operation of a packaging plant but additionally the high-quality eye-catching fine embossing of sophisticated logos such as for example mythical creatures, letters and the like. Embodiments of the present invention further seek to provide the creating of stepped grades of brilliance and of stepped contouring.

According to an aspect of the present invention, there is provided an embossing device for embossing packaging material comprising: a set of embossing rollers including a male die roller and a female die roller co-operating with each other, a surface of the male die roller having texture elements, and a surface of the female die roller having texture elements, wherein the texture elements of the female die roller and the texture elements of the male die roller that are associated to the texture elements of the female die roller, include intended deviations so that a texture element of the female die roller and an associated texture element of the male die roller are not inversely congruent, the intended deviations include, an angular deviation between a side of the texture element of the female die roller and an associated side of the texture element of the male die roller being up to 20°, and a linear deviation between

the texture element of the female die roller and an associated texture element of the male die roller being above 15 µm in an axial and a radial direction, and wherein the texture elements of the male die roller, which are assigned to the texture elements of the female die roller, have facets configured to increase a local pressure.

In general, fine embossing is to mean that the contours of the fine embossing textures of the rollers have a linear total error in axial and radial direction of less than +/- 10 µm and/or an angle error of less than 5°.

In the following, the invention is explained in more detail with the help of drawings of exemplary embodiments.

Fig. 1 shows schematically a device with a set of embossing rollers with a male die and a female die, each of which are provided with a simple texture,

Fig. 1A shows schematically a facetted rounding,

Figs. 2, 2A show schematically a sign with facets,

Figs. 2B - 2E illustrate schematically four rules for facets,

Figs. 3 - 5 show schematically sectional drawings of designs of male die and female die textures which are not inversely congruent,

PATENT CLAIMS

1. An embossing device for embossing packaging material comprising:

a set of embossing rollers including a male die roller and a female die roller co-operating with each other, a surface of the male die roller having texture elements, and a surface of the female die roller having texture elements,

wherein the texture elements of the female die roller and the texture elements of the male die roller that are associated to the texture elements of the female die roller, include intended deviations so that a texture element of the female die roller and an associated texture element of the male die roller are not inversely congruent, the intended deviations include,

an angular deviation between a side of the texture element of the female die roller and an associated side of the texture element of the male die roller being up to 20°, and

a linear deviation between the texture element of the female die roller and an associated texture element of the male die roller being above 15 μm in an axial and a radial direction, and

wherein the texture elements of the male die roller, which are assigned to the texture elements of the female die roller, have facets configured to increase a local pressure.

2. The embossing device according to claim 1, wherein each of the facets have faces, which are inclined at a defined angle, with respect to an imaginary and continuous surface of a texture of a logo represented by the texture elements.

3. The embossing device according to claim 1 or 2, wherein a minimal area for each of the facets is 0.4 mm x 0.4 mm, or 0.16 mm^2.

4. The embossing device according to any one of the claims 1 to 3, further comprising:

a second female die roller,

wherein the male die roller, the female die roller, and the second female die roller are arranged such that the male die roller with a male die elevation first interacts with the female die roller with an associated female die depression, and thereafter the male die roller with the male die elevation interacts with the second female die roller and an associated second female die depression.

5. The embossing device according to any one of the claims 1 to 3, further comprising:

a second male die roller,

wherein the male die roller, the second male die roller and the female die roller are arranged such that the female die roller with a female die depression first interacts with the male die roller with an associated male die elevation, and thereafter the female die depression interacts with the second male die roller with an associated second male die elevation.

6. The embossing device according to claim 4, wherein the male die roller, the female die roller, and the second female die roller are arranged in a three-roller embossing device,

wherein the male die elevation is arranged on the male die roller in such a manner that during an embossing process, the male die elevation interacts first with recesses of the female die roller, and thereafter with recesses of the second female die roller.

7. The embossing device according to claim 4, wherein the male die roller, the female die roller, and the second female die roller are each arranged in pairs in a two-roller embossing device.

8. The embossing device according to claim 5, wherein the male die roller, the second male die roller, and the female die roller are arranged in a three-roller embossing device, wherein the female die depression is arranged on the female die roller in such a manner that during the embossing process, the female die depression interacts first with elevations

of the male die roller, and thereafter with elevations of the second male die roller.

9. The embossing device according to claim 5, wherein the male die roller, the second male die roller, and the female die roller are each arranged in pairs in a two-roller embossing device.

10. The embossing device according to any one of the claims 1 to 9, wherein at least one of a height and a depth of the elevations and recesses and the number of embossing rollers are configured to create high or raised reliefs on the packaging material through multiple embossing, the at least one of the height and the depth and width being greater than the remaining textures of the packaging material.

11. The embossing device according to any one of the claims 1 to 10, wherein a diameter of one of the embossing rollers is wider than the width of the web of the packaging material, the diameter being smaller by an amount S than the other embossing roller, wherein S has a value of over 0.02 mm.

12. The embossing device according to any one of the claims 1 to 11, wherein the surface of the embossing rollers is made of at least one of metal, hard metal, hard material or ceramic, and wherein the surface is covered by a protection layer.

13. The embossing device according to any one of the claims 1 to 12, wherein the set of embossing rollers is arranged in a quick-change

device such that the male die roller and the female die roller can be replaced individually and independently of each other,

wherein the male die roller and the female die roller are rotatably held in a male die roller carrier and a female die roller carrier, respectively, and are fastened individually and removably independently from each other in a quick-change housing in a defined position,

wherein an end of the male die roller carrier is held in a needle bearing and an other end of the male die roller is held in a ball bearing.

14. The embossing device according to claim 13, wherein at least one of the male die roller carrier and the female die roller carrier includes a key at a lower part, and a corresponding slot at a bottom of the quick-change housing.