United States Patent [19]

Grünberger

[11] **3,792,523**

[45] **Feb. 19, 1974**

[54] **PROCESS OF MAKING A CUTTER FOIL FOR DRY SHAVING APPARATUS**

[75] Inventor: **Sigrot Grünberger,** Klagenfurt, Austria

[73] Assignee: **U.S. Philips Corporation,** New York, N.Y.

[22] Filed: **Nov. 13, 1972**

[21] Appl. No.: **306,345**

Related U.S. Application Data

[62] Division of Ser. No. 74,632, Sept. 23, 1970, Pat. No. 3,714,807.

[52] **U.S. Cl.** ..... **29/557,** 29/163.5 R

[51] **Int. Cl.** **B23p 13/04**

[58] **Field of Search** ..... 29/557, 558, 160, 163.5 R, 29/177; 72/335, 478, 54, 55, 324; 83/21

[56] **References Cited**

UNITED STATES PATENTS

1,481,000	1/1924	Erickson	29/163.5 R
2,133,445	10/1938	Guerin	72/55 X
2,248,786	7/1941	Rowe et al.	72/324 X
2,308,998	1/1943	Misfeldt	72/55 X
2,366,487	1/1945	Burgess	29/424
3,130,609	4/1964	Wahl	29/163.5 R

FOREIGN PATENTS OR APPLICATIONS

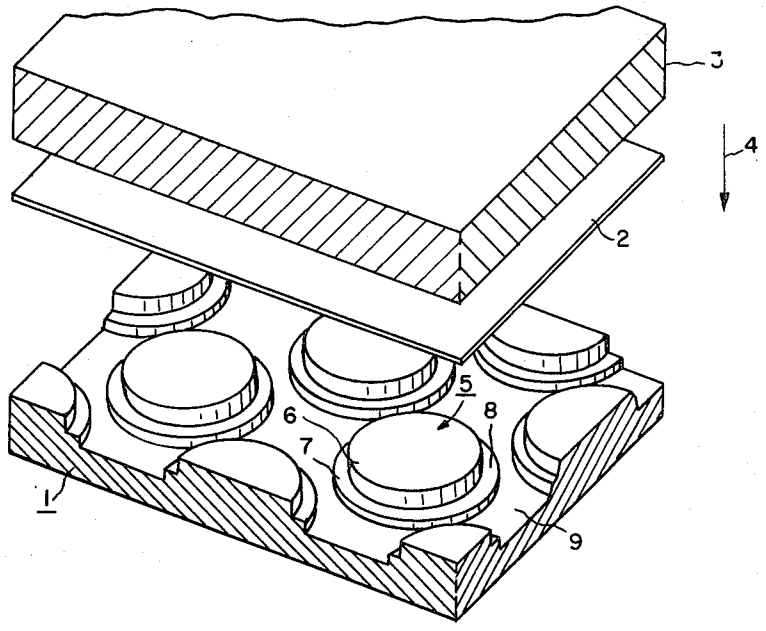
228,605	10/1962	Austria	72/55

Primary Examiner—Charles W. Lanham
Assistant Examiner—Victor A. DiPalma
Attorney, Agent, or Firm—Frank R. Trifari

[57] **ABSTRACT**

A process of making a cutter foil for dry shaving apparatus, using a rubber cushion, and a die having raised parts each of which decreases in cross section from a base to a free end, and consists of two superimposed portions between which is a step-like offset, the end portion having a height at least equal to the thickness of the foil; the process comprising a single operation of pressing the die and the cushion together with the foil between them, which causes the end portion of each raised part to punch a hole in the foil, as a first step, and directly thereafter causes the base portion to turn over the edge of the hole, as a second step; followed by removing part only of the turned-over material by grinding in a plane parallel to the surface of the foil.

3 Claims, 6 Drawing Figures



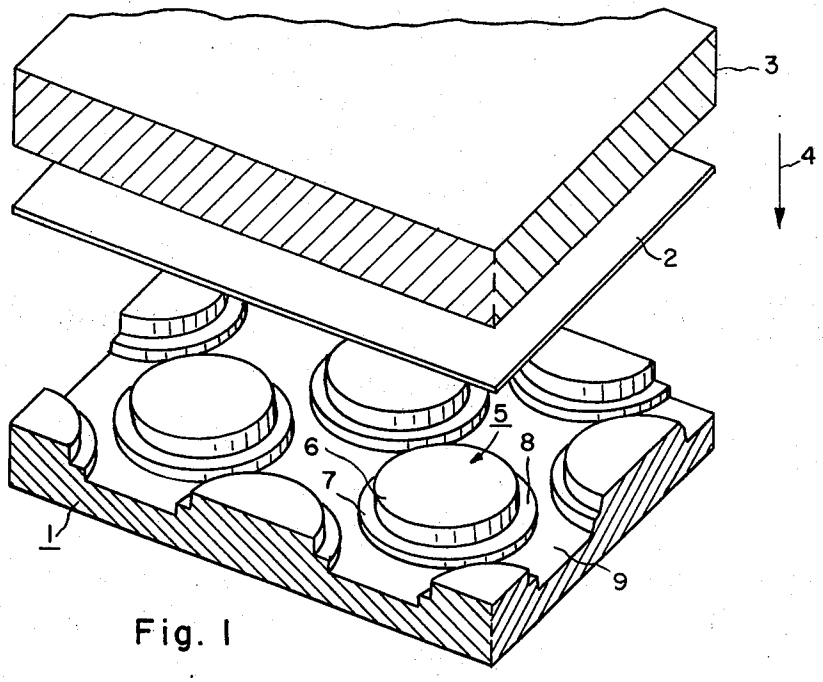


Fig. 1

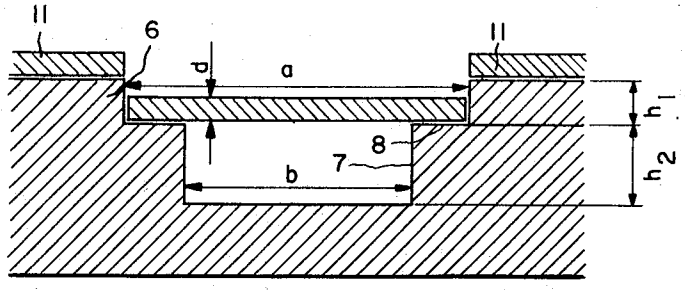


Fig. 2

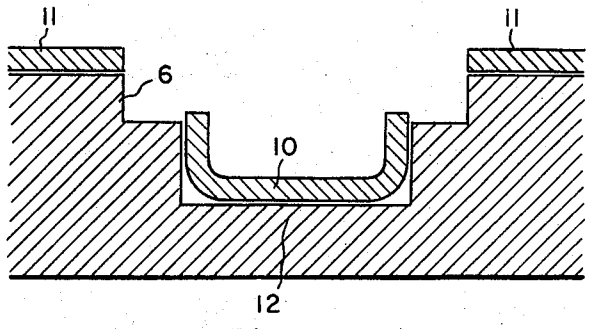


Fig. 3

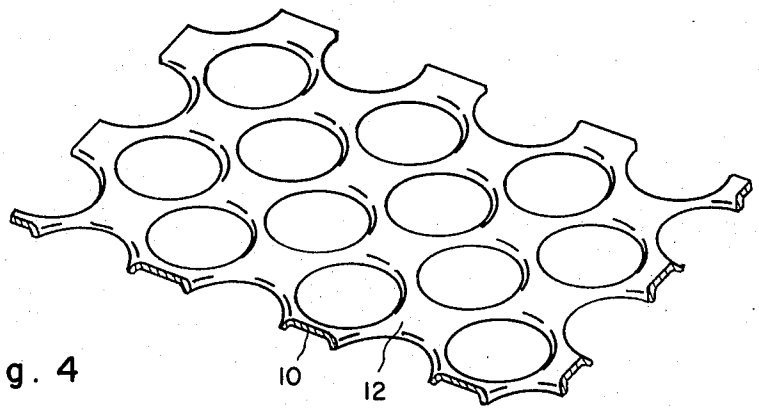


Fig. 4

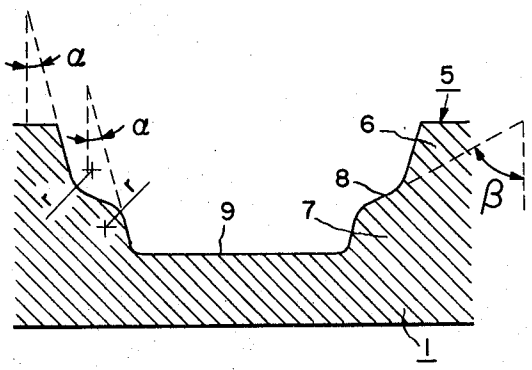


Fig. 5

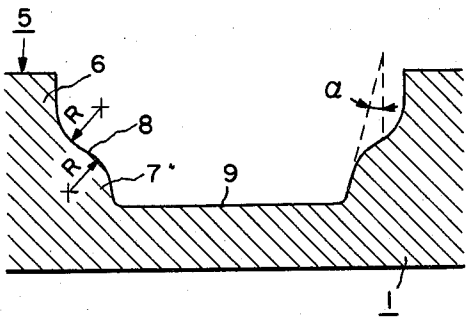


Fig. 6

PROCESS OF MAKING A CUTTER FOIL FOR DRY SHAVING APPARATUS

This is a division, of application Ser. No. 074,632, filed Sept. 23, 1970 now U.S. Pat. No. 3,714,807.

The invention relates to processes for making cutter foils for dry shaving apparatus. The first step is pressing metal foil between a rubber cushion and a die having raised parts, so as to punch out holes, thus leaving a continuous network of bars between the holes. The edges of the holes are truned over, after which the edges of the holes are ground in a plane parallel to the surface of the foil with only partial removal of the material extending above the surface of the foil. Furthermore the invention concerns dies for carrying out the process.

In Austrian Patent Specification No. 228,605 a process of this kind is described, which uses a die, the raised parts of which have a greater diameter at their bases than at their free ends. The foil produced is stated to have edges of the holes bent over through about 70°, and flat, relatively large bearing surfaces for engaging the skin of a user's face, and thus has a thoroughly ideal cross sectional pattern. The shape of the bars between the holes has in fact a substantial influence on the quality of the shave as well as the feeling during shaving, especially on the irritation of the skin. Of particular importance in this connection is the surface, with which the cutter foil engages the face. This surface must on the one hand be as large as possible, but on the other hand an attempted increase of the latter must not occur at the expense of the total of the area of the holes. One must aim, therefore, to keep the bars as narrow as possible and nevertheless to make the area turned towards the face as large as possible, so that a better support of the skin of the face is achieved opposite the cutting area constituted by the bent over edges of the holes. The danger, that pieces of skin will be involved in the cutting process, is thus reduced and the possibility exists of reducing the total thickness of the cutter foil, including the height of the turned over edges of the holes, so as to achieve a greater depth of shaving, without making the shaving operation unbearable by reason of damage to the skin. Practice has now however shown that, with the process described in Austrian Patent Specification No. 228,605 and the die thereby produced, a cutter foil with the ideal cross-sectional shape mentioned (see FIG. 4 of the cited patent specification) cannot be properly achieved, because bars are thereby obtained, which have a cross section somewhat corresponding to a section of a torus, so that the bearing face of the cutter foil on the face, by reason of the curvature of the bars which is present, is less and thus not so satisfactory as in the flat ideal form.

The invention has as its object to overcome this disadvantage. According to this invention, use is made of a die in which each raised part consists of two superimposed portions between which is a step-like offset, the end portion having a height at least equal to the thickness of the foil, and the process comprises a single operation of pressing the die and the cushion together with the foil between them, which causes the end portion of each raised part to punch a hole in the foil, as a first step, and directly thereafter causes the base portion to turn over the edge of the hole, as a second step.

By this means, namely that in one operation, but in two steps of the latter, first the holes are punched out

and only then the edges of the holes are turned over, the result is achieved that the bars can be given whatever form permits a good shave and at the same time preserves the skin.

Brief Description of the Drawing

The invention will be explained more fully below with reference to the accompanying drawings, in which:

FIG. 1 shows in perspective view parts of a die, of the metal foil and the rubber cushion, before the punching and turning-over operation;

FIG. 2 shows in cross section the first step, and FIG. 3 the second step of the unitary working process;

FIG. 4 shows in perspective the cutter foil produced;

FIG. 5 shows in cross section a variation of the die of FIG. 1; and

FIG. 6 shows, likewise in cross section, a further variation of the die.

Description of the Preferred Embodiment

In FIG. 1 there is a die designated 1, a metal foil 2 which is to be operated on to produce a cutter foil, and a rubber cushion 3. According to the known type of process, the rubber cushion is pressed down in the direction of the arrow 4, so that the die, with raised parts or projections 5, punches holes in the metal foil, and in the same operation turns over the hole edges. In a further operation, not shown, the edges of the holes are then ground in a plane parallel to the surface of the foil with only partial removal of the material extending from the plane of the foil, after which the cutter foil is substantially ready.

The raised parts 5 have two portions 6 and 7, namely a base portion or first part 7 and an end portion 6 or second part, between which is a step-shaped offset 8. In the example in FIG. 1, both portions 6 and 7 are cylindrical, while the diameter of the cylinder 6 is smaller than that of the cylinder 7. The offset 8 here consists of a flat surface parallel to the base surface 9 of the die's base member 9'.

On pressing down the rubber cushion 3, as the first stage in this operation, the holes in the metal foil are punched out by the end portions 6 of the die, while the bars 10 which form a continuous network come to lie between the portions 6, as shown in FIG. 2. The cut-out hole parts 11, which form waste, remain for the time being on the top face of the portions 6. The height h_1 of the portions 6 is preferably, as shown, larger than the thickness d of the metal foil, so that the punching out is completed, before the second step of this operation begins.

Upon further downward pressing of the rubber cushion 3, the bars 10 come into engagement with the offset 8, whereupon the second step of the operation, namely the turning over the edges of the holes, begins. Since, during this second step, the foil can only yield in the areas between the base portions 7 of the die, the bars 10 are pressed down to the base surface 9 of the die, while the base portions 7 have the effect that the edges of the holes on the bars are turned over, as shown in FIG. 3. In this last step, however, only a deformation of the bars 10 occurs. This guarantees that the foil material can fit the shape of the die well, so that a shape of

bar is achieved, which satisfies the requirements already mentioned, namely, with a small width *b* of the bar, sharply bent turned over edges and a large flat engaging surface **12** for the face are produced. After the conclusion of this second step the bars which form a continuous network are removed from the die. FIG. **4** shows the cutter foil obtained in this way. In addition to this stamping and bending over process, the cutter foil is then ground.

Advantageously the height h_2 of the base portions **7**, less the thickness of the foil, is smaller than half the difference between the clear width *a* measured at the free ends, and the clear width *b* measured at the bases, between adjacent raised parts. As can be seen from FIG. **3**, the result thereby achieved is that the bent over edges of the holes extend with their free ends above the base portions **7**, so that it is with certainty guaranteed that the foil material properly fills the shape of the die in the area of the base portions **7**, and thus a particular minimum height of bent over hole edges is always produced. Furthermore this guarantees that the perforated cutter foil can be easily removed from the die, since the free ends of the bent over edges of the holes cannot fit tightly on the die itself.

Furthermore, it has been found to be advantageous, if the clear width *b* measured between the bases of adjacent raised parts is larger than half the clear width *a* between the free ends of the latter, but is smaller than the whole clear width *a* between the same free ends less the thickness *d* of the metal foil. With this provision the best shape of bar is achieved having regard to a good shaving performance with simultaneous preservation of the skin.

In the die shown in FIG. **5**, both portions **6**, **7** of each raised part **5** are constituted by a truncated cone. Preferably the semi-vertical angle α amounts to less than 20°. By the selection of this semi-vertical angle α of the portion **7**, the cutting angle which appears later upon grinding of the foil is at the same time also determined. The offset **8** includes a surface of a truncated cone with a semi-vertical angle β of more than 40°. The transition from the portion **7** to the offset **8** and from the latter to the portion **6** is at the same time rounded off, as indicated by the radii *r*. As shown in FIG. **5**, the transition from the base surface **9** to the portions **7** can also be rounded off. Such a die can be relatively easily made, for example by spark erosion or a sand blast process.

In FIG. **6** a die shape is shown, in which only the portions **7** are made in the shape of a truncated cone, while the portions **6** consist of cylinders. This offers the advantages, that in the first step there is absolutely exact punching, and in the second step the foil fits the shape of the die well, while the cutter foil is easily removed from the die. The offset **8** is, in this example, formed by two parts of toroidal surfaces, running into one another, as is indicated by the radii R.

The process according to the invention, may be used in making cutter foils, with other than circular holes, e.g., diamonds, pentagons or the like, for which purpose only the raised parts **5** of the die have to have the corresponding circumferential shape.

I claim:

1. A process of making a cutter foil for dry shaving apparatus, using a rubber cushion, and a die having raised parts each of which decreases in cross section from a base to a free end, and consists of two superimposed portions between which is a step-like offset, the end portion having a height at least equal to the thickness of the foil; the process comprising a single operation of pressing the die and the cushion together with the foil between them, which causes the end portion of each raised part to punch a hole in the foil, as a first step, and directly thereafter causes the base portion to turn over the edge of the hole, as a second step; followed by removing only part of the turned-over material by grinding in a plane parallel to the surface of the foil.

2. A process according to claim **1**, using a die in which the height of each base portion, less the thickness of the foil, is smaller than half the difference between the clear widths, measured at the free ends and at the bases, between adjacent raised parts.

3. A process according to claim **1**, using a die in which the clear width measured between the bases of adjacent raised parts is larger than half the clear width between the free ends of the same parts, but is smaller than the whole clear width between the same free ends less the thickness of the foil.

* * * * *