Dec. 5, 1967 E. H. SCHUTTENBERG 3,356,023

METHOD OF MAKING STENCIL MARKING APPARATUS

Filed June 22, 1965 2 Sheets-Sheet 1

Fig. 1

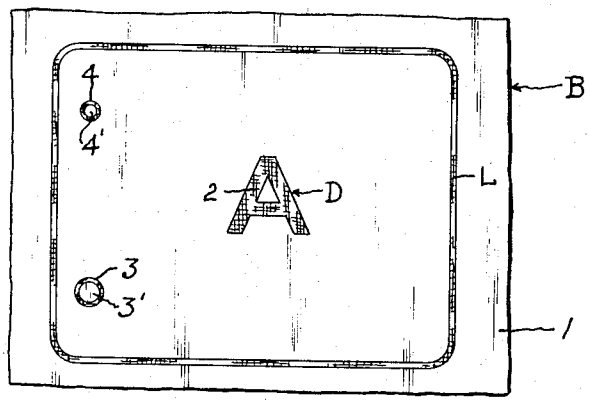
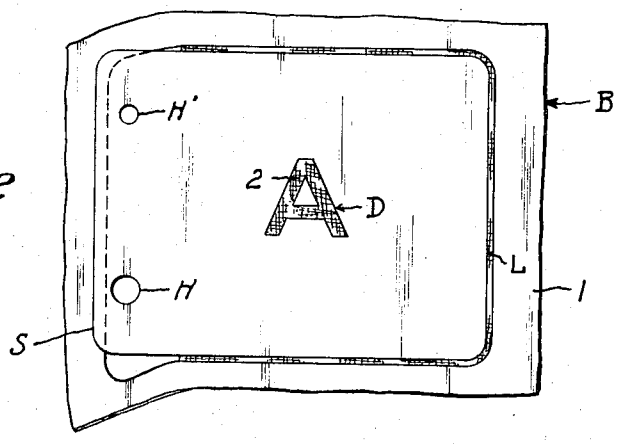


Fig. 2



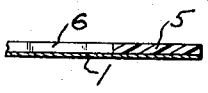


Fig. 5

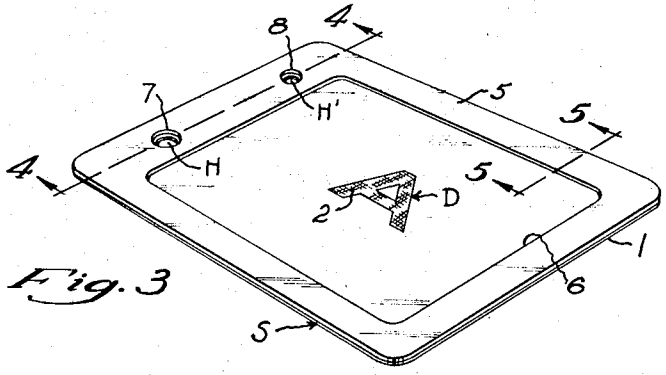


Fig. 3

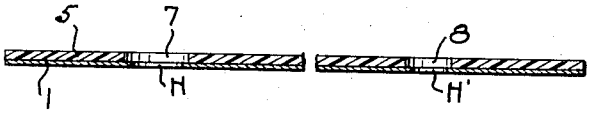


Fig. 4

INVENTOR.
ELMER H. SCHUTTENBERG
BY Bosworth, Sessions, Herstrom & Knowles
ATTORNEYS

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METHOD OF MAKING STENCIL MARKING APPARATUS

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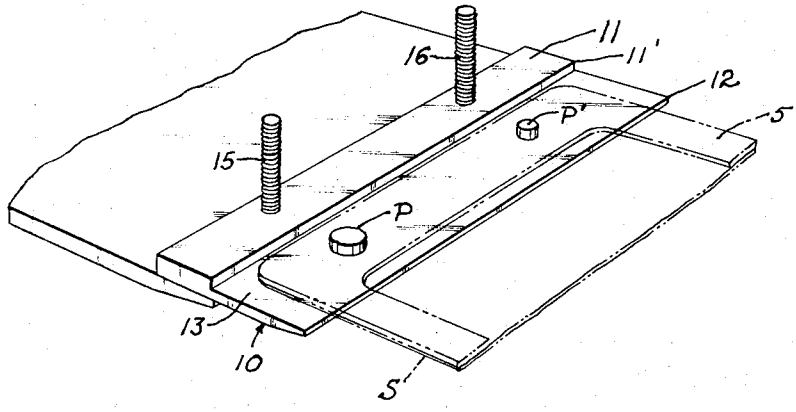


Fig. 6

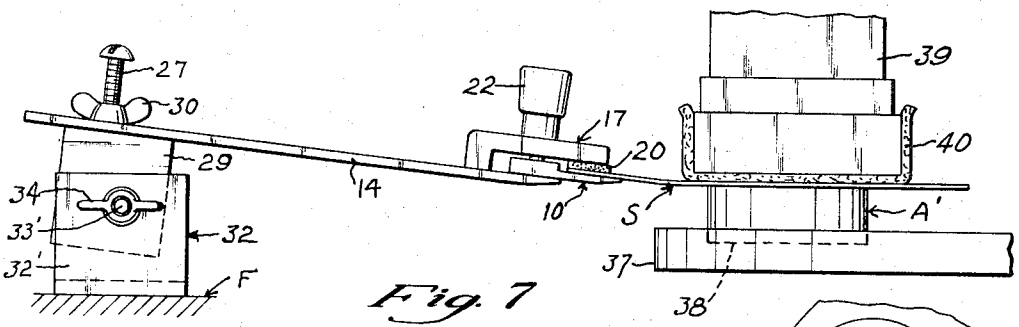


Fig. 7

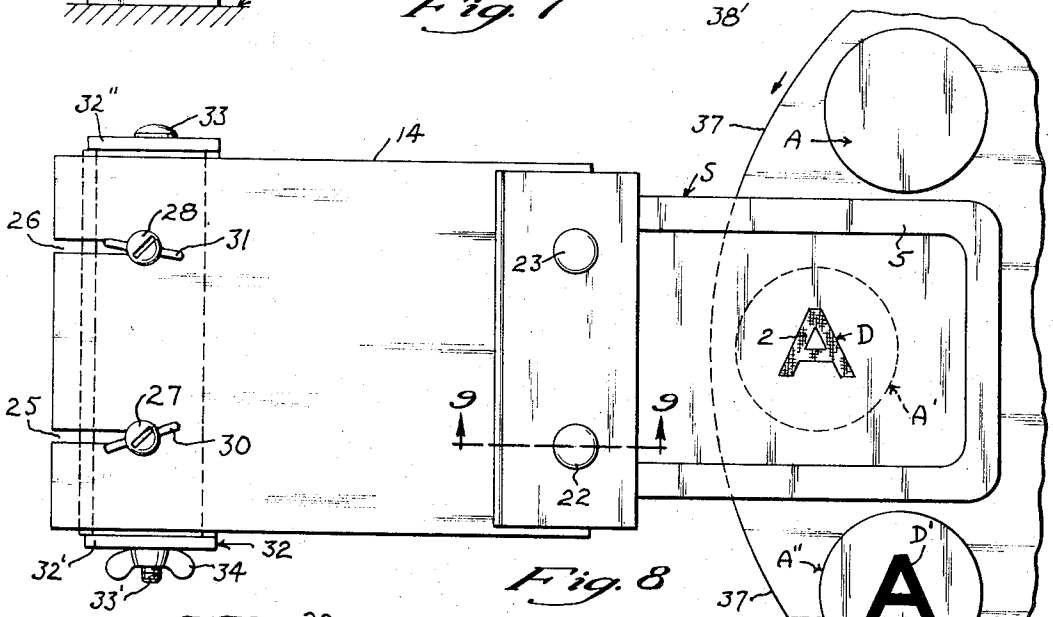


Fig. 8

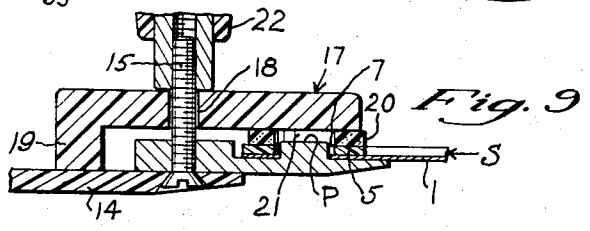


Fig. 9

INVENTOR.
ELMER H. SCHUTTENBERG
BY
Bosworth, Sessions,
Herrstrom & Knowles
ATTORNEYS

United States Patent Office 3,356,023
Patented Dec. 5, 1967

3,356,023

METHOD OF MAKING STENCIL MARKING APPARATUS

Elmer H. Schuttenberg, 2170 Arthur Ave., Lakewood, Ohio 44107

Filed June 22, 1965, Ser. No. 466,040
5 Claims. (Cl. 101—128.3)

ABSTRACT OF THE DISCLOSURE

A stencil for electrolytic marking or the like having a sheet of pervious backing material with an impervious coating thereon except in the area of the design to be reproduced and having a plurality of spaced indexing holes in the sheet; and a method of making such a stencil wherein the design to be reproduced and representations of the indexing holes are applied to a sheet of paper or the like to form a master copy, the design and representations are photographically transferred to a sheet of pervious backing material covered by a photosensitive impervious coating, the impervious coating is removed from the representations of the indexing holes and the design, and the pervious backing material is chemically dissolved at the areas of the representations of the indexing holes to form indexing holes in the backing material located relative to the design exactly as on the master copy.

This invention relates to marking apparatus and methods for making same, and more particularly to stencils for use in high production electrolytic marking applications and means for supporting these stencils in position to mark the workpiece or part.

Many different types of markings, such as identifying symbols or names, trademarks, model numbers, etc., are commonly applied by electrolytic etching of the part to be marked, the etching acid being applied to the part through a stencil having a supporting base of pervious backing material, such as fine mesh nylon fabric, having an impervious coating at all areas except the design to be marked.

Automatic machines have been designed and built for applying electrolytic markings with stencils of this type to high production items. These machines include means for locating and supporting the parts in position adjacent the stencil, applying the marking fluid to the part through the stencil, energizing the electrodes, and removing the marked part so that another unmarked part may be brought into position. After repeated use in this type of operation the stencils wear so that proper marking results are not obtained and it is then necessary to install a new stencil in position in the machine.

Prior to the present invention considerable difficulty and time has been involved in properly locating the replacement stencils and securing them in the machine so that the mark is applied in the exact same location on the parts as it was applied by the preceding stencil. The usual procedure has involved a cut and try marking of a number of parts, with adjustment of the position of the stencil in between, until the proper stencil location has been achieved. Only after such a procedure could the production operation of the marking machine be resumed.

It is, therefore, an object of the present invention to eliminate the necessity for this difficult and time consuming stencil replacement operation. A further object of my invention is to provide a method of making any desired number of identical stencils and to provide stencil supporting means for such stencils whereby they may be readily and interchangeably mounted on a marking machine structure in such a manner that the marking will

be applied to the parts by any and all of the several stencils in exactly the same manner and location and without the necessity for any cut and try adjustment of the position of the stencil. Other objects of my invention including a provision of a method of producing any desired number of stencils bearing identical designs, each of which has identically formed and spaced indexing or registering holes identically positioned on the stencil backing sheet in relation to the design; and the provision of adjustable stencil support means for electrolytic marking machines or the like which may readily be adjusted to properly position the stencil in relation to different sizes and shapes of parts to be marked.

The above and other objects of my invention will appear from the following description of one embodiment thereof, reference being had to the accompanying drawings in which:

FIGURE 1 is a plan view of a stencil blank of pervious backing material having an impervious coating covering all areas thereof except the design to be transferred, outlines of a pair of indexing or registering holes, and an outline defining the outer edge or border of the finished stencil, the design, indexing hole outlines and border line having been photographically applied to the blank and the blank developed to remove the impervious material at the design, indexing hole outlines, and border line.

FIGURE 2 is a plan view of the stencil blank of FIGURE 1 after the left hand end thereof has been subjected to the action of a solvent for the pervious backing material whereby open indexing or registering holes have been formed in and the adjacent portion of the border line has been severed from the blank by action of the solvent.

FIGURE 3 is a perspective view of a finished stencil unit made from the blank of FIGURE 2, a reinforcing frame having been secured to the backing sheet to protect and stiffen the completed stencil unit.

FIGURE 4 is an enlarged cross sectional view taken substantially on line 4—4 of FIGURE 3.

FIGURE 5 is an enlarged cross sectional view taken substantially on line 5—5 of FIGURE 3.

FIGURE 6 is a fragmentary perspective view of the stencil indexing and clamping portion of my improved support means for stencils of the type illustrated in FIGURE 3.

FIGURE 7 is an illustrative side elevational view of my stencil support means as incorporated in an electrolytic marking machine, the locating support or fixture for the part to be marked also being illustrated with a part positioned below the stencil and the upper electrolyte pad and its supporting electrode being shown in stencil contacting and marking position.

FIGURE 8 is a plan view of the apparatus shown in FIGURE 7, the marking pad and electrode being omitted.

FIGURE 9 is an enlarged cross sectional view, taken substantially on line 9—9 of FIGURE 8, illustrating the stencil indexing and support bar with its co-operating clamp bar and resilient gripping strip for retaining a stencil in operating position.

As previously noted, in order to facilitate the repeated identical marking of a large number of identical parts in automatic marking machines it is desirable to be able to produce any required number of identical stencils and to readily and quickly mount these identical stencils in exactly the same position in the marking machine relative to the work support fixtures so that worn out stencils may be replaced and the marking operation continued without delay.

My improved procedure for producing any desired quantity of identical stencils of this type includes the initial preparation, on paper or other suitable material by an artist or draftsman, of a master copy of the design

to be reproduced together with representations of a plurality of indexing holes, normally two, which are spaced from each other and from the design. Advantageously this master copy or layout may also include a border line defining the external outline of the finished stencil. This master copy may be made in any convenient size or scale and it is then photographically transferred, in the desired size, to a stencil sheet or blank of pervious backing material, such as fine mesh nylon fabric, having a photosensitive impervious coating thereon. As this coating is light-sensitive this operation is normally done under reduced or special lighting conditions and the exposed stencil blank is then subjected to a developing operation in a suitable solution whereby the impervious coating on the blank is dissolved away and removed only in those portions of the blank where the design, indexing holes and border line are to appear.

After this photographic exposing and developing operation, which is well-known in stencil art, has been completed the stencil blank will appear as seen in FIGURE 1 in which the blank as a whole is indicated at B, the design to be applied to the part (the letter A) at D, the line outlines of the indexing holes at **3** and **4**, and the stencil border or outline at L. The blank B, as previously noted, comprises a sheet of pervious backing material **1** such as very fine nylon mesh fabric having an impervious coating thereon. The nylon mesh fabric, after development of the blank to remove the impervious coating where not desired, is seen at **2** in the design D, and also in the line outlines **3** and **4** of the indexing holes and in the border line L.

As illustrated herein, the indexing holes in the stencil are represented on the original master copy and on the blank B by the line outlines **3** and **4**, the outer diameter of which represents the exact desired diameter of the finished indexing holes in the stencil. In order to prevent reversal of the stencil when it is being positioned in the marking machine as will be described later, the outlines **3** and **4** of the indexing holes are made of different sizes. The holes are illustrated as circular but it will be understood that they may take any desired form and that, instead of being defined on the master copy and blank B by line outlines, they may be filled in so there are no impervious center portions **3'** and **4'** on the stencil blank.

After the blank B seen in FIGURE 1 has been prepared as described above the next step is to apply a solvent for the pervious backing material to the portion of the blank which includes the outlines of the indexing holes H and H' without permitting the solvent to contact the backing material in the area of the design D. This may be done by dipping the left hand end of the blank B in the solvent (which in the case of nylon mesh may be phosphoric acid) and permitting it to remain in the solvent until the line outlines **3** and **4** are completely dissolved, thus permitting the center areas **3'** and **4'** to drop out to form clean edged accurately located open holes H and H' through the stencil as seen in FIGURE 2. During this submerging of the left hand end of the blank B in the solvent the border line L of the stencil will also be dissolved out in the portions thereof contacted by the solvent and thus, as seen in FIGURE 2, the outer portion of the blank B will be partially served from the stencil per se which is indicated at S.

It will be apparent that the indexing holes H and H' are accurately located with respect to each other and to the design D and that they are of the exact size and form that was photographically transferred from the master copy to the blank B. It will also be apparent that any desired number of blanks B may be photographically exposed to the master copy in the same manner and then developed to produce identical stencil blanks B in which the location of the indexing hole outlines in relation to the design D is exactly the same on each individual blank. Furthermore, as the removal of the pervious backing material to form the actual indexing holes H and H' is done by dissolving away the backing material, the final full

holes or openings H and H' of each stencil S will be exactly the same in size and in location relative to the design D and the outer edge of the stencil.

After the hole dissolving step is completed a reinforcing frame **5** (FIGURES 3–5) is preferably secured to the blank B as by cementing or other suitable means. This frame **5** may advantageously be made of a flexible plastic sheet which is not attacked by the etching acid and is formed with a center opening **6** and a pair of indexing hole openings **7** and **8**. The outer periphery of the reinforcing frame **5** is cut to coincide with the line outline L on the blank B and it is positioned on the blank B of FIGURE 2 so that its outer edge coincides with the border line L and cemented to the backing sheet **1** in this position.

The outer portion of the blank B is then cut off to produce the finished stencil S seen in FIGURE 3. It will be observed that the opening **7** is concentric with and slightly larger than the indexing hole H in the backing sheet **1** and the hole **8** in the frame **5** is concentric with and slightly larger than the indexing hole H' in the backing sheet. Thus, when the protective frame **5** is in position it protects the indexing holes H and H' in the relatively thin and delicate backing sheet **1** from damage but does not interfere with or obstruct the accurate positioning of the stencil by the indexing holes H and H' as will be later described.

The center opening **6** in the reinforcing frame **5** is sufficiently large to permit the electrolyte applying pad of the marking machine to contact the entire area of the impervious sheet **1** around the design D so that the etching acid will be efficiently and properly applied to the part through the exposed pervious backing material **2** which defines the design.

The above described process for making any desired number of identical stencils, having identical designs thereon and identical indexing holes therethrough, permits the rapid and economical production of the supply of stencils required for the substantially uninterrupted marking of mass production items. In order to permit these stencils to be mounted on a marking machine and rapidly and accurately secured thereto and located so that the design has the exact same position relative to a part which is supported in the part supporting fixture of the marking machine, I have provided an improved stencil holder and method of making same which will now be described.

Apparatus for mounting the stencils S (FIGURE 3) on a marking machine is illustrated in FIGURES 6–9. Referring to FIGURE 6, a stencil S is shown in position on a stencil support bar **10**, the indexing holes H and H' in the stencil being fitted over the upwardly projecting indexing pins P and P' on the bar **10**. The pins P and P' correspond in form and spacing exactly to the holes H and H' and, in order to form these pins P and P' on the support bar **10**, the surface **11** thereof is coated with an acid resistant photosensitive material and an image of the outlines of the holes H and H' from the master copy that was prepared for making the stencil S is photographically transferred to said coating which is developed and then removed by any suitable means, either manual or chemical, from the upper surface **11** of the clamp bar, except for the exact areas of the images of the indexing holes H and H', over an area extending from a line **11'** (FIG. 6) to the front edge **12** of the bar **10**. The rest of the bar remains covered by the protective coating so that, when the bar is submerged in a suitable acid, the material thereof will be etched away in the area defined by the line **11'** and the edge **12** except for the pins P and P' which will be left projecting upwardly from the depressed stencil engaging surface **13** of the bar.

As is best seen in FIGURES 6 and 9, the rear edge **11'** of the stencil supporting surface **13** is spaced from the pins P and P' a distance slightly greater than the spacing between the holes H and H' and the adjacent edge of the stencil S so that, when the stencil is positioned on the bar **10** with the pins P and P' projecting upwardly through the holes H and H', the rear edge of the stencil

S will be spaced from the edge 11' and the entire indexing or positioning engagement of the stencil S with the bar 10 is with the pins P and P'.

The stencil support bar 10 is mounted at one end of a flexible stencil mounting arm 14 by means of a pair of screws 15 and 16 which pass through unthreaded holes in mounting arm 14 and have threaded engagement with corresponding holes in the bar 10. By tightening the screws 15 and 16 the support bar 10 is firmly and rigidly secured to the right hand or outer end of the mounting arm 14. A transversely extending stencil clamp bar 17 is provided with holes 18, properly spaced to fit freely over the screws 15 and 16, and has a downwardly projecting rib portion 19 which, when the clamp bar is positioned over the screws 15 as seen in FIGURES 7–9, engages the upper surface of the mounting arm 14. Along the opposite edge of clamp bar 17 from the rib portion 19 is a resilient stencil engaging pad gripping member 20. This preferably is formed of sponge rubber or the like and may advantageously be cemented to the under surface of the clamp bar 17. Holes or recesses 21 are formed in the pad 20 in alignment with and slightly larger than pins P and P' of the support bar 10. Clamping nuts 22 and 23 have threaded engagement with upper ends of screws 15 and 16 respectively and, when they are tightened down (the nuts being illustrated as being adapted for manual operation) against the upper surface of clamp bar 17 it will pivot about the lip portion 19 thereof and the resilient pad member 20 will be clamped down against the top face of the stencil S firmly holding it down upon the support bar 10. Because of the engagement of the pins P and P' in the holes H and H' the stencil S cannot move laterally of the bar 10.

The opposite end of mounting arm 14 from the support bar 10 is formed with elongated slots 25 and 26 which are equally spaced with upwardly projecting screws 27 and 28 carried by an angle member 29 suitably secured to the under side of mounting arm 14. Thumb nuts 30 and 31, on the screws 27 and 28 respectively, are adapted to be tightened down upon the upper surface of the mounting arm 14 to clamp it in selected adjusted position on the angle member 29. When the nuts 30 and 31 are released the mounting arm 14 and the parts carried thereby may be moved longitudinally, by virtue of the slots 25 and 26, to the desired extending or retracted position and the arm 14 may then be locked to member 29 by tightening the nuts 30 and 31.

Mounted on the frame or base of a marking machine, diagrammatically indicated at F, is an upward extending angle member 32 between the upstanding legs 32' and 32'' of which the angle member 29 is pivotally supported on a horizontally extending pivot pin 33. This pin is threaded at one end as seen at 33' to accommodate the clamping or locking thumb nut 34. When the thumb nut 34 is released the angle member 29, together with the mounting arm 14 and the parts carried thereby, may be moved about the horizontal pivot provided by the pivot pin 33. As the stencil support bar 10 and the stencil S carried thereby are disposed at the opposite end of arm 14 from the pivot 33, the vertical position of the stencil S may be adjusted through a considerable range by a relatively small angular movement of arm 14 about the pivot 33. By tightening thumb nut 34 the arm 14 may be locked in any desired adjusted position.

Part positioning and supporting means carried by the frame of the marking machine is illustrated in the form of a turntable 37 which is formed with a circumferential series of part positioning and supporting fixtures which, as illustrated, take the form of recesses 38 in the turntable 37 of proper size to receive and accurately locate the parts to be marked. For purposes of illustration three of these parts are shown as cylindrical objects A, A' and A''.

The turntable 37 is suitably supported for indexed step by step rotation in the direction of the arrow (FIGURE 8) on the frame F of the marking machine by any suitable means (not shown). During the operation of the apparatus parts are loaded into the fixtures 38 on the turntable 37 ahead of the marking station at the stencil S. When a part, A' in FIGURE 8, is at this marking station it will be centered below the design D on the stencil S and the surface of the stencil S will be elevated slightly above the upper surface of part A'. To effect marking of the part the vertically movable plunger electrode 39 of the marking machine is then lowered into the position seen in FIGURE 7 so that the electrolyte carrying pad 40 presses down against the upper surface of the stencil S. This forces electrolyte through the permeable portion 2 of the stencil S and, when suitable electric current is applied between the part to be marked and the electrode 39, the design will be practically instantaneously reproduced upon the surface of the part A in well-known manner. The electrode 39 is next raised, permitting the stencil S to lift up away from the surface of the part A because of its resiliency and that of the mounting arm 14, and the turntable 37 is advanced so that the next part A will accurately be located at the marking station below the design D and the marking operation repeated. In FIGURE 8 the part A'' bears the mark D' which has just been at the marking station.

When a particular stencil S has been used for such a length of time that it does not effect the desired marking it may readily be replaced by removing clamping nuts 22 and 23 from the screws 15 and 16, lifting the clamp bar 17 and the resilient clamping pad 20 from the screws 15 and 16, and then lifting the worn stencil from the indexing pins P and P' of the support bar 10. Next, another stencil, which has been made as described hereinabove and accordingly is identical in all respects to the stencil just removed, is dropped into position of the pins P and P' and the clamp bar 17 and resilient pad 20 are again secured in position to firmly hold the new stencil in place on the pins P and P'.

Because of the identity of the stencils, the design D of the new stencil will be located relative to the part supporting and locating fixture 38 which is at the marking station of the machine exactly the same as was the design D of the previously used stencil. Accordingly the design will be transferred to parts by the new stencil in exactly the same location on the parts as was effected by the previous stencils, and this alignment and positioning of the new stencil design relative to the part to be marked is effected without any adjusting steps, trial marking operations, or other time consuming procedures.

It will be understood that, if preferred, a stationary part positioning and supporting fixture may be provided below the stencil rather than the illustrated rotary turntable. It will also be understood that when starting up an initial marking run some longitudinal adjustment of the position of the design D relative to the part supporting fixture 38 and part carried thereby may be necessary and may be effected by loosening the thumb screws 30 and 31 and moving the mounting arm 14 in the slots 25 and 26. Furthermore, the vertical position of the stencil relative to the surface of the part to be marked will initially be properly adjusted by loosening the thumb nut 34 and swinging the mounting arm 14 on its pivotal support 33 to hold the stencil S at the desired elevation above the part supporting fixture 38 and parts carried thereby.

Although I have described the illustrated embodiment of my invention in consideable detail it will be understood that variations and modifications may be made in the particular procedures that are followed in making my improved stencils, and in the form and arrangement of parts making up my improved stencil supporting apparatus, without departing from the spirit of my invention. I do not therefore wish to be limited to the exact procedures and structures herein illustrated and described but claim as my invention all embodiments thereof coming within the scope of the appended claims.

I claim:

1. A method of making a stencil which includes pre-

paring on paper or the like a master copy of the design to be reproduced and representations of a plurality of spaced indexing holes, photographically transferring said design and representations of indexing holes in the desired size to a stencil blank of pervious backing material having a photo sensitive impervious coating thereon, developing said blank whereby said impervious coating is removed from said pervious backing sheet at said design and said representations of indexing holes, and applying a solvent for the pervious backing material but not for said impervious coating thereon to the portion of said blank in which said representations of indexing holes are located without permitting said solvent to contact the design carrying portion of said blank whereby the pervious backing at said representations of indexing holes is dissolved away to form open indexing holes through said blank and located in the same relation to the design as are said representations of said holes on said master copy.

2. A method of making a stencil which includes preparing on paper or the like a master copy of the design to be reproduced together with outlines of two spaced indexing holes of different form and a border line defining the external outline of the finished stencil, photographically transferring said design, indexing hole outlines and border line in the desired size to a stencil blank of pervious backing material having a photosensitive impervious coating thereon, developing said blank whereby said impervious coating is removed from said pervious backing sheet at said design, said outlines of said indexing holes and said border line, and applying a solvent for the pervious backing material but not for said impervious coating thereon to the portions of said blank in which said indexing hole outlines and said border line are located without permitting said solvent to contact the design carrying portion of said blank whereby the outlines of said indexing holes and said border line are dissolved away to form two open indexing holes through said blank and located in the same relation to the design as are the outlines of said holes on said master copy and to sever the stencil from the stencil blank.

3. A method of making a stencil as defined in claim **2** including securing an apertured reinforcing frame, of the same outside size and shape as said border line, to said backing material after said indexing holes are formed therein with the outer periphery of said frame aligned with said border line, said frame being positioned so that the design thereon and the indexing holes therethrough are surrounded but not overlapped by said frame.

4. A method of making a stencil as described in claim **1** including forming a stencil support bar having stencil indexing pins, projecting upwardly therefrom and of the exact same size and spacing as said indexing holes in said stencil, by photographically transferring to a photosensitive protective coating on the surface of said bar the same image of said indexing holes from said master copy as is photographically transferred to said stencil backing material blank, developing said image, removing said protective coating from the surface of said bar except at said pins, etching said bar to depress the surface thereof and leave indexing pins, identical in form and spacing to said indexing holes in said blank projecting from said bar, and mounting said stencil on said support bar with said indexing pins of said bar extending through said indexing holes in said stencil.

5. A method of making a stencil as described in claim **2** including forming a stencil support bar having stencil indexing pins, projecting upwardly therefrom and of the exact same size and spacing as said indexing holes in said stencil, by photographically transferring to a photosensitive protective coating on the surface of said bar the same image of said indexing holes from said master copy as is photographically transferred to said stencil backing material blank, developing said image, removing said protective coating from the surface of said bar except at said pins, etching said bar to depress the surface thereof and leave indexing pins, identical in form and spacing to said indexing holes in said blank projecting from said bar, and mounting said stencil on said support bar with said indexing pins of said bar extending through said indexing holes in said stencil.

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DAVID KLEIN, *Primary Examiner.*