suitable driving connections and speed changing means and controls therefor being provided connecting with the various operating shafts and screws, and manual operating and control means may also be provided for said shafts and screws, all of which are not more particularly shown or described because well known.

The usual relation of the bed to the column heretofore in general use in machines of this character is as herein shown by the relation of the main bed to the column, the transverse dimensions of the carriage and the table to the bed, however, being only slightly more than the width of the main bed herein shown, causing overhanging of the carriage beyond its supports upon the bed, and still greater overhang of the work supporting table, with relation to the bed and the carriage.

In my improved device I provide auxiliary beds 51, 52, preferably spaced from the main bed by spaces 53, 54, and extending lengthwise of the main bed. The carriage is provided with extensions 55, 56, extending laterally of the main bed over the respective auxiliary beds. The auxiliary beds are provided with guides 59, with which guides 60 on the extensions of the carriage cooperate, these guides extending parallel with the guides between the main bed and the carriage. The guides on the extensions preferably extend throughout the width of the carriage. The guides are shown as slide guides of substantial widths so as to give firm support throughout their areas to the carriage and its extensions.

The extensions of the carriage are shown integral with the carriage, and have ribs 61 at their bottoms at the respective sides of the carriage between the adjacent guides on the main bed and auxiliary beds respectively, the strength of the ribs increasing toward the main bed.

The auxiliary beds and their guides preferably extend throughout the travel of the guides of the carriage thereon.

The auxiliary beds are held rigid with relation to the main bed, shown accomplished by providing a frame structure 62 between each of the auxiliary beds and the main bed, these frame structures being preferably part of the castings of the auxiliary beds. They are shown as ribbed shells located in the spaces 53, 54. They are shown provided with end walls 63, and with side walls 64, 65, ribs 66 between said side walls, and a top plate 67.

The side walls 68 of the main bed and the side walls 64 of the auxiliary beds are, at the respective sides of the main bed, provided with complemental grooves 69, 70, keys 71 being received in these grooves. The upper and lower walls of the grooves and the upper and lower faces of the keys are preferably closely fitted, so that the inner ends of the connecting frame structures are elevationally positioned and maintained with relation to the main bed, thereby also supporting the inner portions of the auxiliary beds, and maintaining the same and the inner guideways thereon parallel with the main bed and the guideways on the latter. Bolts 72 rigidly clamp the inner walls of the frame structures to the side walls of the main bed, some of the bolts being received in recesses 73 in the upper face of the frame structure.

A rigid foundation 75 is provided for the machine, this foundation being preferably a monolithic concrete structure upon which the main bed rests and is leveled. Auxiliary means are provided for leveling the auxiliary beds with relation to the main bed, shown accomplished by providing anchor bolts 76, anchored in the foundation, and received through holes 77 in flanges 78 about the outer edges of the auxiliary beds. Anchor plates 79 are provided, through holes in which the anchor bolts also pass. The anchor plates are shown imbedded in the foundation. Elevation bolts 80 are threaded in the flanges, preferably at the respective sides of the respective anchor bolts, jam nuts 81 being threaded

over the latter bolts for fixing the elevational bolts in adjusted positions. Nuts 82 are threaded over the upper ends of the anchor bolts for clamping the auxiliary beds to the foundation, this clamping being resisted by the elevational bolts.

These adjusting and clamping means are placed at suitable intervals about the outer edges of the auxiliary beds, and provide means for delicately adjusting the various parts of the auxiliary beds with relation to the foundation and to the main bed for placing and maintaining the guides on the auxiliary beds at a level with and parallel to the guides on the main bed.

Recesses 74 are shown formed in the tops of the foundation under the auxiliary bed structures, in which the anchor plates 79 are located.

The upper face of each of the frame structures or shells 62 is lower than the upper parts of the main bed and auxiliary beds, and forms a support for the operator, indicated at 83, who may walk or stand or move about in said spaces 53, 54, so as to enable the operator to occupy positions in a large machine of this type close to the work and close to the tool and close to the operating parts between the column and the standard and between the main bed and auxiliary beds for examination of the same and of the work being done, for attention and adjustment and manipulation of the parts, the fastening of the tools, and other services which may be necessary or desirable, enabling the operator to place himself in convenient positions for accomplishing his work.

The floor level about the machine is represented at 85. The upper face of the frame structure or shell is preferably on a level with the floor about the machine, or may be built up to such level by a layer or layers of flooring material so that the operator may walk directly from the floor about the machine into the space between the main bed and auxiliary bed.

The foundation is shown extending above the bottoms of the beds for forming the floor, although it is obvious that the floor may be built up by suitable blocks or flooring suitably supported about the machine. The edge of the floor about the machine is provided with recesses 86 in which the adjusting means for the auxiliary beds are located for convenience in manipulating the same.

Blocks 84, the upper faces of which are on a level with the tops of the main floor and frame structures 62, are shown located in the recesses 86 between the ends of the frame structure 62 and the main floor to form continuations of the floor levels.

As an exemplification, but not as a limitation, it may be stated that the floor space between the main bed and each of the auxiliary beds is approximately three feet in width.

The respective ends of the main bed may be provided with drip pockets 87, and the respective ends of the auxiliary beds may be provided with drip pockets 88.

My invention provides a convenient, secure, and rigid structure for supporting the outer end of a carriage, and for supporting the work table on the carriage, so that danger of overweight of the same or of the work and of tilting or shifting of the work is avoided, for producing accuracy in operations and avoiding binding of parts; it provides substantial areas of support between the outer ends of the carriage and the auxiliary beds and between the carriage and the table, provides means for rigidly securing the auxiliary beds to the main bed, and provides means for adjusting the various parts of the auxiliary beds to elevation, so as to accurately level the guideways of the auxiliary beds with relation to the guideways on the main bed, and provides an arrangement of the parts whereby the operator has ready access to the work and to the tools and the various operating parts, so that close adjustment and inspection may be had and the parts brought within convenient reach of the operator.

Exemplifying my invention further, it may be instanced that the work supporting table may be adjusted to one limit of movement on the carriage, so that one of the ends of its work supporting surface is in the same vertical plane in which the spindle is located while its other end is still supported on the carriage, as exemplified for instance in full lines in Fig. 3, and the work supporting table may be moved to its opposite limit of movement, so that its other end is in said vertical plane and its first-named end is supported by the other end of the carriage, as exemplified for instance in dotted lines in Fig. 3, the table throughout its work supporting area having support thereunder by said carriage in all the positions of the table, the carriage in turn having support thereunder throughout its area on the guides between it and the main bed and auxiliary beds, so that full support is given to the work throughout all positions of the carriage and of the table.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is:

1. In a metal working machine of the character mentioned, the combination of a monolithic concrete foundation, a main bed, an auxiliary bed extending lengthwise of said main bed at the side of said main bed, said beds located on said foundation, a carriage shiftable lengthwise of said main bed and provided with an extension extending laterally beyond said main bed over said auxiliary bed, guiding means extending lengthwise of said beds between said main bed and said carriage, guiding means parallel therewith between said auxiliary bed and said extension, a work table shiftable on said carriage transversely of said main bed into locations above said main bed and above said auxiliary bed, guiding means at right angles to said first named guiding means between said table and said carriage and its extension, and a tool spindle operable in a plane above the level of said table for operating on the work on said table, said guiding means between said table and said carriage and its extension and between the latter and said main bed and auxiliary bed located substantially throughout their areas in vertical planes in which said foundation is located and being such that said table has support thereunder through said carriage and its extension and said beds substantially throughout the work supporting area of said table throughout positions of substantially all work supporting portions of said table in the vertical plane in which said spindle is located.

2. In a metal working machine of the character mentioned, the combination of a main bed, a column at the end of said main bed, a head elevationally movable thereon, a tool-spindle carried by said head and extending lengthwise of said main bed, an auxiliary bed at the side of and parallel with said main bed, a carriage on said main bed, said carriage provided with an extension extending laterally beyond said main bed over said auxiliary bed, a work table on said carriage shiftable crosswise of said main bed

and said spindle along said carriage and its extension, said work table having a work supporting surface throughout substantially its area, guideways between said main bed and said carriage and between said auxiliary bed and said extension, and guideways between said table and said carriage and its extension, said carriage shiftable lengthwise of said beds on said first-named guideways, and said table shiftable crosswise of said beds on said second-named guideways, a rigid support vertically under substantially all portions of all said guideways, and arranged for having said beds and said carriage and its extension under substantially the entire work supporting surface of said table and substantially said entire work-supporting surface of said table above said rigid support throughout all shiftable positions of said carriage and said table.

3. In a metal working machine of the character mentioned, the combination of a main bed, an auxiliary bed at the side of the same, there being an operator's walking space between said main bed and said auxiliary bed, a rigid foundation vertically under substantially the entire area of said beds and said space, a carriage on said main bed, said carriage provided with an extension extending laterally beyond said main bed over said auxiliary bed, a work table on said carriage shiftable crosswise of said main bed along said carriage and its extension, said extension spanning said operator's walking space for permitting walking of the operator between said beds alongside said carriage and its extension and said table, parallel guideways extending lengthwise of said beds between said main bed and said carriage and between said auxiliary bed and said extension, and guideways at right angles to said last-named guideways between said table and said carriage and its extension, said carriage shiftable lengthwise of said beds on said first-named guideways, and said table shiftable crosswise of said beds on said second-named guideways, whereby to have said beds and said carriage and its extension under substantially the entire work supporting surface of said table and substantially the entire work supporting surface of said table vertically above said foundation throughout all shiftable positions of said carriage and said table.

4. In a metal working machine of the character mentioned, the combination of a main bed, a column at the end of said main bed, a head on said column, a tool spindle thereon extending lengthwise of said main bed, auxiliary beds at the respective sides of said main bed spaced from said main bed, a frame structure in each of the spaces between said main bed and said auxiliary beds, a carriage on said main bed, said carriage provided with extensions extending laterally beyond said main bed over said respective spaces and said auxiliary beds, a work-supporting table slidable on said carriage crosswise of said spindle, guideways between said main bed and said carriage, guideways between said auxiliary beds and said extensions, said respective frame structures having rigid connections with said main bed and said respective auxiliary beds including vertical positioning means, and elevational adjusting means for said respective auxiliary beds whereby to adjust the guideways between said auxiliary beds and said extensions into levels parallel with the levels of said guideways between said main bed and said carriage.

5. In a metal working machine of the character mentioned, the combination of a main bed, a column at the end of said main bed, a head on said column, a tool spindle thereon extending lengthwise of said main bed, auxiliary beds at the respective sides of said main bed spaced from said main bed, a frame structure in each of the spaces between said main bed and said auxiliary beds, a carriage on said main bed, said carriage provided with extensions extending laterally beyond said main bed over said respective spaces and said auxiliary beds, a work-supporting table slidable on said carriage crosswise of said spindle, guideways between said main bed and said carriage, guideways between said auxiliary beds and said extensions, said respective frame structures having rigid connections with said main bed and said respective auxiliary beds including side walls having tongue and groove connections between them vertically relatively positioning said auxiliary beds and said main bed and clamping means between said side walls, and vertical adjusting means for the portions of said auxiliary beds distanced from said main bed, whereby to level said second-named guideways parallel with said first-named guideways.

6. In a metal working machine of the character mentioned, the combination of a main bed, a column at the end of said main bed, a head on said column, a tool spindle thereon extending lengthwise of said main bed, auxiliary beds at the respective sides of said main bed spaced from said main bed, a frame structure in each of the spaces between said main bed and said auxiliary beds, a carriage on said main bed, said carriage provided with extensions extending laterally beyond said main bed over said respective spaces and said auxiliary beds, a work-supporting table slidable on said carriage crosswise of said spindle, guideways between said main bed and said carriage, guideways between said auxiliary beds and said extensions, said respective frame structures having rigid connections with said main bed and said respective auxiliary beds, adjusting means for the margins of said auxiliary beds whereby to level said second-named guideways parallel with said first-named guideways, and a floor about said auxiliary beds extending into said spaces between said main bed and said auxiliary beds.

7. In a metal working machine of the character mentioned, the combination of a main bed, a column at the end of said main bed, a head on said column, a tool spindle thereon extending lengthwise of said main bed, auxiliary beds at the respective sides of said main bed spaced from said main bed, a frame structure in each of the spaces between said main bed and said auxiliary beds, a carriage on said main bed, said carriage provided with extensions extending laterally beyond said main bed over said respective spaces and said auxiliary beds, a work-supporting table slidable on said carraige crosswise of said spindle, guideways between said main bed and said carriage, guideways between said auxiliary beds and said extensions, said respective frame structures having rigid connections with said main bed and said respective auxiliary beds, adjusting means for the margins of said auxiliary beds whereby to level said second-named guideways parallel with said first-named guideways, and a floor about said auxiliary beds extending into said spaces between said main bed and said auxiliary beds, said floor provided with recesses in which said adjusting means are located.

8. In a metal working machine of the character described, the combination with a monolithic concrete foundation, of a main bed, an auxiliary bed

parallel with said main bed, said beds throughout substantially their areas located in vertical lines above said foundation, a carriage shiftable along said main bed and provided with an extension extending laterally beyond said main bed and over said auxiliary bed, a work-table shiftable crosswise of said beds along said carriage to positions above said main bed and said auxiliary bed, guideways extending lengthwise of said beds and located respectively between said main bed and said carriage and between said auxiliary bed and said extension, and guideways at right angles to said last-named guideways and located between said carriage and said work-table, all said guideways substantially throughout their areas located in vertical lines above said foundation.

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