

The invention relates to a positive die for the galvanoplastic moulding of metal foils as a packing for sheet-conveying cylinders and/or drums of rotary printing machines, the one surface of the die being of smooth design and the opposite surface being of structured design.

Known metal foils of this type according to DE-B 2,605,330 preferably consist of solid nickel and have a surface structure which essentially corresponds to the previously known glass bead cloth likewise for the same purposes. This results from the fact that the galvanoplastic moulding of the metal foils takes place from a negative die which, in turn, is moulded from a positive die which consists of a substrate foil with a layer of rubber applied in which glass beads, partially projecting from the surface, are embedded. The fact that the surface structure is reproducible to a great extent is advantageous in these metal foils. This is important for undelayed use in printing operation, for example for the exchange of a damaged metal foil for a new one without control. However, it is disadvantageous in these metal foils that there is no optimum surface topography in terms of different working requirements.

The same disadvantages occur in another previously known solution according to EP-A-0,017,776, in which the sheet-conveying foil as a packing for back pressure cylinders of rotary printing machines for perfecting is of smooth design on the one surface and is provided, on the opposite surface, with statistically evenly distributed ball shapes of equal height, and in which the foil is formed from a substrate layer and a covering layer, the substrate layer consisting of nickel or plastic with a high modulus of elasticity, eg. polyamide or PVC, on the ball-shape side a thin chromium layer, which evens out its micro-roughness, being applied as a covering layer. The evening-out only of the micro-roughness does not change the intended, very even ball-shape topography of the surface.

In terms of a compromise to be achieved by means

of the roughness, DE-C 1,258,873 proposes surface structures of a back pressure cylinder or of an aluminium foil to be assigned thereto, which is designed as a chromium surface with a roughness (RMS) between 2 and 7.5 μm . As
5 a result, two boundary conditions should be fulfilled in the compromise in an optimum manner, namely that roughness is, on the one hand, sufficiently great to realize a particular ink repellent effect (stated therein), for example in order to prevent smearing of the freshly
10 printed sheet on its back during perfecting, that on the other hand, however, the roughness also be kept as small as possible in order to ensure the optimum bearing proportion for the resting surface of the sheet. On the one hand, this compromise is not, as was found, achieved
15 in an optimum manner. On the other hand, it is disadvantageous in this solution that it is not reproducible in terms of the surface structure. Even if the dimensioning of the roughness (as an appropriate mean considered over the entire foil) is reproduced with an acceptable tolerance, the surface structure in total of each foil again
20 differs very considerably from the other foil or each cylinder surface from the next cylinder surface. The reproducible blasting of such thin aluminium foils is also problematic as well as the stability for use thereof. Accordingly, all such previously known products with
25 a surface roughened by blasting constitute unica.

Moreover, a metal sheet-conveying foil is known from DE 2,820,549 A1, which consists of at least two layers. The substrate foil is roughened by means of
30 blasting. Subsequent to this operation, one or two galvanoplastic finishing processes then follow, specifically either two nickel layers of different hardness or one chromium layer are applied. In these finishing processes, experience has shown that the roughness
35 increases insofar as any undercuts present undergo a more pronounced shaping. The metal sheet-conveying foils produced in this manner are unica. Owing to the undercuts present in the structured surface, these unica are not reproducible by electroplating and thus cannot be used as

a die.

Finally, DE 3,537,483 C1 describes a galvanoplastic method for producing a multiplicity of plate-shaped microstructure bodies made of metal. In this case, these are exclusively bodies with a flat surface, which means that undercuts which could preclude reproducibility do not occur.

The object of the present invention is to design a die of the generic type in such a way as to provide a constantly identical reproducibility of the metal foil with optimum adaptation of the surface structure to the functioning conditions of said metal foil which can be produced therewith for conveying sheets without smearing.

This is achieved according to the invention in that the structured surface of the die is roughened by blasting and is coated by a levelling electrodeposition layer of bright nickel to eliminate undercuts.

As a result of this design, a metal foil as a packing for sheet-conveying cylinders and/or drums of rotary printing machines can be produced, the surface structure of which metal foil basically constitutes a duplicate of a surface produced by means of roughening by blasting (and then free from undercuts), and which is thus, on the one hand, clearly reproducible at any time with a very high degree of precision and, on the other hand, affords optimum conditions in relation to preventing smearing. In this respect, the structure of a surface which has been roughened by blasting and correspondingly levelled was found to afford the most favourable compromise both directly (as a positive profile) and with its negative profile, in particular in terms of bearing proportion, washability of the metal foil and prevention of smearing. All these factors together afford optimum conditions of use. In this case, the essence of the invention is the finding that this optimization is achieved if the roughness elevations, produced by blasting of the surface of the die are levelled, thus removing any undercuts, so that the moulded, finished metal foil thus cannot have any depressions which widen down into

the depth or any elevations with an overhang. Blasting to roughen the topside of the die can take place by means of known blowing or blasting methods, eg. by shot-blasting. The respectively produced surface can additionally be
5 provided with a chromium layer, also to stabilize and extend the service life. Such a chromium layer, applied to a surface topography produced by blasting and then levelled by electroplating, improves the evening-out of the surface even further because, for example due to the
10 lack of undercuts, there are no electrolytically preferred edges and/or peaks. The metal foil corresponding to the die can also be used as a dressing for the impression cylinder of a rotary printing machine. In this case, the domes are very well suited to increasing the friction
15 value of the cylinder surface so that the paper tensioning forces for the grippers can be dimensioned to be smaller; nevertheless, the sheet is then prevented from being pulled out of the grippers. The design of the domes (pointed or flat, high or low bearing proportion) can be
20 adapted to the respective application (eg. first transfer cylinder, third transfer cylinder, impression cylinder or delivery drum). A very durable construction shape results despite a relatively thin structure. The sheet-contacting surface is also optimum for cleaning. The levelled flanks
25 of the elevations avoid nests for ink accumulation or residues of any cleaning agent. By means of the respective blasting method to roughen the topside of the die, a far more thorough adaptation to the later application of the metal foil can be achieved than was possible with the
30 metal foils hitherto moulded by electroplating in a ball-shape structure. Owing to the optimum bearing proportions which such a topography entails, such a metal foil is also very well suited to undertaking a very fine adaptation to different paper thicknesses on a cylinder by
35 placing the foil underneath. Owing to the specific conditions in relation to bearing proportion of the surface, design of the bearing surface, material, distribution of the bearing proportions, height difference and its distribution, design of the domes and troughs, in particular

their flanks, a solution was found to result, which is superior in terms of application both to the micro-smoothed ball shapes which are of equal height and are evenly distributed and to the cylinder surfaces roughened by blasting (plus chromium-plated) (with undercut nests).
5 In this case, a good possibility of influencing the above factors also results due to the dimensioning of the mass of bright nickel to be applied.

The subject-matter of the invention is illustrated in two exemplary embodiments by sketches in the
10 attached drawing.

In Figure 1, 1 denotes a section from the topside of the die as a partial cross-section of illustration. This die can, in total, have the shape of a cylinder
15 which preferably consists of aluminium. It has the topside 0 which has a surface structure, the surface structure being achieved by blasting, eg. shot-blasting, so that the elevations 2 with the undercuts 2' and the depressions 3 are produced. This structured surface is
20 subsequently coated with a chromium layer 4 by electroplating. As can be seen, the chromium layer 4 changes the topography of the surface at the points 4', that is to say ahead of exposed points of the elevations 2, but more in such a way that the undercuts are enlarged. It is an
25 essential element of the invention to have recognized that such undercuts are the cause of the surface roughened by blasting appearing to be less favourable in many respects than, for example, a ball-shape topography. If the undercuts are removed, the surface roughened by
30 blasting proves - as was found - to be superior compared to all other surface structures. This chromium layer 4 is subsequently covered with a layer 5 of bright nickel. This completely levels the surface and, in particular, the flanks of the elevations/depressions covered with the
35 chromium layer so that no more undercuts occur at all, whether these be the undercuts from the blasting or those from the application of the chromium layer 4 by electroplating. This topside of the die 1, produced by the levelling electrodeposition layer 5 (layer of bright

nickel) is now used for the galvanoplastic moulding of the metal foil 7 according to Figure 2. Its material preferably consists of nickel. In this case, its side coming into contact with the sheet has the negative profile of the structure profile produced by blasting, but without any overhangs on the flanks 8 of its elevations 9, which not only optimizes it in terms of the printing function, but also improves it in terms of cleaning and avoids nests for long-term corrosion. This metal foil 7 can be the metal foil according to the invention directly or the negative die N to produce the metal foil 7', illustrated in Figure 3. Both the metal foil 7 and 7' are always duplicates, which are homogeneous in respect of material, of the corresponding die surface, it being very important for the positive version according to 7' that the resting surfaces (crest peaks) of different height are provided in a relatively broadly scattered manner and can be influenced in terms of their position and design, the factors of the material homogeneity and the lack of any undercuts on said resting surfaces contributing jointly to optimizing the use.

As can be seen in Figure 4, the metal foil 7 can still be coated with a thin chromium layer 10 after moulding by electroplating, which optimizes not only the stability, but also the characteristics of preventing smearing. The same applies, as illustrated in Figure 5, to the metal foil 7', in which the positive profile of the die is thus fitted with this thin chromium layer 10'.

In each case there is a roughness structure in which the surface structure including the flanks of the roughness elevations produced by blasting is levelled. The roughness is about 30-60 Rz; the bearing proportion TP in the individual depths is:

TP at a depth of 10.0 μm = 15 %
TP at a depth of 20.0 μm = 50 %
TP at a depth of 30.0 μm = 84 %

The thickness of the chromium layer 4 is preferably about 40-50 μm , that of the layer of bright nickel about 10-15 μm . The thickness of the chromium layer 10

or 10' is about 10 μm .

Patent claims

1. Positive die for the galvanoplastic moulding of metal foils (7) as a packing for sheet-conveying cylinders and/or drums of rotary printing machines, the one surface of the die being of smooth design and the opposite surface being of structured design, characterized in that the structured surface of the die (1) is roughened by blasting and is coated by a levelling electrodeposition layer (5) of bright nickel to eliminate undercuts (2').
2. Positive die according to Claim 1, characterized in that the surface of the positive die (1) intended for the galvanoplastic moulding is roughened using a blasting method, and the roughened surface is coated with a chromium layer (4) and an electrodeposition layer (5) which levels the undercuts.
3. Positive die according to Claim 2, characterized in that the roughness achieved by blasting is between 30 and 50 Rz and, after application of the chromium layer (4) and the layer (5) of bright nickel, the bearing proportions rise from about 15% at a depth of 10 μm to 85% at a depth of 30 μm .
4. Use of the positive die to produce metal foils according to one or more of Claims 1 to 3, characterized in that the structured surface, corresponding to the die, of the metal foil (7) consisting of nickel is coated with a thin chromium layer (10) after moulding.



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