[54]	APPARATUS FOR DRILLING HOLES THROUGH A STACK OF SHEET PAPER		
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[62]	Division of Ser. No. 717,738, April 1, 1968, Pat. No. 3,525,126.		
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	408/53		
[51]	Int. ClB23b 39/16		
[58]	Field of Search408/46, 50, 52, 53, 42		

[56]	R	eferences Cited
	UNITEI	STATES PATENTS
2,850,927	9/1958	Grinnell408

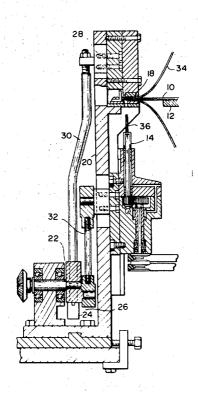
2,850,927	9/1958	Grinnell408/70
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Primary Examiner—Gil Weidenfeld Attorney-Morse, Altman & Oates

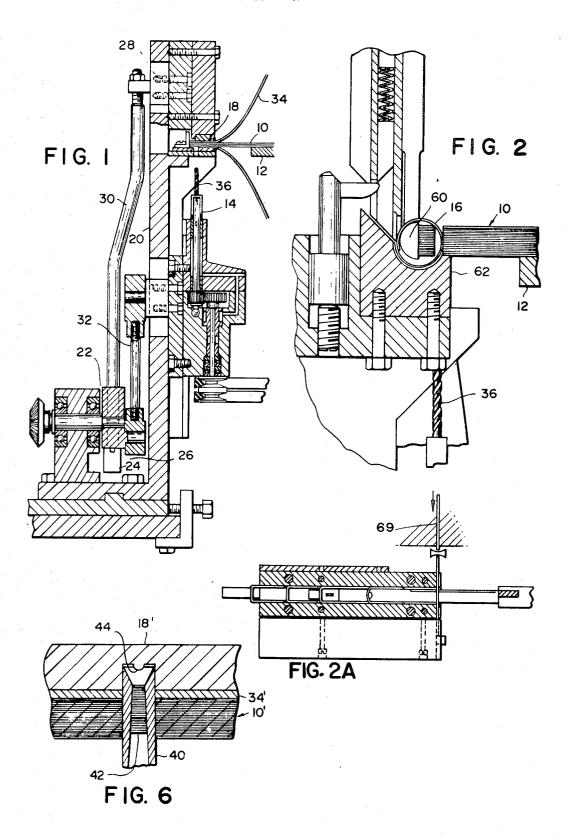
ABSTRACT [57]

Stacks of sheets to be bound are fed into a drilling apparatus which forms a series of smooth openings into which binding elements are subsequently inserted. The stack of sheets is temporarily covered at the drilling station with a protective layer of drill lubricating material held in place by a wooden drill block which prevents development of burrs at the drill openings. The formation of the holes in the stack may be by means of a special design spiral drill or by means of a special design hollow drill.

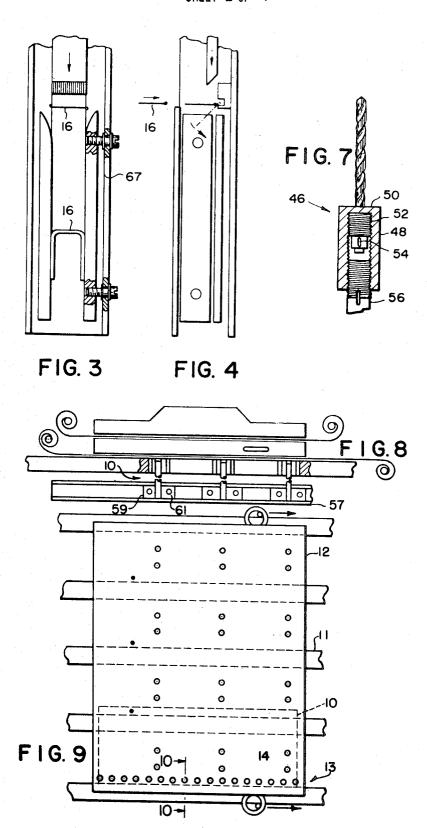
4 Claims, 15 Drawing Figures



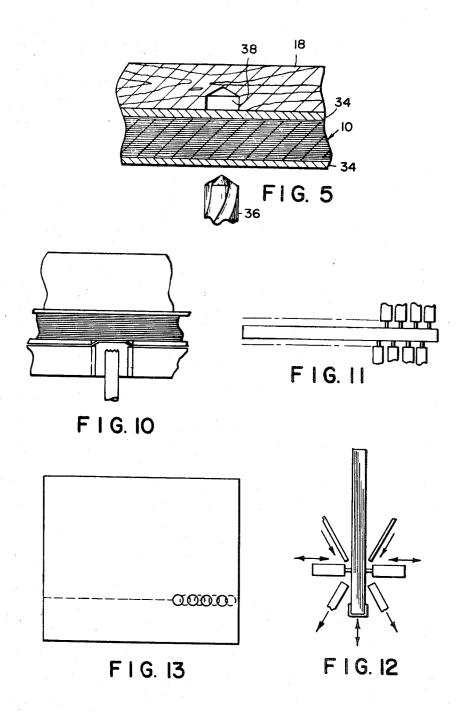
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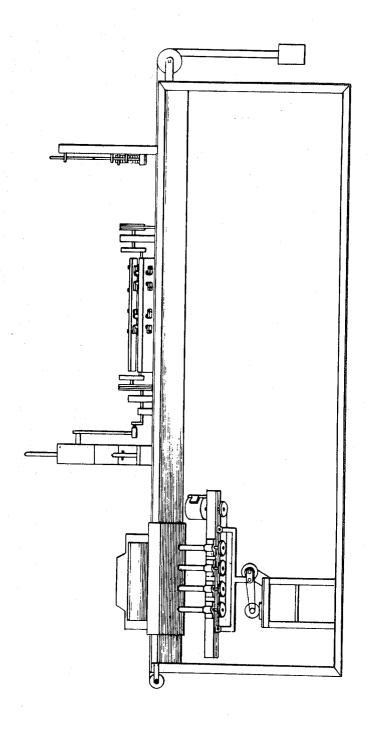
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SHEET 4 OF 4



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APPARATUS FOR DRILLING HOLES THROUGH A STACK OF SHEET PAPER

CROSS REFERENCE TO RELATED APPLICATION

This is a division of application Ser. No. 717,738 5 filed Apr. 1, 1968 now U.S. Pat. No. 3,525,126.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to sheet binding and 10 more particularly is directed towards new and improved, apparatus for drilling stacks of sheets.

2. Description of the Prior Art.

In U.S. Pats. Nos. 2,377,340, 2,850,927 and 3,073,355 there are disclosed various portions of a sheet binding apparatus adapted to form binding elements from wire, drilling a pile of sheets to be bound, and inserting the binders through the drilled holes in the sheets. The apparatus disclosed in these patents at 20 the time represented a substantial advance in the art of sheet binding insofar as it is capable of high productivity as well as producing a bound volume of improved quality. The present invention has for one of its objects providing improvements in the sheet binding apparatus 25 disclosed in the foregoing patents and specifically for providing sheet drilling mechanisms capable of producing bound volumes such as notebooks, check books, paper back books, calendars, loose-leaves or the like at bound volumes of superior characteristics and of uniform quality.

SUMMARY OF THE INVENTION

This invention features an improved mechanism for 35 drilling a stack of sheets such as pad of paper or other material such as perforated paperboard shoe components, for example including a reciprocating drill head adapted to accommodate either a special design spiral drill or a special design hollow drill with the stack 40 of sheets being carried into position along with top and bottom protective layers of burr preventing and drill lubricating material backed by a wooden or aluminum drill guide block. The drills operate at high speeds and the particular type of drill and speed being selected ac- 45 cording to the type of material being drilled for optimum results.

BRIEF DESCRIPTION OF THE DRAWINGS

drilling apparatus made according to the invention,

FIG. 2 is a view somewhat similar to FIG. 1 on an enlarged scale, also including a showing of a binding insertion stage,

FIG. $2\tilde{A}$ is a sectional view of a wire cutting and 55 forming apparatus,

FIG. 3 is a detail front elevation partly in section of the element feed channel of FIG. 2,

FIG. 4 is a sectional side elevation thereof.

FIG. 5 is a cross-sectional view in side elevation showing a drill block for use with a spiral drill,

FIG. 6 is a view similar to FIG. 5 but showing a drill block for use with a hollow drill,

FIG. 7 is a cross-sectional view in side elevation 65 showing a drill head assembly for accommodating either spiral or hollow drills,

FIG. 8 is a side elevation of the pad supporting pan,

FIG. 9 is a top plan view thereof,

FIG. 10 is an enlarged detail cross-sectional view taken along the line 10-10 of FIG. 9,

FIG. 11 is a top plan view of a drilling arrangement,

FIG. 12 is an end elevation thereof,

FIG. 13 is a side elevation thereof, and

FIG. 14 is a front elevation of a drilling and binding apparatus made according to the invention.

DESCRIPTION OF THE PREFERRED **EMBODIMENT**

Referring now to FIGS. 1 through 6 and 8 through 10 there is illustrated an apparatus for drilling a stack of sheets, tablet or pad 10 prior to the insertion of binding elements. The pad drilling and binding element insertion mechanism generally comprises a horizontally movable carriage 12 on which the tablet 10 to be fastened together is carried along. A treadle-controlled step-by-step feed for this carriage is provided to shift the tablet edgewise along guide rails 11 after each drilling and fastening insertion operation to bring the tablet in position for another drilling and fastening insertion operation. A treadle-controlled mechanism is also provided for returning the tablet carriage 12 to a start position after all of the fasteners have been inserted. The mechanism for carrying out this operation is more fully disclosed in U.S. Pat. No. 2,377,340.

A bank 13 of rotary drills, one of which is indicated a much higher rate of productivity and producing 30 by reference character 14, is provided on either or both sides of the carriage 12 for simultaneously drilling a row of holes in the tablet adjacent the marginal edge thereof as suggested in FIG. 9. In some instances both sides of the tablet may be drilled simultaneously where the stack subsequently is to be cut. The drilled holes are properly spaced to receive the legs of a fastening element such as indicated by reference character 16 in FIG. 2. As disclosed in U.S. Pat. No. 2,377,340, the drill head 14 is adapted to reciprocate vertically into and out of engagement with the tablet 10. Likewise, a wooden block 18 is also adapted to reciprocate into and out of engagement with the upper surface of the stack opposite the drill. The wooden block is vertically movable in a standard 20 and caused to move up and down by means of a cam formed on the edge of a crank disc 22 which engages a follower 24 on a lever 26 pivotally mounted and connected with a vertically movable slide 28 by means of a connecting rod 30.

The drill head assembly 14 is caused to reciprocate FIG. 1 is a sectional view in side elevation of a sheet 50 to and away from the pad by means of a connecting rod 32 secured to the crank shaft at one end and pivotally secured to the vertically slidable drill head 14. As more fully disclosed in the above patent, each time the mechanism is cycled, the drill head is caused to be moved up and down in proper timed relation and, in addition, the carriage 12 is advanced along with the pad 10 and tape 34 fed from a supply roll 33 and wound up on a take up roll 35 (FIG. 8). The drill assembly is operated by means of a pulley system which through gearing rotates a drill 36.

As shown in FIG. 5, the wooden block 18 is preformed with a recess 38 which conforms to the tip of the drill 36 and serves to center and stabilize the drill after it passes through the pad 10. The block also serves, in cooperation with the tape 34, to prevent formation of burrs on the pad about the drill hole. In practice, the block 18 is of a hard wood, such as maple, and

the tape 34 may be formed from jute, aluminum foil or waxed paperboard. For spiral drills the aluminum or jute is preferred whereas using a hollow drill 40 as suggested in FIG. 4, the waxed paper is preferred. As shown in FIG. 6 the drill 40 is a tubular device having 5 interior tapered walls which are sharply tapered inwardly near the tip and gradually tapered outward along the shank. The upper peripheral edge of the tip is sharpened and the drill works at high speed. When it passes through the pad 10 into the block 18' a plug 42 $^{\,10}$ is formed from the core of paper cut from the pad. The shape of the drill in cooperation with a boss 44 formed at the top of the block recess serves to force the plug downwardly where it is ejected from the bottom of the open-ended drill. Using waxed paperboard for the tape as indicated in 34' the drill tip will be continuously lubricated during each cycle. In addition, the wax helps to keep the drill clean and aids in the movement of the plug through the drill. With the hollow drill, only one 20 loops of its parallel legs. In FIGS. 3 and 4 there is illuslayer of waxed paperboard is needed on the top of the pad while for the spiral drill, tape should be on both sides of the pad to produce clean holes properly drilled.

The drills are mounted to the drill head assembly by means of an adapter 46, best shown in FIG. 7. The 25 legs of the staple 16. Adjusting screws 67 permit adjustadapter permits mounting of either a spiral drill or a hollow drill, the exchange being made in a quick and easy manner. Generally the adapter is organized about an elongated sleeve nut 48 formed with an end collar 50 which bears against an internal shoulder formed on 30 the drill shank and the upper end of a drill spindle chuck 52. The chuck 52 is externally threaded to the internal threads of the nut 48 and is also provided with a set screw 54 for locking the drill 36 in position. The nut 48 will be seen to be threaded onto the top end of a drive shaft 56. The arrangement is such that the adapter can accommodate either a spiral or a hollow drill, as desired. In practice, the drill is arranged in banks so that a number of holes may be drilled simultaneously. The drills are mounted for variable spacing so that holes may be drilled through the pad according to any desired spacing. In practice, the variable spacing mounting may take the form of a horizontal channel member 57 (FIG. 8) in which are mounted slidable 45 blocks 59 each carrying one or more drill heads clamped in position. The blocks are slidably mounted along the channel member and locked by any suitable means such as bolts 61 or the like. Depending on the type of work to be done the drills and paper can be 50 mounted front to back and top to bottom in various combinations to achieve the most efficient operating arrangement. As a modification of the drilling arrangement the assembly, including the carriage, may be mounted on an angle so that drilling is done at an ap- 55 proximately 45° angle from the vertical as in FIG. 14. This arrangement is particularly useful in forming the holes with the hollow drills since the plugs will drop clear of the driving mechanism. Also a vacuum hood may be employed around the spiral drill to carry away 60 shavings and shields may be employed with hollow drills to guide the paper plugs that drop by gravity.

In some binding operations it may be desirable to form an oblong hole rather than a conventional circular hole. Oblong holes may be produced by imparting a slight lateral shifting motion to the pad of paper. The shifting motion may be obtained by means of bringing a

cam face to bear against the carriage by operation of a foot treadle or the like.

In FIGS. 11, 12 and !13 there is shown an arrangement for drilling on both sides of a pad to obtain a large number of small, closely spaced holes. As shown, drills are mounted on each side of the pad in staggered relation. Both banks drill to and away from the pad which is indexed along between the banks. Air jets and vacuum ducts, as shown in FIG. 12, may be used to clear dust and chips.

Referring now more particularly to FIG. 2 there is illustrated a portion of the apparatus in which binding elements are initially inserted. This station is adjacent the drilling section and includes a forming mandrel 60 and a forming die 62. This mechanism is more fully disclosed in U.S. Pat. No. 2,850,927 and in general the binding element 16, initially in the form of a staple, is forced down between the die and the mandrel forming trated an interchangeable channel assembly for accommodating binding elements of different size wire. The assembly includes replaceable guide plates 63 each with a longitudinal channel 65 of a size to receive the ing the feed tension of the assembly.

In FIG. 2A there is shown a mechanism for severing wire 69, coming from a reel or the like, to proper length before being formed into a U-shape. The mechanism includes a shearing knife 71 the opposing faces of which are concave to produce rounded ends on the cut wire to facilitate its insertion through the holes that have been made through the paper. The remaining portion of this mechanism is more fully disclosed in U.S. Pat. No. 3,073,355.

Having thus described the invention what we claim and desire to obtain by Letters Patent of the United States is:

- 1. Apparatus for drilling holes through a stack of sheet paper, comprising
 - a. a plurality of parallel drills defining a drilling station.
 - b. guide means extending through said station,
 - c. carriage means adapted to support said stack and move along said guide means to carry said stack into and out of said drilling station,
 - d. a wooden block mounted at said station coaxially opposite said drill in position to bear against at least one margin of said stack moved into said sta-
 - e. a layer of sheet material overlaying the opposite surfaces of said margin at said station,
 - f. means mounting said drills for reciprocation below said station, for movement through said margin to and away from said block,
 - g. adjustable mounting means supporting said drills whereby the spacing between drills may be selectively varied,
 - h. each of said drills being hollow and said block being formed with a recess oppositely each of said drills to receive each drill tip after it passes through said stack and a boss formed at the base of each recess for ejecting paper plugs through said
 - 2. Apparatus according to claim 1 wherein said material is waxed paperboard.

- 3. Apparatus according to claim 1 including an adapter mounting each of said drills, said adapter including cooperating threaded chuck and nut adapted to mount drills of various configurations.
- 4. Apparatus according to claim 1 wherein said guide 5 means are inclined whereby said carriage and stack are

moved along a horizontal path through said station with the plane of said stack tilted and the axes of said drills are inclined from the vertical and perpendicular to the tilted plane of said stack.