May 2, 1939. W. K. WILEY 2,156,889

APPARATUS FOR DEFORMING SHEET MATERIAL

Filed April 20, 1937 2 Sheets-Sheet 1

Fig. 1.

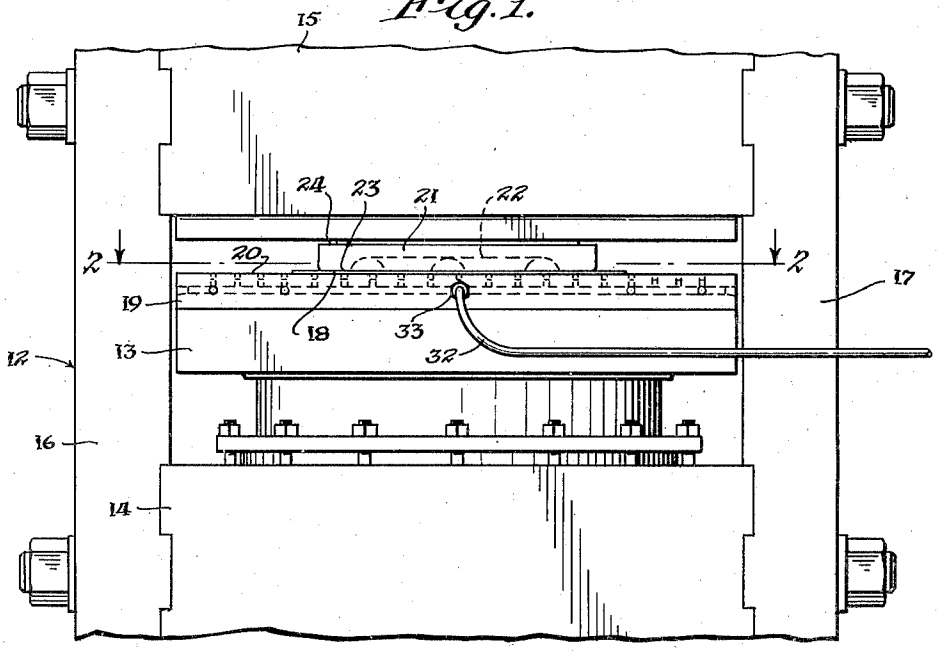
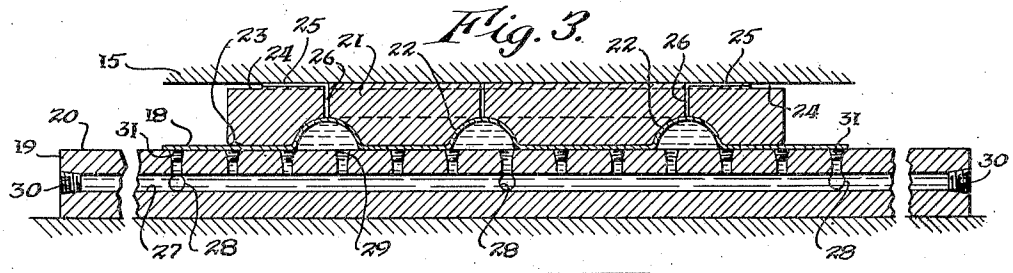


Fig. 3.



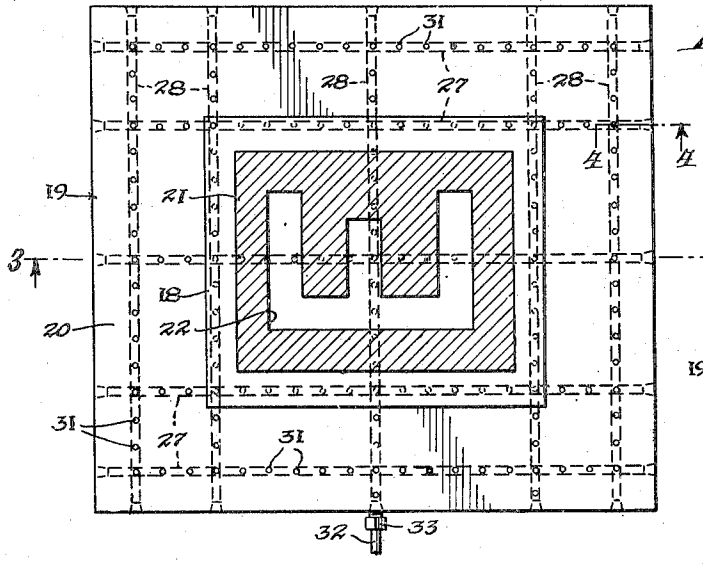
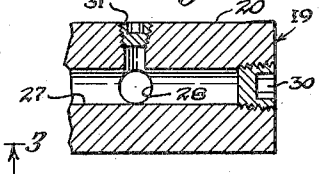


Fig. 2.

Fig. 4.



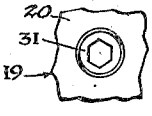


Fig. 5.

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Fig. 6.

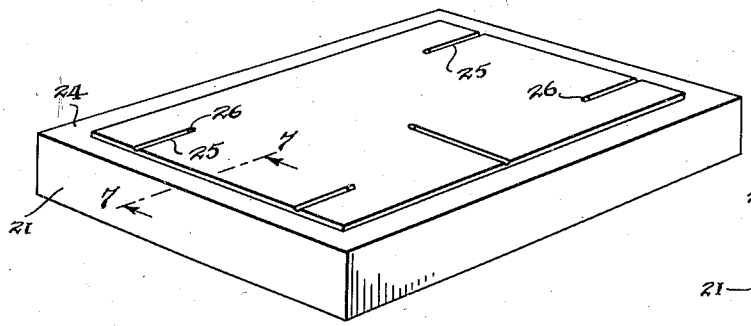


Fig. 7.

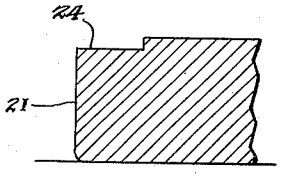


Fig. 8.

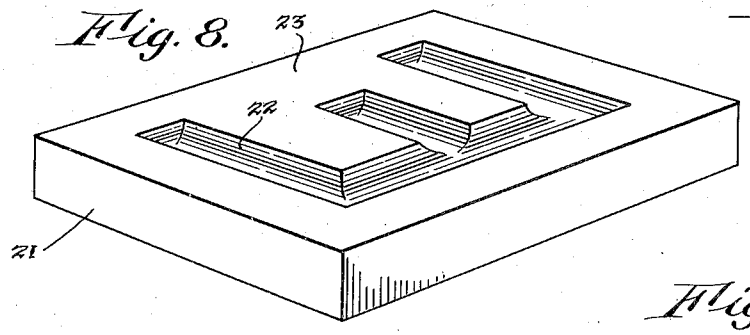


Fig. 9.

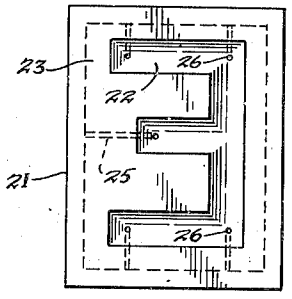


Fig. 10.

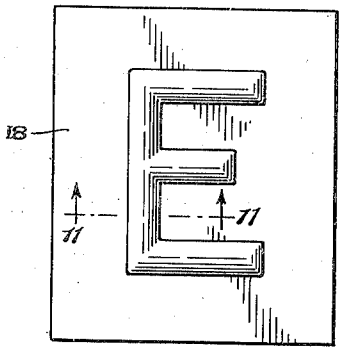
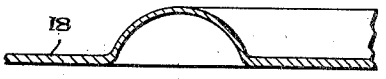


Fig. 11.



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Patented May 2, 1939 2,156,889

UNITED STATES PATENT OFFICE

2,156,889

APPARATUS FOR DEFORMING SHEET MATERIAL

Wallace K. Wiley, Buffalo, N. Y., assignor, by mesne assignments, to Lawrence V. Whistler, Kenmore, N. Y.

Application April 20, 1937, Serial No. 138,008

5 Claims. (Cl. 113—44)

This invention relates to embossing apparatus and more particularly is concerned with improvements in apparatus of the kind wherein a fluid medium under a high pressure is utilized to effect the displacement of the areas which provide the embossments. Although not limited to such use the apparatus is characterized by features which adapt it particularly to the production of sheet metal display characters having raised character strokes.

One object of the invention is to minimize distortion of the regions in the vicinity of the embossed areas and prevent the creation of internal strains in such areas, this object contemplating apparatus which is so designed that the stretching of the metal is confined solely to the areas which are embossed.

A further object is apparatus in which provision is made for preventing defacement of the sheets upon which the embossments are formed.

A still further object is to provide apparatus which is available to produce display characters of various sizes and shapes, singly and in sets, and in the desired spaced relation when formed in a series upon a single sheet.

A still further object is to provide a novel design and arrangement of the parts of the apparatus, whereby simplicity and economy in construction are obtained and a higher speed in production insured.

The invention is illustrated in the accompanying drawings in which:

Figure 1 is a view in elevation of the central part of a press embodying the features of the invention.

Figure 2 is an enlarged horizontal section taken along line 2—2 of Figure 1.

Figure 3 is a section taken along line 3—3 of Figure 2.

Figure 4 is an enlarged fragmentary section through the platen and is taken along line 4—4 of Figure 2.

Figure 5 is an enlarged fragmentary view of the upper face of the said platen.

Figure 6 is a perspective view of the back of a die which is utilized to form the letter "E".

Figure 7 is an enlarged fragmentary section of the die and is taken along line 7—7 of Figure 6.

Figure 8 is a perspective view of the working face of the die.

Figure 9 is a plan view of the working face of the die.

Figure 10 is a front view of a display character produced by the said die.

Figure 11 is an enlarged section through the display character and is taken along line 11—11 of Figure 10.

The apparatus, as illustrated, includes a press 12. The ram of the latter is indicated at 13 and is mounted in a suitable framework comprising a bedplate 14, a crosshead 15 and side members 16 and 17. The sheet 18 upon which a display character, "E" for example, is to be embossed is of metal and may be of any suitable gauge. It is arranged in a cold state upon a platen 19 which is carried by the ram 13 and which is formed or provided with a face 20 which engages the under side of the sheet throughout the entire area within which the embossment is to be formed. A die 21, preferably a metal casting and having a cavity 22 suitable for producing the desired embossment, is arranged upon the sheet 18, the entire area of the face 23 of the said die with the exception of the cavity 22 engaging the upper side of the sheet 18. The back of the die 21 is preferably cut away around the marginal edges as indicated at 24 (Figure 3) in order to space the said edges from the under side of the crosshead 15, grooves 25 which lead to the clearances thus provided communicating with vents 26 which in turn communicate with the cavity 22.

The platen 19 is preferably a casting. It is formed with longitudinally and transversely extending ducts 27 and 28 (Figure 2), respectively, which communicate with one another. Each of the said ducts communicates with a series of outlets 29 formed in the face of the platen and is closed at its ends by threaded plugs 30. Preferably all of the outlets 29 with the exception of one or more of those located beneath the cavity 22 are closed by threaded plugs 31, although the desired results may be obtained so long as any open outlets which are not utilized are located beneath the portion of the sheet engaged by the die so as to be sealed by the said sheet.

In the use of the apparatus the ram 13 is operated to cause the faces of the platen 19 and die 21 to engage the opposite sides of the sheet 18 at the zone in which the embossment is to be formed, precautions first being taken to open one or more of the outlets 29 which are located beneath the cavity 22. Water or any other suitable fluid medium is then introduced, preferably by a pump, into the ducts 27 and 28 through a pipe 32 which communicates with the central one of the transversely extending ducts and which is connected to the platen 19 by a fitting 33. The pres-

sure upon the water is increased until it is high enough to effect the discharge of the water through those of the open outlets 28 which are located below the cavity 22. The water thus discharged forces into the cavity those portions of the sheet 18 which are located below it, the said portions being stretched and reduced in thickness as best illustrated in Figure 11 during such displacement. The air originally present in the cavity 22 escapes through the vents 26 and grooves 25. The pressure necessary to effect displacement of the metal in the manner described is, of course, relatively high and is dependent, among other factors, upon the area of the embossment and the gauge of the sheet upon which the embossment is formed. It may, for example, be of the order of 3000 pounds per square inch or higher. The pressure exerted by the ram 13, on the other hand, may be, and usually is, less per square inch owing to the larger area over which it is applied and may, in the example given, be of the order of 1500 pounds per square inch, it being understood that in all cases the total pressure applied to the platen and die by the ram is substantially greater than the total pressure applied to the portion of the sheet which is to be displaced to provide the embossment. It will be appreciated that the application of such high pressures to the platen and die would, unless provision were made to guard against this, result in the marking of the sheet 18 by the marginal edges of the die. The formation of the back of the die in the manner described, therefore, renders said marginal edges slightly flexible. Hence during the operation of the ram 13 they yield slightly to prevent defacement of the sheet 18. As the platen 19 engages the entire area of that portion of the sheet under the die the stretching of the metal and its attendant reduction in thickness during the formation of the embossment is confined solely to the area which is caused to enter the cavity 22. The apparatus described, therefore, has the advantage that it prevents the formation of wrinkles or other wave-like irregularities or the creation of strains in those portions of the sheet surrounding or lying within the zone in which the embossment is formed.

It is to be noted that the sheet 18 serves to seal the space between the faces of the platen and the die, the ram 13 being operative, owing to the high pressure which it exerts upon the said parts to prevent to any substantial degree leakage of the fluid medium from between them. The necessity for employing a flexible container for the fluid medium is thus avoided, the availability of outlets for the fluid medium over the entire face of the platen 19 providing for the production of display characters of various sizes and shapes either singly or in sets and enabling the display characters of a series to be formed upon a sheet in the desired spaced relation. The construction described has the further advantage that it enables the embossments to be formed rapidly owing to the small amount of fluid medium which is utilized for this purpose.

Although the display characters produced by the apparatus have been described as having raised character strokes it will be apparent that concave strokes may be provided merely by arranging the sheet upon which the characters are formed so that the embossments are carried by the rear face of the sheet. In other words the sheets upon which the embossments are formed may be arranged to adapt the latter to the requirements of the particular installation.

I claim as my invention:

1. Apparatus for embossing a sheet including a platen, a die having a forming cavity, said sheet being arranged between said platen and die, a press having co-operating members for causing said platen and die to engage opposite sides of said sheet around the area within which the embossment is to be formed, means for providing a clearance between the marginal edges of the back of said die and the associated press member so as to enable the marginal portions of the face of said die to yield slightly when said press members exert the necessary pressure upon it, said platen having an opening in the face which is located opposite said cavity, a duct formed in said platen which communicates with said opening and means for introducing a fluid medium into said duct under a pressure which will cause it to discharge through said opening to force into said cavity the portion of said sheet which is located opposite it.

2. Apparatus for embossing a sheet including a platen, a die having a forming cavity, said sheet being arranged between said platen and die, a press having co-operating members for causing said platen and die to engage opposite sides of said sheet around the area within which the embossment is to be formed, said die being cut away to provide a clearance between the marginal edges of its back and the associated press member so as to enable the marginal portions of its face to yield slightly when said press members exert the necessary amount of pressure upon it, said platen having an opening in the face which is located opposite said cavity, a duct formed in said platen which communicates with said opening and means for introducing a fluid medium into said duct under a pressure which will cause it to discharge through said opening to force into said cavity the portion of said sheet which is located opposite it.

3. Apparatus for embossing a sheet including a platen, a die having a forming cavity, said sheet being arranged between said platen and die, a press having co-operating members for causing said platen and die to engage opposite sides of said sheet around the area within which the embossment is to be formed, said die being cut away to provide a clearance between the marginal edges of its back and the associated press member so as to enable the marginal portions of its face to yield slightly when said press members exert the necessary amount of pressure upon it, said platen having an opening in the face which is located opposite said cavity, a duct formed in said platen which communicates with said opening, means for introducing a fluid medium into said duct under a pressure which will cause it to discharge through said opening to force into said cavity the portion of said sheet which is located opposite it, said die having a groove formed in its back which communicates with said clearance and a vent which communicates with said cavity and through which the air escapes to said groove.

4. Apparatus for deforming sheet material to produce embossments of various sizes and shapes including a universal platen having a working face, a die having a co-operating working face of less area than that of said platen and in which a forming cavity is provided, means for causing the working faces of the platen and die to engage the opposite sides of said material around the

area wtihin which the embossment is to be formed, a plurality of spaced outlets formed in the working face of said platen, said die being arranged in such relation to said platen that at least one of said outlets is located opposite said forming cavity while other of said outlets are located beyond the confines of the contacting faces of the platen and die, removable plugs which close said last named outlets, whereby to enable the employment of dies of various sizes and shapes, a duct in said platen with which said outlets communicate and means for introducing a fluid medium into said duct under a pressure which will cause it to force into said cavity that portion of the sheet material which is located opposite it.

5. Apparatus for deforming sheet material to produce embossments of various sizes and shapes including a universal platen having a working face, a die having a co-operating working face of less area than that of said platen and in which a forming cavity is provided, means for causing the working faces of the platen and die to engage the opposite sides of said material around the area within which the embossment is to be formed, a plurality of spaced outlets formed in the working face of said platen, said die being arranged in such relation to said platen that at least one of said outlets is located opposite said forming cavity while other of said outlets are located beyond the confines of the contacting faces of the platen and die, means for closing off said last named outlets during the use of said die, whereby to enable the employment of dies of various sizes and shapes, a duct in said platen with which said outlets communicate and means for introducing a fluid medium into said duct under a pressure which will cause it to force into said cavity that portion of the sheet material which is located opposite it.

WALLACE K. WILEY.