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 [33] **Germany**
 [31] **No. 1,561,442**

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[54] **METHOD AND APPARATUS FOR DIE CUTTING**
BLANKS FROM STACKS OF SHEET MATERIAL
19 Claims, 13 Drawing Figs.

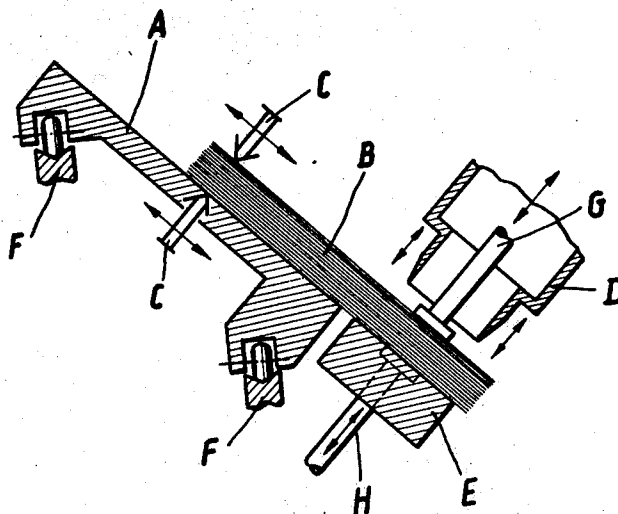
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83/50, 83/55, 83/112, 83/123, 83/126, 83/153,
83/160, 83/206, 83/409, 83/561, 83/648
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B26f 1/38
 [50] Field of Search..... **83/27, 34,**
36, 50, 55, 104, 112, 123, 126, 153, 206, 409, 412,
561, 648, 160

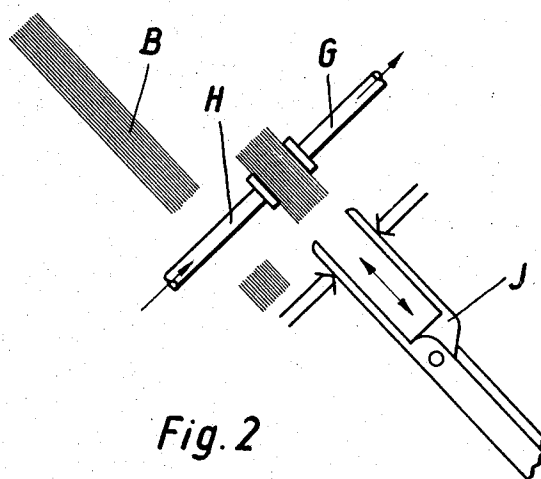
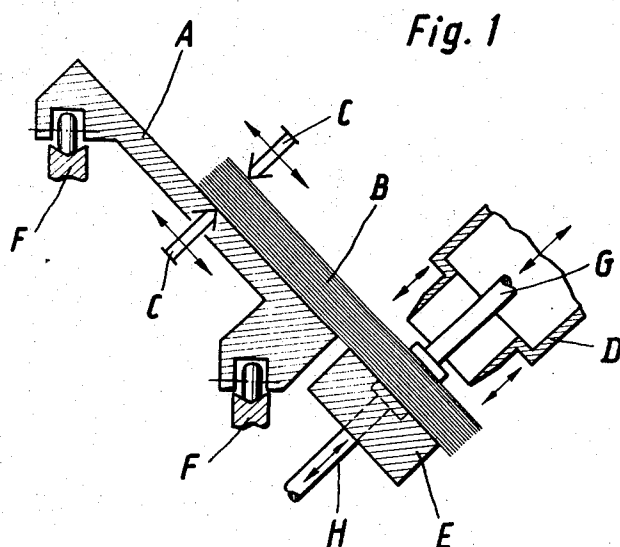
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ABSTRACT: Stacks of sheet material to be die cut into blanks are partially suspended from a single clamped edge by multiple spaced apart, individually actuatable, clamps on a tilted stationary table and under a stationary but rotatable die. A die backing plate is mounted in the table for rotation and adjustment and includes a holding element axially cooperating with a similar element movable within the die for urging the blank stack rearwardly of the die for lateral removal by a grasping tool. The stacks are moved along perpendicular coordinates on the table and an air cushion is provided to reduce friction. A portion of the table is pivotable to the horizontal for initially receiving and aligning the stacks and the clamps are adapted to shift and rock to relieve adverse forces during die penetration. Reduced fluid pressure is supplied to the die press cylinder for stop adjustment of the full pressure die stroke.





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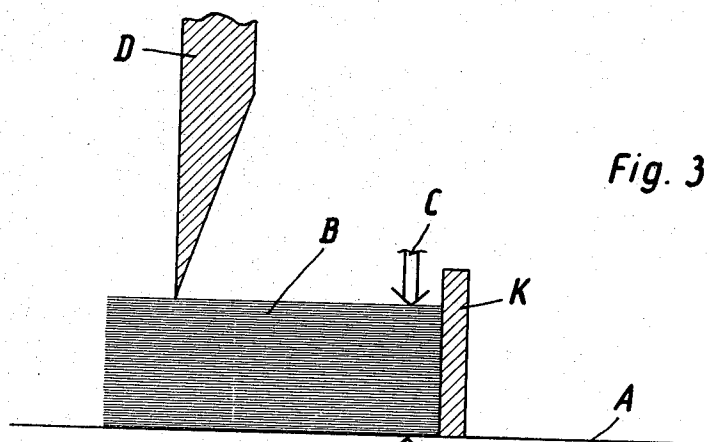


Fig. 3

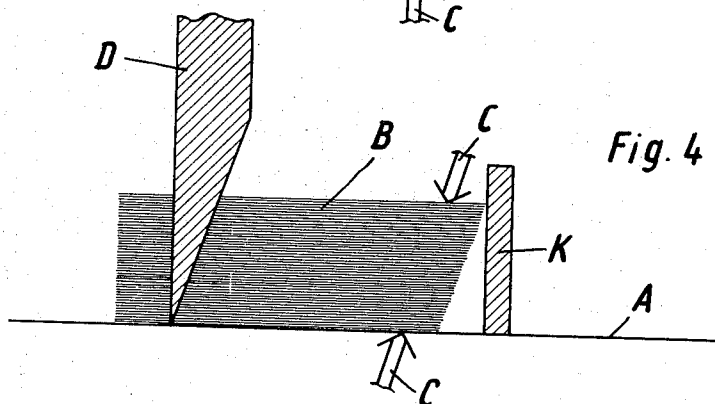


Fig. 4

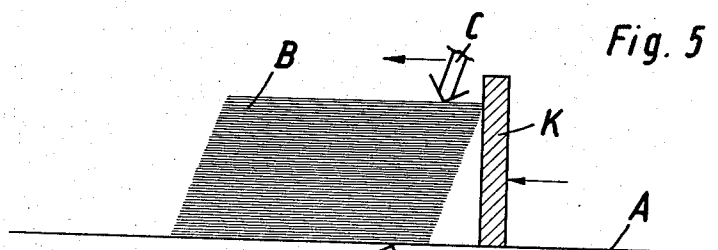


Fig. 5

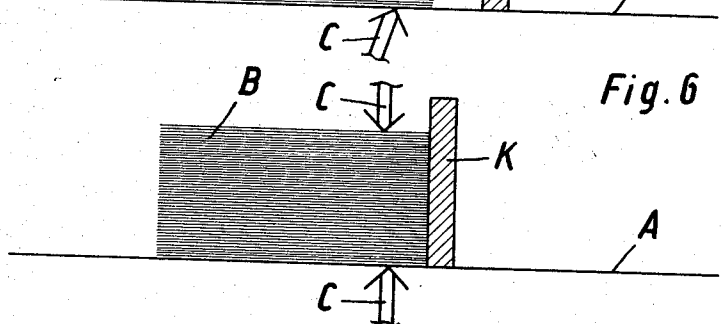
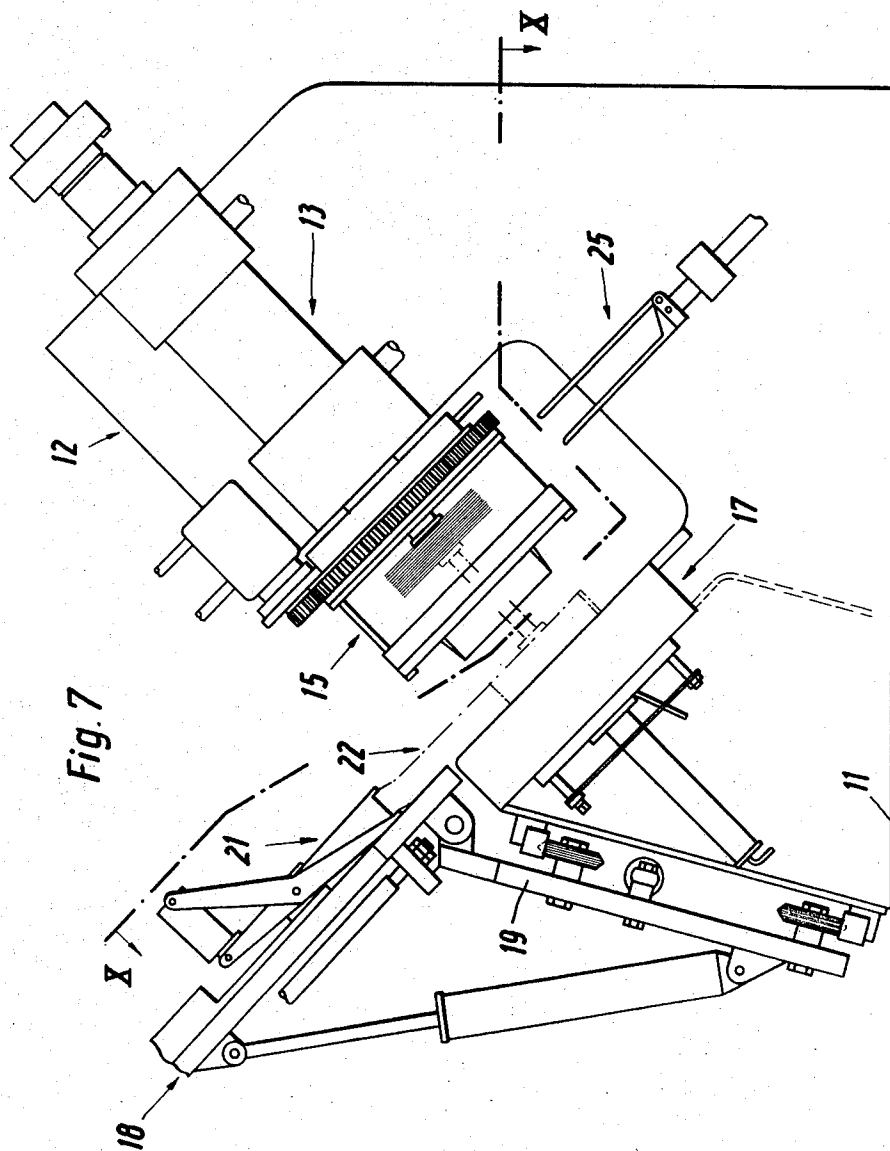


Fig. 6

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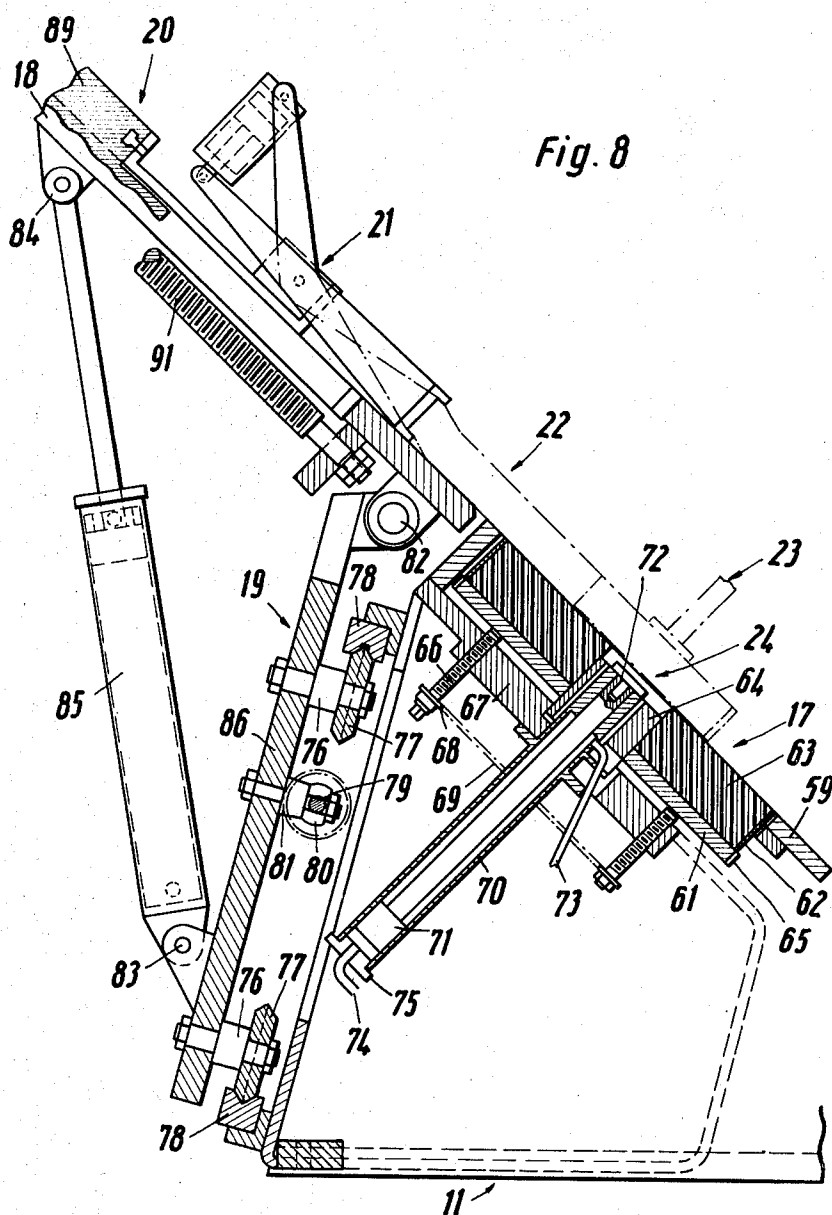
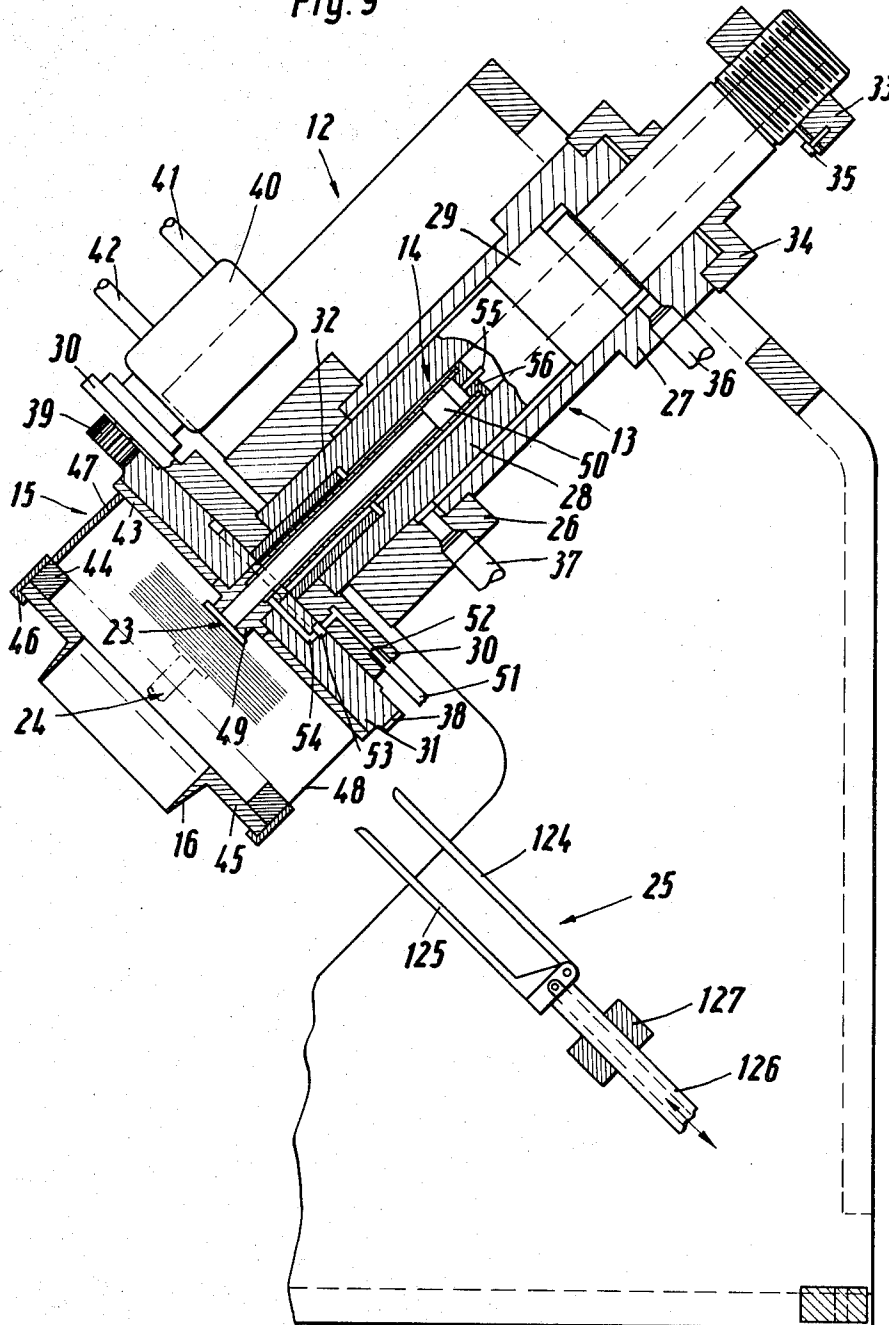


Fig. 8

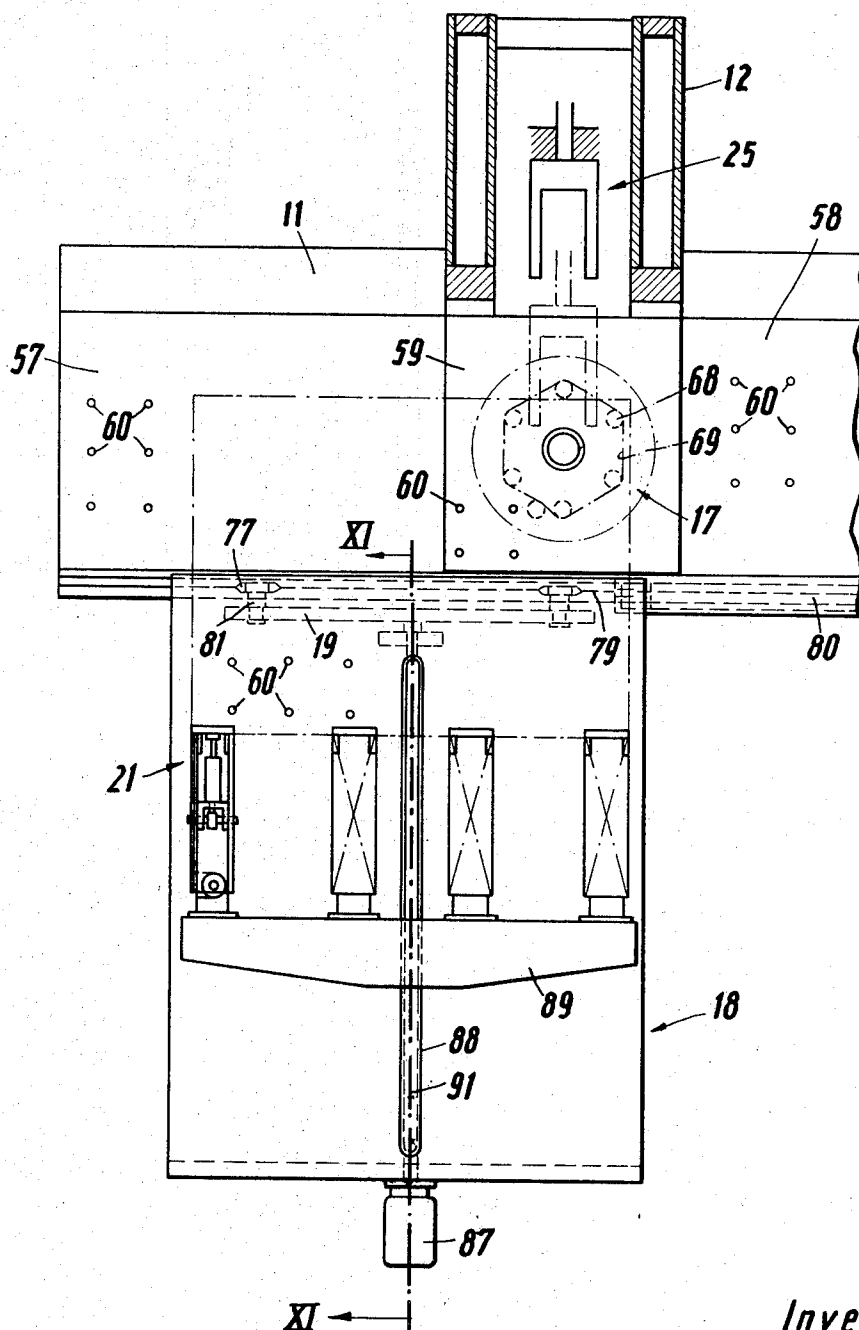
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Fig. 9



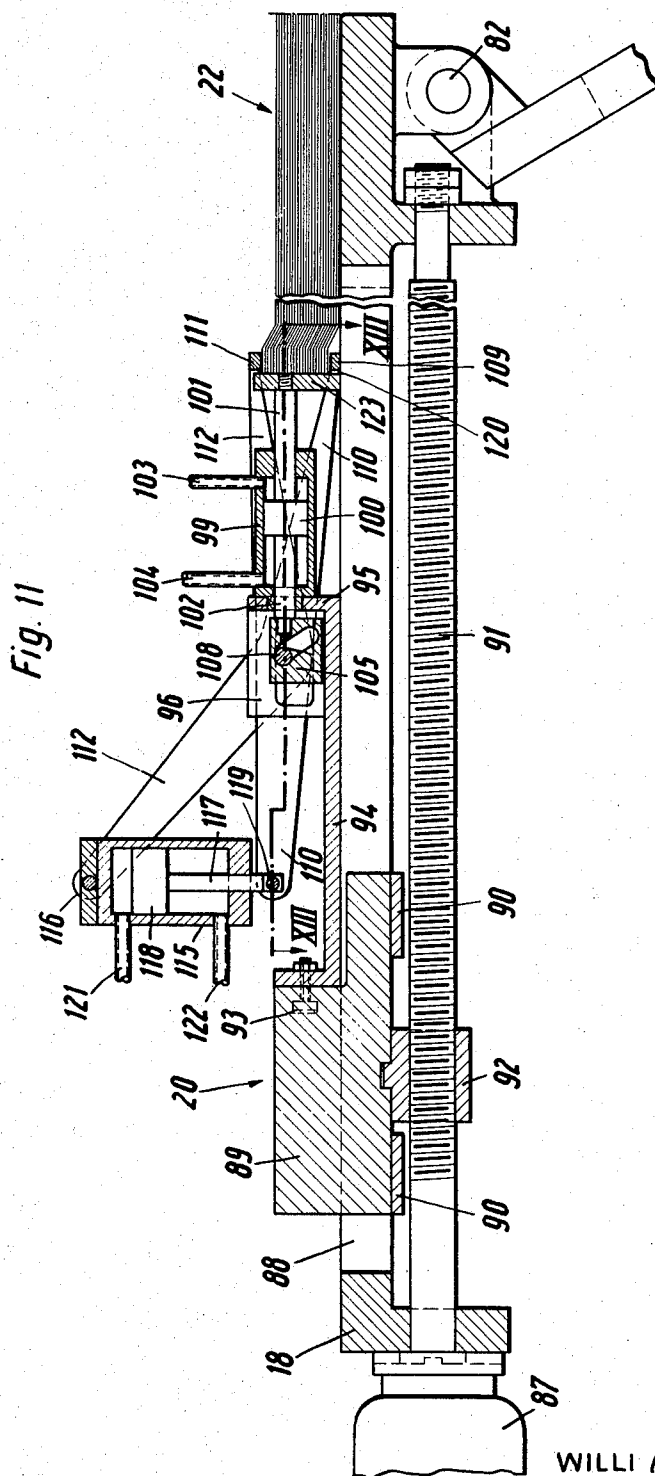
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Fig. 10



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Fig. 12

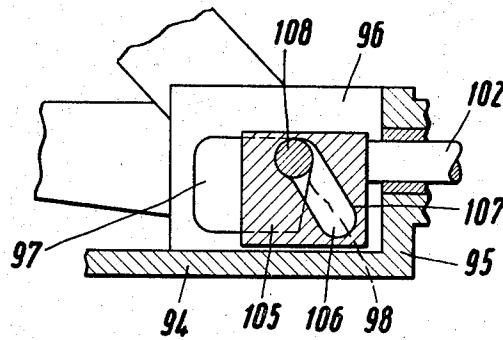
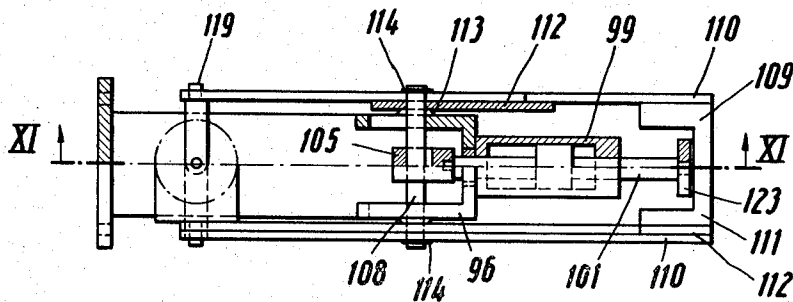


Fig. 13



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METHOD AND APPARATUS FOR DIE CUTTING BLANKS FROM STACKS OF SHEET MATERIAL

This invention relates to a method and apparatus for die cutting blanks and the like from stacks of sheet material, and more particularly to such a method and apparatus which utilizes a relatively movable die and stack support for obtaining multiple die cuts from a single stack.

Apparatus for die cutting blanks from stacked sheet material are known to use a stack supporting table adapted to move the stack in one direction and a die supporting member adapted to move the die in a transverse direction whereby the entire sheet surface may be covered for multiple die cuts. Such die supporting members have been adapted to rotate through desired angles for more efficient nesting of adjacent cuts. In using such prior art apparatus, the die cut blank stacks commonly remain on the table surrounded by waste material until the entire sheet stack is cut, whereupon the individual blank stacks are removed from the table manually.

Such known apparatus presents several difficulties.

Because the die is placed successively into different positions relative to the table, the latter must be covered on the entire die cutting edge contacting surface with a relatively soft backing layer or plate of crosscut or end-grained wood or like material. The distribution of small grooves or notches in the backing plate caused by repeated contact with the die cutting edge produces a rough, high friction surface, rendering it extraordinarily difficult to move the sheet stack over the backing plate for alignment against stops and clamp the stack into proper position with known clamping devices. Also, any subsequent jarring or jolting of the table under these conditions tends to again produce a shifting of aligned sheets which is difficult to correct.

A further problem with known apparatus is the tendency to produce a buckle within the stack upon die penetration. This is caused by the conical or wedge-shaped die walls operating in conjunction with tight clamps on multiple edges of the stack, and is aggravated by the rough surface on the backing plate and retention of cut blanks within the waste material.

A still further difficulty experienced with known die cutting apparatus, and particularly in the vicinity of tight stack clamps, is the lack of axial die penetration through the stack, whereupon the blanks formed from the upper part of the stack deviate from blanks formed therebelow. This may produce serious register problems, especially with previously printed sheets. Also, upon die cutting closely adjacent to the clamps, the resulting forces often lead to die breakage.

It has been recommended to decrease the forces resulting from die penetration by reducing the resistance of the sheets which stretch around the die through the use of crosscutters disposed on the outer side of the die wall. This relieves the tension which would otherwise build up in the waste material surrounding the blanks, but often is not satisfactory because the crosscutters tend to reach partially into the material provided for subsequent die cuts, thus interfering with the economical utilization of the sheet material.

It is the principal object of this invention to overcome the aforementioned difficulties while providing a method and apparatus well adapted for the high speed automatic production of high quality blanks.

In the practice of this invention, the stack of sheet material to be die cut is clamped on only one longitudinal edge and is moved partially into suspension in an inclined plane, such as 45° from the horizontal, onto a stationary, inclined support table under a correspondingly inclined stationary die, the clamped and partially suspended stack being moved in the inclined plane along two perpendicular coordinates. This results in the die always seating at substantially the same place with respect to the support table, whereby the stack bearing surface of the table, except at the limited die contacting area, remains undamaged by the die cutting edge, permitting the friction resistance of the overall table bearing surface to be held as low as possible. Such a construction conveniently permits the table bearing surface friction resistance to be further reduced through the formation of air discharge ports at the

table bearing surface to float the stack on a thin air cushion. By rotatably mounting a suitable die backing plate in the support table, and, depending upon the die shapes, displaced eccentrically from the die axis, the die does not seat repeatedly at exactly the same location whereby the useful life of the backing plate is extended. Such a backing plate also lends itself to convenient height adjustment to compensate for wear and permit ultimate replacement without involving the major portion of the support table.

A further feature of this invention, is that no table stops for sheet alignment are provided in the conventional sense, but rather, the stack is supplied to the table already aligned and held tight along one of its longitudinal edges while being fed through movement in two directions with respect to the stationary die.

A still further feature of this invention is the provision for grasping the cut blank stack within the hollow die between a pair of axially aligned holding elements, one being normally disposed in the die backing plate and the other within the die assembly. The blank stack is urged axially rearwardly through the die, while grasped, and subsequently moved sideways from a position rearwardly of the die through a lateral aperture by means of a pliers shaped tool upon release of the holding elements. Thus, the blank stack is removed after each die penetration without the need for moving the die from its operational axis. Also, this permits the die stroke to be limited to a length only slightly greater than the sheet stack thickness which provides advantages in apparatus construction and operation.

An additional important feature of this invention is the provision of a unique clamp structure for the sheet stack which is adapted to shift and also rock or pivot about an axis extending longitudinally of the clamped stack edge under the forces produced by the penetrating die. Thus, in view of the three unclamped stack edges and ability of the single clamped edge to yield, there is less tendency for the material to bulge and/or exert damaging pressures on the die, while permitting the stack to be easily realigned following the cut. Also, the use of multiple individually controlled and withdrawable clamps permits die cutting adjacent the clamped edge without release thereof.

For convenience in initially depositing and aligning the sheet stack, structure is provided for pivoting a receiving portion of the support table out of an inclined operational position to a horizontal stock receiving position.

As a still further feature of this invention, the adjustment of the die stroke is facilitated by arranging to supply the die press cylinder with a fraction of its normal operating fluid pressure, for example, 1/30 thereof, whereby the die may be bottomed against its backing plate without damage for accurately setting the stroke stop used under operating conditions. This pressure reduction is also desirable as a safety feature during other non-production use of the apparatus.

The above features render die cutting apparatus embodying this invention particularly well adapted for automatic remote control through a programmed coordinating device such as a suitable operational computer receiving instructions from punched card programs or the like.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a diagrammatic, fragmentary cross-sectional side elevation through apparatus embodying this invention illustrating a stack of sheet material clamped on the inclined table for die cutting.

FIG. 2 is a diagrammatic, fragmentary view related to FIG. 1 illustrating the cut blank stack displaced normally from the plane of the sheet stack into alignment with a lateral removing tool.

FIGS. 3 to 6 inclusive are sequential diagrammatic fragmentary cross-sectional views illustrating the displacement of a

stack edge during die penetration and subsequent realignment.

FIG. 7 is a somewhat fragmentary side elevation of the apparatus showing a blank stack in position behind the die for lateral removal.

FIG. 8 is a cross-sectional detail view through the apparatus particularly showing the sheet stack support table including the die backing plate.

FIG. 9 is a cross-sectional detail view through the apparatus particularly showing the die support and press cylinder arrangement.

FIG. 10 is a plan detail view of the apparatus taken generally on the line X-X, FIG. 7, particularly showing the sheet stack support table and edge clamps.

FIG. 11 is a cross-sectional detail view taken on the line XI-XI, FIG. 10, on an enlarged scale particularly showing details of an edge clamp.

FIG. 12 is a cross-sectional detail view on a further enlarged scale showing a portion of an edge clamp.

FIG. 13 is a plan detail view taken on the line XIII-XIII, FIG. 11, showing further portions of an edge clamp.

Referring to the drawings in more detail:

With reference to FIGS. 1 and 2, a sheet stack B is shown lying on an inclined support table A where it is held tightly by its upper longitudinal edge with pivotable edge clamps C, the structure being adapted through means described below to feed the stack B to a stationary die assembly D which is aligned with a die backing plate E forming part of the support table A. The table A includes a portion mounted for horizontal motion on guide rails F and carrying the edge clamps C for movement in the plane of the die backing plate E perpendicularly to the direction of movement on the guide rails F. There is disposed within the die assembly D a holding element or press pad G, and opposite thereto in the die backing plate E an additional holding element H is arranged whereby the two elements cooperate in grasping the stamped out blank stack therebetween and moving same normally out of the surrounding sheet stack B into a position rearwardly beyond the die where a pliers shaped tool J may grasp the blank stack upon release of the elements H and G for withdrawal laterally.

With reference to FIGS. 3 to 6, the sheet stack B is tightly secured along one longitudinal edge by means of the pivotable edge clamps C in such a manner, described further below, that the individual sheets may slightly move or slide with respect to each other in response to forces created by penetration of the die wall in the die assembly D. After the die is withdrawn from the sheet stack B the displaced sheets may be brought back into overlying alignment through a suitable pressure means K which engage the longitudinal edge of the material B still held tight by means of the clamps C.

Referring particularly to FIGS. 7 to 10, the illustrated example of apparatus embodying this invention includes a bed 11 having an upright brace or arm 12 on which an hydraulic press cylinder assembly 13 is mounted inclined 45° and having therein a piston rod assembly 14. A rotatable die assembly 15, described below, is carried by the piston rod assembly 14 and supports a hollow, blank cutting die 16. A circular die backing plate 17 is mounted opposite the cylinder assembly 13 in an inclined plane perpendicular or normal to the cylinder assembly axis. The plate 17 lies in the same plane and forms part of a sheet stack support table 18.

A portion of the support table 18 is pivotally mounted on a carriage 19 whereby it is displaceable horizontally along the bed 11 as well as pivotable from a tilted or inclined position to the horizontal, as will be explained in more detail below. A clamping assembly 20 is slidable on the table 18 transversely to the direction of movement of the carriage 19 and includes edge clamps 21 adapted to grasp an edge of a sheet stack 22, thus making it possible to move each point of the stack 22 over the backing plate 17 and under the die 16.

A press pad or holding element 23 is mounted for axial movement within the piston rod assembly 14 and a holding element 24 is disposed in aligned relation to the element 23 in

the backing plate 17. The elements 23 and 24 are effective, in a manner described below, together with a pliers shaped tool 25 to remove the cut blank stack from the die 16 and convey same laterally of the die stroke axis after each cutting cycle.

Referring more particularly to the cylinder assembly 13, a base member 26 forming a part thereof is fixed on the bed arm 12 and receives a cylinder 27 therein. The conventional packings and known cooperating structure related to the cylinder assembly 13 are not shown. Within the cylinder 27 the piston rod assembly 14 is secured against rotation and comprises a piston rod 28 with a piston 29 located intermediate the ends thereof. A flange 30 is fixed on the lower end of the piston rod 28 and a mating flange 31 is rotatably mounted thereagainst by means of a pin 32 journaled within the piston rod 28 and secured longitudinally thereof. On the upper end of the piston rod 28 a thread is provided adjustably receiving a stop nut 33 which is adapted to engage a stop ring 34 secured on the cylinder 27 for limiting the downward stroke of the piston rod. The stop nut 33 is secured, in this example, in adjusted position by means of a lock screw 35, however, it is to be understood that for remote control purposes, the stop nut 35 may be unlocked, rotated and relocked by any suitable remote control means. The cylinder 27 is connected through suitable hose lines 36 and 37 to control valve and hydraulic pump means (not shown) in a conventional manner. The rotatable flange 31 has gear teeth 38 on the periphery thereof and engaged with a pinion 39 fixed to the shaft of an hydraulic motor 40 secured to the fixed flange 30. The hydraulic motor 40 is connected through suitable hose lines 41, 42 with control valve and hydraulic pump means (not shown) in a conventional manner.

The die assembly 15 is fixed to the underside of the rotatable flange 31 and comprises a box-shaped body having an upper part 43 secured to the flange 31 and a lower part 44 carrying a plate 45 fixed to the die 16. The plate 45 is removably received in the die assembly through insertion against edge retainers 46. The die assembly 15 includes a wall 47 provided with a lateral aperture 48 through which the pliers-shaped tool 25 is inserted and withdrawn for laterally removing the cut blank stack.

A cylinder 49 is disposed axially within the rotatable flange 31 and piston rod assembly 14 and receives therein a piston rod and piston 50 carrying the holding element or press pad 23 for longitudinal relative movement with respect to the surrounding piston rod 28. The cylinder 49 is connected to a source of compressed air below the piston 50 through a hose line 51, bore passageway 52 extending into the fixed flange 30, annular groove 53 in the movable flange 31 and bore passageway 54 in the flange 31. A hose line 55 associated with the end cap 56 carries hydraulic fluid to the upper side of the piston 50.

The die backing plate 17 comprises a circular disc 61 supporting an upwardly projecting ring 62 surrounding a plate 63 made of crosscut or end-grained wood or the like. The disc 61 together with the last-named ring and plate are rotatable on a bushing 64 positioned eccentrically to the axis of the piston rod assembly 14. Positive rotation of the plate 63 may be accomplished through peripheral gear teeth 65 engaged with suitable driving apparatus (not shown). The disc 61 is mounted on six elongated rods or screws 66 which are adjustable through a supporting plate 67 by means of sprocket wheels 68 engaged with roller chains 69. The supporting plate 67 is fixed on the machine bed 11 and, through movement of the roller chain 69 by suitable means (not shown), the plate 63 is adjustable in height. Referring particularly to FIG. 10, the fixed carrier plates 57, 58 and 59, forming part of the support table 18, lie in the plane of the upper surface of the plate 63.

A cylinder 70 is disposed in and below the supporting plate 67, concentrically with the piston rod assembly 14, and movably supports a piston rod and piston 71 therein for longitudinal movement. A contact member 72 forming part of the holding element 24, is rotatably mounted in the last-named piston rod at the end facing the holding element or press pad

23. The cylinder 70 is connected through a hose line 73 with a source of compressed air exposed to the upper side of the piston 71 and through a hose line 74, extending through the cylinder end cap 75, with a source of hydraulic fluid exposed to the lower side of the piston 74.

Because the diameter of the piston 71 is greater than the piston 50 of the press pad 23, with equal fluid pressures the force exerted by the piston 71 may overcome and slide back the press pad 23. The upper side of the piston 71 is constantly exposed to compressed air through the hose line 73 to provide a return stroke. It is noted that, in the case of relatively long and narrow blanks, compressed air may be suitably introduced between the lowermost blank and the plate 63 within the die 16 in order to help support and urge the rearward travel or discharge of the blank stack through the die along with the holding element 24.

The carriage 19 includes a plate 86 mounting four bolts or pins 76 rotatably carrying rollers 77 which are received and guided in rails 78 fixed to the machine bed 11. The piston rod 79, of an hydraulic cylinder 80 engaged with the machine bed 11, is secured to a bolt or pin 81 mounted on the plate 86 whereby the carriage 19 may be displaced as desired in a horizontal direction.

A portion of the sheet stack support table 18 is connected, by means of a hinge pin 82, with the carriage 19 and an hydraulic cylinder assembly 85 is disposed between an anchor pin 83 mounted on the plate 86 and a pin 84 mounted on the pivotal portion of the support table 18. The operation of the hydraulic cylinder assembly 85 causes the hinged portion of the support table 18 to shift between an operating position inclined 45° and a horizontal position for deposit of the sheet stack 22 thereon.

A plurality of apertures 60 are provided in the support table 18 through the pivotal portion as well as the stationary carrier plates 57, 58 and 59. Suitable means (not shown) are provided for introducing compressed air through the apertures 60 so as to form a thin blanket beneath a sheet stack 22 permitting it to slide on the support table surface with little resistance.

Referring particularly to FIGS. 10 and 11, the clamping assembly 20 includes a carriage 89 guided in a slot 88 in the tilting portion of the support table 18, the carriage 89 being maintained in sliding position by means of cover plates 90. A threaded spindle 91 is rotatably mounted below the carriage 89 and secured against longitudinal displacement. The spindle 91 engages a nut 92 fixed to the carriage 89 whereby the rotation of the spindle serves to displace the carriage 89 transversely to the direction of movement of the carriage 19 on the rails 78. The spindle 91 is driven by means of a suitable hydraulic motor 87 coupled therewith.

In this example, four of the edge clamps 21 are secured on the carriage 89 through anchor bolts extending within a key-slot 93. Referring to FIGS. 11, 12 and 13, the edge clamps 21 respectively consist of a base member 94 having a front wall 95 and two sidewalls 96 each having a somewhat rectangular opening 97 therethrough, FIG. 12. The front wall 98 of the opening 97 serves as a guide edge, as further noted below, and is part of an arc whose center point of curvature coincides with a point located at the lower clamped edge of a sheet stack 22, FIG. 11. A compressed air cylinder 99 is secured to the front wall 95 and has a piston 100 slidably received therein with piston rods 101 and 102 extending in opposite directions therefrom through the end walls of the cylinder 99. A source of compressed air is connected to the cylinder 99 through suitable hose lines 103 and 104. A slotted piece 105 is connected to the end of the piston rod 102 and has guide edges 106 and 107 so formed that a bolt or pin 108 is held in the position shown in FIG. 11 when air under pressure is introduced through the hose line 104.

Referring to FIG. 13, a lower clamping jaw 109 is secured between two double arm levers 110 and an upper clamping jaw 111 is secured between two double arm levers 112, the levers 110 and 112 being rotatably journaled on the pin 108 and held laterally by means of spherical washers 113 and

retainer rings 114. The jaws 109 and 111 correspond to the edge clamps C dismissed above in connection with FIGS. 3—6. A compressed air cylinder 115 is pivotally connected between the free arm ends of the levers 112 at 116 and has a piston rod 117 slidably projecting through an end of the cylinder and engaging a piston 118 contained therein. The free end of the piston rod 117 is pivotally connected by means of a pin 119 to the free arm ends of the levers 110. Compressed air flowing into the cylinder 115 through an upper hose line 121 causes the clamping jaw 109 and 111 to move closer to one another, while air inserted under pressure into a lower hose line 122 causes the clamping jaws to move away from one another.

At the right-hand end of the piston rod 101, as seen in FIG. 11, there is disposed a stop member 123, corresponding to the pressure means K discussed above with respect to FIGS. 3—6, for engagement with the clamped edge of the sheet stack 22.

In operating the edge clamps 21, three conditions are utilized as follows: (a) the edge of the stack sheet is clamped between the jaws 109 and 111 by the introduction of fluid under pressure through the hose line 122 while fluid pressure is maintained in the hose line 104 whereby the stop member 123 provides a guide for lining up the sheet stack edge during clamping; (b) when the pressure is relieved from the air cylinder 99, the pin 108 is free to slide downwardly along the front wall 98 of the opening 97 whereby the slotted piece 105 together with the piston rods 101 and 102 move to the left thus shifting the stop member 123 to the left and away from the stack edge. During this occurrence the clamping structure is designed to tilt downwardly about a point 120 at the lower edge of the clamped stack edge. Further, the clamp is free to shift rearwardly until the pin 108 abuts the rear edge or wall of the opening 97. The introduction of air under pressure through the hose line 104 will automatically readjust the proper positions of the clamping jaws and stop member with respect to the table 18 at the beginning of each cut, thus repositioning the stack and realigning the clamped edge, FIG. 6; (c) when it is desired to cut close to one of the edge clamps 21, that particular clamp may be selectively released through operation of the air cylinder 115 and withdrawn rearwardly through the introduction of compressed air through the hose line 103, whereby the stop member 123 and clamping jaws are shifted to the left as viewed in FIG. 11. The remaining edge clamps continue to hold during die cutting adjacent the withdrawn clamp. For regripping the stack edge with the withdrawn clamp, suitable grooves (not shown) may be placed in the table surface or the clamping jaws suitably shaped for replacing beyond the stack edge.

Referring particularly to FIGS. 9 and 10, the pliers-shaped tool 25 is shown in position for laterally removing the stacks of blanks lifted from the plane of the stack 22 and held between the press pad 23 and the holding element 24. The pliers-shaped tool 25 comprises tongs in the form of a fixed jaw 124 and a movable jaw 125 mounted on a rod 126 which is axially slidable in a bearing member 127. The jaws 124 and 125 are thereby movably disposed between an upper position for the reception of the blank stack therebetween and a lower position spaced laterally of the die assembly 15. The operating cycle of the tool 25 may be started when the press pad 23 achieves its rest position as shown in FIG. 9, this condition being sensed, for example, by a limit switch (not shown). In handling very thin or soft blanks, it may be desirable to include a sheet of relatively stiff cardboard on the upper and lower surfaces of the sheet stack.

For the automatic control of the above-described apparatus, suitable solenoid valves (not shown) are disposed in all of the hydraulic and compressed air hose lines to be actuated by suitable control equipment (not shown), in conjunction with limit switches and the like (not shown), such control equipment preferably taking the form of a digital computer adapted to receive a perforated card program.

The pressure applied to the piston 29 for the die cutting stroke is suitably adapted to be quickly variable from normal

cutting pressure, for example 200 atmospheres, to a relatively low pressure, for example about 6 atmospheres. With this arrangement, the die may be bottomed onto the surface of the uncovered die backing plate 17 for proper adjustment of the stroke, without damage to the die or plate, substantially facilitating the adjustment. The reversion to low pressure may be advantageously accomplished also during other periods of nonproduction, for example during program change, apparatus malfunction or any other intentional or unintentional interruption of production.

In operation, the sheet stack 22 is placed upon the pivoting portion of the table 18 while it is tilted into a horizontal plane with the clamp carriage 89 withdrawn toward the hydraulic motor 87. The sheet stack is aligned and clamped with the edge clamps 21 in the manner noted above at (a). The initial alignment and clamping, as well as subsequent operations, are facilitated by the introduction of air through the apertures 60, reducing friction between waste sheet stack and the support table. The pivoting portion of the sheet stack support table is then tilted into the plane of the stationary portion including the carrier plates 57, 58 and 59 and the hydraulic motor 87 and carriage cylinder 80 are operated to successively position the sheet stack beneath the withdrawn die 16 in accordance with a previously designed program to obtain the maximum number of blanks from the sheet stack. Between each stroke of the die, the die assembly 15 may be rotated by the hydraulic motor 40 to properly position the die angularly for minimum waste and, as noted above at (c), the respective edge clamps 21 may be individually withdrawn to permit die cutting adjacent the clamped stack edge. During penetration of the die the clamping assembly 20 may be released as noted above at (b) permitting displacement of the clamped edge as shown in FIG. 4, thereby reducing lateral forces within the stack which may otherwise cause poor quality blanks or damage the die. During penetration of the die, the press pad 23 is urged against the stack and upon completion of the cutting stroke the holding element 24 is urged axially toward the press pad 23 with greater force, thus urging the blank stack rearwardly out of the die and into the hollow interior of the die assembly 15 where the tool 25 enters and withdraws the blank stack through the lateral aperture 48 upon release of the holding element 24.

Although certain specific methods and structures embodying this invention have been illustrated and described, it is not to be limited thereto except insofar as such limitations are included in the following claims:

I claim:

1. The method of die cutting blanks from a stack of sheets and the like comprising the steps of:

- a. clamping said stack along an edge;
- b. partially suspending said stack by said edge in an inclined plane on an inclined support; and
- c. pressing a die through said stack in a direction normal to said inclined plane.

2. The method as set forth in claim 1 including the step of: conveying said partially suspended stack along two coordinates in said plane for positioning said stack with respect to said die.

3. The method as set forth in claim 1 including the step of: rotating said die about an axis normal to said inclined plane prior to pressing through said stack.

4. The method as set forth in claim 1 including the step of: releasing said clamped edge for tilting in response to the penetration of said die into said stack.

5. The method as set forth in claim 1 wherein:

- a. said edge is clamped at spaced-apart locations therealong; and including the step of
- b. selectively releasing said clamped edge at a location adjacent die penetration into said stack.

6. The method of die cutting blanks from a stack of sheets and the like as set forth in claim 1 wherein said die is hollow and receivable against a die backing plate and including the steps of:

- a. axially grasping the cut blank stack within the die;

b. moving the axially grasped blank stack rearwardly through the die;

c. laterally grasping the blank stack in a location rearwardly of the die;

d. releasing the axial grasp on said blank stack; and

e. laterally removing the blank stack from behind said die.

7. Apparatus including a plunging die assembly for die cutting blanks from a stack of sheets and the like comprising in combination:

a. a supporting bed, and a sheet stack supporting table mounted on said bed;

b. said table being divided into an inclined stationary portion including a die backing plate, and an inclined movable portion, said movable portion including sheet stack edge clamping means; and

c. said movable portion being adapted for movement along said stationary portion to position a clamped inclined sheet stack over said die backing plate.

8. The apparatus as set forth in claim 7 wherein: said movable portion is adapted for tilting from a horizontal position for receiving the sheet stack to the inclined attitude.

9. The apparatus as set forth in claim 7 wherein: said movable portion stack edge clamping means is adapted for movement in a direction transverse to the direction of movement of said movable portion along said stationary portion.

10. The apparatus as set forth in claim 7 wherein: said die plunging assembly is adapted to rotate a cutting die in a plane parallel to the inclined plane of said stationary portion.

11. The apparatus as set forth in claim 7 wherein: said stationary and movable portions are in the same plane inclined approximately 45° with respect to the horizontal.

12. The apparatus as set forth in claim 7 including: mounting structure between said die backing plate and said stationary portion adapted to permit rotation of said plate about an axis parallel to the die stroke.

13. The apparatus as set forth in claim 12 wherein: said mounting structure includes means for adjusting the height of said die backing plate with respect to the stationary portion of said support table.

14. The apparatus as set forth in claim 7 wherein: air discharge apertures are located in said sheet stack supporting table for floating the sheet stack on a thin cushion of air.

15. Apparatus as set forth in claim 7 wherein said die assembly includes a hollow die movable against said die backing plate comprising:

a. a first holding element adapted for axial relative movement within said die from a rest position behind said die; and

b. a second holding element associated with said die backing plate and axially movably aligned with said first holding element, said second holding element being adapted to cooperate with said first holding element for grasping a cut blank stack therebetween within said die and urging said blank stack from within said die to a position rearwardly of said die.

16. The apparatus as set forth in claim 15 including: lateral grasping means associated with said apparatus and adapted to grasp said blank stack at said position rearwardly of said die and remove said blank stack laterally thereof upon release of said blank stack by said holding elements.

17. The apparatus as set forth in claim 7 wherein said edge clamping means includes:

a. a base member;

b. an edge clamp including a pair of lever arms each having a clamping jaw at one end thereof;

c. a transverse pin pivotally connecting said arms at positions spaced from said jaws for pivotal movement of said jaws toward and away from each other, force producing means engaging said lever arms for selectively producing said pivotal movement;

d. said base member having a receiving and retaining portion therein for said pin, said receiving and retaining portion being of substantially greater size than said pin permitting said clamping jaws to shift and rock in the plane

- of pivoting of said lever arms but independently of said lever arm pivoting; and
- e. a draw member movable with respect to said base member and engaging said pin, said draw member being adapted to selectively draw said pin into tight engagement with said receiving and retaining portion whereby said clamping jaws are placed into a predetermined position for initial clamping of said sheet stack edge.
18. The apparatus as set forth in claim 17 including: a stack

guide plate associated with said draw member and adapted to assume a predetermined position with respect to said clamping jaws upon drawing said pin into said tight engagement.

19. The apparatus as set forth in claim 17 wherein: said base member receiving and retaining portion includes a pin guide edge having a radius of curvature located approximately at one of said jaws.

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