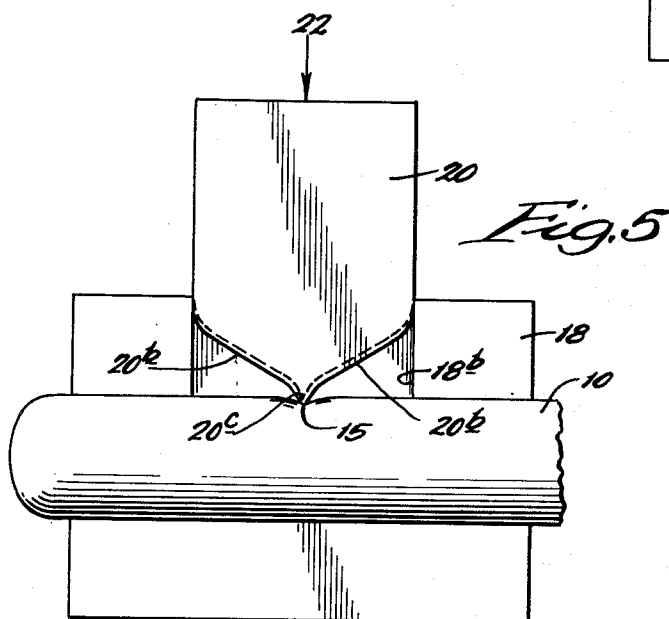
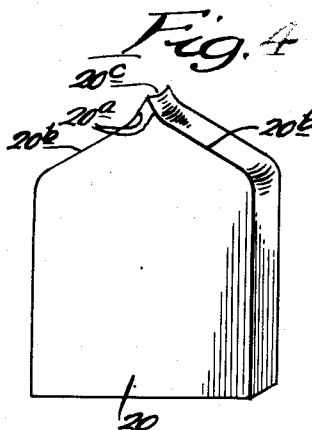
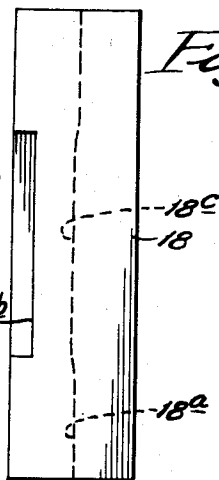
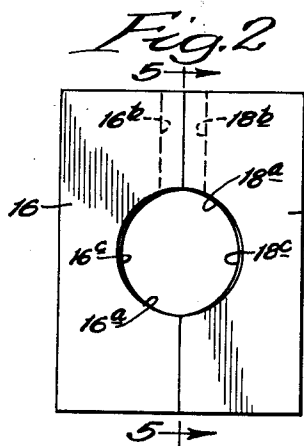
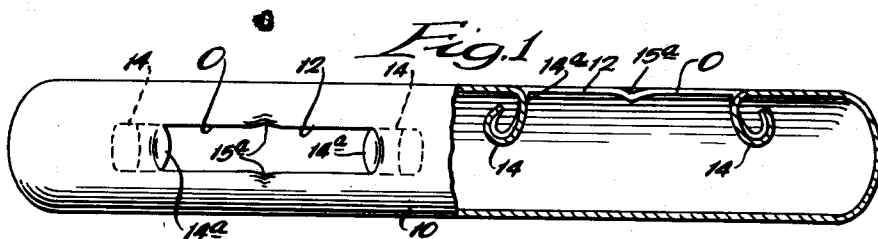


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METHOD OF AND MEANS FOR FORMING AN ELONGATED
OPENING IN A PIPE OR THE LIKE
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METHOD OF AND MEANS FOR FORMING AN
ELONGATED OPENING IN A PIPE OR THE
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2 Claims. (Cl. 164-108)

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My invention relates to an improved method for forming an elongated opening with cleanly punched longitudinal edges and inwardly bent end tabs.

In one method of removably securing objects to pipe or like supporting members, the object is provided with one or more spring clips which are received in elongated openings in the pipe. Each clip has a pair of complementary spring elements that extend beyond the width of the opening in the pipe but flex to retracted positions when the clip is inserted or removed to allow the clip to pass through the opening. Fastening devices of this kind may be used, for example, in a chair where the pipes form the legs and other support members to define a frame and the clips are affixed to the seat, back, and other parts to be removably secured to the frame.

In order to use clips of the above-described type effectively, it is necessary that the pipe have an opening of rectangular shape and of a size and width capable of receiving the clip in a manner permitting a secure fastening. It is desirable that the longitudinal edges of the opening be cut in a clean fashion so that the protruding spring anchoring portions of the clip can snap underneath the adjacent walls of the pipe.

It is also desirable that the elongated openings provided to receive the spring clips be so formed that the clips may be centered over their respective openings and pushed into locking condition without actually sighting the clips over the openings. This desirable feature is dictated by the fact that the fit of the part (such as a chair seat) carried by the clips may be a blind fit where it is impossible or difficult to sight each clip over its hole.

In accordance with the present invention, an improved method of and means for forming elongated clip-receiving holes in pipe is provided. Briefly, the pipe is held between a pair of complementary pipe-supporting dies which define between them a transverse slot of a size and shape corresponding to the desired clip receiving opening. A punch is then placed in the opening and forced through the exposed wall of the pipe to punch out the desired hole. In front elevation, the punch has a cutting face of peak formation. At the peak, the punch presents a transverse cutting edge of substantially straight line formation. This initial cutting edge, when it engages a pipe to be cut, by reason of its substantially straight cutting edge depresses the wall of the pipe trans-

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versely along a line extending beyond the edge of the opening, laterally to the axis of the pipe. The remainder of the cutting edge of the punch is "hollow ground" so as to present a concave formation to cut the pipe wall along the length of the opening. The hollow ground formation provides cutting edges on each side of relatively sharp angular formation, and contributes to the formation of end walls including extending tabs which are curled in the cutting operation and which remain in the pipe at the ends of the opening at the completion of the operation. In this fashion indexing indentations and a hole having cleanly punched longitudinal edges are formed in the pipe in a simple, high speed, and inexpensive punching operation.

It is therefore an object of this invention to provide an improved method of and means for cutting elongated holes having inwardly bent end tabs and clean punched longitudinal edges in a pipe or the like.

It is a further object to provide an improved method of and means for cutting elongated holes having inwardly bent end tabs and clean punched longitudinal edges in a pipe or the like in a simple, inexpensive, fast manner.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings, in which:

Figure 1 is a view in elevation of a pipe having two openings formed by the apparatus and method of the present invention and with some parts broken away in axial cross-section to show more clearly the configuration of one of the openings;

Figure 2 is an end elevational view of the two complementary pipe supporting dies in their assembled position;

Figure 3 is a top plan view of one of the dies of Figure 2;

Figure 4 is a view in perspective of the punch used with the dies of Figure 2, the punch being in the inverted position to show more clearly its configuration; and,

Figure 5 is a view in elevation on the line 5-5, Figure 2, but with the punch and pipe in

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place, the punch being in the position of forming the indexing indentation.

Referring now to Figure 1, there is shown at 10 a pipe of mild steel, or similar material with a pair of openings O, formed by the method and apparatus of the present invention, the left hand opening being shown in elevation and the right hand opening being shown in a broken away central cross-section. As will be evident from the drawing, each opening is of elongated rectangular shape with cleanly punched longitudinal edges 12 where the wall of the pipe is cut in a substantially straight line so that the spring portion of an attaching clip may be received thereunder. The ends of the openings O are defined by the curled tabs 14 which define substantially straight edges 14a and curl within the pipe 10 to form a slot capable of receiving a clip of similar configuration.

The longitudinal edges 12 of the openings O have marginal, central, indentations 15a where the wall of the pipe 10 is slightly depressed. These indentations form indexing conformations with respect to the opening and provide, by means of the user's sense of feel, a method of orienting clips to be received in the holes without actually sighting the clips on the holes.

In accordance with the present invention, the pipe 10 is placed in a supporting die which surrounds the pipe snugly and slightly distorts it in the region where the hole is to be formed. A two-part die suitable for this purpose is shown in Figures 2 and 3. In Figure 2 the die is shown in end elevation without the pipe or punch in place. In Figure 3 one of the mating parts of the die is shown in top plan view.

The die comprises a pair of complementary mating parts, 16 and 18, which, when in the mated condition of Figure 2, form a longitudinal pipe-receiving opening due to their opposed semi-circular mating bores 16a and 18a. A pair of mating rectangular openings are formed in the parts 16 and 18 along the mating edges and extend to the top edges of the bores 16a and 18a to define a punch-receiving slot transverse to the opening defined by the bores 16a and 18a. These rectangular openings are indicated at 16b and 18b, respectively.

Adjacent the openings 16b and 18b the bore 16a-18a has portions of slightly reduced eccentric shape 16c and 18c. When a pipe is positioned in the die in the bore 16a-18a, and clamped together by suitable closing mechanism employing the necessary lateral force, these eccentric positions of the die distort the pipe and force its wall slightly into the slot formed by the opening 16b and 18b, gripping the pipe with lateral pressure to prevent its distortion in the region adjacent the slot and providing in the region to be cut an upward pressure to resist the pressure of the punch 20 sufficiently to insure the clean cut desired. The vertical diameter of the hole formed by the portions 16c and 18c may be 1.01 inches, and the horizontal diameter 0.99 inch, where the outer diameter of the pipe being punched is 1.00 inch, for example.

The hole-forming punch 20 is shown in perspective in Figure 4, as being of rectangular cross-section and having a generally V-shaped cutting face. In elevation the punch 20 has an initial cutting portion 20a formed at an angle of about 30 degrees to the length of the punch. The cutting face of the punch in the less sharply

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angled portions 20b and in some of the sharp portions 20a is of concave shape and may be so formed by suitable milling operations. In the region adjacent the cutting edge 20c at the apex of the initial cutting portion the depth of the concave portion is reduced so as to form the nearly straight cutting edge 20c.

Holes are punched by the apparatus above described by placing the pipe 10 between the pair of dies 16 and 18 as suggested in Figure 5, the lateral openings 16b and 18b of the dies being located over the position desired for the opening. The punch 20 is then placed in the slot formed by the openings 16b and 18b and forced downwardly as indicated by the arrow 22, this force being provided by a suitable press.

As the punch 20 is first forced down on the pipe 10 the edge 20c being of greater radius than the wall of the pipe, engages the wall of the pipe and depresses it along a nearly straight line. The pipe then bends inwardly as shown at 15 before actual cutting action begins. At this time the inwardly bent or indented portion 15 of the pipe extends beyond the edges of the slot formed by the dies 16 and 18, thereby forming the indexing indentations 15a, Figure 1.

As the punch 20 is pressed further against the pipe 10, the punch parts the wall of the pipe along the edge 20c, thereby forming a split edge transverse to the length of the opening. Further pressure on the punch peels the pipe wall inwardly along this edge, the cutting action being made by the sharply angled edges formed on the portions 20b of the punch. When the punch has fully pierced the wall of the pipe, the edges have curled underneath as shown in Figure 1, leaving a free opening of the desired shape with cleanly punched longitudinal edges.

While I have shown the edge 20c as having a nearly straight configuration, it may be somewhat concave so long as it has a relatively large radius of curvature in relation to the outer diameter of the pipe 10.

While I have shown and described a specific embodiment of my invention, it will of course be understood that many modifications and alternative constructions may be made without departing from the spirit and scope thereof. I therefore intend by the appended claims to cover all modifications and alternative constructions falling within the true spirit and scope thereof.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A punch-and-die apparatus adapted to punch a rectangular aperture in a curved metal surface such as a pipe, the aperture to be formed with clean side edges substantially parallel to the axis of curvature and end edges substantially perpendicular thereto and formed by inwardly bent tabs, comprising the combination of a die defining a channel adapted to receive the metal surface snugly and to support the wall thereof and defining also a punch-receiving opening corresponding in shape to that of the desired aperture, and a punch adapted to be received in operative position in the punch-receiving opening, said punch having an initial cutting edge contained in a single plane substantially perpendicular to the axis of curvature of the metal surface and being curved on a radius of curvature substantially greater than the radius of curvature of the metal surface being punched, and having also secondary cutting edges extending away along the side walls of said punch in

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planes substantially parallel to the axis of curvature, the cutting face of said punch being undercut between said secondary cutting edges to provide a concave surface therebetween.

2. Apparatus according to claim 1 wherein said punch is provided with two sets of symmetrically formed secondary cutting edges disposed on opposite sides of said initial cutting edge.

JOHN W. DOLBY. 10

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