United States Patent

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[54] **DESIGN PUNCHING METHOD AND APPARATUS**
3 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **83/50,** 83/237, 83/620, 83/691
[51] **Int. Cl.** **B21d 28/26**
[50] **Field of Search** 83/39, 50, 237, 620, 660, 687, 691

[56] **References Cited**

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ABSTRACT: A design having a limited area and a predetermined outline is punched in metal by positioning a first group of punches transverse to an axis of the design and in an alignment such as to define one end of the design intersected by that axis. The second group of punches is positioned in a second row transverse to said axis in an alignment corresponding to the opposite end of the design. The various punches are spaced from each other, as measured parallel to said axis, distances which are a given measurement multiplied by integers. At least some of the punches of the second row are spaced from at least some of the punches of the first row by an amount that is less than half the distance between the two ends of the design. With the punches so mounted in a punch press the sheet to be perforated is fed through the press with the increments of sheet movement, between punching operations, being equal to said given measurement. The punches are first rendered effective to perforate the sheet at the portion of the sheet at which said one end of the design is to appear and disabled from causing further perforations at the portion of the sheet at which the other end is to appear.

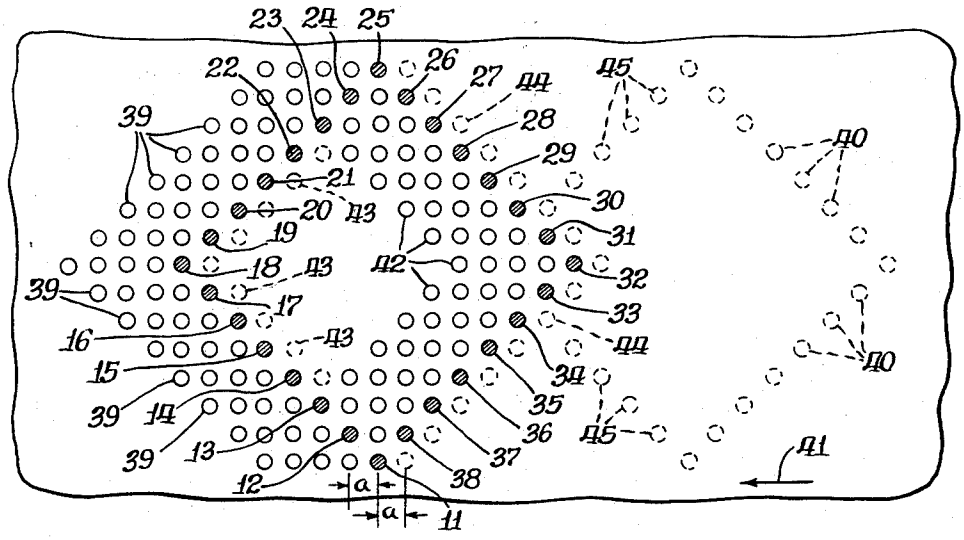

Fig. 1.

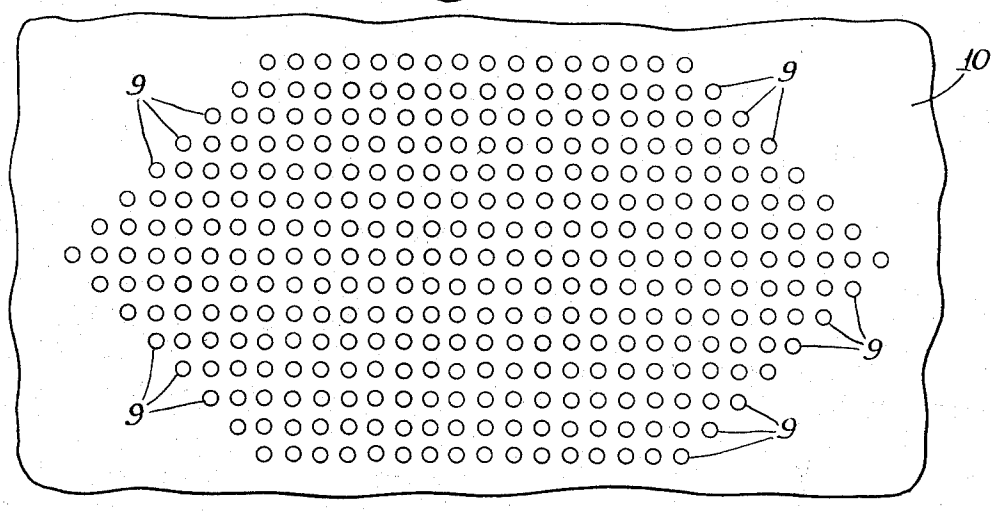

Fig. 2.

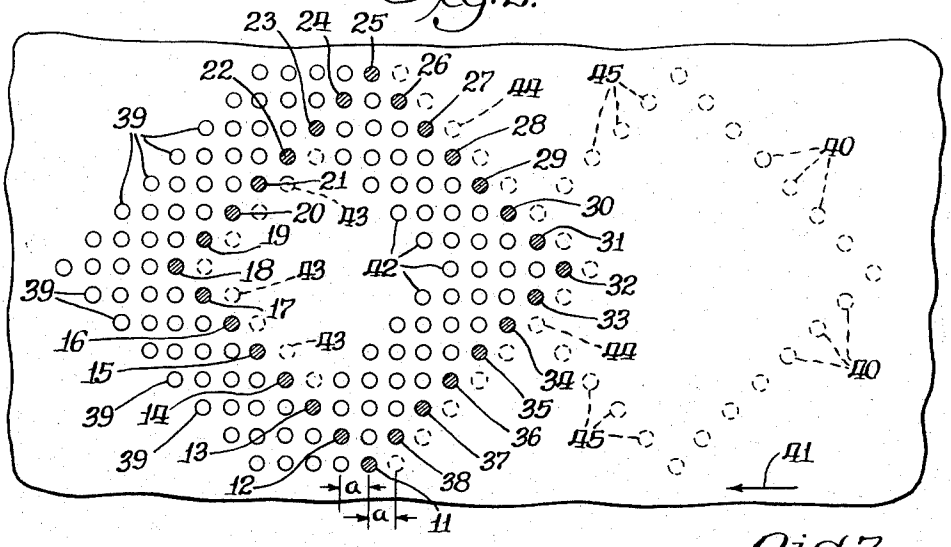

Fig. 5.

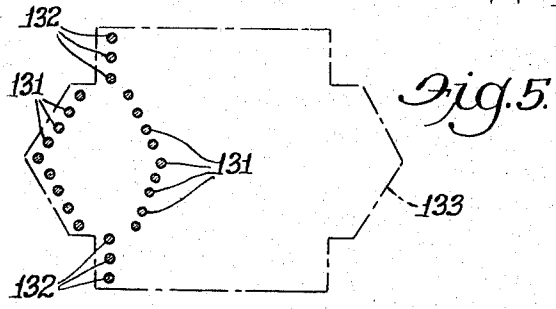

Fig. 7.

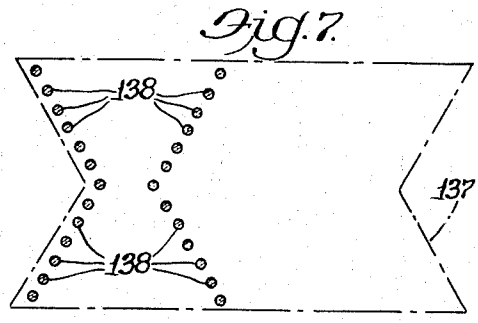

Fig. 6.

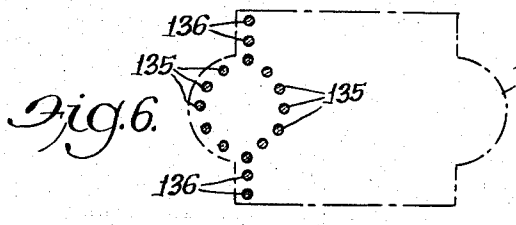

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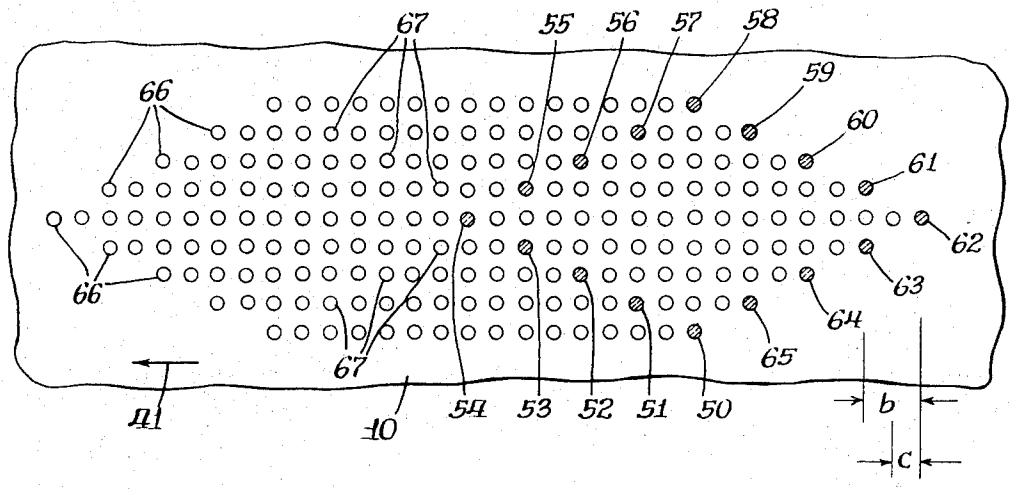
Fig. 3.



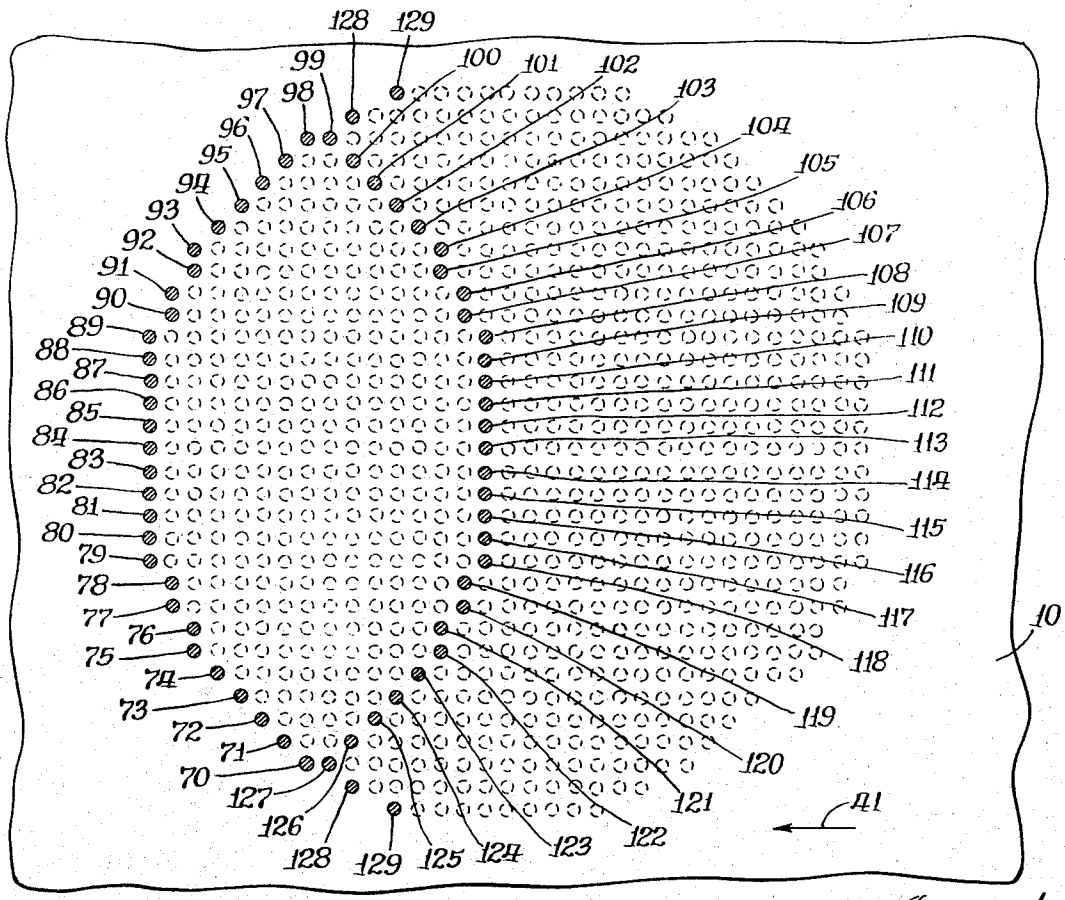


Fig. 4.

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DESIGN PUNCHING METHOD AND APPARATUS

BACKGROUND OF THE INVENTION

The present practice of producing perforate designs in sheet metal is to position a plurality of punches in a configuration corresponding to the overall design to be made. A punch is provided for each of the various openings required to make up the overall design. Thus, for example, a hundred punches would be employed to produce a design which was made up of a hundred openings. The present invention permits the production of such designs with substantially fewer punches.

Designs having parallel ends can be produced by a single row of punches with the sheet being moved so that this row of punches perforates all of the openings, including the two ends and the openings therebetween. However, this will not work where the designs have ends, or portions of ends, which are not parallel. The principal object of the present invention is to provide a method and apparatus for facilitating the production of the latter types of designs in sheet metal or the like.

SUMMARY OF THE INVENTION

The present invention relates to a method and apparatus for simply and economically perforating sheet metal to produce limited area designs therein, which designs are such that the two ends thereof are not parallel.

DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a design to be made by the perforating of a sheet of metal;

FIG. 2 is a partially perforated sheet of metal illustrating the position of the punches when the design of FIG. 1 is partially completed;

FIG. 3 illustrates a sheet of metal and a plurality of punches producing an alternative design;

FIG. 4 illustrates a sheet of metal with punches positioned to produce a substantially circular design in the metal; and

FIGS. 5, 6 and 7 illustrate alternative designs and the positioning of punches to produce them.

DISCLOSURE OF SPECIFIC EMBODIMENTS

Although the following disclosure offered for public dissemination in return for the grant of a patent is detailed to ensure adequacy and aid understanding, this is not intended to prejudice that purpose of a patent which is to cover each new inventive concept therein no matter how others may later disguise it by variations in form or additions or further improvements. The claims at the end hereof are intended as the chief aid toward this purpose; as it is these that meet the requirement of pointing out the parts, improvements, or combinations in which the inventive concepts are found.

FIG. 1 illustrates a design such as might be desired in a piece of sheet metal for use as a ventilating opening in a sheet metal cabinet, or as for a radio loudspeaker grill in an automobile dashboard, etc. To produce this design with conventional practices would require a punch for each of the openings. For the illustrated design, this would require 358 punches. The more punches that are required the greater the cost. The cost of producing the design comprising openings **9** in metal sheet **10** can be substantially reduced if the number of punches employed can be substantially reduced. An alternative, according to present commercial practices, for producing the design of FIG. 1, would be to drill or punch each of the holes **9** individually, one at a time. This is obviously a laborious and expensive procedure.

FIG. 2 illustrates the manner of producing the design of FIG. 1 according to the present invention. One row of punches, *i.e.*, punches **12–24** are positioned to conform to the alignment of the end openings **39**. The second row of punches **26–38** are positioned to conform to the alignment of end openings **40**. Punches **11** and **25** serve, in this embodiment, to complete each of the two rows of punches. As is conventional

in the art, the punches are held in a punch plate in a punch press and are aligned with a platen having correspondingly positioned openings therein. When purchased as standard units, punch presses have predetermined increments of feed of the metal. For example, one punch press might have feed increments (that is, the amount of movement of the metal sheet between the punching strokes) which can be varied between one sixty-fourth of an inch and one-fourth of an inch in steps of one sixty-fourth of an inch. Another punch press might have a range of movement between punch strokes of from one-sixteenth of an inch to one-half of an inch in one-sixteenth inch increments. In practicing the present invention, it would be possible to select the punch press so that the increment of feed was adapted to the hole spacing, but it generally will be more practical to adapt the hole spacing to the feed increment of the available punch press.

It is important, in connection with the present invention, to relate the spacing of the punches to the increments of feed of the punch press or vice versa. Normally, of course, since an existing punch press is to be employed, the spacing of the openings will be related to the amount of feed that is to be employed with the available punch press. For example, assuming that the movement of the metal in the press being employed is the distance *a*, the spacing (as measured along the path of feed of the metal in the punch press) between all of the punches **11–38** is the distance *a* multiplied by integers. The arrow **41** illustrates the path and direction of movement of the metal sheet **10** in the punch press. The term "spacing of holes" or "punches," as employed herein, refers to the center to center spacing. This relationship of the spacing of the punches to increment of feed of the press is necessary because the procedure in accordance with the present invention requires that, during the course of the forming of the overall design, some of the punches enter openings already made in the metal by other punches.

FIG. 2 illustrates the form of the design after it is partially completed. With the initial stroke of the punch press the punches of row **12–24** will have produced end openings **39** while the punches of the row **26–38** will have produced openings **42**. Upon the withdrawal of the punches from the metal in the position illustrated in FIG. **2**, and after the next increment of feed of the punch press, the punches of row **12–24** will produce openings **43**, while the punches of row **26–38** will produce openings **44**. Ultimately, of course, the punches of row **26–38** will produce end openings **40**. At the same time, the punches of row **12–24** will extend into the sheet metal at openings **45**. In producing the design according to the present invention, some punches will pass through holes already made in the metal. This is illustrated, for example, by punch **23** which is entering a hole **42** previously produced by punch **27**.

FIG. 3 illustrates that the spacing of adjacent punches (as measured parallel to the path **41** of movement) need not be equal to the increment of feed between punch strokes of the punch press. Here there are a series of punches **50–65**. The spacing of the punches is represented by the dimension *b* while the increment of feed between punch strokes is represented by the dimension *c*. In this embodiment the dimension *b* is twice as large as the dimension *c*. The position of the punches in FIG. 3 would be that at the completion of the design formation. At the first stroke, the end row punches **51–57** would have produced end holes **66**. At the same time, the other end row of punches **59–65** would have produced holes **67**.

FIG. 4 illustrates how the present invention, with some supplementation, can be used to produce a design which, in appearance, approximates that of a circle. Substantially the same procedure can be followed to produce oval appearing designs. Here there are a basic set of punches **70–127**. Punches **70–98** form one end row and punches **99–127** form the other end row. Along each side are supplemental punches **128** and **129**.

To produce the design as illustrated, the basic punches **70–127** are employed to make eighteen punch strokes through the metal sheet **10**, with the metal being moved by the punch

press an increment *a* equal to the punch spacing (as measured parallel to the path of movement **41**) between each punch stroke. Punches **128** and **129** are held by the same punch plate. For the first eleven punch strokes (of the eighteen) punches **129** are effective to perforate the metal, but for the remaining punch strokes (of the eighteen), the gag bar of the punch press is withdrawn so that punches **129** no longer are effective to perforate the metal, but just remain idle. Similarly, punches **128** are effective only for the first fifteen strokes (of the eighteen) and thereafter the gag bar is withdrawn so that punches **128** are no longer effective. The end result is to produce the overall, circular appearing, design of FIG. **4**. The use of gag bars, or the like, on punch presses to control when a punch is effective or not to perforate the metal is a conventional structure and procedure.

FIG. **5** illustrates a series of punches **131** with side or supplemental punches **132** employed to produce an overall design having the outline generally illustrated by the dot-dash line **133**. FIG. **6** illustrates another overall design indicated by the dot-dash outline **134**. Here there are basic punches **135** with supplemental punches **136**. Another design indicated by outline **137** through the use of punches **138** positioned as illustrated in FIG. **7**.

I claim:

1. A method of using punches and a punch press adapted to move a sheet to be punched along a path to form in said sheet a perforate design which has two non-linear ends, said method comprising the steps of:

arranging a first group of said punches in a first row transverse to said path in a configuration generally corresponding to one of said ends, arranging a second group of said punches in a second row transverse to said path in a configuration generally corresponding to the other of said ends, said punches being spaced from each other, as measured along a line parallel to said path, distances which are a given measurement multiplied by integers, said first row having at least some of the punches thereof spaced from at least some of the punches of the second row an amount that is less than half the distance between the furthest spaced portions of said ends; and

feeding said sheet through said press in increments between the times that the punches perforate the sheet, which increments are equal to said given measurement, and rendering said punches first effective to perforate said sheet at the portion of the sheet at which said one end is to appear and finally effective to perforate said sheet at the portion of the sheet at which said other end is to appear.

2. A method of punching metal with a plurality of punches to form a design comprising a perforated area in a portion only of the metal and using a press adapted to move the metal along a given path with a given increment of feed between punch strokes, said method comprising the steps of:

arranging said punches to define a closed figure having, with respect to said path a front row of punches and a back row of punches, said punches being spaced from each other, as measured along a line parallel to said path, distances which are said increment multiplied by integers, some of which integers are greater than **1**; and

feeding said metal in said press for a distance such that at least some punches of one row enter holes made in the metal by some punches of the other row.

3. In a punch press having a punch plate with a plurality of punches and a platen with the press feeding the material to be punched along a given path with a given increment of feed between punch strokes, the improvement comprising:

said punches being positioned to define a closed figure having, with respect to said path a front row of punches and a back row of punches, said punches being spaced from each other, as measured along a line parallel to said path, distances which are said increment multiplied by integers, some of which integers are greater than **1**, said punches being arranged, with respect to said increment of feed, that during a complete punching operation some punches of one row enter holes made in the metal by some punches of another row.