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DESCRIPTION

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SCREEN PRINTING FORM AND APPARATUS FOR ACCOMMODATING A FLEXIBLE
SCREEN PRINT FORM

The invention concerns a screen printing form with screen printing cloth comprising mutually crossing plastic yarns and a coating comprising an - in particular photosensitive - emulsion. The invention also concerns a printing apparatus as set forth in the classifying portion of claim 12.

Centuries after it was first used in China the screen printing process has been known in Europe approximately since the 19th Century; a fine-mesh textile cloth or wire mesh material is stretched out in a screen printing frame and covered at the image-free regions so as to be impermeable to ink. Besides manual cut stencils - for example for labelling or writing - nowadays preferably photographically produced direct or indirect stencils are the usual practice; the choice of the kind of stencil adopted - in the case of direct stencils those with emulsion, with direct film and emulsion or with direct film and water - is left to the discretion of the screen printer.

A plurality of steps are usually required to produce a screen printing form. Firstly a screen printing cloth is stretched out over a clamping frame of light metal or alloy, wood or the like, and is glued to the frame in its stretched position. Cleaning of the cloth permits the subsequent application of a photosensitive emulsion, for example using a coating channel manually or by machine with an automatic coating apparatus. As the coating thereon cannot be produced exactly as far as the inward side of the frame, the

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remaining surface area must be subsequently sealed off using screen filler. The coated surface is now exposed by means of a copy original (film) corresponding to the print image. The regions of the print image which are not exposed are washed out.

5 After the washing-out operation, what is produced is the actual screen printing stencil, the edge zones of which often still have to be covered over. When those covering portions are also dried, printing can be effected with the stencil. In addition the individual items of equipment which are used for the respective
10 stencil production steps have to be cleaned. Thus the amount of work involved in the production of a screen printing stencil and in particular an individual stencil is relatively great.

For certain areas of use, it is known, when dealing with plastic meshes, to settle palladium nuclei or seeds on the surface by
15 a chemical treatment of the surface, and to metallise the filaments. Those chemical treatment procedures involve a plurality of stages and are to be matched in terms of their compositions and operating procedures to the respective plastic material involved. Limitations in regard to the choice of material are predetermined on the basis of
20 poor or unsuitable materials. The known expensive preliminary treatments can be followed by expensive chemical metal deposition processes; because of its inadequate conductivity, the pre-treated plastic cloth surface cannot be directly covered with a galvanic metal deposit.

25 A further aspect is that the stencil carriers which are used nowadays in screen printing, prior to mounting of the actual stencil, have to be braced and glued on a frame on all sides. In that respect the quality of the printing is dependent on the correct cloth tension, relaxation of the cloth, the adjusted deflection effect, the
30 squeegee pressure or the like factors. So that the adjusted deflection effect as between the cloth and the object being printed upon can be overcome, stretching of the stencil is necessary. In the case of stencil carriers without natural stretch or with only a very low degree of natural stretch, that results in high alternating
35 tensile loadings which can result in the stencil carriers suffering



from rapid fatigue effects or possibly can result in destruction thereof.

As printing can satisfactorily occur with those low-stretch stencil carriers in a flat screen printing process, a printing or
5 clamping frame is necessary which is capable of compensating for the variations in length caused by the deflection effect.

US-A-3 303 777 describes a holding arrangement for a stencil on a screen printing machine, in which it is to be fixed and tensioned at two parallel regions - which cross the direction of movement of a
10 displaceable squeegee which presses the printing inks through screen meshes.

In consideration of those factors the inventor set himself the aim of considerably simplifying manufacture and handling of screen printing forms or stencils, making the use thereof in printing
15 mechanisms more operator-friendly and increasing their register accuracy - even with high numbers of print runs. In addition the inventions seeks to provide that the print quality is optimised in the case of fine lines and patterns by homogenous coating, with a constant structure.

In regard to the printing or clamping frame, the invention
20 seeks to make it possible to use stencil carriers without natural stretch while seeking to eliminate the changes in length caused by the above-mentioned deflection effect - and therewith changes in tension of the stencil. Minimum stencil tightening tensions are
25 intended to permit minimum squeegee pressures, which results in a reduced amount of wear of the stencil and the squeegee. Tightening the screen printing stencil in only one direction permits a constant specific squeegee pressure over the printing width.

In accordance with the invention the plastic threads or yarns
30 are coated with a casing layer which is produced thereon by vapour deposition and which in turn is covered over by a metal coating which carries the emulsion and which is produced by galvanisation. In accordance with another feature of the invention the plastic cloth can also be prepared for the galvanisation operation by so-called
35 sputtering or cathode sputtering with the casing layer.

In both cases, the result obtained is a casing layer comprising metal material which preferably contains gold, silver, nickel, copper, steel and/or a light metal, in particular aluminium, alone or as an alloy.

5 In the above-mentioned vapour deposition or sputtering procedure, for the screen printing cloth according to the invention, layer thicknesses of about 5 to over 200 nanometres - in particular over 50 nm - are produced, which may have surface resistance values of below 0.2 ohm/2 to some hundred ohm/2, depending on the type of
10 cloth and the kind of vapour deposition.

Electrical conductivity of the cloth is afforded by the dry process step of vapour deposition, cathode sputtering as mentioned above or vacuum plasma spraying.

The mechanical properties of the conductive cloth are primarily
15 determined by its metallisation, for example by means of galvanic nickel-plating. Stretching is strikingly reduced, with an increased level of strength of the cloth, and - irrespective of the nature of the initial cloths - the resistance to slip of the cloth is increased to an extraordinary degree. The metallising substances contribute in
20 particular to the strength at the bonding locations of the cloth of plastic base materials and form a conductive surface. It thus becomes possible to replace expensive metallic cloths by metallised plastic cloths with similar properties.

Therefore, the basis used for the screen printing plate which
25 is produced in a finished condition and which is provided with a coating is a metallised plastic cloth, preferably with a metal coating of nickel because of its general strength. The metallic surface of the screen printing plate reduces the wear of the stencil, whereby it is possible to achieve very high numbers of print copies
30 with the latter. The conductive surface of the screen printing plate prevents static charging phenomena. Limitations in regard to materials to be printed or inks, due to problems with static, can be practically eliminated.

The metallised plastic cloth according to the invention
35 guarantees very minimal stretch phenomena with an adequate level of

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basic strength and provides that there are scarcely measurable register differences on the stencil, irrespective of the set clamping tension.

5 The fact that the limitedly flexible metallised cloth is coated over its full surface area by machine provides for a high, reproducible stencil quality with excellent edge sharpness and accurate ink metering. A protective foil which is applied if necessary reduces improper manipulation operations which could cause impairment of the quality of coating. As the coating is effected on 10 the endless roll of cloth, there is no need for covering operations, as are the conventional practice at the present time.

It has been found advantageous to cut screen printing plates of predetermined format sizes out of the metallised plastic cloth. They can be provided in particular at two oppositely disposed edges with 15 connecting elements for fixing to a printing or clamping frame - preferred connecting elements are profiled connecting bars, between which the comparatively stiff screen printing plate extends.

The above-mentioned operation of cutting the screen printing plates to fixed format sizes - which if required can additionally be 20 provided with register perforations - permits the end user to enjoy a standardised working procedure which begins directly with exposure of the screen printing plate, in accurate register relationship. After the procedure for washing out and drying the screen printing plate, it can be used for printing.

25 By virtue of this novel screen printing plate, restoration of an individual screen printing stencil which has failed during use thereof is also possible in a very short period of time.

The invention also embraces the above-mentioned printing or clamping frame in which the screen printing plate is fixed - with the 30 interposition of connecting bars arranged at two parallel plate edges - on the one hand to one side of the printing or clamping frame and on the other hand to a tensioning bar or the like movable element which is displaceable in the frame parallel to the first-mentioned side thereof. The tensioning bar is disposed transversely to the 35 direction of movement of a squeegee which presses the printing inks



through the stencil. That form of fixing in two regions which cross the squeegee direction - and unsecured longitudinal edges - eliminates sag such as to distort the printing result, in the form of a catenary curve which is produced in terms of cross-section between the longitudinal edges.

By virtue of the particular configuration of two edge zones of the screen printing plate, it can be very easily fitted into a printing or clamping frame on the printing mechanism and tensioned. For that purpose specific connecting or attachment profile members are to be disposed at the ends of the plate. However, the provision of a perforation arrangement for engaging the ends of the plates in position is also within the scope of the invention.

In order to facilitate handling in particular when dealing with large stencil formats, it is also possible to use bars in the attachment region or a closed thin-wall frame of metal sheet or like material, of the same size as the screen printing plate.

The metallisation of the cloth, in accordance with the invention, affords an adequate level of angular strength with the result that the screen printing plate only has to be tensioned in one direction and in that case nonetheless there are no register differences transversely with respect to the tensioning direction. In addition that tensioning effect at one side means that the print image can be taken laterally as far as the edge of the screen printing plate; it is only necessary to leave space for mounting an ink delimitation means which can be glued in position, welded, sewn or fixed in some other manner.

It has been found desirable for the tensioning bar which tensions the screen printing plate to be connected by means of force storage means within the printing or clamping frame to one side thereof or to a frame member.

In order to adjust the tensioning position of the tensioning bar or the tensioning and printing position of the screen printing plate, it is possible in accordance with the invention to use mechanical, pneumatic, hydraulic or other means.

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To facilitate the printing operation the screen printing plate should be stretched out at a spacing relative to a surface to be printed upon.

Various forms of the so-called connecting or attachment bars are of significance in terms of the invention. Thus, there is provided a connecting bar which is of a substantially S-shaped angled configuration in cross-section and whose support limb, in the tensioning position, lies on the one hand against a lower edge of the side of the frame - or the tensioning bar - and on the other hand against a shoulder in the interior, of undercut configuration, of the hollow side of the frame - or the hollow tensioning bar.

In the case of another connecting bar of approximately S-shaped angular configuration, the support limb thereof lies in the clamping position against a support surface of a tensioning shaft extending in the interior of the hollow side of the frame or the hollow tensioning bar.

The form of a further connecting bar is a hook bar which is inclined relative to the plane of the screen printing plate and which is adapted to be fitted into an inclined groove in the side of the frame or the tensioning bar. A further connecting bar is provided with a support limb which is bent out of the plane of the screen printing plate at an angle and which is adapted to be fitted into an equally inclined slot in the side of the frame or the tensioning bar.

In accordance with a further feature of the invention, the screen printing plate in a further configuration has at two parallel edges a respective strip bead which can be fitted into a mounting profile member as a connecting element.

By virtue of those features, the screen printing plate comprises a metallised plastic cloth which is coated by machine with a photosensitive substrate and which is possibly protected with a foil on the coating side. That means that all the preparation operations which are conventionally adopted nowadays in the production of a screen printing stencil are eliminated; the screen printing plate can be directly exposed and developed.



In addition the metallic surface of the stencil carrier guarantees substantial chemical resistance and a high level of mechanical abrasion resistance.

5 The coating operation by machine guarantees a uniformly high print quality with brilliant edge sharpness and precise metering of the medium to be used for printing.

The use of this screen printing plate considerably reduces the length of the stencil production procedure and eliminates possible sources of error in preparation for printing.

10 A fact that is to be considered as a further advantage is that the degree of utilisation of the screen printing plate - that is to say the ratio of the printable surface area to the total surface area - is far above that of a conventional cloth and is possibly doubled.

15 Due to the high inherent stability of the screen printing plate and its angular stiffness, tensioning of the printing plate during the printing process at only one side is also possible. In spite of tensioning exclusively in the squeegee direction, no noteworthy register differences transversely to the tensioning direction can be detected. With that tensioning effect in the squeegee direction, one
20 plate fixing position is designed to be fixed (commencement of printing) and the other movable (end of printing). When the screen printing plate is clamped in position the biasing force of the spring or the pneumatic or hydraulic system takes effect. When the screen printing plate is pressed downwardly by virtue of the deflection
25 effect by the squeegee, that change in length is compensated by virtue of the movable fixing of the screen printing plate. The tensioning force on it remains constant and independent of the selected deflection and it is not subjected to any fatigue loadings by virtue of the appropriate deflection being surpassed. As the
30 screen printing plate is only tensioned at one side, there are also no additional loadings whatsoever by virtue of transverse stresses.

The squeegee pressure remains at a minimum as there are no deformation phenomena of the print carrier to be overcome. The squeegee loading over the printing width is constant as the known

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additional forces at the squeegee ends do not occur, due to the lack of transverse tensioning.

The following advantages for example are therefore enjoyed:

- the printing or clamping frame - by virtue of a single-sided movable stencil holding arrangement - permits the use of screen printing stencils with an extremely low degree of inherent stretch;
- the tensioning loadings on the screen printing stencil carrier can be kept low by means of printing or clamping frames, and that can be used for minimum squeegee pressure settings, and wear in respect of the printing plate and squeegee are thereby minimised;
- the printing or clamping frame permits printing with screen printing plates in accurate register relationship; the variations in length of the stencil by virtue of surpassing the stencil deflection and a variation in length of the stencil by virtue of unequal squeegee frictional forces are eliminated; and
- the lack of alternating loadings on the stencil carrier by virtue of the constant tightening tension in the clamping frame enhances the service life of the screen printing plate.

Further advantages, features and details of the invention will be apparent from the following description of preferred embodiments and with reference to the drawing in which:

Figure 1 is a view in cross-section through a cloth,

Figure 2 is a perspective view of an enlarged part of the cloth,

Figure 3 shows a part of Figure 2 on an enlarged scale, with a perspective view onto a bonding between two mutually crossing yarns,

Figure 4 is a sectional perspective view of a screen printing frame with screen printing stencil and squeegee;

Figures 5 to 7 show views in longitudinal section through different embodiments of screen printing frames with a screen printing stencil,

Figures 8 to 12 show views in cross-section through a portion of a screen printing frame, on a larger scale than Figures 5 to 7,

Figures 13 and 14 show views in cross-section on a larger scale than figures 5 to 12, and

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Figures 15 and 16 are diagrammatic views showing assembly aids.

A cloth 10 for the production of screen printing stencils is produced from mutually crossing warp threads or yarns 12 and weft yarns or threads 14, as shown in Figure 1 in a so-called linen or basket weave, in which two warp threads 12 and two weft threads 14 belong to a respective repeat - namely, a unit of repetition which is fixed by a given number of bonding locations as indicated at 16. The threads 12, 14 can comprise any plastic base materials, for example polyamide (PA), polyethylene (PE), polyethyleneterephthalate (PET), or the like.

The plastic cloth 10 is subjected continuously, as a roll, to a vapour deposition process, the maximum web length being determined by the largest possible winding diameter in the vapour deposition installation.

The vapour deposition material used is for example gold, silver, copper, nickel, steel, aluminium or the like precious, non-ferrous, heavy or light metals - each alone or in combination - , more specifically, in such a way as to be matched to the subsequent galvanisation operation.

The vapour deposition or sputtering operation - or possibly also vacuum plasma application - is effected on both sides and is possibly repeated a plurality of times, for special requirements. In that operation, a casing layer 18 of a layer thickness b of about 50 to over 200 nm, which is clearly shown in Figure 3, is produced around the threads 12, 14 each as a respective plastic core - which is identified in Figures 2 and 3 by references 12_a and 14_a to distinguish them from the warp and weft threads 12 and 14 respectively for the sake of enhanced clarity of the drawing - of a diameter a of for example 15 μm to 100 μm ; depending on the type of cloth and the kind of vapour deposition, the casing layers can involve surface resistance values of below 0.5 ohm/2 to over 100 ohm/2.

That dry coating operation can also result in accumulations of material in the region of each bonding 16, one such bonding being

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indicated at 20 in Figure 2 between the mutually crossing threads 12, 14.

Direct galvanic metal deposition can now be effected on the plastic cloth which has been prepared by vapour deposition in the above-described manner. In the galvanic application procedure, once again any metals can be used such as for example Cu, Ni or the like.

The vapour deposition material and the vapour deposition thickness are to be matched to the subsequent galvanising process in order to prevent the casing layer 18 from being reduced by the galvanic bath, whereby the conductivity of the vapour deposition would be reduced or eliminated in the event of prolonged exposure times. Combinations for galvanic metallisation are inter alia as follows:

- a Cu-vapour deposition with a surface resistance of about 0.5 to 1 ohm/2 for subsequent galvanic nickel-plating, or
- steel vapour deposition with a surface resistance of about 0.4 ohm/2 to 10 kohm/2 for subsequent galvanic nickel-plating.

The galvanic metallisation operation can be implemented as a continuous procedure with practically any roll length and results in a closed metal coating 22 of selectable layer thickness e - of preferably 2 μm to 20 μm and more - over the entire cloth 10_a; that metal coating 22 provides both for a high level of mechanical stability, in particular slip resistance, and also for chemical resistance on the part of the metallised cloth 10_a; as stated, its strength is considerably increased, with a considerable reduction in stretchability.

Figure 4 shows in a printing or clamping frame 24 a plate-like screen printing stencil or screen printing form 26 comprising metallised cloth 10_a produced in the above-described manner, and connecting profile members or bars 28 which are fixed at two oppositely disposed sides. The drawing does not show that the cloth 10_a is provided with a photosensitive layer of emulsion which includes a print pattern which is produced by photographic procedures and which is to be printed on a print material 30 disposed therebeneath. The print material 30 is supported on a print table at

a deflection distance or spacing h beneath the tensioning plane (not shown in Figure 4) of the screen printing stencil 26; during the printing operation a squeegee 32 which is guided over the cloth 10_a in parallel relationship to the connecting bars 28 pushes the cloth 10_a in a linear configuration onto the print material 30. The squeegee 32 which is also referred to as a scraper or doctor is in this case a rectangular member with a print edge 33, the length of the rectangular member approximately corresponding to that of the connecting bars 28, and over its path of movement it presses the printing ink through the mesh openings of the cloth 10_a, which are open in the print pattern.

The rectangular printing frame 24 comprises four frame profile members or frame sides 34 which are here in the form of hollow profile portions and of which one - identified as 34_a - affords an internal space 36 of undercut configuration for engagement of the one connecting bar 28 therein; the latter is of a substantially S-shaped configuration in cross-section with support limbs 29 at both sides of a main strip portion 28_a, projecting in opposite directions at the longitudinal edges thereof; one of the support limbs 29 is fixed in the internal space 28 while the other which is arranged on the cloth 10_a bears snugly against a lower edge 38 of the hollow profile member.

The other connecting bar 28 which is of the same configuration but which is disposed in the opposite position in terms of cross-section is mounted in the above-described manner in the internal space 36, of an undercut configuration, of a tensioning bar 40 which is the same in terms of cross-section but in opposite relationship to the hollow profile member 30_a and which is connected to the adjacent parallel hollow profile member 34 of the printing frame 24 by coil springs acting as force storage means 42, and therefore when pressure is applied to the cloth 10_a it can be moved limitedly in the opposite direction to the tensioning direction x .

The screen printing stencil 26 of smaller format as shown in Figure 5 is attached to the frame profile member 34_b shown therein of the printing frame 24 - and also in the tensioning bar 40_b of the

same configuration - by a hook bar 44 which is inclined relative to the surface of the cloth. Figure 11 shows further details in this respect.

Figure 6 shows a screen printing stencil 26 with the parallel
 5 connecting bars 28 which were described with reference to Figure 4 and which here are mounted on the frame profile member 34_c at an insert shoulder 46 of an additional bar 47 and on the tensioning bar 40_c on a segment shoulder 48 of a tensioning shaft 50. These mounting arrangements are shown in the views on an enlarged scale in
 10 Figures 8 and 9.

In Figure 7 a tensioning spring 52 presses against a mounting profile member 54 which applies a load to a support nose 56 of the frame profile member 34_d or the tensioning bar 40_d respectively; in the bar-like mounting profile member 54 a strip bead 58 of the screen
 15 printing stencil 26 is disposed in a strip groove.

The frame profile member 34_e in Figure 10 accommodates in an inclined slot 60 a limb 29_a, which is inclined upwardly at an angle w of $< 40^\circ$, of a connecting bar 28_e which is of approximately angular configuration in cross-section. That limb 29_a is held by a spring-
 20 loaded clamping portion 62 of the frame profile member 34_e.

Figure 11 shows the mounting of the above-mentioned hook bar 44 which engages behind a groove wall 64 of an inclined groove 66 of the frame profile member 34_b, the groove wall 64 being inclined at an angle t of about 120° relative to the surface of the screen printing
 25 stencil 26.

When a screen printing stencil 26 with a flat connecting bar 28_f is used, then as shown vertical register or tensioning pins 68 of the frame profile member 34_f engage through corresponding bores in the connecting bar 28_f. The latter is held against the support
 30 surface 72 of the frame profile member 34_f by a pressure bar 70 which is screwed to the frame profile member 34_f.

Figures 13 and 14 show a further possible fixing means for fixing a screen printing plate 26 on a printing table 74. Disposed in an inclined groove 66 of a hollow profile member 78 provided with
 35 two side bar portions 76 formed thereon is an air bellows 80 of

approximately square cross-section, which presses with an outside surface against a plastic bar 82. The latter in turn bears against a rubber strip 84 associated with the edge of the screen printing plate 26; as shown in Figure 15, passing therethrough are coil springs 53 which are seated at one end in the plastic bar 82 and at the other end in a web 79 which engages under the rubber strip 84. The web is screwed to the side bar portion 76 which is at the right in Figure 13, and is provided, towards the table, with an inclined surface 79_a which is parallel to the printing table 74. The coil springs 53 open a clamping jaw arrangement 86 produced in that way when the pressure in the air bellows 80 has fallen to 0 bar.

In the clamping jaw arrangement 86 - that is to say between the web 79 and the rubber strip 84 - there extends an edge region of the screen printing plate 26 which is fed to the printing table 74 by means of an elastic bead portion 88 which partially projects out of the other side bar portion 76. That elastic edge 88 produces here a smoothing effect.

The embodiment shown in Figure 14 does not have the coil springs 53; the plastic bar 82_a is possibly cambered in order to compensate for flexing of the frame or to relieve the load on the plate edges.

Figures 15 and 16 shows assembly aids; in Figure 15 the clamping jaw arrangement 86 accommodates an angled and magnetic plate 90 with which there are associated register or fitting pins 68_a and - under a shaft 92 - a magnetic strip 94. By virtue of that arrangement the edge region of the stencil 26 can be better handled.

Figure 16 shows a suction cup 96 on a vacuum bar 98 which has an elastic foil 27 bearing at the edge against the screen printing plate 26, as a guide and lift means.

Protection is claimed separately for the assembly aids shown in Figures 15 and 16.

CLAIMS

1. A screen printing form with screen printing cloth comprising mutually crossing plastic threads and a coating comprising an emulsion, characterised in that the plastic threads (12, 14) are coated with a casing layer (18) which is produced thereon by vapour deposition or sputtering and which in turn is covered by a metal coating (22) which carries the emulsion and which is produced by galvanisation.

2. A screen printing form according to claim 1 characterised in that the casing layer (18) comprises a metal material.

3. A screen printing form according to claim 1 or claim 2 characterised in that the casing layer (18) contains gold, silver, nickel or copper, in a form which is as pure as possible.

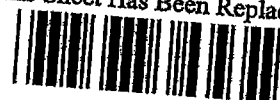
4. A screen printing form according to claim 1 or claim 2 characterised in that the casing layer (18) contains gold, silver, nickel, copper, steel and/or a light metal, in particular aluminium, as an alloy constituent or constituents.

5. A screen printing form according to one of claims 1 to 4 characterised by a layer thickness (b) for the casing layer (18) of between 5 and over 200 nanometres, in particular between about 50 and 200 nanometres and/or by a surface resistance in respect of the casing layer (18) of about 0.2 ohm/2 to over 200 ohm/2.

6. A screen printing form according to one of claims 1 to 5 characterised in that the galvanically produced metal coating (22) on the casing layer (18) is of a layer thickness (e) of about 2 μm to over 20 μm .



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7. A screen printing form according to claim 1 or claim 6 characterised in that the metal coating (26) contains nickel and preferably consists of nickel.

8. A screen printing form according to one of claims 1 to 7 characterised in that the emulsion forming a covering on the metal coating (22) is covered by a protective foil.

9. A screen printing form according to at least one of claims 1 to 8 characterised in that screen printing plates (26) of a predetermined format size are cut out of the metallised plastic cloth (10_a).

10. A screen printing form according to claim 9 characterised in that the screen printing plate (26) is provided at two oppositely disposed edges with connecting elements (28, 28_e, 28_f) for fixing to a printing frame (24) and/or the connecting element for an edge of the screen printing plate (26) is a profiled connecting bar (28, 28_e, 28_f).

11. A printing apparatus for accommodating a flexible screen printing form, in particular a screen printing form of metallised plastic cloth produced in accordance with at least one of the preceding claims, in a printing frame, wherein the screen printing form can be fixed and tensioned at two parallel regions which cross the direction of movement of a displaceable squeegee or the like tool, characterised in that the screen printing form (26) is fixed with the interposition of connecting bars (28, 28_a, 28_f, 44) arranged at two parallel plate edges, on the one hand to a frame side (34_a to 34_f) of the printing frame (24) and on the other hand to a tensioning bar (40) or the like movable element which is displaceable in the printing frame parallel to said frame side.

12. A printing apparatus according to claim 11 characterised in that the tensioning bar (40) is connected to one of the frame



sides (34) of the printing frame (24) by means of force storage means (42) within the printing frame.

13. A printing apparatus according to claim 11 or claim 12 characterised in that the spacing of the tensioning bar (40) from its frame side (34) in the tensioning position is adapted to be mechanically adjustable.

14. A printing apparatus according to one of claims 11 to 13 characterised in that the spacing of the tensioning bar (40) from its frame side (34) in the tensioning position is adapted to be pneumatically or hydraulically adjustable.

15. A printing apparatus according to one of claims 11 to 14 characterised in that the screen printing plate (26) is stretched at a spacing (h) relative to a surface (30) to be printed upon.

16. A printing apparatus according to one of claims 11 to 15 characterised by a connecting element or connecting bar (28) which is of a substantially S-shaped angled configuration in cross-section and whose end support limbs (29), in the tensioning position, lie on the one hand against a lower edge (38) of the frame side (34_a, 34_c) or of the clamping bar (40) and on the other hand against a shoulder in the internal space (36), of undercut configuration, of the hollow frame side or of the hollow tensioning bar (Figures 4 and 6).

17. A printing apparatus according to one of claims 11 to 16 characterised by a connecting bar (28) which is of substantially S-shaped angled configuration and whose end support limbs (28) in the tensioning position bear against a support surface (48) of a tensioning shaft (50) which extends in the internal space (36) of the hollow frame side (34) or the hollow tensioning bar (40_c) (Figures 6 and 9).



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18. A printing apparatus according to at least one of claims 11 to 15 characterised in that the connecting bar (44) is a hook bar which is inclined relative to the plane of the screen printing plate (26) and which is adapted to be fitted into an inclined groove (66) of the frame side (34_b) or of the tensioning bar (40_b) (Figures 5 and 11).

19. A printing apparatus according to at least one of claims 11 to 15 characterised in that the connecting bar (28_e) has a support limb (29_a) which is bent out of the plane of the screen printing plate (26) at an angle (w) and which is adapted to be fitted into an equally inclined slot (60) in the frame side (34_e) or the tensioning bar (40) (Figure 10).

20. A printing apparatus according to at least one of claims 11 to 15 characterised in that the screen printing plate (26) has at each of two parallel edges a respective strip bead (58) which is fitted into a mounting profile member (54) as a connecting element (Figure 7).

21. A printing apparatus according to one of claims 16 to 20 characterised in that the connecting element (28, 28_e, 44, 54) is held in the tensioning position by a force storage means (52), wherein possibly the force storage means (52) is part of a clamping portion (62) of the frame side (34_d, 34_e) or of the tensioning bar (40).

22. A printing apparatus according to at least one of 11 to 15 characterised in that register or clamping pins (68) of the frame side (34_f) or at the tensioning bar (40) pass through the connecting bar (28_f), and the connecting bar is held on the surface of the frame side or the tensioning bar by a pressure bar (70).

23. A printing apparatus according to one of claims 11 to 22 characterised in that provided in an open hollow profile (78) with



inclined groove (68), in same, is a profile member (80) of variable cross-section, in particular an air bellows, and associated therewith towards the groove opening is at least one bar portion (82) which adjoins an elastic strip portion (84).

24. A printing apparatus according to claim 23 characterised in that the elastic strip portion (84) is associated with the screen printing plate (26).

25. A printing apparatus according to claim 23 or claim 24 characterised in that disposed opposite the bar portion (82), forming a clamping jaw arrangement (86), is a web (79) which engages over the bar portion and which is connected to the hollow profile member (78).

26. A printing apparatus according to one of claims 23 to 25 characterised in that force storage means (53) pass through the clamping jaw arrangement (86).

27. A printing apparatus according to one of claims 23 to 26 characterised in that an elastic bead (88) or the like elastic edge projects from the hollow profile member (78) as an abutment for the screen printing plate (26).

28. A printing apparatus according to one of claims 23 to 27 characterised in that the web (79) and/or the elastic bead (88) is/are mounted on a side bar portion (76) of the hollow profile member (78).

29. A printing apparatus according to one of claims 23 and 25 to 28 characterised in that the elastic strip (84) is fixedly associated with the bar portion (82) and in a fixing condition of the screen printing plate (26) clampingly co-operates with an edge region of the screen printing plate (26).



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30. A printing apparatus according to claim 29 characterised in that the edge region of the screen printing plate, even opposite a printing region thereof, does not have any reinforcing means or the like connecting means.

