Aug. 30, 1966 A. K. SCHOTT ETAL 3,269,241

PUNCHING MACHINE AND STRUCTURE THEREFOR

Original Filed Nov. 1, 1960 6 Sheets-Sheet 1

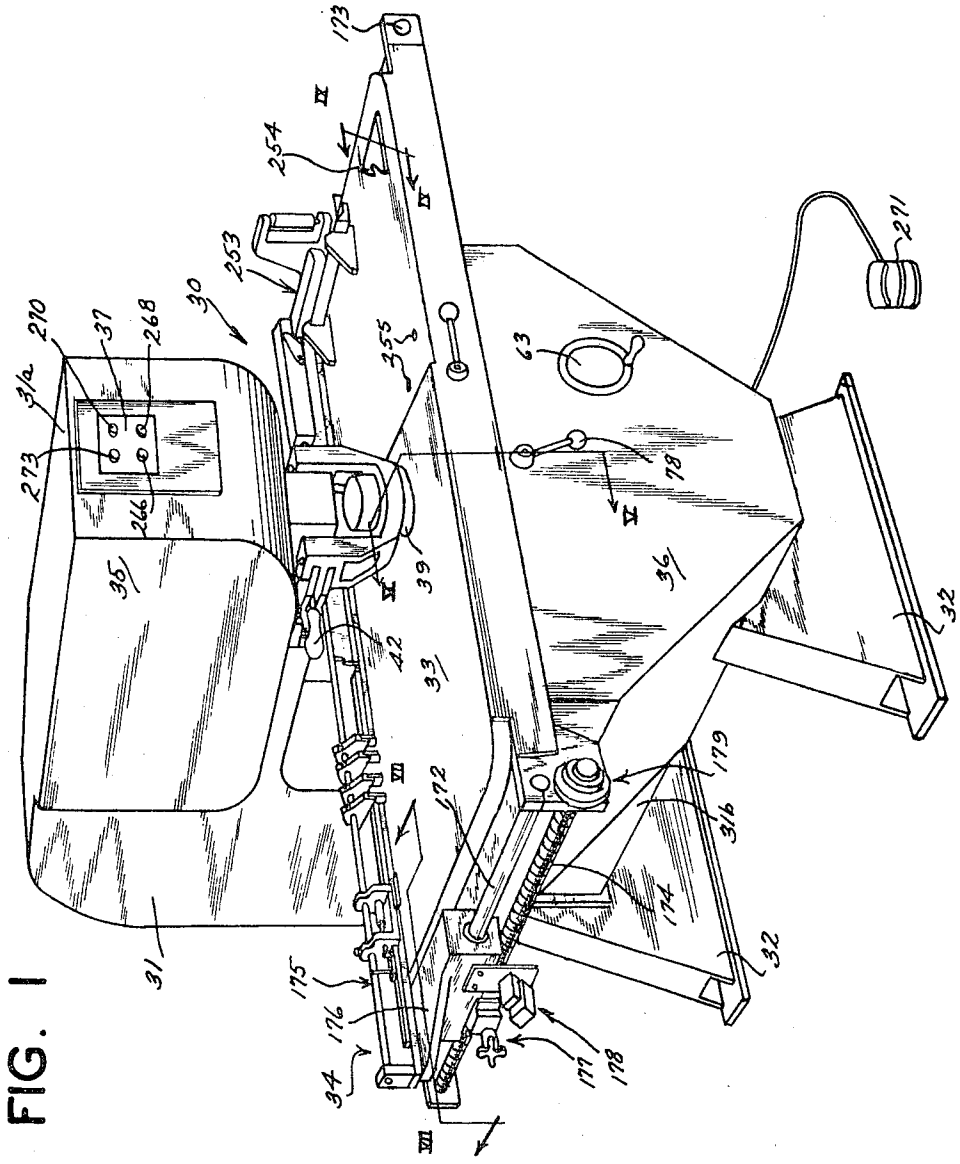


FIG. 1

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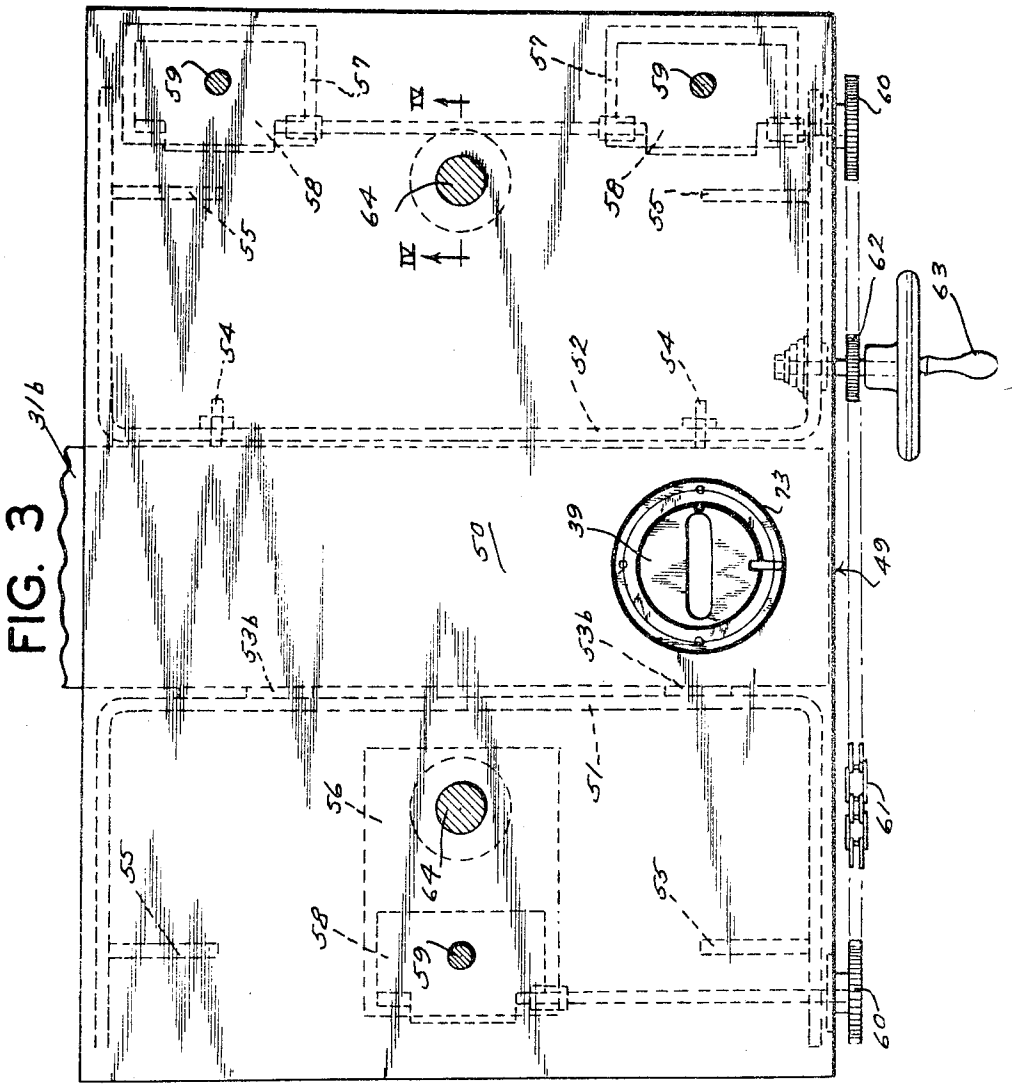
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PUNCHING MACHINE AND STRUCTURE THEREFOR

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FIG. 3



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FIG. 2

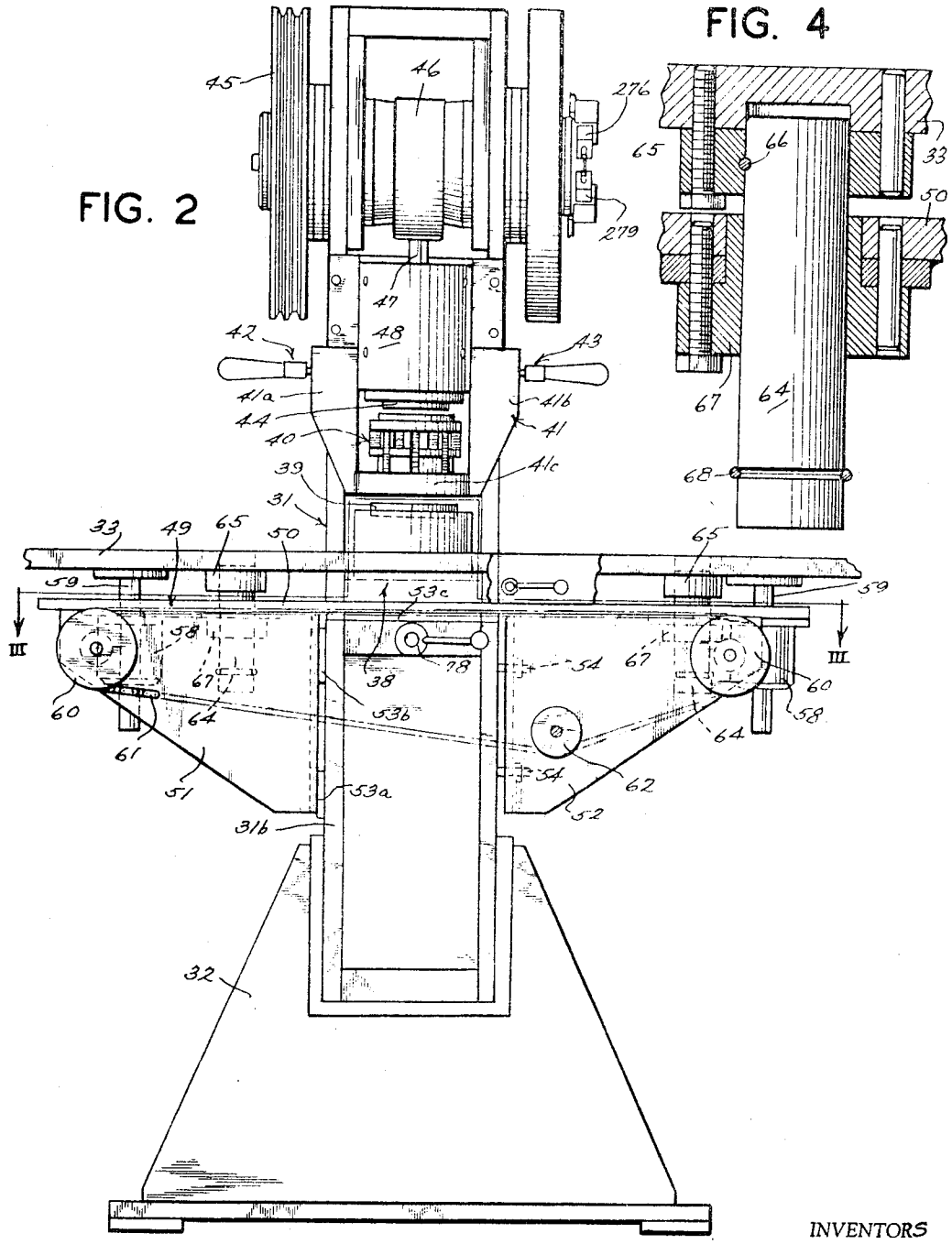


FIG. 4

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PUNCHING MACHINE AND STRUCTURE THEREFOR

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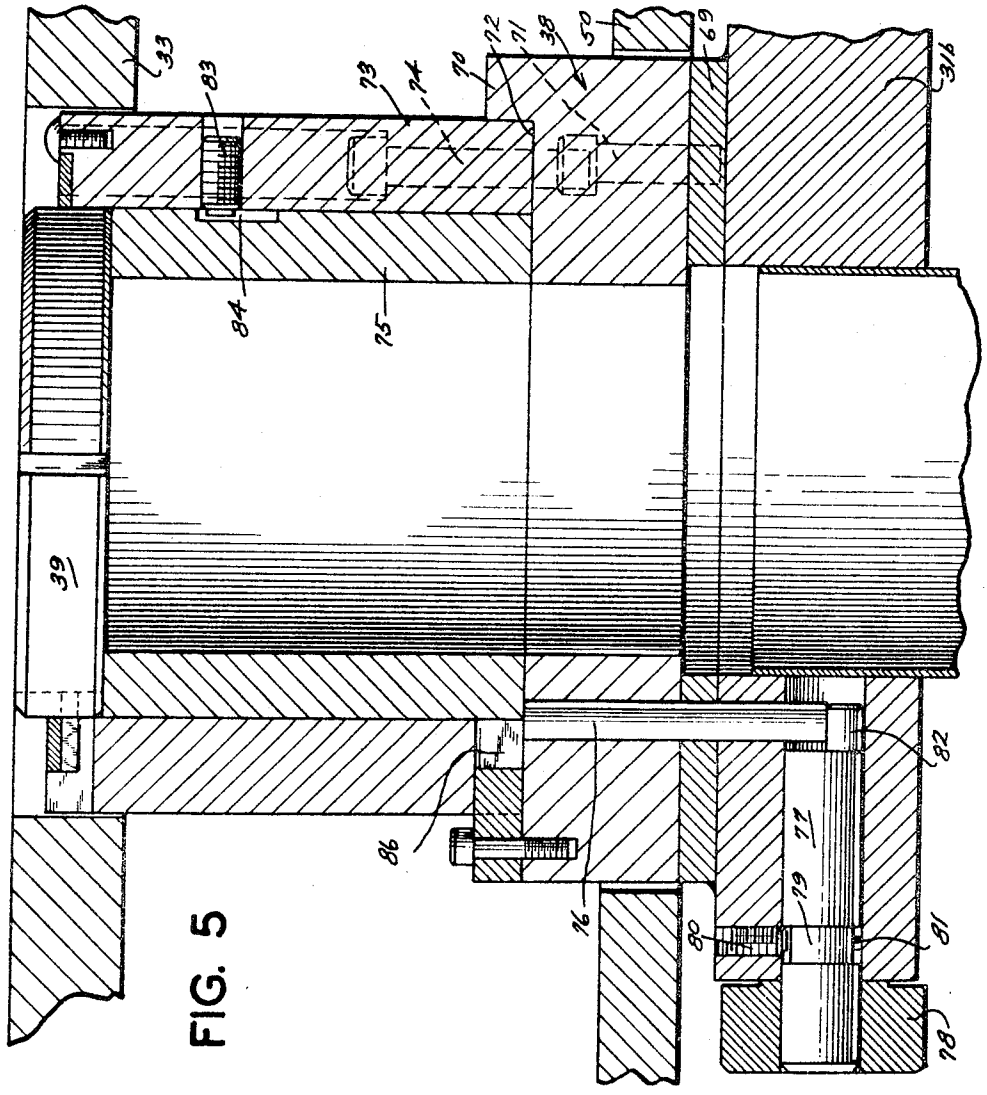


FIG. 5

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PUNCHING MACHINE AND STRUCTURE THEREFOR

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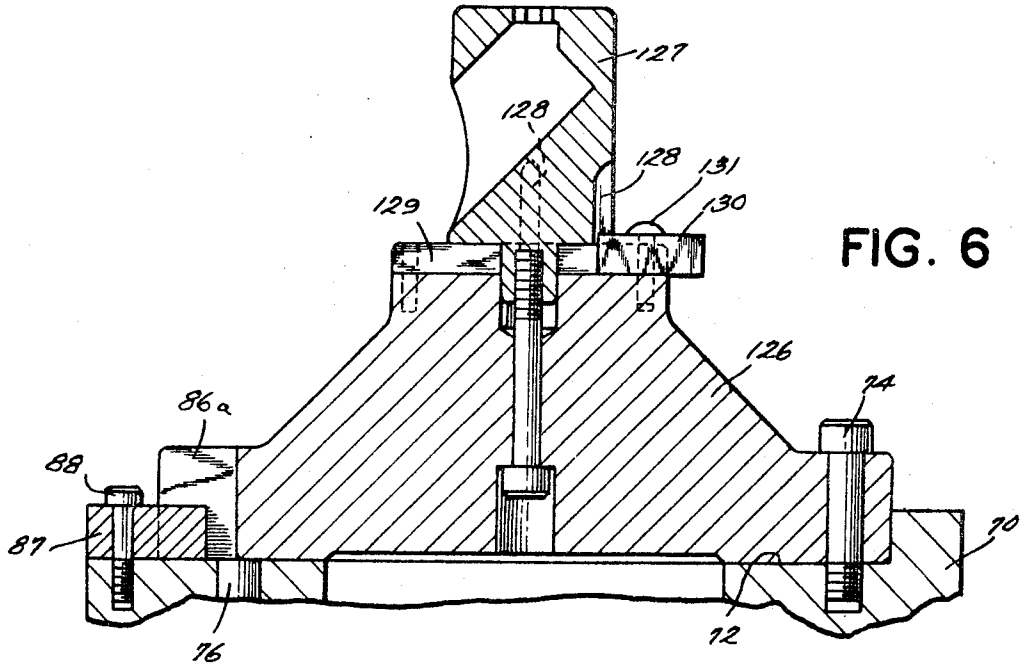
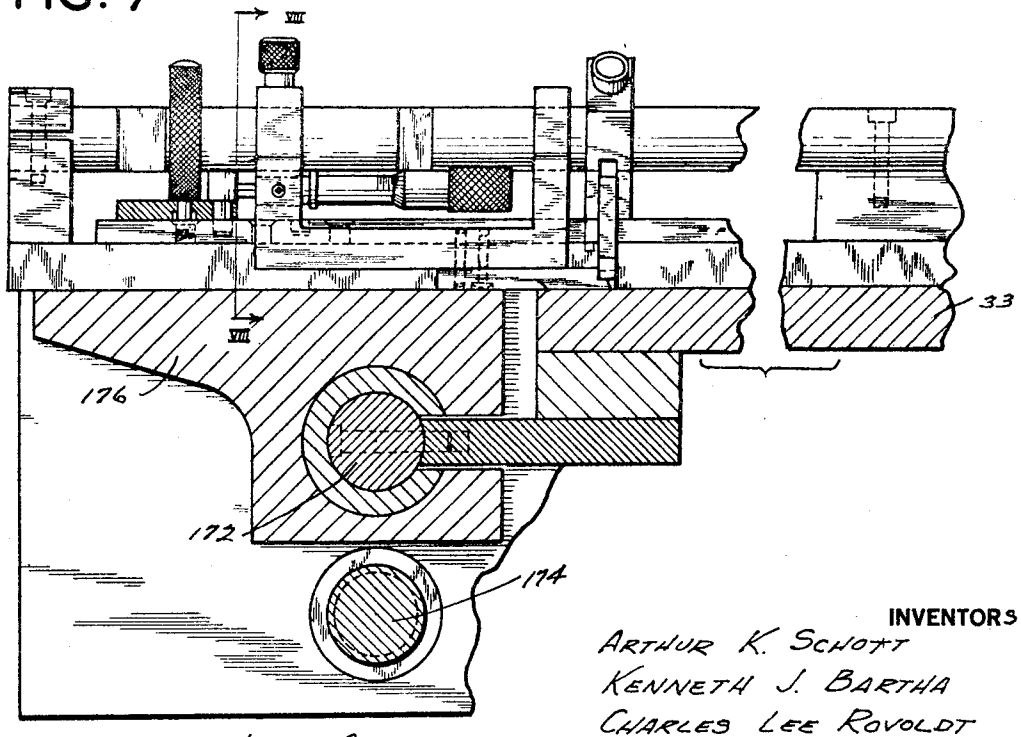


FIG. 6

FIG. 7



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PUNCHING MACHINE AND STRUCTURE THEREFOR

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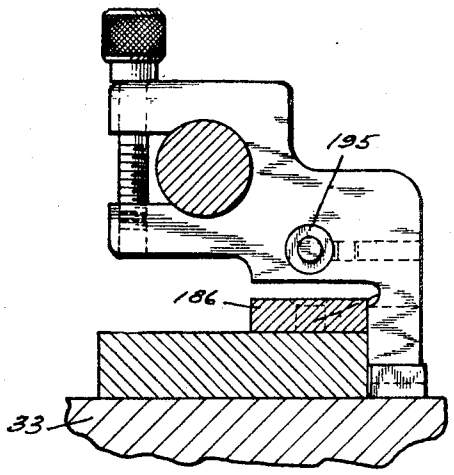


FIG. 8

FIG. 9

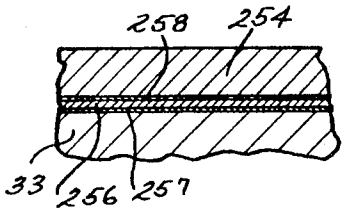
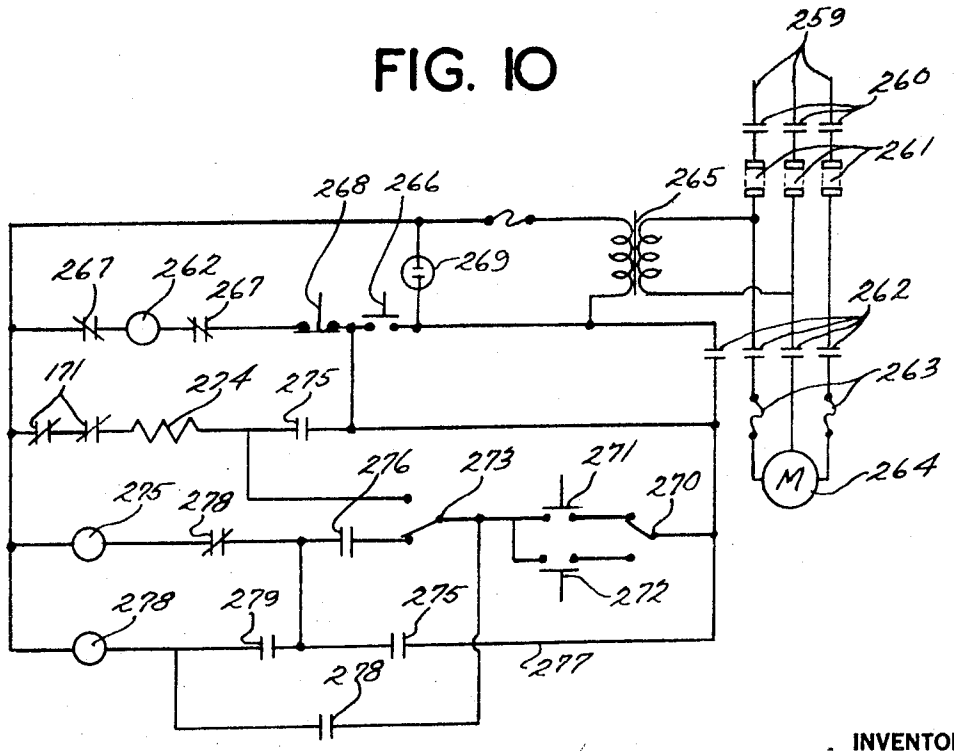


FIG. 10



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United States Patent Office 3,269,241
Patented August 30, 1966

3,269,241

PUNCHING MACHINE AND STRUCTURE THEREFOR

Arthur K. Schott, Clarence, Kenneth J. Bartha, Tonawanda, and Charles Lee Rovoldt, Getzville, N.Y., assignors to Houdaille Industries, Inc., Buffalo, N.Y., a corporation of Michigan

Original application Nov. 1, 1960, Ser. No. 66,639, now Patent No. 3,225,636, dated Dec. 28, 1965. Divided and this application Apr. 19, 1965, Ser. No. 449,248
10 Claims. (Cl. 83—144)

This application is a division of our co-pending application of the same title, U.S. Serial No. 66,639, filed November 1, 1960, now Patent No. 3,225,636, granted December 28, 1965.

This invention relates generally to punching machines, and more specifically to an improved punching machine embodying novel coacting features.

Although the principles of the present invention may be included in various punching machines and devices, a particularly useful application is made in a punching machine of the type that acts on a single workpiece, the workpiece being positioned by either adjustable gaging carried on the machine, or by a template follower, the machine being provided with appropriate punch and die means for effecting punching, notching, and nibbling on the workpiece.

The present invention contemplates the utilization of a workpiece-supporting table which is vertically adjustable with respect to the punch and die means, the table being provided with gaging structure engageable with adjacent edges of a workpiece and adapted to indicated desired dimensions numerically directly.

Accordingly, it is an object of the present invention to provide an improved punching machine.

Another object of the present invention is to provide a punching machine embodying numerous novel coacting features, combinations, and sub-combinations thereof.

A still further object of the present invention is to provide gaging structure for accurately positioning the workpiece to be worked on in relation to a predetermined

Many other advantages, features, and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description and the accompanying sheets of drawings in which a preferred structural embodiment incorporating the principles of the present invention is shown by way of illustrative example.

On the drawings:

FIGURE 1 is a perspective view of a punching machine provided in accordance with the principles of the present invention;

FIGURE 2 is an enlarged front elevational view of the punching machine of FIGURE 1 with certain parts removed therefrom;

FIGURE 3 is an enlarged view of the sub-table and die taken generally along line III—III of FIGURE 2;

FIGURE 4 is an enlarged sectional fragmentary view taken along line IV—IV of FIGURE 3;

FIGURE 5 is an enlarged sectional view of a die and supporting structure therefor taken generally along line V—V of FIGURE 1;

FIGURE 6 is a cross-sectional view of a pedestal die supported on structure shown in FIGURE 5;

FIGURE 7 is an enlarged front view, partly in section, taken along line VII—VII of FIGURE 1, and illustrating certain gaging structure;

FIGURE 8 is an enlarged cross-sectional view taken along line VIII—VIII on FIGURE 7;

FIGURE 9 is an enlarged fragmentary cross-sectional view taken along line IX—IX of FIGURE 1; and

FIGURE 10 is a schematic diagram of the electrical circuit employed to operate the machine shown in FIGURE 1.

As shown on the drawings:

The principles of this invention are particularly useful when embodied in a punching machine such as illustrated in FIGURE 1, generally indicated by the numeral **30**. The machine **30** includes a rigid frame **31** of both hollow and C-shaped construction having an upper arm **31***a* and a lower arm **31***b*. The lower arm **31***b* is provided with a pair of bases **32**, **32** which support the frame **31** on the floor. Also prominent in FIGURE 1 is a horizontal workpiece-supporting table **33** supported in a manner presently to be described. To the table **33** there is secured adjustable gaging means generally indicated at **34**, and to be described in detail later herein. Certain components of the device are covered by an upper shroud **35** and a lower shroud **36**, a control panel **37** being secured to the upper arm **31***a*.

Referring now to FIGURE 2, there is shown a front elevational view of the structure of FIGURE 1 wherein the upper shroud **35**, the control panel **37**, the lower shroud **36**, and the gaging **34** have been removed for clarity of illustration. On the lower arm **31***b* of the frame **31** there is provided a bed **38** on which tooling means such as the die **39** are supported. In alignment with the die **39**, there is a punch and stripping assembly generally indicated at **40** which is supported by an upper tool support generally indicated at **41** which is secured to the frame **31** by a pair of clamping mechanisms generally indicated at **42** and **43**. It will be noted that the upper tool support **41** comprises a generally U-shaped member or yoke having spaced arms **41***a*, **41***b* extending along opposite sides of the tool **40** supported on a bight **41***c* which connects the arms **41***a* and **41***b*.

Also disposed between the arms **41***a* and **41***b* is a ram **44** which is reciprocably driven. A motor shown diagrammatically in the circuit diagram of FIGURE 10 operates continuously through belts to drive a pulley-flywheel assembly **45** which includes an eccentric **46** which continually reciprocates a shaft **47**. The continuously reciprocating shaft **47** is selectably connected to the ram **44** by an electrically actuated press clutch **48** which includes a solenoid shown schematically in FIGURE 10. The structural details of the clutch are shown in the copending application of Arthur K. Schott and Charles E. Wilson on a "Press Clutch," U.S. Serial No. 825,028, now U.S. Patent No. 2,979,905.

The workpiece-supporting table **33** is supported on the frame **31** by structure shown in FIGURES 2–4. Means are provided by which the table **33** may be vertically adjusted and by which the table **33** is locked against any horizontal or angular movement. To this end, a sub-table assembly **49** is provided which includes a sub-table **50** which is apertured so that the bed **38** which supports the die **39** is independent thereof. The sub-table **50** is provided with a pair of generally U-shaped brackets **51**, **52** which are welded thereto and which jointly comprise a saddle which rests on suitable bearing surfaces **53***a*, **53***b*, and **53***c*. Clamping screws **54** rigidly hold the sub-table assembly **49** in a fixed position with respect to the rigid frame **31**. If desired, each of the U-shaped members **51**, **52** may be provided with stiffening means **55**. Attached to the lower surface of the sub-table **50**, there are three suitable pads **56**, **57**, and **57**, to each of which is attached a screw jack assembly **58**. The detailed structure of each screw jack is known and forms no part of this invention. The screw jacks **58** each include a shaft **59** secured to the workpiece supporting table **33**. Raising and lowering of the table **33** is effected by simultaneous operation of the various screw jacks **58**. Each of the screw jacks **58** is

connected by appropriate shafting to a sprocket wheel **60**. A roller chain **61** connects the sprocket wheels together and to an additional sprocket wheel **62** which is supported on a shaft for corotation with a handle **63**. When the jointly driven screw jacks are manually adjusted, operated, or actuated, the position of the table is adjusted vertically. It is thus apparent that the adjustment mechanism also secures and supports the table **33** on the sub-table **49**. By manipulation of the handle **63**, the table **33** may be made coplanar with the upper surface of the die **39** as shown in FIGURE 1, a position which is particularly advantageous for flat workpieces, and the table **33** may be vertically spaced from the die **39** as shown in FIGURE 2, a position which is particularly advantageous for punching certain channel forms and other non-flat workpieces.

To keep the table **33** in laterally fixed position, to preclude both any lateral displacement and any angular movement about a vertical axis, there is provided a pair of guide pins **64**. Each guide pin **64** is secured to a support ring **65** by a pin **66**, the support ring **65** being secured to the table **33** by a screw and pin arrangement. The guide pin **64** is slidably received in a guide bushing **67** which is secured to the sub-table **50** by a similar screw and pin arrangement extending through a pad corresponding to the pad **56**. The guide pin **64** is provided with a stop ring **68** of the snap-ring type which limits upward movement or adjustment of the table **33**.

One purpose for adjusting the table **33** so that its upper surface is coplanar with the die **39** is to provide adequate support for the workpiece so as to be able to position it accurately and also so as to position it coplanarly with the die **39**. In practice, it has been found that some oil will be present quite frequently on the workpiece, a fact which makes picking up the finished workpiece from the table **33** even more difficult than may be expected. By rotation of the crank **63**, the table **33** may be lowered slightly independently of the die support means so that the die will act on the unpunched portion of the workpiece to raise the same from the upper surface of the table **33** to facilitate grasping the same. Thus the table adjusting mechanism comprises selectively actuatable means for effecting relative vertical movement between the tool supported on the bed **38** and the table **33** to space the workpiece upwardly from the table **33** to facilitate grasping and to overcome the holding force of any oil present. Referring now to FIGURE 5, there is shown the structure by which the lower tool or die **39** is supported. The lower tool support or die support comprise components which are rigidly secured to the lower arm **31***b* of the frame **31**. These include the bed generally indicated at **38** which includes a bed pad **69** welded to the frame **31** independently of the sub-table **50** which is spaced from the workpiece supporting table **33**. To the bed pad **69** there is secured a bed block **70**, by a plurality of screws such as **71**. The bed block **70** has an upwardly directed circular recess **72** in which is received a cylindrical member **73** which is secured to the bed block **70** by a plurality of screws such as **74**. Within the cylindrical member **73**, there is slidably supported and received a slidable element **75** which also rests at its lower end on the bed block **70** within the recess **72** as shown. The axial extent of the sliding element **75** is less than the axial extent of the cylindrical member **73** so that at their upper ends, they jointly define a nest-like tool receiving structure within which the die **39** is supported. To this end, the slidably mounted element or member **75** is normally stationary, but means are provided to selectively reciprocate it. To this end, there is provided a pin **76** which is guided in the bed **38** for reciprocation. A horizontal shaft **77** is rockably guided in the lower arm **31***b* of the frame **31**, and at its inner end is provided with an eccentric or cam **82** by which the pin **76** is selectively reciprocated. To the outer end of the shaft **77** there is provided a handle **78**, seen also in FIGURES 1 and 2, the shaft having an annular groove **79**. A set screw **80** is received in the groove **79** to limit axial movement of the shaft **77**. A stop pin **81** is carried by the shaft **77** in fixed alignment with the eccentric or cam end thereof **82** for abutting the set screw **80** at such an angular position that the eccentric **82** can never be positioned in dead center. Actuation of the handle **78** causes the eccentric **82** to raise the pin **76** which acts through the normally stationary member **75** to raise the tool or die **39**. Raising the tool has a two-fold purpose. One of these is to facilitate removal of the tool from the nest defined by the upper end of members **73** and **75**. A further purpose of this structure is to raise the workpiece from the upper surface of the workpiece supporting table **33**, as already described, so that this mechanism constitutes not only a tool lifting means, but a selectively actuatable means for effecting relative vertical movement between the tool support on the bed and the table **33** to space the workpiece upwardly from the table **33**. In this instance, as illustrated, there is effected an upward movement of the tool support means on the bed.

If the eccentric **82** were left in a raised dead-center position, and forgotten there, subsequent operation of the punching machine would likely damage the tool raising mechanism. Since the stop pin **81** prevents such positioning of the eccentric **82**, even if the eccentric is left in a raised position during subsequent punch operation, the force acting on the slidable element or member **75** would merely return the eccentric to the illustrated position without damage to the same. To retain the slidable element **75** within the cylindrical member **73**, there is provided a set screw **83** and slot **84** in the members **73** and **75**. If desired, a liner **85** may be provided to guide punchings from the die **39**.

By detaching the screws such as **74**, shown in FIGURE 5, the cylindrical member **73** and the slidable element **75** may be removed from the recess **72** of the bed lock **70**. In place thereof, as shown in FIGURE 6, there may be provided an upwardly extending rigid pedestal **126** which has a lower portion corresponding to the lower part of the cylindrical member **73** which fits in the same manner in the recess **72**. Similarly, a keyway **86***a* receives the key **87** to provide angular orientation for use of shaped dies. Also shown in FIGURE 6 is a pedestal die **127** arranged to discharge slugs laterally from a shaped opening of T-shaped configuration. The die **127** is provided with a pair of horizontally directed keyways **128**, **128**, and the upper face of the pedestal **126** is provided with a keyway **129** adapted to receive a key **130** at either end thereof for selectively registering with one of the keyways **128**. The key **130** is held in a locked position by a screw **131**. It is thus apparent that the die **127** may be angularly locked in any one of four positions. The die **127** may be replaced by other pedestal dies during operation of the device. Preferably, the pedestal **126** includes an axial aperture so that a die locking screw **132** may be employed when desired, as shown.

By use of a pedestal die support **126** and pedestal die **127**, the punching machine **30** may be adapted to perforate channels and other formed workpieces. Thus the workpiece supporting table **33** may be lowered to a point where it would engage the top of the screw **88**, thereby causing the die **127** to project a substantial distance from the workpiece supporting surface.

It is apparent that any punch and stripping assembly may be employed with an appropriately shaped punch bit to cooperate with the structure of FIGURE 6. However, the structure of FIGURE 6 is particularly advantageous with dies having a relatively small cutting aperture.

The gaging mechanism **34** with respect to which the disclosed punch and die means are accurately located, is shown in perspective in FIGURE 1. The gaging means **34** are secured directly to the workpiece supporting table **33**, and have a number of reference surfaces against which

workpieces and gage components engage. The gaging means **34** also includes structure for directly numerically indicating the distance from these reference surfaces to the center line of the punch and die support means, such as **186, 195,** and **178, 179.**

More specifically, the gaging means **34** includes a pair of spaced side rail bars **172, 173** which are fixedly secured to the table **33** at opposite sides thereof in a parallel relation to each other. A rack-like member **174** is also supported on the table **33** in parallel relation to the side rail bar **172,** and in a preferred embodiment, includes an elongated threaded portion comprising the major central portion thereof, supported for rotation in end bearing portions adjacent to the side rail bar **172.**

An elongated rigid means or gage bar assembly **175** is slidably supported by slide blocks **176** rigidly secured thereto at its ends, on the side rail bars **172, 173,** the gage bar assembly **175** extending transversely, namely perpendicularly to, the side rail bars **172, 173.** The gage bar assembly **175** is disposed on the upper surface of the table **33.** The gage bar assembly **175** is provided with a number of stops which are slidably adjustably supported thereon. The left slide block **176** supports a mechanism generally indicated at **177** for engaging the threaded portion of the member **174.** The left slide block **176** also supports a counter mechanism indicated at **178.** On the forward end of the member **174** there is a calibrated knob assembly generally indicated at **179.**

Referring now to FIGURE 7, certain portions of the gaging means are shown in greater detail.

The back rail bar **183** also slidably supports a template follower mechanism **253,** and a selective reciprocation of the follower mechanism **253** effects a fore and aft movement of the reference surface on the rigid base **182.** The follower mechanism **253** is adapted to overlie a template **254** shown fragmentarily in FIGURE 1 and in enlarged cross-section in FIGURE 9, and to engage the workpiece in a manner to effect joint movement therebetween. The workpiece supporting table **33** is slightly undercut adjacent to the punch and die means for receiving such a template in substantially coplanar relation with the rest of the workpiece supporting table **33** so that the workpiece can also for certain positions overlie the template **254.** The template **254** is located by means of guide buttons **255** and is held securely against the table **33** by a sheet of pressure sensitive tape **256** having a first pressure sensitive coating **257** in engagement with the upper surface of the table **33,** and a second pressure sensitive coating **258** in engagement with the lower surface of the template **254.** We have found that this type of template attachment is particularly advantageous since there is thus no obstruction provided to free movement of the template follower mechanism **253** or workpiece driven thereby, as has been true in the past with various types of overlapping clamping means employed. We have also found that this mode of attaching the template **254** is extremely reliable and rigidly locates the template in a truly fixed position.

Referring now to FIGURE 10, the operation of the punching machine **30** will be described. A three phase line **259** leads through a master switch **260** and fuses **261** through certain contacts of a motor starter **262** and a thermal overload means **263** to a motor **264** which continuously drives the flywheel-pulley **45.** A transformer **265** provides lower voltage for the control circuits.

By manual operation of a start switch **266,** the circuit is completed to the coil of the motor starter **262,** said circuit including thermal overload contacts **267** and a manual stop switch **268.** Completion of the circuit to the coil of the motor starter **262** closes the various contacts thereof which includes a holding contact connected across the starting switch **266.** Therefore, any subsequent actuation of the stop switch **268** breaks the circuit to the motor starter **262** to stop the motor **264.** For convenience, a power outlet **269** is connected across the secondary of the transformer **265** to energize other accessories, not shown.

Power from the transformer **265** is also directed to a first selector switch **270** which has two positions. In the illustrated position, the selector switch **270** directs power toward a foot switch **271,** and in its other position, the selector switch **270** directs power to a switch **272** which forms a part of the template follower mechanism **253.** The other side of the switches **271** and **272** are directed to a second selector switch **273.** In the illustrated position of the switch **273,** it connects the switches **271** and **272** in series with a circuit branch employing two relays and two switches by which single strokes of the ram are effected. In its other position, the selector switch **273** is connected to another circuit branch by which continuous reciprocation of the ram is effected. A mentioned previously, the ram is connected by an electrically actuated clutch to the reciprocating mechanism, the electrically actuated clutch including a solenoid or coil **274.** The switches **171, 171** which are responsive to the position of the clamping mechanisms **42, 43,** and which are closed as shown when the clamping mechanisms are in a clamped position, are connected in series with the solenoid **274** so that if either clamping mechanism be even partially loosened, the solenoid **274** cannot be energized. Thus it is apparent that if the selector switch **273** be positioned in its other position, and the actuating switch **271** be closed, power will flow continuously through the solenoid **274,** so long as the actuating switch **271** is held in a closed position. This is a condition which is particularly advantageous for nibbling operations. It is to be noted that the power for the solenoid passes through the holding contact of the motor starter **262** so that any time that the stop switch **268** is actuated, not only does the motor **264** become de-energized, but also the solenoid **274** is rendered inoperative. Of course, changing the position of any one of switches **270, 271, 273,** or **171** also instantly de-energizes the solenoid **274** of the clutch **48.**

When the selector switch **273** is in the illustrated position, the solenoid **274** may also be energized through contacts of a control relay **275** which are connected between the holding contact of the motor starter **262** and the solenoid **274.** To energize the coil of the control relay **275,** the actuator switch, such as **271,** is closed, thereby bringing potential to opposite sides of a limit switch **276,** also shown in FIGURE 2, which is disposed to be momentarily operated once for each revolution of the flywheel **45.** The limit switch **276** is normally open, and when it is momentarily actuated, it completes the circuit to the coil of the control relay **275,** thus also closing a holding circuit **277** which bypasses the selector and actuating switches as well as the limit switch **276.** Thus the circuit to the solenoid **274** is also closed.

It will be noted that the circuit to the coil of the control relay **275** includes normally closed contacts of a second control relay **278,** and the opening of these contacts is utilized to de-energize the holding circuit of the control relay **275,** to thereby de-energize the solenoid **274.** The control relay **278** includes a coil connected in series with a second limit switch **279.** Further rotation of the flywheel closes the limit switch **279** to bring power through the then closed holding contacts of the control relay **275** to the coil of the control relay **278,** thereby opening the normally closed contacts in the coil circuit of the control relay **275** and also closing holding contacts of the control relay **278** which are energized through the actuator switches, such as **271.** Release of the foot switch **271** thus breaks the holding circuit to the control relay **278** to place it in position for initiation of a second single stroke of the ram.

It is thus apparent that the control circuit provided will regulate the operation of the clutch solenoid **274,** and that by proper manipulation thereof, continuous reciprocation of the ram will be provided for a selected period of time, and also single strokes of the ram will be provided even though the actuator switch **271** or **272** is held continuously in a closed position.

Although various minor modifications might be sug-

gested by those versed in the art, it should be understood that we wish to embody within the scope of the patent warranted hereon, all such embodiments as reasonably and properly come within the scope of our contribution to the art.

We claim as our invention:

1. A punching machine comprising in combination: a frame having a bed; a movable ram carried by said frame and adapted to be selectively moved toward and from said bed; an upper tool support secured in a fixed stationary position to said frame and adapted to slidably support a separate upper tool below and in alignment with the ram; means on the bed adapted to support a separate lower tool for cooperation with the upper tool; a horizontally directed table encircling said tool support means on said bed and disposed to directly support a workpiece with the lower face of the workpiece normally in substantially coplanar relation with the upper face of the lower tool; said tool supporting means on said bed being operative to support its tool with the upper end of the tool substantially flush with the upper surface of said table; and manually actuatable means carried by said bed and normally disposed in a position out of any supporting relation to said tool support means on said bed, for effecting a relative vertical movement between said lower tool support means and said table in such direction that the workpiece may thereby be spaced upwardly from said table, said manually actuatable means including a handle extending to one accessible side of the machine below the upper surface of said table to enable actuation thereof with the workpiece overlying any portion of said table.

2. A punching machine comprising in combination: a frame having means adapted to support and to reciprocate punch and die means relatively to each other; a horizontally directed table disposed to directly support a workpiece adjacent to one of the punch and die means; a sub-table rigidly secured to said frame; a plurality of adjustable jacks connecting said table to said sub-table and providing vertical support for said table; a plurality of guide pins interconnecting said table and said sub-table and acting to preclude horizontal movement of said table; and a manually operable mechanism interconnecting said jacks for vertically adjusting them simultaneously, said manually operable mechanism including a handle extending to one accessible side of the machine below said tube to enable manipulation thereof with the workpiece overlying any portion of said table.

3. A punching machine comprising in combination: a frame having a bed; a movable ram carried by said frame and adapted to be selectively moved toward and from said bed; an upper tool support secured to said frame in a fixed stationary position, said upper tool support having means and said bed having an upwardly extending rigid pedestal for supporting relatively reciprocable cooperating punch and die tools; a horizontally directed table disposed to directly support a workpiece between said bed and said ram; and manually adjustable means connecting said table to said frame and adapted to position said table at a selected height in relation to said punch and die tools in response to actuation of said adjustable means and to position said table to various workpiece supporting positions vertically spaced a selected amount from the upper surface of the lower of the tools, said manually adjustable means including a handle extending to one accessible side of the machine below said table to enable manipulation thereof with the workpiece overlying any portion of said table.

4. A punching machine comprising in combination: a frame having a bed; a movable ram carried by said frame and adapted to be selectively moved toward and from said bed; an upper tool support secured to said frame; said upper tool support and said bed having means for supporting relatively reciprocable cooperating tools, comprising punch and die means, between said ram and said bed; a horizontally directed table disposed to support a workpiece with the lower face thereof in substantially coplanar relation with the upper face of the tool supported by said bed; and selectively actuatable means, normally disposed in a position out of any supporting relation to said tool support means on said bed, for effecting an upward movement of said tool supporting means on said bed for spacing the workpiece upwardly from said table, said tool supporting means on said bed being stationary during a punching operation.

5. A punching machine comprising in combination: a frame having a bed; a movable ram carried by said frame and adapted to be selectively moved toward and from said bed; an upper tool support secured to said frame; said upper tool support and said bed having means for supporting relatively reciprocable cooperating tools comprising separate punch and separate die means, between said ram and said bed, said tool supporting means on said bed being operative to support its tool substantially flush with the upper face of said bed; and selectively actuatable means, normally disposed in a position out of any supporting relation to said tool support means on said bed, for effecting an upward movement of said tool supporting means on said bed by which its tool is elevated above the upper face of said bed to facilitate manual grasping thereof, said tool supporting means on said bed being stationary during a punching operation.

6. A punching machine comprising in combination: a frame having a bed; a movable ram carried by said frame and adapted to be selectively moved toward and from said bed; an upper tool support secured to said frame; said upper tool support and said bed having means for supporting relatively reciprocable cooperating tools comprising punch and die means, between said ram and said bed; one of said tools being normally stationary; said tool supporting means on said bed comprising a nest-like tool-receiving structure including a slidably mounted normally stationary member on which the normally stationary tool rests; and a cam-actuated pin guided for reciprocation in said bed and normally disposed out of any supporting relation to said normally stationary member and engageable with said normally stationary member to effect sliding thereof for removing the tool from said nest-like structure.

7. A punching machine comprising in combination: a frame having a bed; a movable ram carried by said frame and adapted to be selectively moved toward and from said bed for reciprocating an upper tool; means on the bed adapted to support a separate lower tool for cooperation with the upper tool; a horizontally directed table encircling said tool support means on said bed and disposed to directly support a workpiece with the lower face of the workpiece normally in substantially coplanar relation with the upper face of the lower tool; said tool supporting means on said bed being operative to support its tool with the upper end of the tool substantially flush with the upper surface of said table; and manually actuatable means carried by said bed and normally disposed in a position out of any supporting relation to said tool support means on said bed, for effecting a relative vertical movement between said lower tool support means and said table in such direction that the workpiece may thereby be spaced upwardly from said table, said manually actuatable means including a handle extending to one accessible side of the machine below the upper surface of said table to enable actuation thereof with the workpiece overlying any portion of said table.

8. A punching machine comprising in combination: a frame having a bed; a movable ram carried by said frame and adapted to be selectively moved toward and from said bed for reciprocating a punch tool; an upwardly extending rigid pedestal fixedly carried by said bed for supporting a die tool; a horizontally directed table disposed to directly support a workpiece between said bed and said ram; and manually adjustable means connecting said table to said frame and adapted to position said table at a

selected height in relation to said punch and die tools in response to actuation of said adjustable means and to position said table to various workpiece supporting positions vertically spaced a selected amount from the upper surface of the die tool, said manually adjustable means including a handle extending to one accessible side of the machine below said table to enable manipulation thereof with the workpiece overlying any portion of said table.

9. A punching machine comprising in combination: a frame having a bed; a movable ram carried by said frame and adapted to be selectively moved toward and from said bed; an upper tool support secured in a fixed position to said frame and adapted to slidably support a separate upper tool in alignment with the ram; means on the bed adapted to support a separate lower tool for cooperation with the upper tool; a horizontally directed table encircling said tool support means on said bed and disposed to directly support a workpiece with the lower face of the workpiece normally in substantially coplanar relation with the upper face of the lower tool; said tool supporting means on said bed being operative to support its tool with the upper end of the tool substantially flush with the upper surface of said table; manually actuatable means carried by said bed and normally disposed in a position out of any supporting relation to said tool support means on said bed, for effecting a relative vertical movement between said lower tool support means and said table in such direction that the workpiece may thereby be spaced upwardly from said table; a second table for supporting a template; and a layer of pressure sensitive tape having a first downwardly directed pressure sensitive coating adhering to said second table, and an upwardly directed pressure sensitive coating for engaging and holding the template in fixed position.

10. A punching machine comprising in combination: a frame having a bed; a movable ram carried by said frame and adapted to be selectively moved toward and from said bed; an upper tool support secured in a fixed position to said frame and adapted to slidably support a

separate upper tool in alignment with the ram; means on the bed adapted to support a separate lower tool for cooperation with the upper tool; a horizontally directed table encircling said tool support means on said bed and disposed to directly support a workpiece with the lower face of the workpiece normally in substantially coplanar relation with the upper face of the lower tool; said tool supporting means on said bed being operative to support its tool with the upper end of the tool substantially flush with the upper surface of said table; manually actuatable means carried by said bed and normally disposed in a position out of any supporting relation to said tool support means on said bed, for effecting a relative vertical movement between said lower tool support means and said table in such direction that the workpiece may thereby be spaced upwardly from said table; a solenoid-operated clutch for selectively coupling continuously reciprocating means to said ram; an electric circuit for controlling the solenoid; said circuit including a normally open actuating switch; a two-position selector switch connected thereto; a first circuit branch connected in series with said actuating switch only when said selector switch is in a first position for directly providing continuous power to the solenoid to effect continuous ram reciprocation; and a second circuit branch connected in series with said actuating switch only when said selector switch is in a second position, and including relays actuated by other switches operated by the continuously reciprocating means, to provide power to the solenoid to effect only a single stroke of the ram.

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