

June 26, 1951

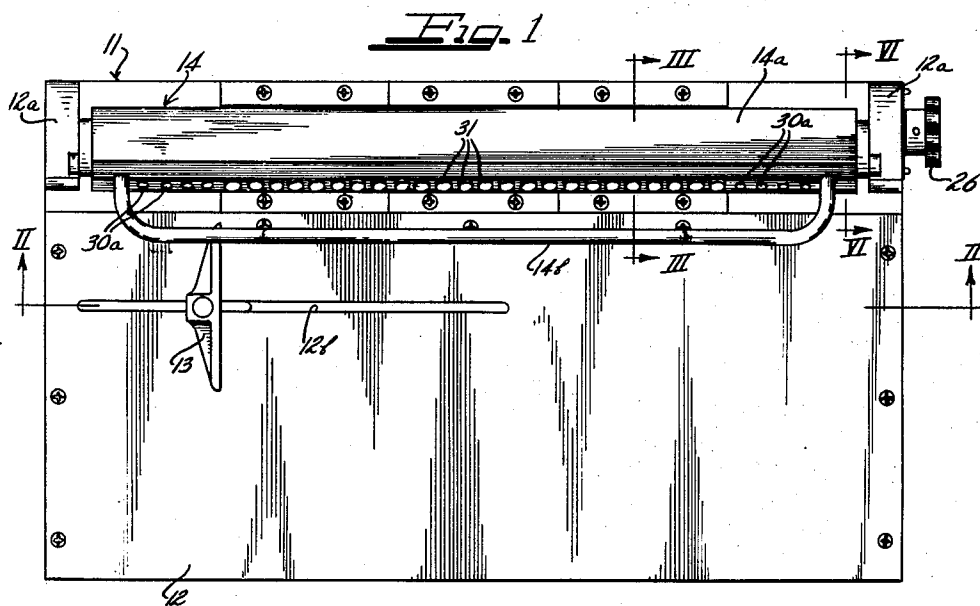
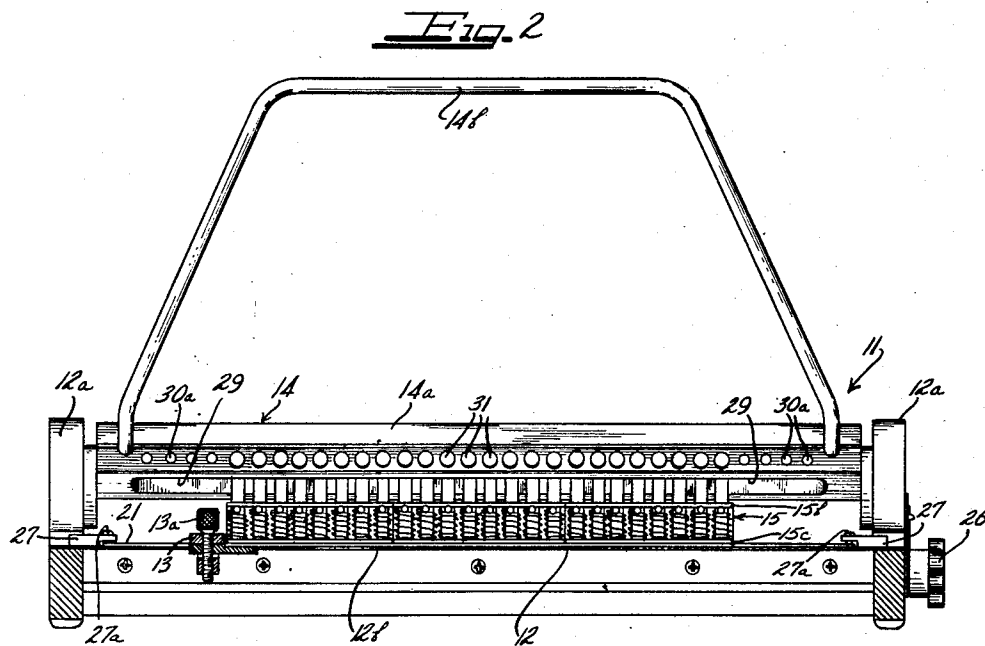
C. E. EMMER

2,558,044

PORTABLE PUNCHING MACHINE

Filed March 5, 1949

4 Sheets-Sheet 1



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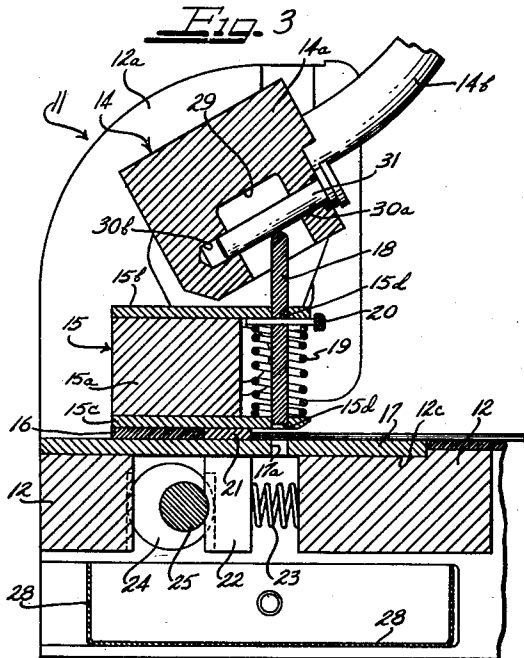
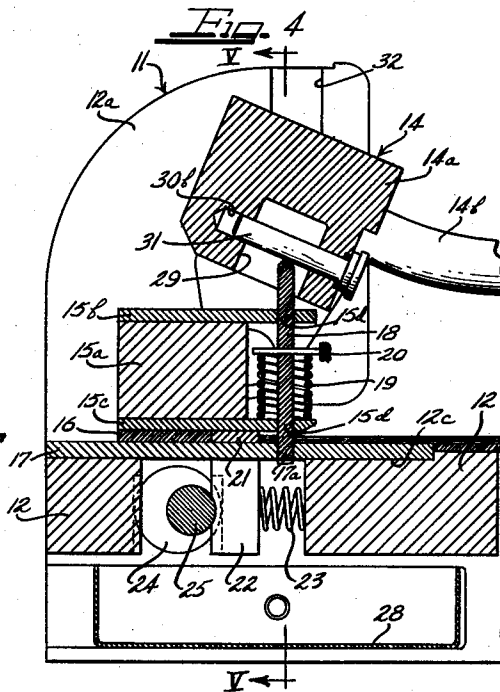
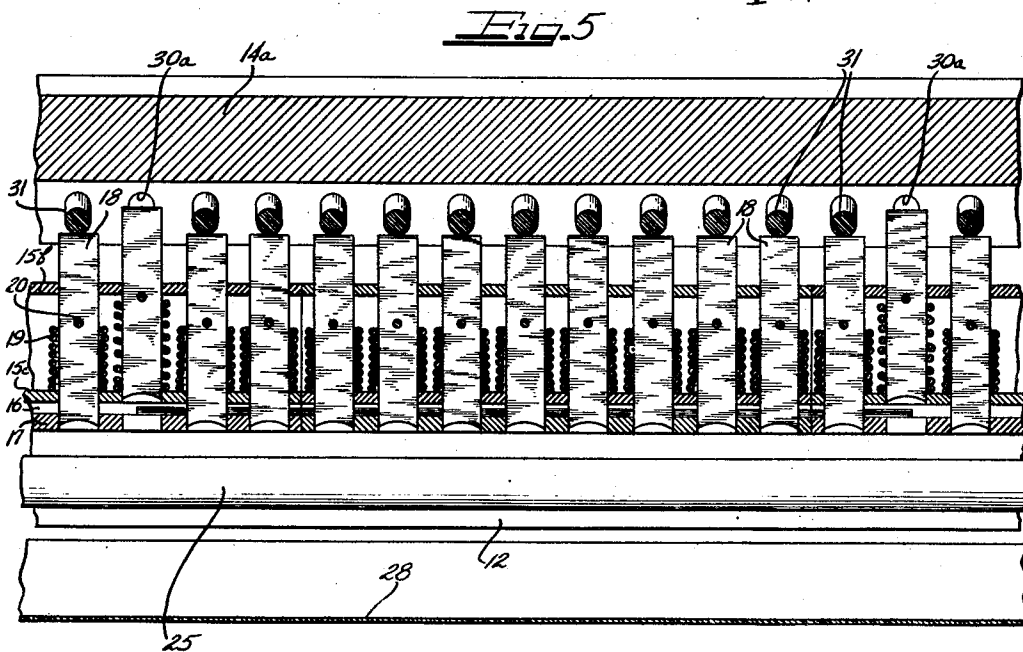
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PORTABLE PUNCHING MACHINE

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4 Sheets-Sheet 2



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PORTABLE PUNCHING MACHINE

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Fig. 6

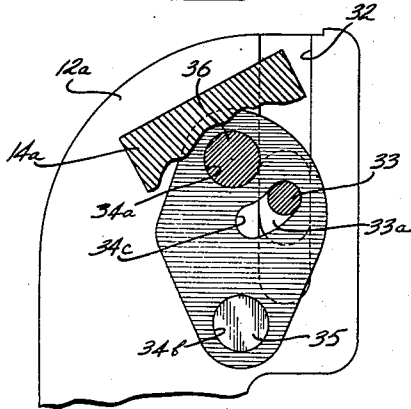


Fig. 7

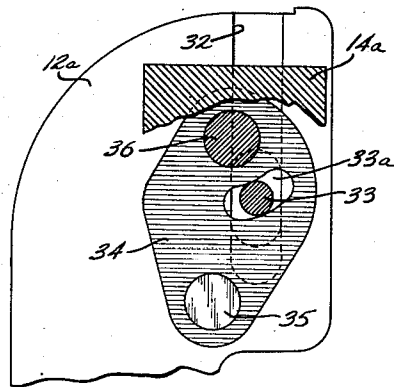


Fig. 9

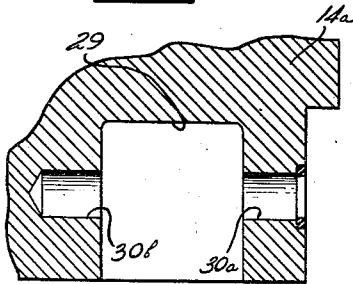


Fig. 8

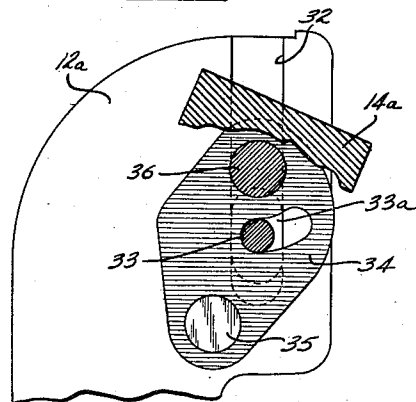
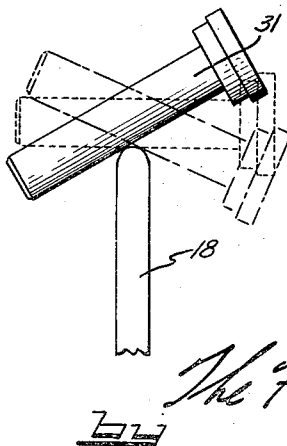


Fig. 10



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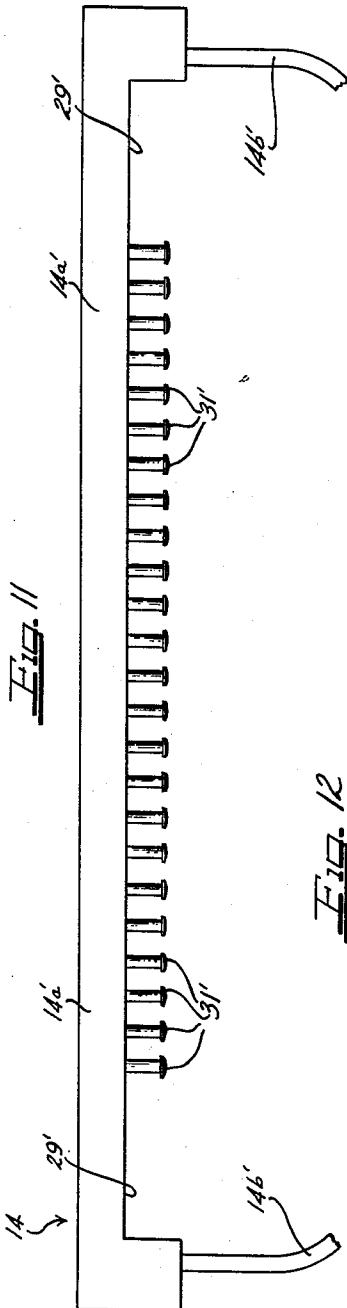
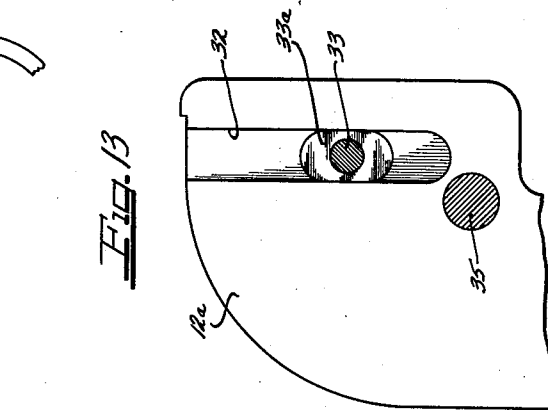
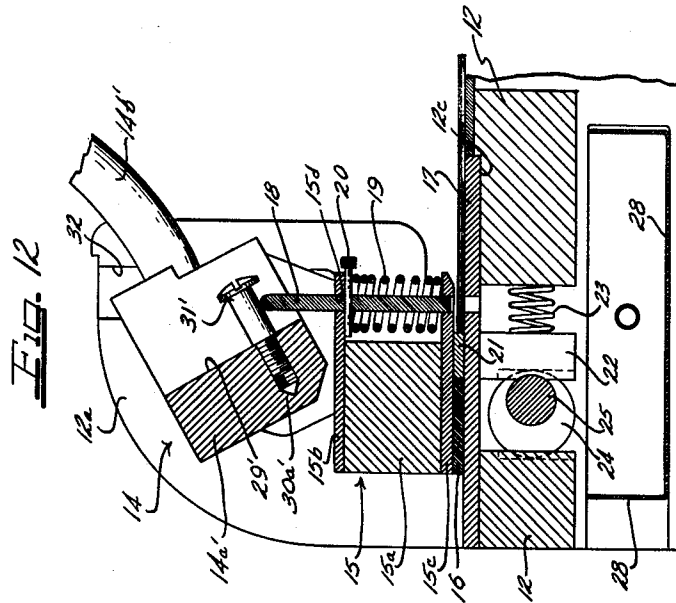
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PORTABLE PUNCHING MACHINE

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,558,044

PORTABLE PUNCHING MACHINE

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Application March 5, 1949, Serial No. 79,760

9 Claims. (Cl. 164—91)

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My invention relates to a portable punching machine, and more particularly, to a portable machine adapted to punch a row or rows of holes in predetermined alignment along the edge of a stack of sheets to be bound together as an integral unit.

Punching machines of the general plan herein described have heretofore been provided for the purpose of equipping unskilled office workers with a convenient machine for adapting loose-leaf reports and other miscellaneous papers for binding in neat, attractive folders having the appearance of a manufactured bound book. Machines having these characteristics have generally included a single block carrying all of the punches or a single block carrying a single punch. The punch block is the most expensive part of a punching machine and because maximum utility of a punching machine can only be achieved if it is of such simple construction and reliability in operation that it may be used by ordinary help, the machines heretofore known in the art have had serious deficiencies.

For example, it has frequently been necessary in business office practice to punch a limited number of holes through a stack of aligned sheets at spaced points adjacent a longitudinal periphery of a stack of sheets. Therefore, it has been imperative that some of the punches be capable of being inactivated. Heretofore, inactivation of selected punch elements has frequently been precluded or, if obtainable, has resulted in gross inefficiencies because it has frequently been necessary to duplicate a punching operation to effect a desired perforation pattern.

A portable punching machine constructed in accordance with the teaching of the present invention incorporates a plurality of removable bearing pins which may be withdrawn from the machine, thereby rendering any selected individual punch inoperative. Thus, the operation of the machine may be varied to produce a wide variety of possible perforation patterns. My portable punching machine may thus be adapted to punch stacks of sheets which accommodate various types of ring binders and different sheet binders.

It is, therefore, an object of this invention to provide a portable punching machine having improved adjustability characteristics and which is easily adapted to accommodate a wide variety of perforation patterns.

Inasmuch as a punching operation is preferably performed through the actuation of a punch into a cooperating die, machines of the type hereto-

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fore provided have usually included a pivoted lever arm whereby a plurality of punches may be reciprocated thereby upon a vertical axis extending substantially through the center line axis or axes of the bores defined by the cooperating die members. Leverage arrangements having sufficient mechanical advantage to overcome the punching shear resistance by the stack of sheets to be punched are usually held and pivoted on a fixed axis. Therefore, the force applied to the plurality of punches by the leverage system has actually consisted of a thrust directed along the tangential periphery of an arc of fixed radius.

Although a resolution of the force components present in such a thrust may indicate that the vertical component is of sufficient magnitude to overcome the shear resistance of the aligned stack of sheets, it has generally been recognized that the effect of the horizontal component of the thrust is most undesirable inasmuch as the punching element, when subjected thereto, tends to become misaligned with respect to the center line axis of each cooperating die.

A portable punching machine constructed in accordance with the teaching of the present invention employs a pressure bar of unique construction having a fulcrum point which automatically shifts within geometrically predetermined limits to cause a straight downward pressure to be exerted in the punching element at all times. Therefore, another object of this invention is to provide a portable punching machine wherein a substantially true vertical pressure is exerted upon the punching element at all times during the punching operation.

A further object of this invention is to provide a portable punching machine capable of simple adjustment to produce a wide variety of holes and locations of holes which is convenient in operation and which may be used by unskilled office help.

A further object of this invention is to provide a portable punching machine which minimizes the physical effort necessary to produce a quantitative value of vertical thrust necessary to overcome the shear resistance presented by a stack of sheets to be punched.

Another object of this invention is to provide a portable punching machine wherein a plurality of punching elements is provided which may be selectively adjustable to an active or inactive position.

Many other advantages and objects of the present invention will become manifest to those skilled in the art through reference to the fol-

lowing detailed description and accompanying drawings, in which:

Figure 1 is a plan view of a portable punching machine embodying the principles of my invention;

Figure 2 is a sectionalized view taken on line II—II of Figure 1;

Figure 3 is a sectionalized view taken on line III—III of Figure 1;

Figure 4 is a sectionalized view similar to the view shown in Figure 3 showing the arrangement of the punching structure after actuation of the punching machine;

Figure 5 is a cross-sectional view taken through line V—V of Figure 4;

Figure 6 is a fragmentary, cross-sectional view, partly in section and partly broken away, showing the structural details of a pressure bar constructed in accordance with the present invention and is taken substantially on line VI—VI of Figure 1;

Figure 7 is a fragmentary view, partly in section and partly broken away, of the pressure bar structure shown in Figure 6 showing the arrangement of parts during one phase of actuation of the punching machine;

Figure 8 is a view similar to Figure 7 showing the arrangement of the structural parts during another phase of actuation;

Figure 9 is a fragmentary, cross-sectional view of a pressure bar cross-arm with part removed to show the structural details thereof;

Figure 10 is a diagrammatic view showing a bearing pin member and a punching element and depicting the fixed relationship of the bearing point with respect to the bearing pin member employed in the present embodiment of the invention;

Figure 11 is a fragmentary plan view of a modified pressure bar as may be incorporated in the present invention;

Figure 12 is a cross-sectional view similar to Figure 3 showing the structural details of the modified pressure bar shown in Figure 11; and

Figure 13 is a fragmentary view, partly in section and partly broken away, with parts removed showing further structural details of the parts shown in Figures 6, 7 and 8.

As shown on the drawings:

Referring to Figure 1, a portable punching machine is indicated generally by the reference numeral 11 and is shown as including a frame 12, a side guide 13 and a pressure bar 14. The pressure bar 14 is supported between a pair of upstanding arm portions 12a formed on the frame 12.

As may be seen on Figures 1 and 2, the main body portion of the frame 12 defines a longitudinally extending slot 12b through which is passed an adjusting screw 13a of the side guide 13. The adjusting screw 13a passes through an upper body portion of the side guide and is threadedly received by a corresponding lower body portion positioned on the underside of the frame 12. Thus, when the adjusting screw 13a is loosened, the side guide 13 may be positioned along the longitudinal limits of the slot 12b. It should be noted that the upper body portion of the side guide 13 defines a substantial planar surface suitable for engaging a stack of aligned sheets in abutting contact so as to permit the sheets to be properly positioned upon the surface presented by the frame 12 for punching operations.

Referring now to Figures 2 and 3, the punching machine 11 is shown as being provided with

one or more punch blocks 15. Each punch block 15 may take the form of a bar-like body 15a having affixed thereto a top member 15b and a bottom member 15c. The top and bottom members 15b and 15c project forwardly of the body portion 15a and are appropriately formed to define a plurality of spaced openings 15d lying in vertical registry with one another. The punch blocks 15 are mounted in firm assembly with the frame 12. However, it may be noted that one or more separate plate members 16 may be interposed between the punch blocks and the frame so as to permit a stack of sheets to be inserted between the frame and the lower member 15c of each punch block 15.

Referring specifically to Figure 3, it may be noted that the frame 12 may be countersunk as at 12c to receive in firm assembly therein a die plate 17. The die plate 17 is suitably formed to define a plurality of die bores 17a spaced in longitudinal alignment in such a manner as to lie in registry beneath the openings 15b in the punch blocks 15.

A plurality of punches 18 is carried by each of the punch blocks 15. Each of the punches 18 is adapted to be received by the corresponding openings 15d of each punch block 15 and is resiliently retained therein by means of a plurality of small coil springs 19 positioned between the projecting portions of the top and bottom members 15b, 15c.

Each punch is further adapted to receive a retaining pin 20 as shown. Thus, it will be apparent that each of the springs 19 seated on the bottom members 15c of the punch blocks 15 will bear against one of the pins 20 which is passed through a punch 18, thereby normally biasing the punch 18 to an upper inactive position.

Selective alignment of a stack of sheets on the frame 12 is further expedited by means of an adjustable mechanism which includes a longitudinal bar 21 extending across the frame 12 adjacent the plate member 16. The bar 21 is arranged to be adjustably positioned relative to the die bores 17a by means of a pair of end carriage supports 22 which may be reciprocated backward and forward against the spring bias of a pair of coil springs 23 by means of a pair of cams 24 formed on a shaft 25 (Figure 3). As may be seen in Figures 1 and 2, the shaft 25 may be selectively rotated by means of an adjusting knob 26 and the adjustable longitudinal bar 21 may be locked in any predetermined position by means of a pair of screws 27a which pass through a projecting arm portion of a pair of guide members 27 assembled upon the frame 12.

It may also be noted that the punching machine 11 is provided with a removable tray 28 which is positioned within the machine so as to receive the punching scraps.

As may best be seen in Figures 3, 4 and 5, the pressure bar 14 preferably takes the form of a longitudinal body portion 14a having affixed thereto a suitable operating handle 14b. The body portion 14a of the pressure bar 14 defines a longitudinal rectangular slot or recess 29 and further defines a plurality of pin-receiving apertures 30a and counterbores 30b extending inwardly into the body portion 14a on a plane transverse to the longitudinally extended slot 29 (Figure 9). Each of the apertures 30a and counterbores 30b is adapted to receive in removable assembly therewith a bearing pin 31.

The pins 31 are provided with a suitable enlarged head portion so as to facilitate grasping thereof, as for example, between the thumb and

the forefinger. Thus, if a pin 31 is inserted into its corresponding aperture 30a and counterbore 30b, it will come in bearing registry with a corresponding punch 18. Therefore, as may be seen on Figure 4, when the handle 14b of the pressure bar 14 is pressed downwardly, the pins 31 will bear against the punches 18 in such a manner as to overcome the spring bias of the springs 19, thereby placing the punches 18 in punching registry with the die bores 17a of the die plate 17.

The present invention contemplates the provision of various modified forms of a pressure bar 14 and, by way of illustrative example, reference may be had to Figures 11 and 12. As shown therein, the pressure bar 14 takes the form of a longitudinal body portion 14a' having affixed thereto a suitable operating handle 14b'.

The body portion 14a' may be recessed as at 29' and further defines a plurality of spaced pin-receiving apertures 30a' which extend inwardly into the body portion 14a'. Each of the apertures 30a' may be internally threaded to receive a corresponding threaded bearing pin 31' in removable assembly therewith.

The pins 31' are provided with a suitable enlarged head portion so as to facilitate grasping thereof and may further define a suitable slot to facilitate the use of adjusting tools therewith, if desired.

It will be understood that the operation of the punching machine, equipped as shown in Figure 12, will be carried out in the manner previously described in connection with Figures 3, 4 and 5.

Referring particularly to Figure 5, it may be seen that the specific structure embodied in the present machine facilitates adaptation of the machine to a wide variety of operating problems. For example, if a stack of sheets of limited size is to be punched, it is highly desirable that the outermost perforations do not lie too close to the edge of the sheets. It is also desirable that the ends of the sheets not be cut away by a superfluous partial punching. To that end, Figure 5 shows how one or more pins 31 or 31' may be removed from the pressure bar 14, thereby inactivating a corresponding number of punches.

A punching machine constructed in accordance with the teachings of the present invention is provided with a specially designed shifting pivot connection whereby the pressure bar 14 may be supported in the frame 12. The structural details of this connection will be described with reference to Figures 6, 7, 8 and 13.

Referring specifically to Figures 6 and 13, an upstanding arm portion 12a of the frame 12 is shown as defining a vertically extending guide slot 32. The guide slot 32 is adapted to receive in sliding contact therewith a guide pin 33 formed on or affixed to the ends of the body portion 14a of the pressure bar 14. The guide pin 33 may be provided on its outer extremity with a suitable sliding shoe 33a shaped so as to be snugly and slidably received by the slot 32. Interposed between the upstanding arm 12a of the frame 12 and the pressure bar 14 is a lever arm 34.

As may be seen in Figure 6, the lever arm 34 is provided with a first bore 34a, a second bore 34b in spaced relation to said first bore 34a, and an arcuate slot 34c which is adapted to pass the pin 33 in geometrically confining relation with the lever arm 34. The lever arm 34 is pivotally mounted on the upstanding portion 12a of the frame 12 by means of an anchor pin 35 (Figure 13.)

The pressure bar 14 is pivotally mounted upon

the lever arm 34 by means of a pivot pin 36 which is formed on or connected to the end of the body portion 14a of the pressure bar 14 and which extends into the bore 34a in pivotal relation therewith.

Figures 6, 7 and 8 illustrate the operational sequence of a typical punching operation. Thus, it may be noted that Figure 6 represents the arrangement of the parts in a normal, inactive position. Figure 7 represents the arrangement of parts after the pressure bar 14 has traversed a portion of its normal path during the course of a punching operation. Figure 8 shows the arrangement of parts after the pressure bar 14 has reached the bottom of its stroke. It should be noted that the actual fulcrum point of the pressure bar 14 partakes of a constant geometrical change during the operational sequence relative to the frame 12 because of the respective positioning of the guide pin 33 and the pivot pin 36 of the pressure bar 14 relative to the lever arm 34.

The end result is that each bearing pin 31 or 31' does not undergo a lateral displacement relative to the corresponding punch 18, but, rather, partakes of an oscillatory motion which permits the pin 31 or 31' to rock around the end of the punch 18 at a substantially predetermined and fixed point of bearing engagement.

This phenomenon is illustrated in Figure 10 where the solid outline illustrates the pin 31 in a position relative to the punch 18 corresponding to the Figure 6 position of the pressure bar 14. The dotted line portion corresponds to the mid-point position similar to that shown in Figure 7 and the dashed line portion indicates the positioning of the pin 31 relative to the punch 18 at the bottom of the pressure bar stroke as shown in Figure 8.

It will be apparent to those versed in the art that I have described a portable punching machine which greatly facilitates adaptation of the machine to various types of punching operations. It will be further apparent that I have described a punching machine wherein a substantially true vertical punching thrust is applied to the punches by means of a novel single joint connection for securing a pressure bar to a frame support.

Although I have resorted to detail in the description of my invention for the sake of clarity, it should be understood that the present embodiment herein shown has been set out by way of example only, and I do not wish to be limited thereto.

I claim as my invention:

1. A shifting-pivot mechanism for producing a substantially vertical shear force in a punching machine comprising a frame, lever arms pivotally connected to said frame, a pressure bar pivotally connected to said lever arms, each of said lever arms defining an arcuate slot, said frame defining vertical grooves in alignment with said lever arms, said pressure bar having guide pins extending therefrom and passing through said slots for sliding engagement in said grooves, whereby the effective fulcrum point of said pressure bar is changed upon actuation thereof to permit rocking of said pressure bar at a substantially fixed bearing point.

2. In a mechanism for producing a vertical shear force in a punching apparatus, an improved shifting-pivot connection comprising a stationary member, a lever arm pivotally connected thereto, and an actuating member pivotally connected to said lever arm at a point spaced

from said first mentioned pivot, said stationary member defining a vertical guide groove, said lever arm defining a guide slot, said actuating member defining a guide pin adapted to extend through said slot for sliding engagement with said guide groove, whereby angular displacement of said actuating member and said lever arm within the limits prescribed by said guide groove and said slot effects a substantially vertical thrust at a substantially fixed bearing point on said actuating member.

3. A mechanism comprising a stationary member, a member mounted for reciprocatory movement on said stationary member, a second member pivotally mounted on said stationary member, a third member pivotally mounted on said second member, a portion of said third member spaced from its pivot point being in thrust-engaging position with said reciprocatory member, and means for confining the path of movement of said thrust-engaging portion of said third member to the same path of movement as that of said reciprocatory member, whereby angular movement of said third member about its pivot effects a thrust against said reciprocatory member in a single direction along its reciprocatory path of movement.

4. In a portable punching machine adapted to punch a plurality of perforations through a stack of aligned sheets, the improvement comprising a frame, die means on said frame, punching means, a pressure bar for actuating said punching means, and a lever arm for connecting said bar to said frame, said pressure bar adapted for pivotal assembly to said lever arm, said lever arm adapted for pivotal assembly to said frame, said frame adapted for receiving a portion of said pressure bar in sliding vertical guiding relationship therewith, whereby said pressure bar will operate to deliver substantially a vertical pressure thrust only to said punching means.

5. In a method of controlling a shear force in a portable punching machine adapted to punch a plurality of holes in a stack of aligned sheets, the steps of applying a resultant pressure having vertical and horizontal components at a given location, translating said pressure into a tangentially applied force, segregating the horizontal component of force by converting same into a lateral displacement of a fulcrum point and applying the vertical component of force at a predetermined fixed location as a shear force.

6. In a portable punching machine adapted to punch a plurality of perforations through a stack of aligned sheets of the type having a plurality of punches in operative cooperation with a corresponding plurality of dies, the improvements comprising a pressure bar having removable bearing pins, said pressure bar defining a substantially longitudinal rectangular shaped body with a lower slot-like recess therein, said bar further defining a plurality of pin-receiving apertures and counterbores lying in spaced alignment on a longitudinal axis and extending into said bar, said pins adapted for removable assembly in said apertures and counterbores whereby a selected number of said punches may be selectively placed in bearing registry with said pins for punching a predetermined perforation pattern.

7. In a portable punching machine adapted for punching a plurality of perforations through a stack of aligned sheets, the improvement comprising a connection joint for securing a pressure bar to a frame, said joint including the end of a pressure bar, a lever arm and a frame support,

said pressure bar end defining a pivot pin and a guide pin, said lever arm defining a first bore for receiving said pivot pin in pivotal assembly therewith, a second bore in spaced relation to said first bore for receiving a presently mentioned anchor pin in pivotal assembly therewith, and an arcuate slot for passing said guide pin through said lever arm in constraining relationship therewith, said frame support defining an anchor pin for pivotal connection with said lever arm and a vertical groove for receiving said guide pin in sliding guide relationship therewith, whereby said pressure bar is pivotally rotated about a changing fulcrum point within the predetermined limits established by said anchor pin, said pivot pin and said guide pin.

8. A portable punching machine adapted to punch a plurality of perforations through a stack of aligned sheets comprising, in combination, a frame, a side guide on said frame, said frame and said side guide relatively adjustable for supporting the stack of sheets to be punched in correct alignment, at least one die plate assembled with said frame, at least one punch block adjacent said die plate and assembled with said frame, a plurality of punches in spaced longitudinal alignment in said block each above a corresponding registering die, a pressure bar on said frame in spaced vertical alignment with said punches, and a plurality of removable pins in said pressure bar, each arranged in removable bearing registry with a corresponding punch, said pressure bar connected to said frame with connection means whereby a substantially true vertical thrust may be applied to said punches for punching a selected number of perforations in said stack of sheets.

9. A portable punching machine adapted for punching a plurality of spaced perforations along the longitudinal edge of a stack of aligned sheets comprising, in combination, a frame having a substantially flat surface for supporting a stack of aligned sheets, said frame defining a longitudinally disposed slot, a side guide adapted to be adjustably received in said slot, said guide being longitudinally reciprocal and adjustably retainable in said slot for positioning said stack of sheets in correct punching alignment on said frame, a back guide bar extending longitudinally across said frame and transversely adjustable relative to said frame for positioning said stack of sheets in correct punching alignment on said frame, at least one die plate defining a plurality of die bores firmly assembled to said frame, and a corresponding number of punch blocks spaced on said frame adjacent said die bores of said die plates, a plurality of punches in said blocks, said punches arranged in spaced longitudinal alignment for cooperating registry with said die bores, spring means surrounding said punches cooperatively engageable with said blocks for normal spring biasing of said punches to an upper inactive position, a pair of upstanding arm portions on said frame adjacent said die plates, each of said arm portions defining a vertically disposed guide slot, a pair of lever arms, each pivotally mounted on one of said upstanding arm portions, said lever arms each defining an arcuate slot, a pressure bar positioned longitudinally in spaced alignment above said punches, each of the ends of said pressure bar defining a pivot pin for pivotal connection to one of said lever arms and guide pins on the ends of said pressure bar extending through said arcuate slot of said lever arm and into said guide slot of a corresponding

upstanding arm portion, said pressure bar further defining a longitudinal recess and a plurality of pin-receiving bores arranged in spaced longitudinal alignment and extending into said pressure bar transversely to said recess and a plurality of bearing pins removably insertable into said pin-receiving bores for selective cooperating engagement with said punches, whereby a selected number of said punches may be actuated into said die bores with a substantially true vertical thrust from said pressure bar despite application of a pressure to said pressure bar by a resultant force resolvable into horizontal and vertical components.

CHARLES EDWARD EMMER. 15

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