April 6, 1937. N. H. NELSON 2,076,436

MACHINE AND METHOD FOR THE MARGINAL NOTCHING OF PAPER SHEETS

Filed June 24, 1935

Fig. 1

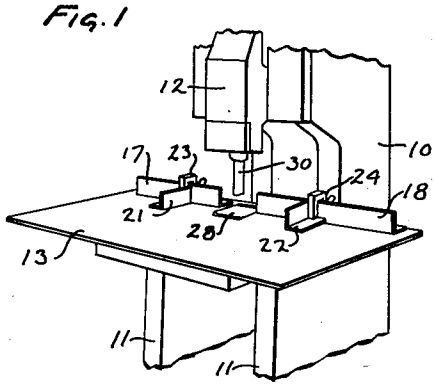


Fig. 4

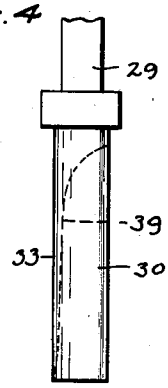


Fig. 5

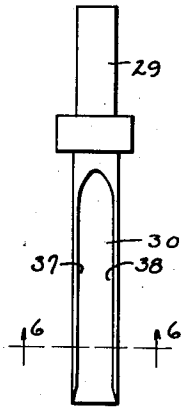


Fig. 2

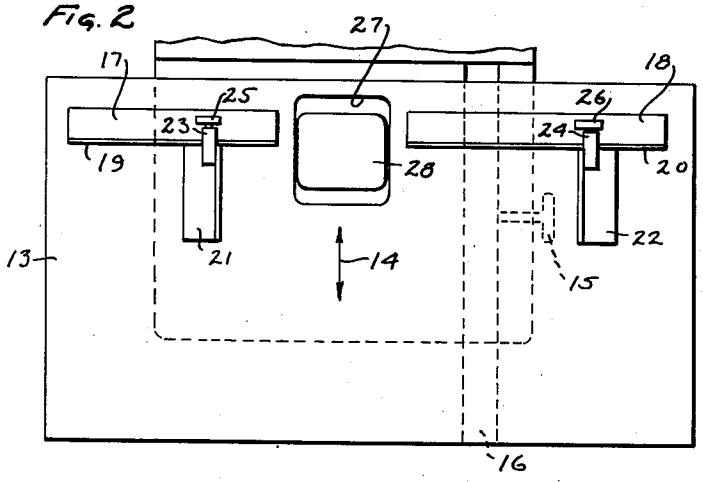


Fig. 6

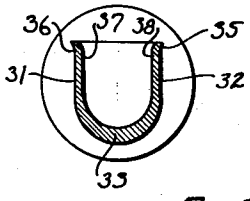


Fig. 3

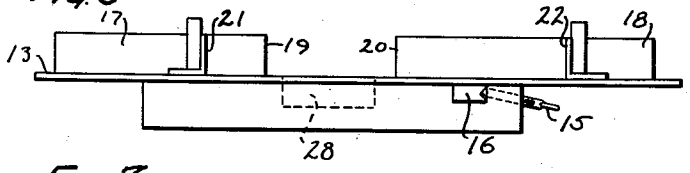


Fig. 8

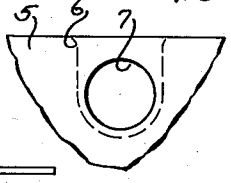
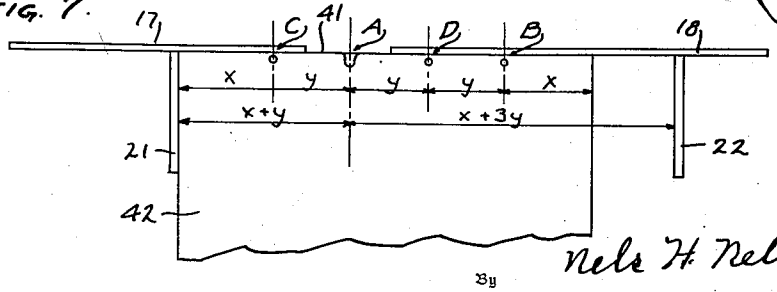


Fig. 7.



Inventor

Nels H. Nelson

By

Marechal & Noe

Attorney

Patented Apr. 6, 1937

2,076,436

UNITED STATES PATENT OFFICE

2,076,436

MACHINE AND METHOD FOR THE MARGINAL NOTCHING OF PAPER SHEETS

Nels H. Nelson, Dayton, Ohio

Application June 24, 1935, Serial No. 28,039

9 Claims. (Cl. 164—17)

This invention relates generally to the formation of apertured sheets; and more particularly to a process of forming marginal apertures in the binding edge of sheets of paper and like material; and of apparatus for effectively carrying out such process.

Marginal apertures such, for example, as are utilized in conjunction with binding posts to removably assemble blank sheets or printed forms in loose leaf binders, are commonly formed with dies. The interfitting parts of the die function primarily to shear, rather than to cut, and the displaced portion of each sheet, as defined by the contour of the die, must be forced through the aperture in each successive sheet, and finally through the female section of the die itself before being ejected. Otherwise stated, the die is incapable of being "relieved" as its part approach their interfitting relationship thereby necessitating the use of relatively greater pressure than would otherwise suffice and correspondingly limiting the number of sheets which can be apertured in a single operation.

A further inherent limitation of dies, when so employed, resides in the fact that the apertures in sheets adjacent the female section of the die are imperfectly made because the pressure of the male component must be exercised through the entire pile of intermediate sheets rather than directly upon each and every sheet. Thus the range of usefulness of the die is limited to operations on not more than a few sheets regardless of the amount of power available.

It is accordingly one object of my invention to provide a method of forming apertures in sheets of paper and like material which method is productive of apertures of uniform excellence throughout relatively great depths of piles of paper sheets and may be carried out with an attendant use of less power than has heretofore been required. A more specific object of the invention resides in the provision of a method of forming apertures in paper, and like material, which comprises the steps of first drilling or otherwise forming the material to partially remove a portion of the stock within the bounds defined by the aperture desired, and then cutting around the hole thus formed to provide an aperture of desired contour and size, the space rendered available by formation of the first mentioned hole serving to relieve the cutting tool in the final operation.

Yet another object of the invention resides in the provision of a method of cutting marginal apertures in a stack of paper sheets which comprises the steps of cutting a hole through the stack inwardly of the margin to relieve the cutting tool in the final operation, and then enlarging the first made hole and removing the paper between the hole and the margin by a continuous shearing cut down through the stack.

Yet another object is to provide a method utilizing relatively fixed or adjustable aperture forming means in conjunction with a plurality of adjustable guides whereby a greater number of spaced apertures may be formed with a single setting of the aperture forming means and/or guides.

Other objects and advantages of the invention will be apparent from the following description, the appended claims and the acocmpanying drawing, in which is disclosed a preferred form of apparatus, embodying, and for practicing the invention, and in which like characters of reference designate like parts throughout;

Fig. 1 is a fragmentary perspective view of a press adapted for use in conjunction with the improved aperture cutting tool for practicing the present invention;

Fig. 2 is a partial plan view of the structure shown in Fig. 1;

Fig. 3 is a front elevation of the parts illustrated in Fig. 2;

Fig. 4 is an enlarged side elevation of the form of aperture cutting tool shown in Fig. 1;

Fig. 5 is a rear elevational view of such tool;

Fig. 6 is a view taken in the plane of line 6—6 of Fig. 5;

Fig. 7 is a diagrammatic showing of aperture formation; and

Fig. 8 is a somewhat diagrammatic view which illustrates how a sheet is apertured.

In the practicing of this invention use may be made of a suitable form of machine,—that shown generally in Fig. 1 being adapted to the purpose. The machine includes side frames 11 which operatively support a tool head or plunger 12, arranged for reciprocatory movement toward and away from a work-table 13. It will be understood that the tool head 12 may be reciprocated either manually or by power means under control of suitable levers or pedals.

The work-table 13 is slidably mounted on the frame members 11 for manual adjustment in a plane substantially perpendicular to the reciprocatory axis of the tool head 12. The direction of movement of the table is indicated by the arrows 14 in Fig. 2. The table may be fixed against movement in any desired position of adjustment by means such as a thumb screw 15 (Fig. 3)

which threadably engages a stationary part of the press and is arranged to bear against an integral part of the table, as for example the underlying bar 16.

A pair of spaced, aligned binding edge stops 17 and 18, (Figs. 2 and 3) are rigidly secured to the surface of table 13 on a line extending normally to the path of adjustment thereof. In the present embodiment of the invention the stops 17 and 18 include upstanding legs 19 and 20 which define stop surfaces against which the binding edge of a work-piece is abutted preparatory to an aperture cutting operation. A left-hand lateral guide 21 (Fig. 2) is adjustably secured to the stop 17 and a right-hand guide 22, similar in all respects to the guide 21 is fitted to the stop 18. In the present instance each of the lateral guides 21 and 22 comprise normally disposed legs, one of which is adapted to rest upon the surface of the work-table, the second leg extending perpendicularly to both the plane of the table and the respective stop to which it is attached. Similar C clamps 23 and 24 are arranged to maintain the guides and stops in assembled relationship as shown in Fig. 2, and conventional hand screws 25 and 26 with which one leg of each clamp is fitted, serve to lock the parts in any desired positions of adjustment.

The table is recessed at 27 to receive an inset 28 of relatively soft material such as wood, so as to prevent damage to the cutting edge of an aperture forming tool.

Referring now to Figs. 4, 5 and 6 wherein I have illustrated a cutting tool adapted to cut substantially U shaped apertures, or notches in a pile of paper sheets; the tool cutting edge corresponding in contour to the line 6 of Fig. 8. As shown, the tool comprises a shank 29, which is of non-symmetrical cross-section to insure correct mounting of the tool in the head 12, and an integrally formed elongated body section 30. As shown particularly in Figs. 5 and 6, the body of the tool comprises spaced, parallel side walls 31 and 32, corresponding edges of which merge into an arcuate portion 33 to complete an external surface of U shaped contour. The opposed edges of the side walls define the open face of the U and are preferably flared outwardly at 35 and 36 to eliminate sharp corners from an aperture formed by the tool. The walls 31 and 32 are relatively thin and their parallel internal surfaces 37 and 38, merge into the internal surface of the arcuate portion 33 to define a relieving face 39 inclined outwardly toward the open face of the tool.

Considering now the method employed in forming a marginal aperture in a stack of sheets of paper. Let it be assumed that the configuration desired is that indicated by the broken line 6 in Fig. 8. A part of the stock within the outline 6 of the aperture to be formed is first removed from a thick stack of sheets. While a suitable punching operation may be satisfactory, in this specific instance the hole is made by drilling, a drill of such diameter being used as to form the hole 7. From an examinatioin of Fig. 8 it will be evident that the drill will function to remove a sufficient proportion of the stock within the confines of the outline 6 to insure relief of the tool utilized in the final aperture forming operation.

The hole 7, having been drilled or punched, the machine head is fitted with a cutting tool of a contour corresponding with that of the aperture desired. In the illustrative embodiment of the invention such a tool is shown in Figs. 4, 5 and 6, but it will be understood that tools of a wide variety of forms may be employed. In the use of marginal aperture cutting tools, such as that of Figs. 4 to 6, the binding edge stops 17 and 18 are set so that the binding edge of the paper, as shown at 41 in Fig. 7, will be intersected at two points by the cutting edge of the tool, thus completely severing the area defined by its contour.

Now as the aperture forming tool is forced down through the stack of sheets of paper the severed areas of successive sheets are crowded outwardly by the internal relieving face of the tool and the space formed by the prior drilling operation serves the two-fold function of weakening the severed areas sufficiently to overcome any tendency to stick or bind the tool, and provides a space to freely receive the severed stock which fails to eject properly.

Thus the aperture cutting operation may be accomplished with a minimum expenditure of power and the apertures formed in successive sheets throughout a relatively deep stack of paper will be uniformly excellent. Inasmuch as the entire peripheries of the clean-cut apertures are formed in a thick stack of paper sheets in one operating stroke of the cutting tool, the production of apertured sheets is greatly expedited. The hole that is preferably made through the sheets within the contour of the aperture to be formed, and inside of the marginal edge of the sheet provides for the relieving of the pressure which would otherwise be created on the sides of the tool and that would tend to resist the passage of the tool through the stack of sheets. This initial hole is made in a comparatively simple and quick operation inasmuch as a thick stack of sheets can be simultaneously drilled at a comparatively rapid rate. And in the shearing operation that takes place on the stack of paper, the successively severed areas as soon as they are cut, move into the relief space and do not impede the progress of the cutter so that operation can be successfully performed on a stack of paper sheets that may be a couple inches in thickness. In spite of the thickness of the stack of sheets operated upon, a comparatively smooth edge is obtained, quite in contrast with the edge that would be produced by a solid die forcing its way by sheer pressure through a stack of sheets and mashing out the notches of the lower sheets of paper by the pressure created on the sheet above. In the shearing operation of the present invention, the cutting edge of the tool contacts with one sheet after another until it has cut its way entirely through the thick stack.

In operations involving the formation of a plurality of apertures, the lateral guides 21 and 22 are fixed in positions where they may be mutually employed, in conjunction with a novel method of handling the stock to be worked upon, so as to permit of the cutting of said apertures with a single adjustment of the tool and guides.

Let it be supposed that four apertures are desired in the binding edge and that they are to be spaced a distance "y" from each other and a distance "x" from the respective lateral edges of the sheet. Such an arrangement of apertures is indicated in Fig. 7. The left hand guide 21 will be clamped to the binding edge stop 17 at a position corresponding to the distance (x plus y) from the vertical axis of the tool thereby serving to laterally position the paper to form the aperture "A".

The right hand lateral guide 22 is now secured

to the binding edge stop 18 at a position corresponding to the distance (x plus $3y$) from the axis of the tool, thus affording a means of locating the paper stack, when moved to the right, to form aperture "C".

Now it will be obvious that if the paper stack is turned over so as to reverse its upper and lower surfaces, and enable what was originally its left hand lateral edge to coact with the right hand guide 22, the aperature "B" can be formed. By merely shifting the stack of sheets to the left into engagement with the left hand guide 21 the aperture "D" can be made.

Thus with the use of a single tool, and a plurality of guides, it is possible to differentially position a thick pile or stack of sheets to be apertured, so as to form a plurality of spaced apertures without attendant resetting of the tool or guides. It will be understood to be within the scope of the present invention to employ a plurality of tools with either one or two lateral guides in the accomplishment of the above described result.

While the method herein described, and the form of apparatus for carrying this method into effect, constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to this precise method and form of apparatus, and that changes may be made in either without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. The method of cutting a marginal aperture in a thick stack of paper sheets which comprises drilling through the stack inwardly of the margin and then enlarging the hole and removing the paper between the hole and the margin by a continuous shearing cut down through the stack.

2. The method of cutting a marginal aperture in a thick stack of paper sheets which comprises drilling through the stack inwardly of the margin and within the confines of the aperture that is to be formed and then cutting around the drilled hole by shearing down through the stack to form the aperture.

3. The method of cutting substantially U-shaped marginal apertures in paper sheets which comprises positioning a thick stack of paper sheets with respect to an open sided U-shaped knife edged tool so that the open side of the tool extends to the marginal edge of the paper, and then cutting the entire periphery of the marginal apertures all at the same time by pressing the tool through the stack to successively cut apertures in the successive sheets.

4. The process of cutting spaced apertures in the binding edge of a work piece which comprises the steps of orienting the binding edge, and a second normally disposed edge of the work piece with respect to a pair of guides defining perpendicular axes, cutting an aperture in said binding edge at a fixed point with respect to said axes, then orienting the binding edge, and a third edge normally disposed thereto, with a different pair of guides defining perpendicular axes, one of which axes is common to the axis of one of said first mentioned pair of guides, cutting an aperture in said binding edge at the before-mentioned fixed point, and then inverting the work piece to reverse the relative positions of its said second and third edges and finally orienting the inverted work piece with respect to each of said pairs of axes and cutting an aperture in its binding edge at the before-mentioned fixed point as an incident to each such orientation.

5. The process of cutting marginal apertures in spaced relationship along a binding edge of a quadrilateral sheet of a paper which comprises the steps of successively moving the paper to selectively align a second, and then a third relatively opposite edge, with respective ones of a pair of guides spaced further apart than are the said opposite edges and cutting an aperture in said binding edge at a fixed point intermediate said guides as an incident to each such alignment, and finally inverting the paper and aligning its third and second edges with the respective ones of said guides, and cutting apertures in said binding edge as an incident to each such alignment.

6. In a device of the character described, the combination of a work table, an aperture cutting tool movable toward and away from said table in a fixed path extending substantially normal thereto, stop means on said table to locate an edge of a work piece to be apertured, in the path of movement of said tool, and a plurality of guides adjustably supported on said table and arranged to individually and jointly define different positions of the work piece in accordance with a plurality of predetermined points at which apertures are to be formed in said edge.

7. The method of cutting marginal apertures in a stack of paper sheets, which comprises the steps of successively pressing an aperture cutting tool through the stack at positions determined by fixed guides spaced apart a distance greater than the width of the stack, and then inverting the stack and pressing the tool therethrough at corresponding positions on its inverted face.

8. The method of cutting apertures in the margin of sheets of paper and the like comprising making a hole through a thick stack of the sheets inwardly of the edge and within the confines of the aperture that is to be formed, and then shearing down through the stack to form the entire marginal aperture, the space rendered available by the making of the hole serving to relieve the shearing tool which forms the entire aperture.

9. The method of cutting an aperture of substantially U-shape in the marginal edge of a thick stack of paper sheets which comprises drilling through the stack inwardly of the margin and entirely within the confines of the aperture that is to be formed and then enlarging the hole and removing the paper between the hole and the margin by a continuous shearing cut down through the stack so as to cut the entire U-shape aperture all at the same time, the space rendered available by drilling the hole serving to relieve the shearing tool.

NELS H. NELSON.