United States Patent

Deman

[15] **3,689,185**

[45] **Sept. 5, 1972**

[54] **MACHINE FOR CUTTING AND HEADING**

[72] Inventor: **Heiko T. Deman,** Alameda, Calif.

[73] Assignee: **Abildgaard Laboratories,** Mountain View, Calif.

[22] Filed: **Feb. 11, 1971**

[21] Appl. No.: **114,557**

[52] **U.S. Cl.** ..... **425/289,** 11/1 R

[51] **Int. Cl.** **B29c 17/10**

[58] **Field of Search** ..... 425/289; 11/1 R; 72/71

[56] **References Cited**

UNITED STATES PATENTS

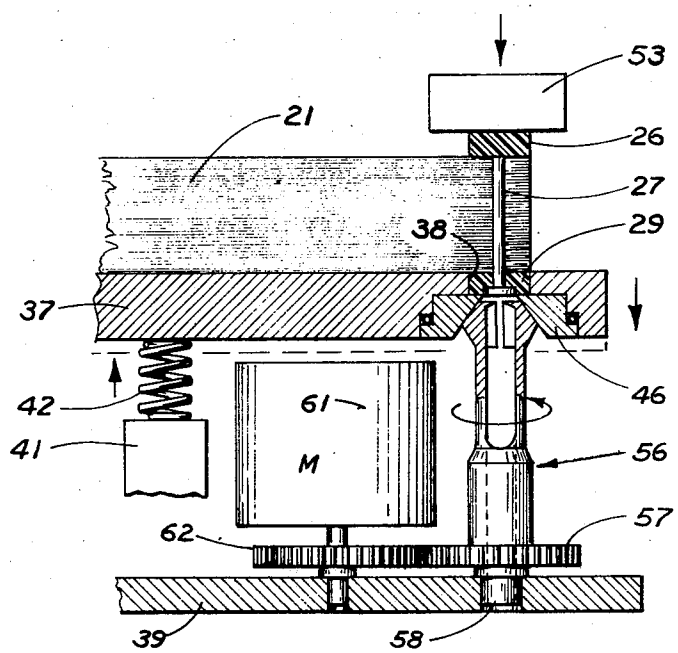
3,452,376 7/1969 Ito ..... 11/1 R

Primary Examiner—J. Spencer Overholser
Assistant Examiner—David S. Safran
Attorney—Julian Caplan and Gregg, Henrricson and Caplan

[57] **ABSTRACT**

To cut and form heads on a plastic stud or rod, particularly in binding papers together, a rotating tool of special construction is forced against a conical concave cam surface. The tool has a hollow shank with at least one flexible arm extending therefrom, said arm formed with a head, the arm being normally outwardly slanted so that the head is spaced outward of the axis of rotation. Each head has an inward projecting blade at its distal end. The space between the axis and the inner edge of the blade in normal position is sufficient to permit longitudinal movement of the stud inward of the head. The exterior of the distal end of the head is conical, convex and complementary to the cam. As the tool head is brought toward the cam, the head is forced inward causing the blade to sever the stud. Simultaneously the distal end of the head as it spins splays the severed end of the stud, forming a rivet head, which holds the papers in place. In a preferred embodiment there are two cooperating heads on the tool.

7 Claims, 5 Drawing Figures



PATENTED SEP 5 1972

3,689,185

SHEET 1 OF 2

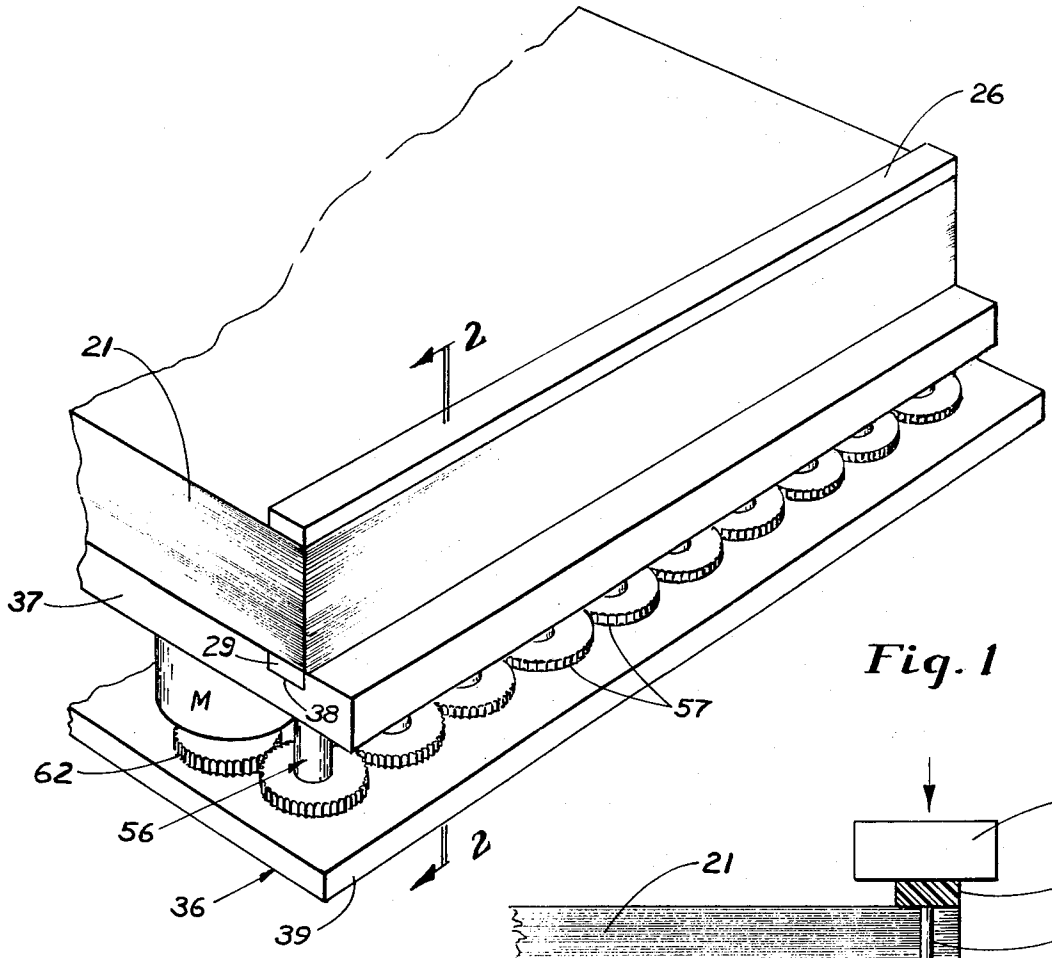


Fig. 1

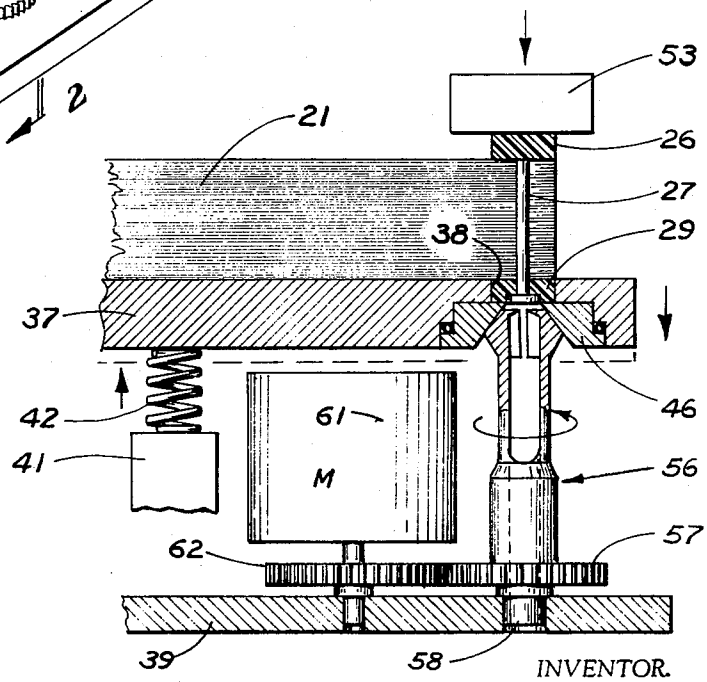


Fig. 2

INVENTOR.
Heiko T. deMan
BY
Julian Caplan
Attorney

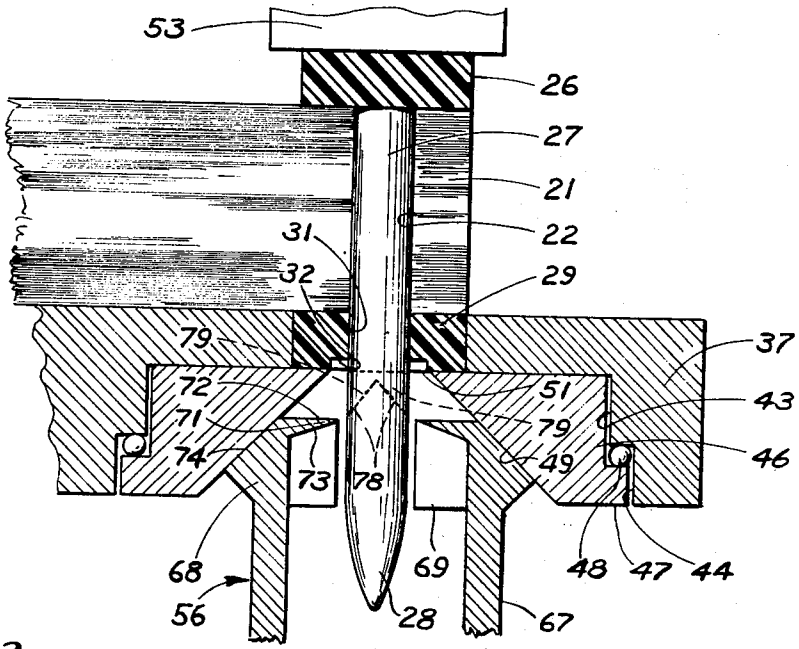


Fig. 3

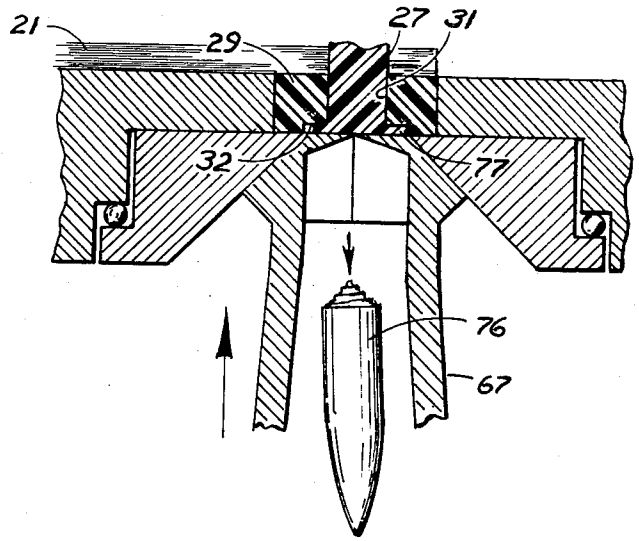


Fig. 4

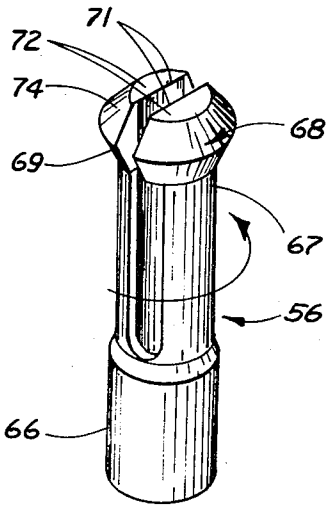


Fig. 5

INVENTOR.
Heiko T. deMan
BY
Julian Caplan
Attorney

MACHINE FOR CUTTING AND HEADING

This invention relates to an improved machine and method for cutting and heading plastic studs.

A feature of the present invention is the fact that it provides a machine of a size suitable for use in a business office which binds sheets of paper or books together, using two plastic strips, one having spaced studs which project through holes in the sheets and the second formed with apertures to receive the ends of the studs. The two strips are pressed toward each other with the sheets to be bound interposed and with the studs fitting through the holes in the sheets and through the apertures in the second strip. By the machine hereinafter described, the excess length of each stud is sheared off by means of a rotating tool having a blade which is brought inward as the tool is advanced toward the second strip. The head of the tool simultaneously splays the portion of the stud which remains after the excess has been severed, deforming the said remaining portion into a head similar to a rivet head.

One of the features of the invention is the fact that the machine and method bind a wide variety of types of materials. Thus ordinary paper which has been punched or drilled adjacent one margin may be used. It is sometimes desirable to rebind books or to bind assembled pamphlets, magazines or the like. Further, books similar to conventional books may be bound. The versatility of the machine is an important feature of the invention.

Another feature of the invention is the wide range of thickness of pages accommodated. The studs of the first strip are of extended lengths so as to fit through a relatively thick book. The machine shears off the excess lengths of the studs where less than maximum length is required. The effectiveness of the binding is relatively independent of the thickness of the paper involved.

Another feature of the machine and method is the fact that the sheets are tightly pressed together and then secured into place in compressed condition.

Another feature is that the machine is easily operated by relatively untrained personnel. Little or no physical effort is required to operate the machine and the machine is quite rapid in operation, particularly as compared to conventional bookbinding practices.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings in which similar characters of reference represent corresponding parts of each of the several views.

In the drawings:

FIG. 1 is a partially schematic, fragmentary, perspective view of a machine in accordance with the present invention.

FIG. 2 is an enlarged fragmentary sectional view taken substantially along the line 2—2 of FIG. 1.

FIG. 3 is a further enlarged, fragmentary sectional view through a portion of the machine showing the tool in position at the commencement of the cutting and heading operation.

FIG. 4 is a view similar to FIG. 3 showing the tool at the conclusion of the heading operation.

FIG. 5 is a perspective view of the tool of the present invention.

The machine hereinafter described is used to bind together temporarily or permanently pluralities of

sheets of paper 21 which may be provided with front or back cover sheets, all formed with a series of spaced holes 22 along one margin thereof. A first plastic strip 26 of a length approximately equal to the length of the sheets 21 is provided with studs 27 spaced along the strip 26 at intervals corresponding to the spacing between holes 22. The studs 27 may be formed with pointed ends 28. Cooperating with first strip 26 is a second strip 29 formed with holes 31 spaced apart the same distance as studs 27 and dimensioned to accept the same. Preferably, one surface of strip 29 is formed with counterbores 32. Strips 26 and 29 may be formed with various plastic materials, preferably a polyvinyl chloride or some other similar suitable material which is capable of being deformed both by cold flowing and by heat. Strip 26 is preferably rectangular in cross-section and is about one-fourth inch wide and one-sixteenth inch thick. The studs 27 are preferably between three thirty-seconds and one-eighth inch in diameter and may be of a length up to about 3 inches. The second strip 29 is approximately one-fourth inch in width and one-sixteenth inch in thickness and the holes 31 are of slightly larger diameter than the studs 27.

As has previously been stated, the sheets 21 may be separate sheets of printed or typewritten material or copies thereof or they may be pamphlets, magazines or the like which are formed with holes 22 in order to bind the material together in a book. Thus, the type of material which may be used with the present invention, the dimensions of the sheets 21 which will be accepted, and the thickness of the book which is to be bound are subject to considerable variation.

The machine 36 is illustrated herein more or less schematically, it being understood that it is of a size that may be mounted on the desk or table of a business office, or it may be made suitably larger and used by commercial binding establishments. A horizontal support 37 is provided which is dimensioned to support the largest of the sheets 21 which the machine will accept. Adjacent one edge of support 37 is a rectangular depression 38 which is complementary to strip 29 and receives such strip with countersinks 32 down. The sheets 21 are then positioned on the support 37 with their holes 22 aligned with the holes 31 in strip 29. Suitable aligning stops (not shown) may be used to properly position the sheets 21. After the sheets 21 have been properly positioned, the strip 26 is installed the studs 27 being inserted through the holes 22 and through the holes 31 in strip 29. As is best shown in FIG. 3, the points 28 of each stud 27 project beyond strip 29, the amount of projection depending upon the thickness of the sheets 21.

Support 37 has a base 39 and interposed between base 39 and support 37 is a foot 41 having a spring 42 which biases support 37 upwardly to create pressure against the bottom of the stack of paper 21. As viewed in the drawings, the underside of support 37 is formed with a plurality of bores 43 and counterbores 44 corresponding in number and spacing to studs 27. It will be understood that the preferred location of support 37 is horizontal and below the sheets to be assembled, but the relative location may be varied. Each bore 43 accepts cam member 46 which is formed with a peripheral flange 47 which fits in counterbore 44. Balls 48 are interposed between support 37 and cam 46 so

that the cam may revolve during the operation of the apparatus as hereinafter explained. Rotation of the cam **46** is not essential although it is highly desirable in the operation of the apparatus. The underside of each cam **46** is formed with a conical cam surface **49**. At the center of each cam surface **49** is a hole **51** which is aligned with the hole **31** in strip **29**. Above support **37** is a pressure bar **53** which is forced down on top of strip **26**, pressing the sheets **21** down upon the support **37** against the force of spring **42**. The position of the parts after bar **53** has been lowered and before other steps are performed is shown in FIG. **3**.

For each stud **27** there is a tool **56**, hereinafter described in detail, which is provided at its proximal end with a gear **57** having a stub shaft **58** which is rotatably mounted in base **39**. Likewise mounted on base **39** is a motor **61** having a pinion **62** which meshes with one of the gears **57** and preferably the gears **57** for all of the tools **56** mesh so that the tools **56** are driven in unison. However, various other means may be used to drive the tools **56** as will occur to one skilled in the art.

Each tool **56** has a shank **66** which is preferably hollow at its proximal end. Extending distally of shank **66** are arms **67**, which are here shown to be two in number but which may be any convenient number, formed of spring steel or other suitable material. The arms **67** at the inception of the cycle of operation of the tool slant upwardly-outwardly. On the distal end of each arm **67** is the head **68**. At the extreme end of each head **68** is a cylindrical portion **69** and where there are two arms **67**, each portion **69** is approximately semi-cylindrical. At the distal of each portion **69** is a blade **71** having a distally inwardly slanted surface **73** and an approximately flat end surface **72** which is radial relative to the axis of rotation of the tool. The exterior of each head **68** is a conical surface **74** which is complementary to the surface **49** of the cam **46**.

At the outset of the shearing and head forming operation, support **37** is backed off from tools **56** so that arms **67** extend slanting outward and studs **27** are freely accepted between the heads **68** without interference. The shank **66** is rotated (as by means of motor **61**) and the action of the pressure bar **53**, after compressing pages **21** and overcoming spring **42** on foot **41**, forces support **37** containing cam surface **49** toward heads **68**. The action of cams **49** is to press the heads **68** toward each other and toward the axis of rotation. As the blades **71** move inwardly and upwardly, they cut the excess length of each stud **27** theoretically in a conical shape defined by dotted line **78**. However, not only is the excess length **76** of the stud **27** sheared off as the blades move together (i.e., move from the position of FIG. **3** to FIG. **4**) but the surfaces **72** engage the volume of stud material which is indicated generally by reference numerals **79**, heating by friction, cold flowing and splaying the material **79** outwardly and upwardly into the counterbore **32** in strip **29**, forming a head **77** on the end of stud **27** within the counterbore **32**. The head is formed by a combination of heat generated by the friction of the head **68** against the material **79** and also by the mechanical deformation of the plastic material. The tool **56** is withdrawn from the position shown in FIG. **4** and the head **77** is allowed to cool and thus rigidify while pressure on sheets **21** is maintained. Thereupon, the pressure bar **53** is removed and the completed book is removed from support **37**.

In the completed book, the studs **27** extend through the holes of the sheets **21** between the first strip **26** and the second strip **27** and the heads **77** formed on the ends of the studs lock the book in position.

What is claimed is:

1. Apparatus for cutting and heading plastic studs comprising a support formed with a plurality of holes spaced apart for protrusion of studs, means for projecting studs through said holes and beyond said support, first cam means on the surface of said support through which said studs protrude surrounding each said hole, a tool for each said hole, drive means for rotating each said tool and for advancing each said tool and said first cam means toward each other; each said tool having a proximal shank, at least one springy arm slanting distally outwardly away from said shank and a head on said arm; said head having an external second cam means cooperable with said first cam means to force said head inward as said tool and said first cam means are advanced toward each other, a blade to cut off the excess length of said stud, and a distal end extending generally transverse to the axis of rotation of said tool to splay and deform the end of said stud to form a head of enlarged size on the end of said stud.

2. Apparatus according to claim **1** in which said blade comprises a sharpened edge on the inside of said head, said edge having an included angle of 360° divided by the number of said heads but of less than 180°.

3. Apparatus according to claim **1** in which there are two said arms the distal end of each said head being semi-circular in plan and having a sharpened inside edge, said distal end being approximately half the size of said hole.

4. Apparatus according to claim **1** in which said first cam means comprises means forming a conical surface on the underside of said support under said hole.

5. Apparatus according to claim **4** in which said means forming a conical surface is rotatably mounted in said support.

6. Apparatus according to claim **1** in which said drive means comprises a base, each said tool having a shank rotatable in said base and a gear meshing with gears of adjacent tools, a pinion meshing with one said gear and a motor driving said pinion.

7. Apparatus according to claim **6** which further comprises means for moving said support and said base toward and away from each other.

* * * * *