Dec. 31, 1940. C. B. GRAY 2,227,081

METAL CUTTING APPARATUS

Filed March 20, 1937 2 Sheets-Sheet 1

Fig. 6

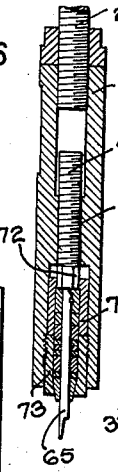


Fig. 1

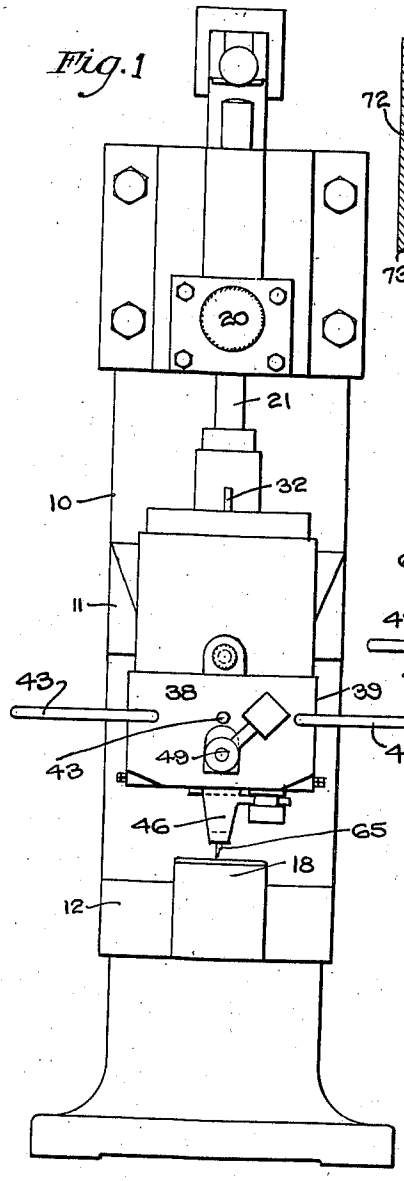
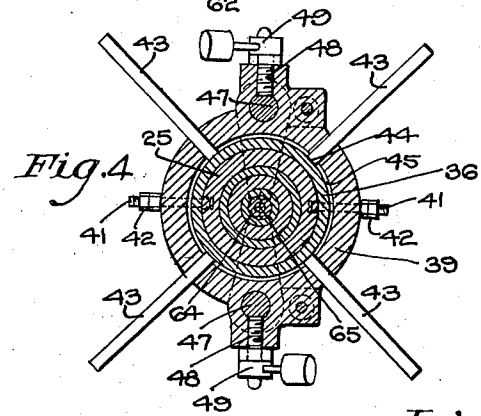


Fig. 3

Fig. 4



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METAL CUTTING APPARATUS

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Fig. 2

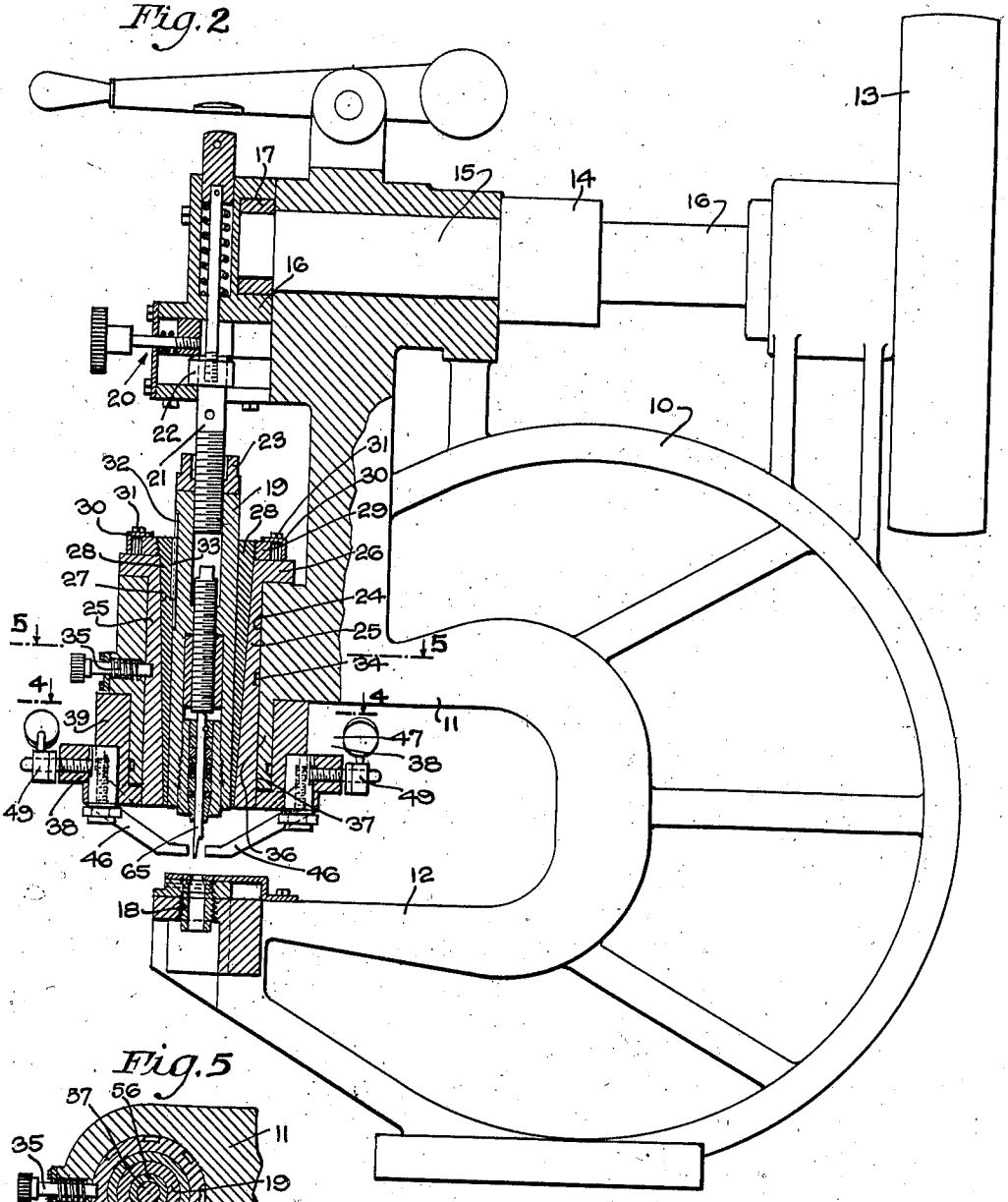
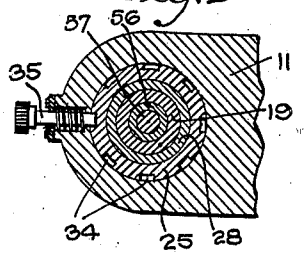


Fig. 5



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UNITED STATES PATENT OFFICE

2,227,081

METAL CUTTING APPARATUS

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Application March 20, 1937, Serial No. 132,010

18 Claims. (Cl. 164—47)

This invention relates to machines for cutting or slotting sheet or plate material and more particularly to an improved construction of machines known in the art as "nibbling machines," one form of which is shown in my prior Patent No. 1,849,829, granted March 15, 1932. In these nibbling machines, a punch and pilot member are employed in such manner that they cooperate to slot a sheet or plate material fed through the machine, the pilot member serving to limit the increment of feed. The punch and pilot member of the present machine are in the form of a unitary member which is carried by a vertically reciprocable ram, the latter being also rotatable about its vertical or longitudinal axis so as to present the cutting edge of the punch in position to permit cutting or nibbling of the stock in any desired direction.

It is among the objects of the present invention to provide in a nibbling machine of the character just stated a supporting structure for the ram which not only permits vertical reciprocation and rotatable adjustment of the ram along and about its axis but also provides a bearing for the ram which is practically coextensive in length therewith, thereby affording greater bracing for the ram against lateral deflection than has been afforded heretofore.

Still another important object is to provide an arrangement wherein the ram is vertically reciprocable within a bushing rotatably mounted within a fixed guide bearing formed as a part of the machine in consequence of which a greater vertical support is provided for the ram during its reciprocatory movement, thereby reducing to a minimum the length of the ram which is unsupported against possibility of lateral deflection due to eccentrically applied loads, at the same time providing for rotation of the ram about its vertical axis to permit presentation of the cutting edge of the tool in any desired direction.

A still further object of the invention is to provide an improved construction of tool holder of such character that the tool is supported against buckling throughout substantially the entire length thereof and in which provision is had for adjusting the tool axially of the ram and the tool support to compensate for decreased tool length occasioned by redressing dull or broken tools.

A still further object is to provide a tool assembly having means for facilitating the insertion and removal of the tool in and from the ram and for insuring accurate axial alinement of the tool and ram so that when the tool is firmly secured within its holder there is no possibility of the tool having any cocking or twisting tendency such as would result in eccentric motion when the tool was rotated, it being noted in this connection that in the machine of the present invention the die with which the tool cooperates to "nibble" the stock is stationary, in consequence of which it is absolutely necessary, in order to save both the tool and die from premature wear and probable total destruction, that the tool be constantly in axial alinement with the die regardless of the angular adjustment of the tool about its axis.

Still another and important object of the present invention is to provide a tool assembly embodying a vertically reciprocable ram and an adjustably associated tool together with means for relating the tool axially of the ram so that regardless of the overall length of the tool a predeterminedly fixed relation is always obtainable between the tool and its associated fixed die, said means being so operative that in every positional adjustment of the tool axially of the ram it is supported in its entirety against buckling or lateral defection at the same time that it is also supported against any axial displacement relatively to the ram during both working and back strokes thereof.

Other objects and advantages of the invention will be apparent more fully hereinafter, it being understood that the present invention consists substantially in the combination, construction, location and relative arrangement of parts, all as will be described more fully hereinafter, as shown in the accompanying drawings and as finally pointed out in the appended claims. In the said accompanying drawings, which are intended to be illustrative of the principles of the present invention:

Figure 1 is a front elevational view of the machine constructed in accordance with and embodying the principles of the present invention;

Figure 2 is a side view thereof with the operating parts thereof shown in vertical cross-section;

Figure 3 is an enlarged vertical cross-sectional view of the ram and tool assembly and the parts of the machine immediately associated therewith;

Figure 4 is a horizontal sectional view taken on the line 4—4 of Figure 2;

Figure 5 is a horizontal sectional view taken on the line 5—5 of Figure 2; and

Figure 6 is a vertical cross-sectional view of a modified construction of the ram and tool holder assembly.

Referring now more particularly to the drawings, it will be observed that the nibbling machine of the present invention includes a frame 10 hav-

ing an upper jaw 11 and a lower jaw 12. The upper jaw carries a driving member 13 connected by a connectible coupling 14 interposed between the shafts 15 and 16 to an eccentric 17 for converting rotary motion of the driving member into reciprocatory motion of the slide 16 to which a suitable tool may be connected. The lower jaw 12 is provided with means for receiving and holding firmly in adjusted position a suitable fixed die or block 18.

Operatively associated with the sliding head 16 of the machine is a ram 19, suitable mechanism being interposed between said sliding head and ram for effecting the desired reciprocatory operation of the ram. This mechanism includes a gag mechanism, designated generally by the reference numeral 20, which permits of ready retraction of the tool from the work by means and for the purpose more particularly described in the Letters Patent No. 1,849,829, granted March 15, 1932, referred to hereinabove. Inasmuch as the gag mechanism in the present machine is of the same character and functions in the same manner as that disclosed in the said prior patent, it will not be described in detail herein, reference being made for that purpose to the said prior patent.

The present invention relates more particularly to the ram and tool holder assemblies and these will now be described, it being observed that the said ram 19 is threadedly connected at its upper end to the stem 21 operatively associated by means of its swivel head 22 with the aforesaid gag mechanism 20. By means of this threaded connection between the ram 19 and the swivel stem 21, the ram 19 may be vertically adjusted as desired, a nut lock 23 being provided to maintain the ram in its adjusted position.

The upper jaw 11 of the machine is provided in its extremity with a vertically extending bore 24 of substantial axial dimension. Disposed interiorly of this bore for rotation therewithin is a sleeve 25, the upper end of which is provided with a radially extending flange 26 overlying the upper surface of the jaw 11 immediately surrounding the vertical bore 24 thereof. The rotatable sleeve 25 is provided with an internally tapered bore 27 within which is fitted a complemental externally tapered bushing 28, the internal bore of this bushing being of cylindrical surface and of a diameter to snugly accommodate for reciprocatory motion therein the ram 19. It will be observed that the sleeve 25 and the bushing 28 fitted therein extend downwardly to a point below the lower extremity of the vertical bore 24 provided in the upper jaw 11 of the machine, the purpose of this construction being to afford the ram a bearing surface of maximum extent as to reduce to a minimum the portion of the ram which is unsupported against sidewise thrust during the operation thereof. The bushing 28 is retained in position by a nut 29 threadedly engaging the upper end thereof and resting against the upper surface of the flange 26 of the sleeve 25, this nut 29 being in turn secured in position against vertical displacement with respect to said flange 26 by means of an angular retainer 30 secured to the flange by circumferentially spaced bolts 31. By loosening the said bolts 31 and lifting the retainer 30 away from the flange 26, the nut 29 may be rotated in one direction or another to shift the bushing axially of its sleeve 25 in order to secure it in or remove it from its final proper position within the said sleeve. As appears most clearly in Figure 2, the ram 19 is provided with an elongated vertical groove 32 in the cylindrical surface thereof for coaction with a key 33 fixed interiorly of the bushing 28 to guide the ram and restrain it from angular movement relatively to said bushing during vertical restriction of the ram.

Provided in the sleeve 25 intermediate the upper and lower extremities thereof are a series of circumferentially spaced depressions or recesses 34 for receiving the inner end of a spring pressed locking pin 35, this pin being adapted for projection into any one of the said recesses to lock the sleeve 25 against rotation within the bore 24 provided in the upper jaw 11 of the machine. By so locking the said sleeve 25 in its adjusted desired position, it will be apparent that the ram 19 will likewise be locked in corresponding position because the ram, while free to reciprocate vertically with respect to the sleeve 25, is restrained from rotation relatively thereto by means of the slot and key connection 32—33 connecting it to the bushing 28, which latter in turn is nonrotatably connected to the sleeve 25 by the elements 29, 30 and 31.

Depending from the arm 11 of the machine is the lower extension 36 of the guide for the rotatable sleeve 25, it being observed that this extension terminates just above the lower extremity of said sleeve 25 and is provided with a plane cylindrical outer surface 37 upon which is rotatably journalled a turret assembly, designated generally by the reference numeral 38. This turret assembly 38 essentially comprises an annular member 39 (see Figures 2, 3 and 4) of substantially L-shaped vertical cross-section, the bottom section 40 of which extends across and is disposed immediately beneath the lower extremity of the fixed guide extension 36. Projected radially through the bottom section 40 of the turret annulus 39 are a plurality of circumferentially spaced pins 41, the inner ends of which are threaded into the sleeve 25 and the outer ends of which are provided with lock nuts 42 for retaining the pins securely in position. If desired and in some instances it may be preferred, the pins 41 are threadedly secured in the turret member 39 and project radially therethrough with their inner ends more or less loosely accommodated in recesses provided in the sleeve 25. By means of these radial pins 41, the turret 38 is so related to the sleeve 25 that rotation of the turret effects rotation of the sleeve 25 and the ram 19 through the intervention and by means of the parts above described.

In order to readily effect rotation of the turret as desired, it is provided with a plurality of circumferentially spaced capstan handles 43, these handles being projected radially through the annular body 39 of the turret with the inner ends 44 thereof seating in a circumferential groove 45 formed in the cylindrical outer surface of the fixed guide extension 36. The capstan handles 43 thus serve together with the pins 41 to retain the turret against vertical displacement with respect to the fixed guide extension 36, yet free rotation of the turret relatively to said extension is not impeded. Secured to the turret for rotation therewith are a pair of strippers 46—46, each of which is provided with means for vertically adjusting it axially of the turret, this adjusting means including in each instance, as appears most clearly in Figures 2 and 4, a pin 47 vertically adjustable in the turret and a transverse set screw 48 equipped with balanced lock nuts 49 for maintaining the pin 47 and its associated stripper

secure against chatter and vibration during the nibbling operation.

From the foregoing, it will be apparent that rotation of the ram 19 about its axis may be readily effected by angular adjustment of the turret through its capstan handles 43, the ram being held in its angularly adjusted position by means of the spring pressed locking pin 35, the inner end of which is adapted to seat in any one of the recesses 34 provided in the sleeve 25. To change the angular position of the ram, it is merely necessary to withdraw the locking pin 35 sufficiently to permit free rotation of the sleeve 25 within the fixed guide bearing formed in the extremity of the arm 11 of the machine, this sleeve being non-rotatably associated with the turret through the intervention of the radial pins 41 and with the ram through the intervention of the bushing 28 and the slot and key connection 32—33 between the bushing and the ram. This latter slot and key connection, while preventing relative rotation between the ram and bushing, permits the ram to reciprocate vertically within the guide bushing and this is true regardless of the angularly adjusted position of the ram.

One of the outstanding advantages of the construction just described is that the bearing for the ram 19 is substantially coextensive in length with the ram, thereby affording a greater bracing for the ram against sidewise thrust than has been possible of attainment heretofore. Moreover, the arrangement not only permits the slot and key connection 32—33 to be located at any point lengthwise of the bushing 28 but also permits of the use of a slot and key of such substantial length that better control against torsional strains and stresses is obtained during vertical reciprocation of the ram. And finally, the arrangement provides a minimum of unsupported ram at the lower end thereof during operation of the machine, in consequence of which the tendency for the tool carried by the ram to become misaligned with its fixed die, thereby resulting in injury to both the tool and die, is for all practical purposes entirely obviated.

To further support the tool against buckling and lateral stresses and strains, the present invention contemplates the provision of a tool assembly of the character now to be described. As appears most clearly in Figures 2 and 3, the ram 19 is axially bored throughout its length, a relatively short intermediate section 50 of the bore being of reduced diameter. The upper end of the ram bore is interiorly threaded, as at 51, for threaded engagement with the swivel stem 21, while the lower end of the ram bore is provided with an internal bearing surface 52 and an internally threaded section 53, the latter being disposed between the bearing surface 52 and the main section 54 of the internal bore of the ram. An annular shoulder 55 is provided at the upper extremity of the section 54 of the bore, the diameter of the latter being somewhat less than that of the bearing surface 52.

Fitted within the section 54 of the ram bore and adapted to abut against the annular shoulder 55 aforesaid is a stripping sleeve 56 which is interiorly threaded to adjustably receive an adjusting screw 57. The upper end of this screw is squared or otherwise formed to provide a tool-engaging head 57a, while the lower end thereof is provided with a smooth cylindrical surface 58a for a purpose which will be immediately apparent.

Fitted within the lower extremity of the ram is an axially bored collet nut 58, the intermediate section of which is externally threaded, as at 59, and the upper and lower sections of which are externally smooth to provide axially spaced bearing surfaces 60 and 61. These sections 59, 60 and 61 respectively cooperate with the complementally formed sections 53, 52 and 54 formed upon the internal surface of the ram at the lower end thereof so as to maintain the collet nut accurately coaxial with the ram.

The lower extremity of the collet nut bore is tapered, as at 62, to provide a tapered seat for a collet 63, which may be formed of two or more separable segments or of one piece suitably split or notched to permit of its contraction when the collet nut 58 is threaded into the ram.

Above its tapered lower section, the bore of the collet nut 58 is cylindrically smooth to accommodate a plurality of centrally apertured spacers 64 arranged in stacked, coaxial relation. Projected through the alined apertures of the spacers and the bore of the collet 63 is the nibbling tool 65, the upper end of which abuts against the adjusting screw 57. And fitted to the upper end of the tool is a removably fixed collar 66 which is secured to the tool by means of a removable transverse pin 67 coacting with complementally formed grooves in the tool and fixed spacer in the manner more particularly described in my earlier Patent No. 1,883,713, granted October 18, 1932. This relatively fixed spacer 66 is of the same external diameter as the spacers 64 and together with the latter form a substantially continuous sleeve which snugly embraces the tool and snugly fits within the bore of the collet nut to prevent lateral buckling of that portion of the tool which is disposed within the ram. In other words, the spacers 64 and 66 conjointly provide a continuous support for the entire length of the tool 65 except for the relatively short portion thereof which pierces the work and, therefore, necessarily projects unsupported below the lower extremity of the ram.

As the tool wears shorter and it becomes necessary to adjust it axially downward of the ram (which adjustment is accomplished by means of the adjusting screw 57) as many of the spacers 64 as may be necessary are removed and the adjusting screw 57 is projected into the bore of the collet nut to an extent sufficient to compensate for the drop in tool position occasioned by the removal of the spacers 64. It will be observed that in all positions of tool adjustment the upper end of the tool is constantly in abutting relation to the lower end of the adjusting screw so that at no time is there any slack or play between the tool and ram during the downward or working stroke of the latter, the downward thrust being imparted by the ram to the tool as follows: ram shoulder 55 to stripping sleeve 56 to adjusting screw 57 and finally to tool 65. Neither is there any slack or play between the tool and ram on the upward or stripping stroke of the latter because in this stroke the load is transmitted from the tool to its fixed sleeve 66, thence to the collet nut and finally to the ram.

Preferably, the adjusting screw 57 is provided with threads of reverse direction and different pitch from the threads on the collet nut 58 to obviate the possibility of the adjusting screw backing out and away from the tool during the operation of tightening the collet nut in the ram.

From the foregoing description of the tool holder assembly, which includes the lower part of the ram and the internal parts thereof immediately associated therewith, it will be apparent that the ar-

rangement provides very accurate centering of the tool and at the same time provides such full and complete bracing thereof that any tendency for the tool to buckle or spring out of line with the die is entirely obviated. In addition, the assembly provides for easy and ready adjustment of the tool axially of the ram to compensate for wear of the tool occasioned by normal use thereof and it also facilitates the removal of the tool from the ram whenever required. It will be observed that in the construction shown more particularly in Figure 3, in order to effect adjustment of the adjusting screw 57 axially of the ram it is merely necessary to remove the collet nut 58 so as to permit the tool holder assembly, including the sleeve 56 and screw 57, to be withdrawn from the ram bore whenever the screw may be adjusted axially of its sleeve 56. In other words, the adjustment of the adjusting screw is accomplished by operating upon the upper end thereof.

Figure 6 shows a modified form of tool holder assembly wherein provision is made for effecting adjustment of the adjusting screw 70 by manipulating the lower end thereof and so obviating the necessity of removing the ram from the machine. In this modified arrangement, the adjusting screw 70 is threaded into the intermediate section 71 of the ram and the lower extremity thereof is provided with a tool engaging extremity 72. Inasmuch as this latter extremity of the adjusting screw directly abuts the upper end of the tool, exactly as in the construction shown in Figure 3, it will be apparent that the downward or working thrust of the ram is imparted directly to the adjusting screw 70 and by the latter to the tool. The arrangement of Figure 6 thus eliminates the necessity of employing a threaded sleeve such as that designated 56 in Figure 3. Also, it will be observed that in the modified arrangement the collet nut 73 is not of the same length as that shown in Figure 3 but instead it cooperates with an additional separate sleeve member 74 to accomplish the same results as are accomplished by the relatively long collet nut 58 of Figure 3. In all other respects, the arrangement shown in Figure 6 is similar structurally and functionally to that previously described.

The invention is susceptible of various changes and modifications which may be made from time to time without departing from the real spirit or general principles thereof and it is intended, therefore, to claim the same broadly, as well as specifically, in accordance with the appended claims.

What is claimed as new and useful is:

1. In a cutting machine, a frame having upper and lower arms, the upper of said arms being provided in its forward extremity with a guide member having cylindrical bore, the axis of which bore extends vertically, a sleeve rotatably journalled in said guide bore, a ram disposed interiorly of said sleeve and arranged for vertical reciprocation relatively thereto, and means disposed exteriorly of and journalled upon the external surface of said guide member for rotating said sleeve.

2. In a cutting machine, a frame having upper and lower arms, one of said arms being provided with a guide having a vertically disposed cylindrical bore, a sleeve rotatably journalled in said guide bore, a ram disposed interiorly of said sleeve, means providing for vertical movement of said ram relatively to said sleeve while preventing relative rotation therebetween, and means disposed exteriorly of and journalled upon the external surface of said guide for commonly rotating said sleeve and ram, said last-mentioned means being provided with circumferentially spaced radially extending operating handles.

3. In a cutting machine, a frame having upper and lower arms, one of said arms being provided with a fixed die, and the other of said arms being provided with a guide having a cylindrical bore disposed coaxially with respect to said die, a sleeve rotatably journalled in said guide bore, a ram disposed interiorly of said sleeve, said ram being vertically reciprocable but non-rotatable with respect to said sleeve, and a turret journalled upon the external surface of said guide and connected to said sleeve for effecting rotation of the latter within its journalling sleeve.

4. In a cutting machine, a frame having upper and lower arms, one of said arms being provided with a fixed die, and the other of said arms being provided with a guide having a cylindrical bore disposed coaxially with respect to said die, a sleeve rotatably journalled in said guide bore, a ram disposed interiorly of said sleeve, said ram being vertically reciprocable but non-rotatable with respect to said sleeve, and a turret journalled upon the external surface of said guide and connected to said sleeve for effecting rotation of the latter within its journalling sleeve, the connection between said turret and sleeve being disposed beneath the lower extremity of said guide bore.

5. In a cutting machine, means providing a vertically disposed cylindrical guide bore and a coaxial outer cylindrical bearing surface, a sleeve rotatably journalled within said guide bore, a ram disposed interiorly of said sleeve for reciprocation relatively to and rotation with said sleeve, said guide bore and sleeve being extended downwardly to a point closely adjacent the lower extremity of said ram whereby to provide the latter with maximum bearing surface during both working and non-working strokes thereof, and means journalled upon said bearing surface for commonly rotating the sleeve and ram.

6. In a cutting machine, means providing a vertically disposed cylindrical guide bore and a coaxial outer cylindrical bearing surface, a sleeve rotatably journalled within said guide bore, a ram disposed interiorly of said sleeve for reciprocation relatively to and rotation with said sleeve, said guide bore and sleeve being extended downwardly to a point closely adjacent the lower extremity of said ram whereby to provide the latter with maximum bearing surface during both working and non-working strokes thereof, and a turret journalled upon said bearing surface for commonly rotating said sleeve and ram, said turret and sleeve being connected together at a point disposed beneath said guide bore.

7. In a cutting machine, means providing a vertically disposed cylindrical guide bore and a coaxial outer cylindrical bearing surface, said bearing surface encompassing the lower portion of said guide bore, a sleeve rotatably journalled within said guide bore, a turret journalled upon said bearing surface and having means projecting radially beneath the lower end of said bearing surface for affording a connection between said turret and said sleeve, and a ram disposed interiorly of said sleeve and adapted for vertical reciprocation relatively thereto.

8. In a cutting machine, means providing a vertically disposed cylindrical guide bore and a coaxial outer cylindrical bearing surface, said bearing surface encompassing the lower portion of said guide bore, a sleeve rotatably fitted within

and extending the full length of said guide bore, a bushing non-rotatably fitted within said sleeve, a vertically reciprocable ram fitted within said bushing, and means journalled upon said bearing surface and connected to said sleeve for angularly adjusting said sleeve about its central vertical axis.

9. In a cutting machine, means providing a vertically disposed cylindrical guide bore and a coaxial outer cylindrical bearing surface, said bearing surface encompassing the lower portion of said guide bore, a sleeve rotatably fitted within and extending the full length of said guide bore, a bushing non-rotatably fitted within said sleeve, a vertically reciprocable ram fitted within said bushing, means journalled upon said bearing surface and connected to said sleeve for angularly adjusting said sleeve about its central vertical axis, and a slidable key connection between said ram and bushing to permit said vertical reciprocation of the ram relatively to said sleeve at the same time preventing relative rotation therebetween.

10. In a cutting machine, a tool holder including a ram having an axial bore, an annular shoulder formed within said bore, an interiorly threaded sleeve disposed within said bore in abutting relation to said shoulder, a threaded screw fitted in said sleeve axially adjustable with respect thereto, a tool disposed interiorly of the ram bore in coaxial alignment with said threaded screw and with its upper end abutting the lower end of said screw, and means clamped within the bore of said ram below said sleeve and in embracing relation with respect to said tool to secure the latter in position and restrain it against buckling, said means including a plurality of removable spacing elements adapted to be arranged in stacked embracing relation with respect to said tool and one or more of which may be removed as said threaded stem is axially adjusted to compensate for shortened length of the tool.

11. In a cutting machine of the reciprocatory type, a ram construction having a bore, a tool in the bore having a collar removably secured to the upper end thereof, axially adjustable means for transmitting thrust from the ram construction directly to the upper end of the tool, collet mechanism carried by the lower end of the ram construction for gripping and centering the lower end of the tool, said collet mechanism including an elongated axially bored bushing threadedly received with in the lower end of said ram construction, and a plurality of centrally apertured spacer discs disposed within the bore of said bushing and fitted over the shank of said tool to resist buckling of the latter.

12. In a cutting machine of the reciprocatory type, a ram construction having a bore, a tool in the bore having a collar removably secured to the upper end thereof, axially adjustable means for transmitting thrust from the ram construction directly to the upper end of the tool, collet mechanism carried by the lower end of the ram construction for gripping and centering the lower end of the tool, said collet mechanism including an elongated axially bored bushing threadedly received within the lower end of said ram construction, and a plurality of centrally apertured spacer discs disposed within the bore of said bushing and fitted over the shank of said tool to resist buckling of the latter, one or more of said spacer discs being removable from within the bore of said bushing to permit axial adjustment of the tool downwardly.

13. In a cutting machine of the character defined in claim 12 wherein the thrust transmitting means is in the form of a threaded screw the lower end of which is adapted for projection into the bore of said bushing to a greater or less extent depending upon the number of spacer discs removed from said bushing.

14. In a cutting machine of the reciprocatory type, a ram construction having a bore, the lower section of said bore having vertically spaced cylindrical surfaces of different diameters, said surfaces being separated by a threaded section, bushing means adapted to be fitted into said lower section of the ram and having vertically spaced external cylindrical surfaces and an intermediate threaded section for respectively engaging the complementally formed surfaces and threaded section in the ram construction bore to insure coaxial centering of the bushing means within the ram construction, a tool disposed interiorly of said bushing means and having a collar secured to the upper end thereof, said collar being snugly fitted within the bore of said bushing means, collet mechanism carried by the lower end of said bushing for gripping and centering the lower end of the tool, and spacing means fitting the bore of said bushing means between said collar and said collet mechanism and surrounding the tool shank to resist buckling of the latter.

15. In a cutting machine of the reciprocatory type, a ram construction having a bore, the lower section of said bore having vertically spaced cylindrical surfaces of different diameters, said surfaces being separated by a threaded section, bushing means adapted to be fitted into said lower section of the ram and having vertically spaced external cylindrical surfaces and an intermediate threaded section for respectively engaging the complementally formed surfaces and threaded section in the ram construction bore to insure coaxial centering of the bushing means within the ram construction, a tool disposed interiorly of said bushing means and having a collar secured to the upper end thereof, said collar being snugly fitted within the bore of said bushing means, collet mechanism carried by the lower end of said bushing for gripping and centering the lower end of the tool, spacing means fitting the bore of said bushing means between said collar and said collet mechanism and surrounding the tool shank to resist buckling of the latter, and means for transmitting thrust from the ram to the upper end of the tool and for providing adjustment of the tool axially of the bore.

16. In a cutting machine of the character defined in claim 15 wherein said thrust transmitting means is in the form of a threaded screw, the upper end of which is fashioned to take an adjusting tool.

17. In a cutting machine of the character defined in claim 15 wherein said thrust transmitting means is in the form of a threaded screw, the lower end of which is fashioned to take an adjusting tool.

18. In a cutting machine of the character defined in claim 15 wherein said thrust transmitting means is in the form of a threaded screw, one extremity of which is fashioned to take an adjusting tool.

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