July 14, 1959 D. G. LAMBERT 2,894,455

ADJUSTABLE SCREEN PRINTING FRAME

Filed Nov. 22, 1957

FIG. 1.

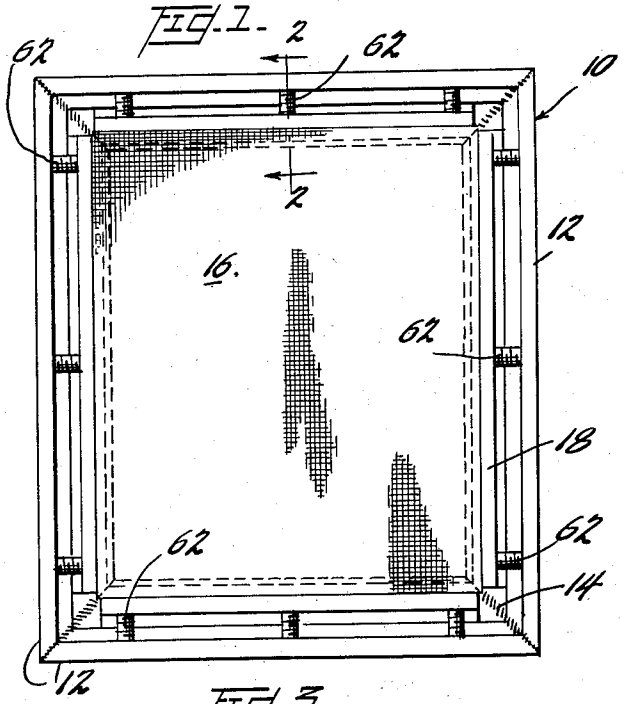


FIG. 2.

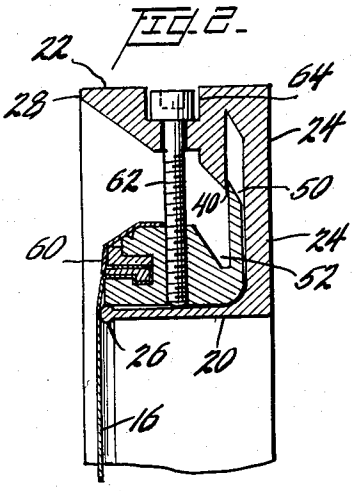


FIG. 3.

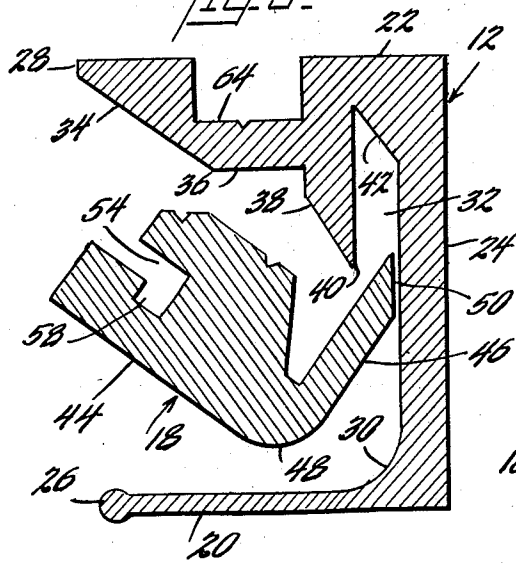
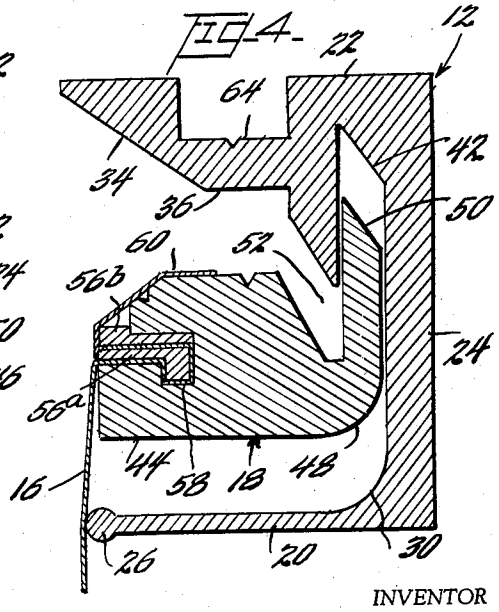


FIG. 4.



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ADJUSTABLE SCREEN PRINTING FRAME

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6 Claims. (Cl. 101—415.1)

This invention relates to a frame for screen printing. The screen material first used for screen printing was silk and, although many other fibers have come to be used as well, the process is, even now, frequently referred to as silk screen printing. Although the early types of frames did not permit variable screen tension, adjustable tensioning devices have long been known.

More recently, fine metallic screen has become available for use in screen printing. The firmer texture of this material, its superior resistance to wear and its complete indifference to atmospheric conditions makes it especially attractive for exacting requirements. With a suitable frame, many more prints of a given pattern may be run off and there is complete assurance that each print will be identical in dimensions with every other print. Such advantages are especially significant in the reproduction of "printed circuits" for electrical use, where any variation in dimension would bring about a consequent variation in the electrical properties of the printed circuit.

To deal with the somewhat less malleable metallic screen in the precisely controlled manner necessary for the high quality of work desired, I have devised a new adjustable frame. For a fuller understanding thereof, reference should be made to the accompanying drawing wherein:

Figure 1 is a plan view, taken from the underside, of a complete frame of my invention;

Figure 2 is a section taken along the line 2—2 of Figure 1, showing the parts before tension is applied to the screen;

Figure 3 is a greatly enlarged section showing the parts in the process of disassembly; and

Figure 4 is a similarly enlarged section showing the parts with the screen under tension.

Referring now to the drawings, the numeral **10** refers generally to the frame. Although any polygon arrangement would be suitable, it is obvious that, in almost every instance, the frame will be rectangular in shape, being made up of four channel shaped members **12**. Conveniently, the frame may be formed from an extruded shape, cut to the proper dimensions. The frame members **12** may be united in any suitable manner; I have found that welding, as at **14**, is entirely satisfactory.

The screen **16** is held by a set of four clamping bars **18**, each of which is located within one of the channel shaped frame members **12**. The clamping bars may also be formed of metallic extrusions. This arrangement is advantageous from the standpoint of both durability and ease of cleaning.

Reference should now be made to Figures 3 and 4 where the sectional views most effectively disclose the relationship of the frame member **12** to the clamp-member **18**. As has been stated, the frame member **12** is of channel shape, having an inner flange **20** and an outer flange **22** connected by a web member **24**, the terms inner and outer referring to the relationship of the parts to the assembled frame.

The inner flange **20** terminates in a bulb edge **26** which is slightly less distant from the outer face of web **24** than is the flat surface **28** on the rim of the outer flange **22**. When the frame members **12** are assembled, this permits the frame **10** to be set down upon a plane surface with the screen **16** clear of the surface so that there will be no contact between the screen and the surface. It will be obvious that the amount of clearance between the screen and the surface can be adjusted by the relative lengths of the two flanges. The bulbular shape of the rim **26** prevents undue wear at this point on the screen. The inner flange **20** is connected to the web **24** by a rounded inner curve **30**, the purpose of which will be pointed out as the description proceeds.

The outer flange **22**, of generally triangular shape, is separated from the web **24** along a considerable part of its length by the internal channel **32**. The inner side of the flange, proceeding from the flat rim **28**, has a relatively sharply inclined outermost face **34**, an intermediate section **36**, parallel to the outer face and a less sharply inclined innermost face **38** terminating in a toe **40**. The walls of the channel **32** are generally parallel to the outer face of the web **24**, save at the deepest portion of the channel which slopes inwardly at **42**, approximately parallel to the face **38**. The toe **40** of the triangular section of web **24** extends approximately to the mid-point of the channel. Its dimensional relationship will be covered more precisely as the description proceeds.

The clamping bar **18** may be conveniently thought of as of roughly angle cross-section with a heavy body flange **44** and a lighter side flange **46** connected by a rounded surface **48**, intended to conform generally to the curvature **30** of the frame member. The outer rim of the side flange **46** is tapered at **50** to correspond with the surface **42** of the channel **32**.

The thickness of the side flange **46** is such that it may slide freely in the channel **32**. When the flange **46** has entered the full depth of the channel **32**, the face **50** will approximately contact the face **42**. When the face of flange **44** of the member **18** is positioned closely against the flange **20** of channel **12**, the rim of the flange **46** is not fully withdrawn from the channel **32** but remains in the channel between ¼ and ⅙ of the depth thereof. Between the body flange **44** and the side flange **46** is an internal channel **52** of roughly triangular shape for receiving the toe **40** of the flange **22**. Assuming that the bar **18** is in place in the frame channel **12**, it may be removed therefrom by rotating the bar toward the outer part of the channel as shown in Figure 3, thus permitting complete disassembly of the bars from the frame for cleaning purposes.

To secure the screen, each of the bars **18** has an L-shaped channel **54**, having the recessed portion **58** facing the inner portion of the frame. To secure the screen, after it has been cut to size, one of the marginal portions is pressed into the slot **54** by means of beaded strip **56***a*. The bead on strip **56** is sufficiently smaller than the recess **58** as to permit the bead plus the screen to fit within the recess. Twice the thickness of the strip **56** plus the thickness of the screen should fit firmly in the slot **54** but there is no need for excessive crowding. If the strip **56** is made of wood or extruded plastic, there will be sufficient resilience so that differences in screen thickness may be accommodated by slight compression of the strip.

The strips **56***a* and **56***b* may be of identical configuration and, for this reason have been given a common reference numeral. The strip **56***a* is inserted in the slot **54** with the screen to secure initial tensioning of the screen. Somewhat greater tension may be obtained by holding the outer edge of the strip **56***a* to prevent its withdrawal from the slot, while grasping the free edge of the screen and pulling it outwardly to cause the bight

of the screen in the slot 54 to conform closely to the outer surface of strip 56*a*. While such tension still prevails, the free end of the screen is drawn back toward the center of the frame 10 and strip 56*b* is pushed in behind strip 56*a* in slot 54, to substantially fill the slot.

The free end of the screen may be trimmed down so that only a small margin will be left protruding between the two strips 56*a* and 56*b*. To prevent this margin from interfering with the use of the assembled article, the free end is bent down over the head of strip 56*b* and secured in place by means of a strip of pressure sensitive adhesive tape 60.

At suitably spaced points, the clamping bars 18 are connected to the frame members 12 by means of Allen-head bolts 62. In order to prevent the heads of these bolts from interfering with the handling of the frame 10, it is convenient to provide a channel 64 in the outer face of flange 22. The flange 22 is drilled and the flange 44 is tapped to receive bolts 62. Thus, after the screen 16 is initially stretched by being secured at all four edges within the four slots 54 of the respective bars, the bars 18 may be drawn to the outer flanges 22 by progressive tightening of the bolts 62 until adequate tension is attained in the screen 16. I have found that it is not necesary to pinch the screen tightly, as in a vise, to hold it securely. It is only necessary to subject it to several abrupt changes in direction, as for example, the various right angle bends in the slot 54. After a day or so of tension, the screen will be firmly set so that it will retain its shape after the tension is removed.

Although other equivalent clamping devices may be used for attaching the screen 16 to the clamping bars 18. I prefer the means shown because of its simplicity and economy besides the ease with which the bars may be cleaned, when replacing one screen with another. No special tools are required. A conventional screw-driver such as may be found around any shop, is all that is necessary.

Since the frame member 12 and the bar 18 may both be made of metallic extrusions, the frames may be made in a wide variety of sizes from standard stock. The frame members may be fitted together by simple mitering of the corners and welding as described. The clamping bars need only to be cut to appropriate length to fit within the channels of the frame members 12, although it is good practice to chamfer the ends.

It is desirable to apply a substantially straight line pull upon the screen from the center of the screen area directly out to the edge of slot 54, with no substantial change in direction of the screen as it passes over the bulbular edge 26. An extensive area of contact between the useful area of the screen and any supporting surface along the edges, especially when accompanied by a change in direction of the screen, produces friction at the point of engagement of the screen with the supporting surface, which friction dilutes the effectiveness of the tension applied to the edges of the screen.

Although the frame that I have disclosed effectively obtains the superior advantages inherent in the use of metallic screen, it is apparent that its use is not so limited. When used with other types of screen, its simple, positive construction is equally useful for maintaining firm, even tension upon the screen in use while permitting ease of cleaning between jobs.

The construction of my frame is especially advantageous from the standpoint of cleaning. The printing paste is confined within a space where there is no opportunity for excess paste to accumulate. The tensioning apparatus is entirely out of communication with the printing paste and is even housed in such manner that spillage cannot easily come in contact with it. When, after extended use, it is desired to thoroughly cleanse the frame, it may be entirely disassembled and the parts soaked in a solvent bath with ease.

I claim:

1. An adjustable tension frame for screen printing including a rectangular main frame having side members of channel cross-section, screen-clamping members for reception within said channels for movement from side-to-side therewithin to modify the tension of the screen and a plurality of threaded means connecting the side frame members and the clamp-members to effect adjustment wherein: in the frame channel: the inside flange has a rounded outer rim and is shorter than the outside flange; the outside flange is of generally triangular cross-section, the hypotenuse of said triangle extending from the rim of said flange to about the midpoint of the web of said channel; and an internal channel extends parallel to the web of the main channel and into the base of the triangular-shaped flange; and the clamp-member is of generally angular cross-section: the main flange thereof being of enlarged cross-section having a flange width somewhat less than the internal depth of the frame channel, having means on its rim along the length thereof for securing an edge of the screen; the side flange of the clamp-member being of a thickness to slide freely within the internal channel of the frame channel, of a width slightly greater than the free distance between the toe of the triangle forming the outside flange of the frame channel and the inner wall of the inside flange of the frame channel and having its rim sloping from the outer face to the inner face thereof; the external faces of the flanges of the clamp-member meeting in a rounded curve and the internal faces meeting in a triangular internal channel, the walls of such channel generally facing and paralleling the walls of the toe formed between the triangular outside flange of the frame channel and the internal channel thereof; whereby the clamp-member may move from side to side in the frame channel with the side flange of the clamp-member moving in and out of the internal channel of the frame to guide the clamp-member in substantial straight-line movement to stretch the screen; and whereby, when the screen is removed, the clamp-member may be canted out of the frame channel by rotating it, along its length, moving the rim of the main flange thereof out of the frame channel and toward the outer flange of said channel.

2. An adjustable tension frame for screen printing including a rectangular main frame having side members of channel cross-section, screen-clamping members for reception within said channels for movement from side-to-side therewithin to modify the tension of the screen and a plurality of members for connection of the side frame members with the clamp-members to effect adjustable coupling thereof wherein: in the frame channel: the inside flange has a rounded outer rim; the outside flange is of substantial overall cross-section, the innermost portion extending to about the midpoint of the web of said channel; and an internal channel extends parallel to the web of the main channel between said web and the base of the outside flange; and the clamp-member is of generally angular cross-section: the main flange thereof being of enlarged cross-section having a flange width somewhat less than the internal depth of the frame channel, having means on its rim along the length thereof for securing an edge of the screen; the side flange of the clamp-member being of a thickness to slide freely within the internal channel of the frame channel, of a width slightly greater than the free distance between the innermost portion of the outside flange of the frame channel and the inner wall of the inside flange of the frame channel; the internal faces of the flanges of the clamp-member meeting in an internal channel; whereby the clamp-member may move from side to side in the frame channel with the side flange of the clamp-member moving in and out of the internal channel of the frame to guide the clamp-member in substantial straight-line movement to stretch the screen.

3. The structure of claim 2, wherein the outside flange of the frame channel is provided with a channel in its outer face for housing the operative portions of the adjustable means for connecting the side members and the screen clamping members.

4. An adjustable tension frame for screen printing including a rectangular main frame having side members of channel cross-section, screen-clamping members for reception within said channels for movement from side-to-side therewithin to modify the tension of the screen and a plurality of threaded means connecting the side frame members and the clamp-members to effect adjustment wherein: in the frame channel: the inside flange has a rounded outer rim and is shorter than the outside flange; the outside flange is of substantial thickness; and the clamp-member is of substantial cross-section: having a depth somewhat less than the internal depth of the frame channel, having means on its rim along the length thereof for securing an edge of the screen; whereby the clamp-member may move from side-to-side in the frame channel in accordance with the operation of the threaded connecting means in substantial straight-line movement to stretch the screen; and whereby, when the screen is removed, the clamp-member may be moved out of the frame channel.

5. In an adjustable tension frame for screen printing, a rectangular main frame having side members of channel cross-section, the outer flanges of said channels being longer than the inner flanges, the faces of the inner flanges being substantially smooth and uninterrupted and joined to each other at their meeting ends and screen clamping members housed within each of the side channel members, the screen making substantially line contact with the lips of the inner flanges of the side frame members.

6. In an adjustable tension frame for screen printing, a rectangular main frame, the four respective members thereof being joined together to present a substantially smooth inner wall, one edge of said wall having a relatively thin, rounded form to present substantially line contact to the printing screen, a web member attached to the rim of the wall opposite the screen contact edge and extending outwardly of the frame and turned inwardly upon itself to form a channel facing said wall and a set of four elongated screen holding members one for each wall of the frame, each having a screen engaging face for positioning along a rounded wall edge and each having a relatively thin channel-engaging flange arranged for movement into and out of the wall-attached channel for guiding its respective screen-holding member to and away from said wall, whereby the screen may be subjected to limited movement in the plane of its face, in substantial line contact with the rounded wall edge.

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