Jan. 24, 1967 F. HUNSTIGER 3,299,777

WEB REGISTER MECHANISM

Filed June 14, 1965 2 Sheets-Sheet 1

FIG-1

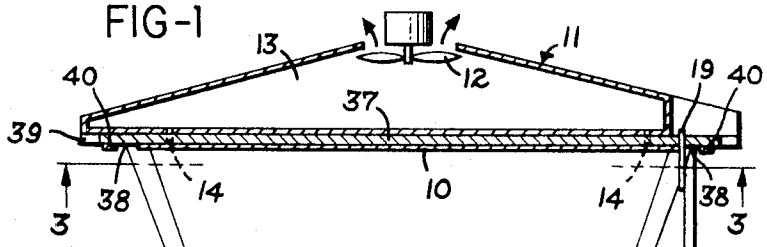


FIG-3

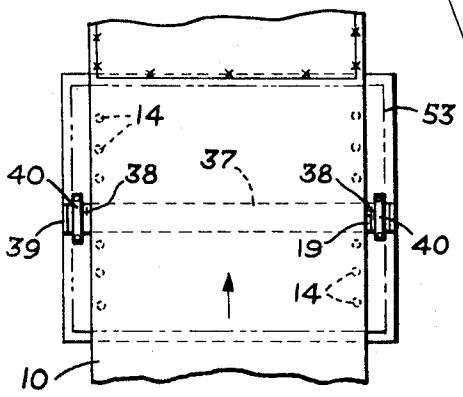
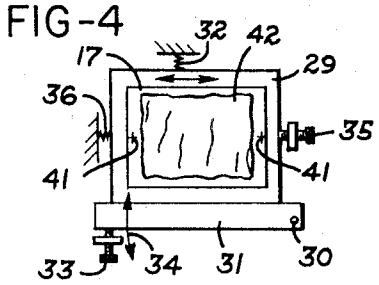


FIG-4



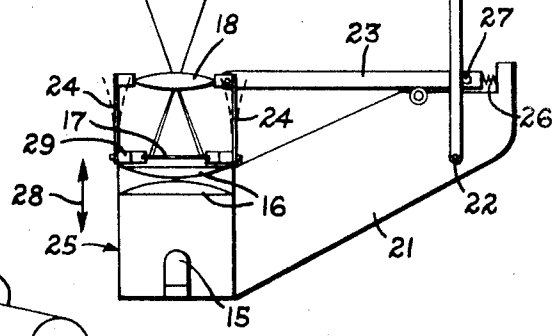
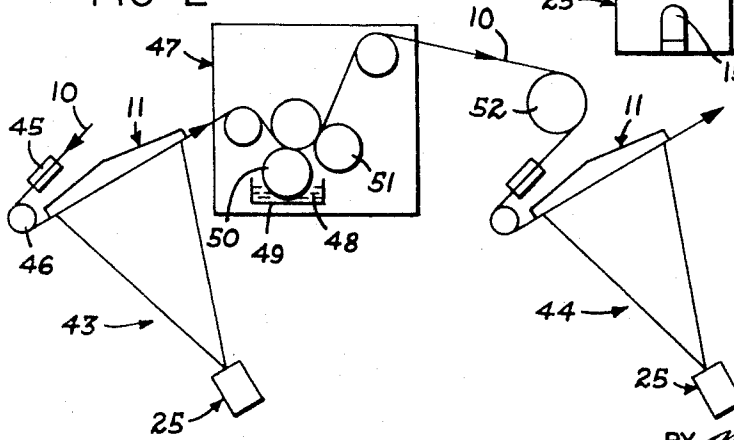


FIG-2



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WEB REGISTER MECHANISM

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FIG-5

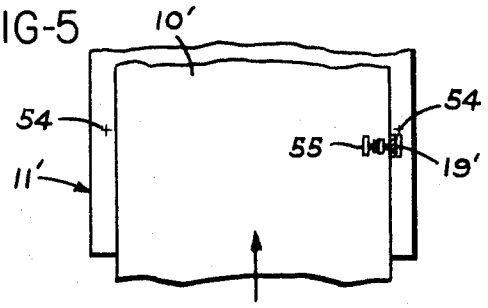


FIG-6

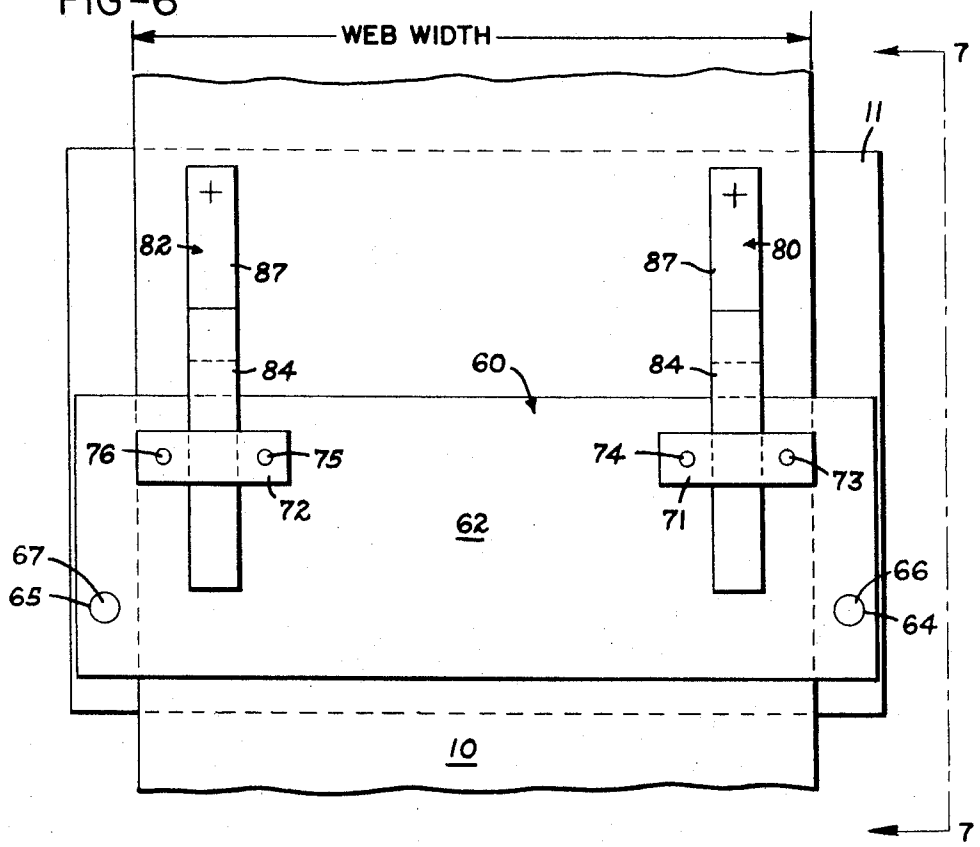
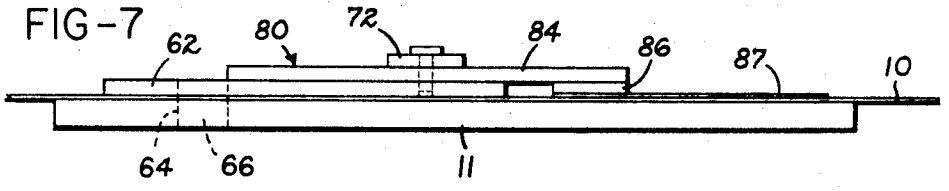


FIG-7



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United States Patent Office 3,299,777 Patented Jan. 24, 1967

3,299,777

WEB REGISTER MECHANISM

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Filed June 14, 1965, Ser. No. 463,754
14 Claims. (Cl. 88—24)

This application is a continuation-in-part of application Serial No. 385,441 filed July 27, 1964, now abandoned, and assigned to the same assignee.

This invention relates generally to machines for electrophotographically printing onto a moving web of photoconductive material and more particularly to an apparatus for registering one or more images on such a web.

Register make-ready on machines of the general type referred to has been difficult in the past, particularly on multi-color machines in which successive colors are to be produced in precise register with each other. For example, in an electrophotographic machine for printing multiple colors, a given portion of the web first receives an electrostatic charge, and then, as it travels to an exposing station, the given portion of the web receives a projected image by being exposed to light through transparent areas of a transparency. This discharges the light-receiving areas of this portion of the web. The portion then passes into a developing station in which electrostatic toner particles for a first color are deposited on and adhere to the areas retaining the charge, and the adhering particles are fixed thereto. The web portion is then recharged, exposed and developed to form a second image which should be in proper registry with the first. Previously, it has been difficult under the circumstances described to determine whether the second exposure was in register with the first and to make the necessary compensating adjustments until after the electrostatic toner particles for the second color are deposited and fixed over the first. A register check therefore had to await the development of the second color. Naturally, this problem exists at each subsequent unit, and increases with an increase in the number of units. This trial and error method to accomplish registration was time consuming and inconvenient.

It is customary, with existing machines of this type, to make register checks of one color to the next while the web is moving through the machine. This is due in part to the fact that the web may have a tendency to weave sideways or transversely very slightly during travel along its normal path. To compensate for this, there has been developed a detecting and leverage system as described in the copending application of Francis Hunstiger and Herbert E. Drake, Serial No. 372,503, filed June 4, 1964. This detecting and leverage system causes the projected image to follow the web laterally or transversely in proper ratio according to the magnification ratio of transparency to the ultimate size of print on the web.

In a machine of the type described means are provided for obtaining image register from one unit to the next in a multi-color machine, or from the one unit to the web in a single color machine, such register being obtainable while the web is either stationary or absent from the machine. This pre-register enables a substantial reduction in the amount of waste web material such as is common in existing multi-color electrophotographic machines, and considerably reduces the amount of time spent in obtaining register.

The principal object of this invention is to provide a simple and accurate apparatus for registering a transparency with a web of material in a machine of the type described while the web is held stationary or before it has been threaded through the machine.

Another object of the invention is to obtain side register, angular orientation, and sizing of a projected transparency image with respect to a predetermined location on a continuously travelling web of material, such register being obtainable while the web is stationary.

Another object of the present invention is the provision of a registration jig which may be used in conjunction with a multi-color electrophotographic apparatus to register the several images in each unit for accomplishing alignment of the images in each unit with the remaining units.

Other objects and advantages will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings—

FIG. 1 is a simplified elevational view of one form of apparatus embodying the invention, and is taken substantially across the path of travel of a web of material.

FIG. 2 is a simplified side elevational view of one type of machine which may embody the present invention;

FIG. 3 is a view taken generally along the line 3—3 of FIG. 1, on a reduced scale;

FIG. 4 is an enlarged simplified view of a transparency holder which may be used with the invention;

FIG. 5 is a view similar to FIG. 3, illustrating a second modification of the invention;

FIG. 6 is a view of a projection table with the registration jig of the present invention positioned thereon; and

FIG. 7 is a view from the left of FIG. 6.

Referring now to FIG. 1, a web of photoconductive material **10** is shown being fed toward the viewer along the bottom side of a table **11**. It is held in position against the table by vacuum created by an exhaust fan **12**. The fan evacuates a chamber **13** of the table **11** through perforations **14** in the lower surface of the table.

The web **10** is provided with a surface which is adapted to receive an electrostatic charge on the lower side as viewed in FIG. 1. This charge is provided over the entire surface of the web **10** in the absence of light. The web is then fed along a path into an area at which certain selected portions of the charged surface are discharged by impinging upon those portions light from a conventional high-intensity, short-duration flashlamp **15**. The light passes through condensers **16** and then through a transparency **17** which has selected image and non-image areas thereon. These areas may be defined hereinafter as "light areas" being those which transmit light, and "shadow" areas being those which prevent transmission of light, however the light areas may correspond either to the image or non-image areas on the final print at the web **10**. For purposes of understanding this invention, it will be assumed that the light areas of the transparency discharge the electrostatic charge on what are to be the non-image areas of the final print. The remaining charged areas will subsequently receive electrostatic toner particles of a given electrical potential and will become the image areas of the final print.

The light passing through the transparency **17** from the flashlamp **15** enlarges the image on the transparency through a lens **18**. In the example shown in FIG. 1 the magnification is shown as being in an approximate ratio of 10 to 1.

Since it is practically impossible to maintain a travelling web of material sidewise in its exact theoretical path, a means is provided for detecting one side edge of the web and translating any slight deviation of the web from its exact theoretical path into a corresponding movement of the lens **18** in the same transverse direction. This is accomplished in the aforementioned application of Hunstiger and Drake. It should be understood, however, that other detecting means may readily accomplish the same objective, and such detecting means need not act on the

edge of the web. Furthermore, while it is preferred to move the lens transversely, the principal objective is to move the projected image. Lens movement is simply a convenient and desirable way to accomplish this.

Very simply shown, the preferred form of detecting or sensing means includes a ski 19 which glides over one side edge of the web 10. The ski is fastened to a lever 20 pivoted on a frame member 21 at point 22. A cross-link 23 which lies in the plane of the lens 18 (and is therefore parallel to the plane of the web 10), is operatively connected to the lens 18 through parallel flexure plates 24 connected at their lower ends approximately in the plane of the transparency 17 to a projector housing 25. The housing 25 is carried by the frame member 21.

The flexure plates 24 are shown in FIG. 1 in their neutral or "zero" position and are capable of movement to the right and left to follow rightward or leftward movement of the cross-link 23 in response to movement of the lever 20. The cross-link 23 is urged leftwardly by a spring 26 and rightwardly by the side edge of the web 10 acting upon the ski 19. Consequently it can be seen that the spring 26 and the edge of the web 10 oppose each other and stabilize the ski 19 and the mechanism operated thereby. When the side edge of the web is in its theoretically correct path, the ski 19 will be in the position of FIG. 1 and the flexure plates 24 mounting the lens 18 will be in the full-line positions of FIG. 1. A deviation of the web 10 to the left will cause the ski 19 to pivot counterclockwise very slightly about point 22 under the urging of spring 26. A roller 27 carried by the cross-link 23 rides against one side of the lever 20. The roller 27, upon movement of the lever 20, will permit the cross-link 23 to move leftwardly under the urging of the spring 26, and will cause the flexure plates to move the lens 18 leftwardly. The amount of leftward movement of the lens will be in the same ratio as the magnification of the transparency to the web, in this instance, 10:1. Since the lens movement is only one-tenth of the actual side movement of the web, it will be seen that the lens 18 will remain sufficiently parallel to the web so as not to distort the image to be produced on the web. It will be seen that the mechanism described thus far causes the projected image to move laterally or transversely in response to similar web movement, so that any side deviation of the web from its normal path is compensated for by a corresponding side movement of the image.

A problem with previous machines of the general type described has been the difficulty of obtaining initial registration of the transparency 17 with respect to the web 10. Registration is required in three directions. First, the image must be properly sized or magnified onto the web. To obtain tht proper enlargement ratio, the projector 25 and frame 21 are moved in known manner toward and away from the web 10, as shown by arrow 28. Such movement is normally small. If, in movement of the projector 25, the image goes slightly out of focus, the lens 18 may be adjusted relative to the transparency in very small amounts by a lens focusing mechanism (not shown). Second, the transparency must be angularly oriented with respect to the web 10. This is accomplished by mounting the transparency 17 in a transparency holder 29 and adjusting the holder and transparency angularly relative to the projector 25. The details of such adjusting mechanism are shown in the Hunstiger and Drake application previously identified and shown simply in FIG. 4. A pivot 30 is provided for a bar 31 against which the holder 29 is urged by means of a spring 32. An adjustment screw 33 engaging one edge of the bar 31 permits the entire holder 29 and the transparency 17 held thereby to pivot about the point 30 in the directions of the arrow 34.

Thirdly, the transparency must be aligned transversely with the web. The theoretical side edge of the web is preferably used as a reference point for obtaining transverse or lateral registration. Such lateral registration may be obtained through adjustment of a screw 35 which is opposed by a spring 36. The spring urges holder 29 into engagement with the screw 35. Obviously, any type of mechanism can be used to provide the necessary movements of the transparency toward and away from the web for sizing, angularly with respect to the web to square the transparency therewith, and laterally with respect to the web for side registration. The mechanism shown in FIG. 4 is for purposes of illustration only.

Previous machines of this general type accomplished these different registrations while the web was running. In earlier machines, a first print would be made on the web in the desired location at the first printing unit or exposing station. Subsequent prints at subsequent exposing stations required these three different registrations to be made one at a time by running the web, exposing and printing the second color over the first, and checking the resultant print to determine the accuracy of registration. This trial and error method resulted in waste of the photoconductive paper.

It has been found further that it is impractical to start and stop the web to obtain register from one unit to the next. This is due to a number of factors, perhaps the most important of which is that it is difficult to run a web in reverse if it overshoots its correct stopping point. Additionally, machines of this type provide for the flashing of an image onto a web in response to a photocell pick-up of a register mark electrostatically formed by the first unit. This mark triggers the flashlamp at subsequent stations for exposing subsequent images to the web. For the details of registration and photocell detection, reference is made to application Serial No. 240,253 filed November 27, 1962. Thus it can be seen that if a first print is to be made and the web is to be stopped at the second exposing station, it must be stopped in an exact relationship with the first print. It is extremely difficult to line up web marks longitudinally so that the web is stopped at the exact position in each station at which the photocell pick-up triggers the flashlamp to make the exposure. Because of these and other problems, it has been found necessary in the past to effect registration while the web was travelling through the machine.

This invention relates to apparatus enabling the simple setup of the projector and the transparency mounted therein with certain machine elements in order to achieve registration between units in a multi-color machine (or between the only unit and the machine in a single color machine) without the necessity of running the web through the machine while establishing pre-register. It is also possible to obtain such registration by use of the apparatus of the present invention without a web being present in the machine whatsoever. These ends are accomplished in the FIG. 1 form of the invention by providing the outer surface of a register slide bar 37 flush with the lower surface of the table 11. The bar contains register marks 38 as shown in FIG. 3. The marks are shown in the form of cross-lines. The portion of the mark parallel to the side edge of the web is for obtaining side register while that portion perpendicular thereto is for angular orientation of the image to the web. The bar 37 is mounted for sliding movement in a groove 39 in the table 11, which groove is arranged transverse to the web. The bar 37 is held in its groove 39 by means of straps 40, but is permitted to slide freely in response to movements of the ski 19 as the web shifts to either side of a zero or neutral condition of the ski 19. It will be noticed that the bar 37 is arranged to permit passage of the ski 19 therethrough in such a fashion as to provide bearing surfaces between the ski 19 and bar 37 which accurately engage the ski but which permit it to move with the lever 20 and frame member 21 whenever they are adjusted toward and away from the web 10 for sizing. It will be noted that the register marks 38 on the bar are outside the edges of the web. This is preferred since the difficulty of threading a web through a machine

of this type makes it desirable to leave the web in position from one job to the next. By placing these marks beyond the side edges of the web, register can be obtained whether the web **10** is present in or absent from the machine. Corresponding register marks **41** are located on the transparency **17** in exact registration with an image **42** on the transparency. The transparency register marks **41** are obtained through normal photographic techniques in preparing the transparencies. When the transparency is mounted in the holder **29** in the first unit and located in the projector **25**, the operator need merely adjust the transparency holder **29** in accordance with the techniques previously discussed. He can adjust the projector **25** toward and away from the web to properly size the image **42** with the web. He can also provide angular orientation and side registration of the image **42** with respect to that edge of the web which is to engage the ski **19**. Actual registration is provided by operating flashlamp **15** at such a high rate that marks **41** appear as near-continuous light at the table **11**. While this is occurring, the transparency holder is moved according to the visual out-of-register indication of the projected marks **41** relative to marks **38**.

It will be seen that if this arrangement is provided at each of the units in the machine, the roll of web material need only be placed in proper side-to-side location in the machine with its theoretical side edge aligned with the zero or neutral position of the ski **19** at the first exposing station. Since the register marks **38** at each station are mechanically connected through the bar **27**, ski **19**, lever **20** and cross-link **23** to the projector **25**, and since the transparency holder **29** can be aligned in the projector **25** to cause coincidence of the transparency register marks **41** with the machine register marks **38**, it will be seen that sizing, angular orientation and lateral registration with respect to the ski can be easily obtained. Consequently, since the ski **19** rides the edge of the web, such registration will also occur on the paper. The entire registration is obtainable while the web is stationary. If running register is desired between units, it will be only for very minor corrections after preregister has been accomplished.

Referring now to FIG. 2, a multi-color machine is shown including a first unit **43** and a second unit **44**. The web **10** travels in the direction of the arrows through a corona charger **45** in which its photoconductive surface receives an overall electrostatic charge in known fashion. The web then passes over a roll **46** and against the under side of vacuum table **11**. At the desired time, the flashlamp in the projector **25** of unit **43** exposes the transparency in that unit to the web **10** to discharge those areas on the charged web surface corresponding to the light transmitting areas of the transparency. After exposure, the web then passes into a developing and fixing unit **47** which is simply shown as having a number of rollers which direct the web to receive liquid electrostatic toner **48** contained in a pan **49**. A roller **50** transfers the liquid toner to the web, and thereafter a roller **51** squeegees excess liquid and causes it to run back into the pan **49**. Any form of developing and fixing unit may be utilized, the one described being for purposes of illustration only. The system may, in fact, use electrostatic powder toner rather than liquid. After the toner is applied to the web **10**, the web is customarily dried to fix the pigment contained in the toner to the desired areas to be printed. Upon completion of the first print, the web passes over a roller **52** and then through a corona charger similar to charger **45** and then through the unit **44** in the same fashion as in the first unit **43**.

Referring again to FIG. 3, which is a view taken substantially along lines **3—3** of FIG. 1, it will be seen that a projected image **53** is shown to be greater in width than the web **10**. The purpose of this is to enable the transparency register marks **41** to extend beyond the side edges of the web in order to register with the preferred arrangement of the machine register marks **38**. Marks **38** are preferably located outside the edges of the web as stated earlier. The marks **38** are shown as being at the approximate transverse center-line of the projected image area **53**, but obviously can be located anywhere within the projected image area. The register marks may be of any desired shape and are shown simply as a pair of cross-lines for purposes of convenience in explanation. As mentioned earlier, the portion of the cross-lines parallel to the side edge of the web are for obtaining side registration of the transparency to the marks and also sizing of the transparency to the web. The register marks also contain lines which are perpendicular to the web edges for obtaining angular orientation of the image **42** on the transparency **17** with the web **10**.

Referring now to the modification of the invention shown in FIG. 5, register marks **54** may be placed directly on the table **11'**. These marks serve the identical function that is served by the marks **38** of the FIG. 3 modification. Since the marks **54** are on a stationary part of the machine, all of the skis **19** in each of the stations are aligned with each other, and all of the register marks **54** in the various stations are originally manufactured and arranged to be in exactly corresponding positions throughout the machine. Now, with the marks **54** at each station being registered with each other, register of the various skis **19** and lens **18** at the various stations with each other may be obtained and then the transparency holders **29** are adjusted to cause the transparency register marks to coincide with the register marks **54** on each table **11'**. This may be done by providing a gauge screw **55** (see FIGS. 1 and 5), which is threaded through a portion of the machine at each station and adapted for adjustment and locking in adjusted position. A gauge block **56** may be provided for insertion between the tips of the gauge screws **55** and their levers **20**. Each gauge block **56** can be held in position against its gauge screw **55** by the fact that the levers **20** are urged toward the screws **55** under action of the springs **26**. The tips of the screws **55** are ordinarily adjusted at the factory and need be adjusted further only rarely. They provide an adjustable abutment to eliminate the need for precise manufacturing of a fixed abutment. The tips of the gauge screws **55** at each station will have a definite relationship to the register marks **54**, and consequently, through the use of the gauge block **56**, will predetermine the positions of the levers and links for controlling side movement of the lens **18** in the machine. Although the gauge screws **55** are shown in the FIG. 1 modification, they need not be used with the slide bar **37**, but can be so used if desired.

Any type of register mark for obtaining registration may be used. It has been found desirable when using marks on the table **11'** of FIG. 5 to form the marks on a piece of photoconductive paper taped to the table in the location where the marks are to be projected. This enables register marks of any size or shape, or in any position on the transparency to be used. Where the machine is arranged to print webs of different widths, it can be seen that this is highly advantageous since the marks **54** should be moved inwardly when a narrower width web than that shown in FIG. 5 is printed, for example. Where the machine is adapted to handle different width webs, appropriate provisions are made for mounting the pivot **22** of FIG. 1 closer to or further from projector **25** to reposition the ski **19** according to the actual web width. For different web widths, it will be seen that the FIG. 5 arrangement has certain advantages over that shown in FIG. 3, since smaller transparencies which cannot be enlarged to reach the marks **38** on both sides of the bar **37** can be used. Necessary provisions are made for relocating the gauge screw **55** at each unit for different width webs, or several gauge screws may be positioned in each station, one for each width web. Obviously also, perforations **14** are arranged to properly handle such various web widths.

Although it is preferred to have the register marks 54 or 38 on opposite side edges of the web, it is feasible to use one or more such marks on the same side of the web near the corners of the projected image.

Referring to FIG. 6, a register mark memory device or jig 60 is shown including a plate 62 having therein precision drilled holes 64 and 65 which receive locating pins 66 and 67 projecting downwardly from the table 11 toward the projector 25. The projecting pins 66 and 67 are spaced beyond the edges of the web 10 as shown so they do not interfere with web travel across the table, and pin 66 is located for non-interfering movement of ski 19. The register mark memory device may be positioned over the web if desired. Mounted on the plate 62 are a pair of spaced clamps 71 and 72 which face towards the projector with the jig 60 mounted on the table. Each clamp includes a pair of spaced locking screws 73, 74 and 75, 76 which are threaded into the plate 62. Received between the plate 62 and each clamp is a movable arm 80 and 82 each carrying a register mark or indicia in the form of cross-lines as indicated in FIG. 6. By tightening down on the screws the position of the movable arms 80 and 82 may be fixed relative to the jig and thus with the pins 66 and 67.

Referring to FIG. 7, each of the arms 80 and 82 is of the same structure and includes a relatively thick support member 84 having at one end thereof a foot 86 to which is attached a relatively thin register mark plate 87. In this way, the register mark on the arm is positioned in substantially the same plane as the web 10. The plate 62 is dimensioned with respect to the support member 84 and foot 86 so that the plate 87 rests either on the web, if one is present, or on the table if no web is in the machine. The plate 62 is shown as being approximately equal in width to the width of the web but shorter than the table 11. Its lengthwise dimension (along the direction of web travel) is about one half that of the table 11 so that the register marks of the transparency may be located beyond the image areas. In a preferred form, as shown, the reference marks on the transparency are located in spaced corners of the projected pattern and the register mark plates are arranged to place their respective register marks in corresponding spaced relation.

In use, the register mark memory device operates to locate the projected reference marks from the transparency 17. When the transparency is mounted on the holder 29 in the first unit and located in the projector 25, the operator need merely adjust the transparency holder 29 in accordance with the techniques previously discussed to achieve focus, magnification and lateral and angular orientation of the projected image.

Once this has been done, arms 80 and 82 are moved in and X and/or Y coordinate to position the register marks on the register mark plate 87 in alignment with the corresponding projected register mark from the transparency. Once the register mark for each arm is in coincidence with the corresponding projected registration mark, the locking screws for each clamp are tightened to fix the position of the movable arms 80 and 82.

If a web is in the machine the ski may be positioned against the edge of the web so that there is proper lateral alignment of the projected image with the projector and then the procedure previously described is carried out. In the event no web is present in the machine, each unit of the machine may be provided with a gauge screw 55 and gauge block 56 whose function and operation were previously described so that each projection station of each unit of the machine will be in alignment with the remainder.

Although the apparatus in FIG. 2 shows merely two stations, it is understood that the present invention may be utilized with any number of stations in a multi-color electrophotographic apparatus. Each table 11 of each unit of the apparatus includes precision locating pins 66 and 67 which are precisely oriented with the theoretical side edge of the web as determined by each gauge screw 55, gauge block 56 and lever 20. These locating pins in each station form stationary reference means so that each projector is properly oriented with respect to the theoretical side edge of the web. Thus, a roll of web material need only be placed in proper location in the machine with its theoretical side edge aligned with the zero or neutral position of the ski in each station. In the event a web is not used, the gauge screws 55 may be used as an alignment device to get the proper lateral registry of the ski and thus the projector from one unit to the next so that all skis and projectors are in proper lateral registry along the path of web travel.

After proper lateral registry has been accomplished in all units of the machine which in effect places the projector of each unit in alignment with each other and with respect to the web, the register memory device is assembled in fixed position over the pins in the first unit and in angular, lateral positioning and magnification and focus of the image of the first station is accomplished as noted. Thereafter, the register marks on each register mark plate are brought into alignment with projected register marks and the respective movable arms of the register mark memory 60 are locked in place by the locking screws. After this has been accomplished the register mark memory device is moved from the first unit to the second unit without disturbing the relative orientation of the register marks on the register mark plates with reference to the drilled holes 64 and 65 on the plate 62.

In the second and remaining stations, the second and remaining transparencies include register marks. These marks are in the same precise orientation with respect to the corresponding image as the register marks of the first transparency are with respect to the first image. Magnification and focus and adjustments are completed, and angular and lateral orientations are made by manipulating the transparency holder to bring the projected reference marks into coincidence with the register marks on the register mark plate 67 of the jig 60. Once there is coincidence for the projected register mark of the second transparency and the register marks of the register mark memory or jig 60, the second or subsequent projected image is in proper registry with the first or previous images. This procedure is then carried out for each of the stations so that each projected image is thus in alignment with the first projected image. As noted previously, the longitudinal alignment along the line of the web is accomplished by an index mark placed on the web electrophotographically during the first exposure and thus serves to trigger the flash tube in each successive unit as the first image reaches a predetermined position with reference to the proper image orientation in each successive unit.

The advantage of the register mark memory device of the present invention is the fact that the web need not be moved to accomplish registration of the images, and in fact the web need not be present at all. Any shape or registering mark for obtaining registry of the registration mark on the memory device with those of the transparency may be used. The cross-lines parallel to the side edge of the web are used for obtaining side registry and the cross-line which is perpendicular to the web edges may be used to obtain angular orientation of the projected image with the image projected from the transparency.

The register marks may be in any position on the transparency and the principles of the register mark memory device may be adopted so that the registration marks of the memory device may be brought into alignment with the projected register marks. While the machine is adapted to print webs of different widths, the movable arms 80 and 82 may be so positioned with respect to the plate so as to accommodate a smaller web length, and provision is made for mounting pivot 22 of FIG. 1

further or closer to the projector **25** to reposition the ski **19** according to actual web width. Necessary provisions may also be made for locating the gauge screws **55** for different web or several webs may be positioned in each station, one for each width web.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In a machine for exposing a light image onto a moving photoconductive web during passage of said web along a path through said machine, means for maintaining a section of said web in a predetermined, relatively flat plane during exposure, an image-bearing transparency having register mark means thereon, a holder for mounting said transparency for exposure to said web, means located on the side of said holder remote from said web for projecting an image on to said web, means for detecting the position of the side edge of said web and sensing any lateral deviation of said side edge from a normal position, means responsive to the movement of said detecting means for laterally shifting said projected image in accordance with the lateral deviation of said web from a normal position, machine register mark indicia in the approximate plane of said web, means for adjustably positioning the register mark means of said transparency with respect to said register mark indicia, and said register mark indicia having a predetermined relationship with respect to the detecting means when in position to detect the side edge of the web in its normal path and with respect to said projection means.

2. The apparatus as set forth in claim **1** wherein said register mark indicia and said transparency register mark means include side register marks and additional register marks spaced from the side register marks are provided on both the machine and the transparency, wherein said transparency holder is adjustable angularly in its plane and toward and away from the plane of said web to provide also for angular orientation and sizing of the transparency with respect to the web, and wherein means are provided for effecting said adjustments.

3. The apparatus as set forth in claim **1** wherein said detecting means is movable and wherein said machine register mark indicia is operatively connected to said movable detecting means.

4. The apparatus as set forth in claim **2** wherein all of said machine register marks are operatively connected to said movable detecting means.

5. The apparatus as set forth in claim **1** wherein said means for maintaining said web in a flat plane comprises a supporting table, and wherein said machine register mark indicia is mounted on said table.

6. The apparatus as set forth in claim **2** wherein said means for maintaining said web in a flat plane comprises a supporting table, and wherein all of said machine register marks are mounted on said table.

7. The apparatus as set forth in claim **1** wherein register mark means includes spaced register mark members carrying reference mark indicia thereon for movement in alignment with the register mark means projected from said transparency, said means for maintaining said web in a flat plane including a supporting table, and support means for said movable register mark members mounted on said supporting table in predetermined relationship with respect to the detecting means when in position to detect the side edge of the web in its normal path with respect to the projection means.

8. The apparatus as set forth in claim **5** including means for maintaining said detecting means and lens system in predetermined positions with respect to the side edge of the web in its normal path and with respect to said machine register mark indicia while said transparency holder is being adjusted to align the register mark on the transparency with the machine register mark indicia.

9. The apparatus as set forth in claim **8** wherein said register mark indicia and said transparency register mark means include side register marks and additional register marks spaced from the side register marks are provided on both the table and the transparency, wherein said transparency holder is also adjustable angularly in its plane and toward and away from said web to provide also for angular orientation and sizing of the transparency with respect to the web, and wherein means are provided for effecting said adjustments.

10. In a machine for successively exposing a plurality of light images onto a travelling web of imprint-receiving, photoconductive material during travel of said web along a path through successive exposing stations, each of said stations including means for maintaining said web in a predetermined, relatively flat plane as it passes through each station, an image-bearing transparency having register marks thereon, a holder for mounting said transparency for exposure to said web, means on the side of the holder remote from said web for illuminating the web through said transparency at a predetermined time in the passage of said web through the station, an enlargement lens system located between the transparency and said web, means for mounting said lens system for movement in opposite directions transversely of the web path while being maintained relatively parallel with the plane of said material, means for detecting the position of the side edge of said web and sensing any lateral deviation of said side edge from a normal position, means interconnecting the detecting means and said lens means for transmitting movement of said detecting means to movement of said lens system and in proper ratio with respect to magnification of said transparency to said web whereby any side deviation of said web from its path through a given station will be compensated for by corresponding movement of said lens means, register marks on said machine in the approximate plane of said material, said machine register marks at one station being in predetermined registration with corresponding register marks at other stations, and means for adjusting each said transparency holder to align the transparency registration marks with their corresponding machine registration marks, the lens means at each station being in predetermined relationship with said machine registration marks during alignment of said transparency register marks and said machine register marks.

11. Apparatus as set forth in claim **10** wherein said machine register marks in each station are operatively connected to said detecting means.

12. The apparatus as set forth in claim **10** wherein said means at each station for maintaining the web in a flat plane comprises a supporting table, and wherein said machine register marks are mounted on said table.

13. In a machine for exposing a light image onto a travelling web of imprint-receiving, photoconductive material during passage of said web along a path through said machine, means for maintaining a section of said web in a predetermined, relatively flat plane during exposure, an image-bearing transparency having a side register mark thereon, a holder for mounting said transparency for exposure to said web, means for illuminating said web through said transparency, an enlargement lens located between the transparency and said web, means for detecting lateral deviation of said web from a normal path, means responsive to a deviation detection by said detecting means for effecting corresponding lateral movement of the transparency image with respect to said web in proper ratio relative to the magnification of said transparency to said web by said lens system, a machine side register mark in the approximate plane of said material,

and means for adjustably positioning said transparency holder transversely of the normal path to align the transparency mark with said machine register marks, whereby an image placed upon the web in said flat plane will have a predetermined relationship relative to the normal path of said web.

14. In a machine for successively exposing a plurality of light images onto a travelling web of imprint-receiving, photoconductive material during travel of said web along a path through successive exposing stations, each of said stations including means for maintaining said web in a predetermined, relatively flat plane as it passes through each station, an image-bearing transparency having register marks thereon, a holder for mounting said transparency for exposure to said web, means on the side of the holder remote from said web for illuminating the web through said transparency, lens means located between the transparency and said web, means for mounting said lens means for movement in opposite directions transversely of the web path while being maintained relatively parallel with the plane of said material, means for detecting the position of the side edge of said web and sensing any lateral deviation of said side edge from a normal position, means interconnecting the detecting means and said lens means for transmitting movement of said detecting means to movement of said lens means

whereby any side deviation of said web from its path through a given station will be compensated for by corresponding movement of said lens means, stationary reference means in each exposure station oriented with respect to the corresponding lens means whereby all said lens means may be precision aligned along the path of web travel, said register mark memory means including movable indicia alignable with the register marks projected from the transparency in the first exposure station, and said register mark memory means being receivable in each exposure in the same predetermined orientation with the respective stationary reference means whereby the projected registration marks of the transparencies of subsequent stations may be aligned with said indica of said memory device to align all subsequent images with the image projected in said first exposure station.

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