May 7, 1946. J. A. BALL 2,399,975

REGISTRATION PROCESSES AND APPARATUS

Filed March 15, 1943

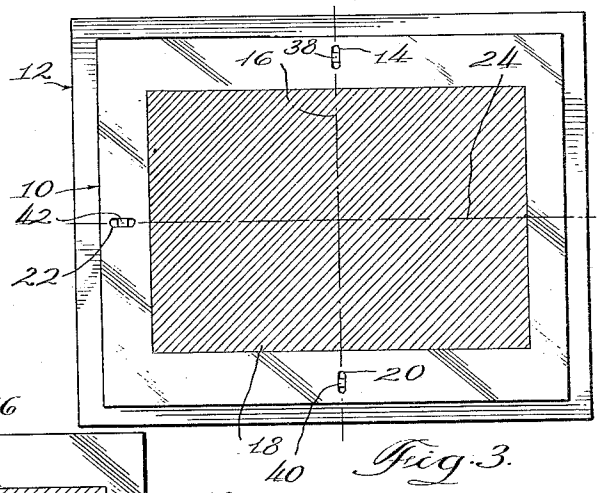
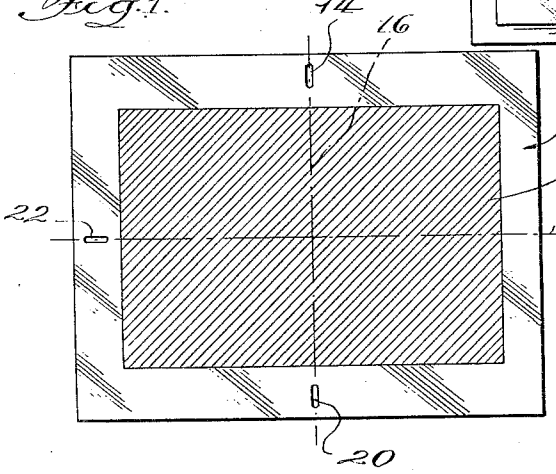


Fig. 3.

Fig. 1.



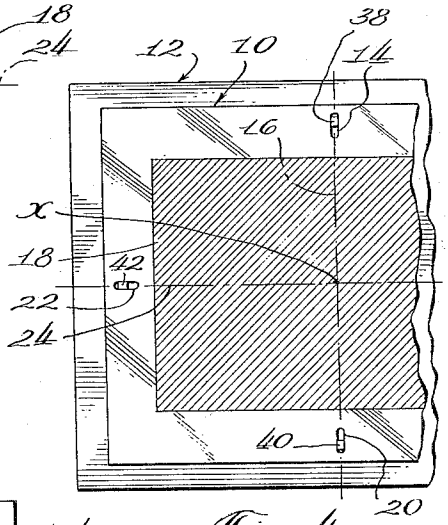
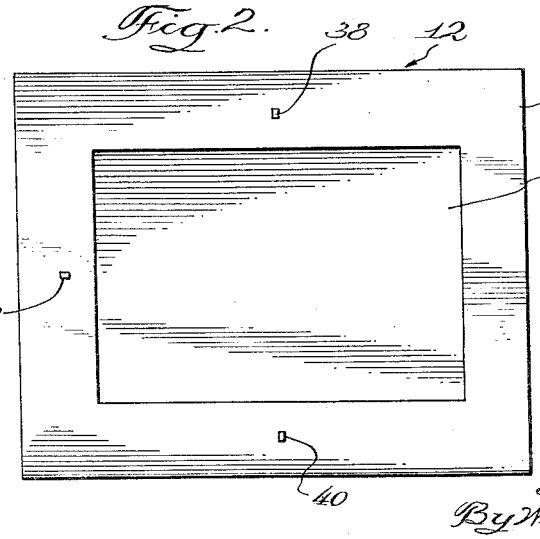


Fig. 4.

Fig. 2.



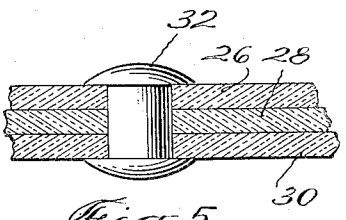


Fig. 5.

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REGISTRATION PROCESS AND APPARATUS

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6 Claims. (Cl. 33—184.5)

The present invention relates to a registration process and apparatus for carrying out the process. More particularly, the present invention is directed to a method for registering separate sheets having images thereon, or other elements of a sheet-like nature used in color printing or similar processes. The invention also includes apparatus useful in practicing the process.

It is an object of the present invention to provide a mechanical registration process which insures a minimum of noticeable lack of registry in a finally produced print even though the separate elements assembled to produce the print have expanded, shrunk, or otherwise changed dimensions differentially.

An additional object of the present invention is to provide a novel mechanical registration method which insures the proper location of the central portion of a positive or negative picture area regardless of differential shrinkage or expansion of the picture prior to registration.

Yet another object of the present invention is to provide a novel arrangement for registering a set of color separation or other related negatives relative to each other and relative to positive prints produced from these negatives.

Other objects and advantages will become apparent from the following description of a preferred embodiment of my invention, illustrated in the accompanying drawing.

In the drawing, in which similar characters of reference refer to similar parts throughout the several views,

Fig. 1 may be considered as a plan view of a photographic negative incorporating a feature of the present invention;

Fig. 2 is a plan view of a negative carrier or similar object incorporating the present invention adapted for use with the negative shown in Fig. 1;

Fig. 3 is a plan view of the negative illustrated in Fig. 1 registered upon the negative carrier of Fig. 2;

Fig. 4 is a view similar to Fig. 3, illustrating the effect upon registration which occurs if the negative shown in Figs. 1 and 3 shrinks; and

Fig. 5 may be considered as a sectional view through a portion of a pack of assembled films such as are used in forming color separation negatives by the so-called tri-pack process.

In practicing many types of photographic processes, particularly color processes, it is necessary to register several images in producing the final product. One way to accomplish this is to disregard any attempt at registration throughout the process until arriving at the step where several color images are superposed to produce the final print or transparency. If such a scheme is used, the act of registering the final images requires considerable skill in order to produce a satisfactory result. Another expedient is to use some mechanical means for registering the color separation negatives relative to each other at the time of printing and then use a similar mechanical registration scheme to insure proper registration of the subsequently produced positive elements at the time the color images are applied to the print surface. It is appreciated, however, that other color processes are now in use which accomplish registration by mechanical means at some point in the process, and the present invention is intended for use with any such processes.

As a specific example of one way in which the present process may be used to advantage, the invention will be described in connection with the registration of a set of color separation negatives at the time of printing, so that the images printed from these negatives will be identically located upon a set of positive prints.

In the past, in carrying out certain types of color processes, sets of color separation negatives have been registered and punched with holes located at their margins, these holes being located over pins at the time of printing with a view toward holding these negatives in identical relationship in a negative carrier. All such mechanical registration arrangements with which I am familiar are deficient in that they permit a considerable shift of the picture area if any shrinkage or expansion takes place in the negatives subsequent to the time they are originally registered and punched. For instance, if a set of three color separation negatives are registered and punched in any prior known manner and then at a later date it is decided to prepare prints from these negatives, shrinkage or expansion of one or more of the negatives in the meanwhile will result in considerable lack of registration of the final images.

The present invention is an improvement over these prior used registration processes, principally in that differential shrinkage or expansion of the negatives will result in much less displacement of the images at the time of printing, and further that whatever displacement does take place, will occur in a portion of the picture area where it will be less objectionable. By the use of the present method, shrinkage or expansion which occurs in the negatives will not affect registration of the center of the picture area, the lack of registry caused by such shrink-

age or expansion, if it becomes apparent at all, will appear only toward the edges and corners of the picture area where important picture elements are seldom encountered.

In Fig. 1, I have shown a photographic negative, indicated generally by the numeral 10, which may be considered as one of a set of color separation negatives.

In Fig. 2, I have shown a negative carrier 12 relative to which it is desired to register the negative 10 at the time of printing in such manner that if all of the negatives of the set are similarly registered, the several images produced by printing through these negatives will be in register. To accomplish this purpose, I have provided the top margin of the negative with a registering aperture 14, located along the vertically extending center line 16 through the picture area 18. The aperture 14 is generally rectangular with its ends rounded to inhibit tearing of the film stock. It is considerably longer than wide and has its longer dimension positioned vertically. A similar aperture 20 is similarly located and oriented along the vertical center line 16 in the lower margin of the negative, while a third similar aperture 22 is located along one of the side margin of the negative in alignment with the horizontal center line 24 with its longer dimension positioned horizontally.

The registration openings 14, 20 and 22 may be punched in any suitable manner. As an example, a master sheet, similar to the sheet 10, but preferably formed in metal and having the registration openings therein, is placed over one of the negatives and a hand punch is used for punching the openings 14, 20 and 22, the openings in the master sheet being used as guides. After this has been accomplished, the punched negative can be placed over another of the negatives in the color separation set and the two shifted about until they are in register, after which the hand punch is used for forming the openings 14, 20 and 22 in the second negative, using the first negative as a guide in forming the punched openings. If the color separation set comprises three or four negatives, the remaining negatives are registered relative to the first negative and are punched in the same manner as used in punching the second negative. Another expedient is to arrange the color separation negatives in register, one on top of the other, and punch all of the negatives at one time in a multiple punching device of any suitable type. In any event, preferably all of the negatives in a set should be punched soon after development, before shrinkage or expansion has taken place.

Still another arrangement is shown in Fig. 5. In this figure three negatives, indicated by the numerals 26, 28 and 30, are illustrated as grouped together to form what is known as a tri-pack. In the tri-pack process for forming color separation negatives, three films are arranged in a pack and this pack is inserted in the negative carrier of the camera so that all three negatives are exposed at the same time. Light striking the first of the negatives acts upon a color blind emulsion and forms the blue record, this emulsion being sensitive to blue light only. The light then passes through a filter layer which takes out any remaining blue light and into a second emulsion located upon the second film. This second emulsion is of the orthochromatic type, that is, it is sensitive to blue and green light only. Since the blue light has been removed, this second film forms the green record. The remaining light passes through a red filter into a panchromatic emulsion located upon the third film. The panchromatic emulsion therefore forms the red record. In adapting the present invention to use with such a tripack, the films can be punched in a machine before assembly to form the pack. After assembly, the several films can be held in proper relationship by means of soft rivets 32 formed of plastic material or soft metal, these rivets extending through the aligned apertures 14, 20 and 22 in the several negatives. The rivets should fit the apertures closely from side to side, but need not fit these apertures from end to end. All of the registration openings in the several negatives, therefore, are in proper relationship relative to each other at the time the exposure is made. After exposure, the heads of the rivets can be clipped off with a knife and the rivets removed to permit separation of the negatives for development and future use.

The negative carrier 12 comprises a frame 34 of any suitable type adapted to be held rigidly in place in a projection machine at the time of printing. This frame has a central rectangular opening 36 slightly smaller than the negative picture area, the opening being normally covered with a glass sheet, at least in the larger negative sizes. Centrally located relative to the opening 36, the frame 34 is provided along its top edge with a generally rectangular pin 38 of such width that it closely fits the film aperture 14 from side to side so as to prevent side to side movement of the negative relative thereto. The pin is somewhat shorter than the opening 14, however, thereby permitting vertical sliding movement of the negative. A similar pin 40 is located at the lower edge of the frame 12 and is adapted closely to fit the opening 20 from side to side, but to permit up and down movement of the negative. A third similar pin 42 is located along a side edge of the frame 34 and fits the opening 22 across its narrowest dimension. It, like the pins 38 and 40 however, is shorter than the longer dimension of the opening 22.

Now if the openings 14 and 20 are placed over the pins 38 and 40, the pins will prevent side to side movement of both the upper and lower negative margins. The negative, therefore, cannot rotate and cannot move from side to side. It can, however, move upwardly and downwardly relative to the negative carrier, since both of the pins 38 and 40 are shorter than the slots 14 and 20. If, in addition, the third opening 22 is placed over the pin 42, upward and downward movement of the negative is prevented. The use of all three of these pins, therefore, prevents movement of the negative in any linear direction in the plane of the support, and also prevents rotation of the negative. The negative therefore can lie in only one position upon the negative carrier.

In Fig. 4, I have shown what takes place if the negative shrinks subsequent to the time the registration openings 14, 20 and 22 have been punched. With the pins and openings arranged as previously described, it will be seen that the pins 38 and 40 prevent side to side movement of the vertical center line 16. Similarly, the pin 42 prevents upward or downward movement of the horizontal center line 24. Thus these center lines cannot move from the positions shown in Fig. 3. The central point X at which the vertical and horizontal center lines cross therefore cannot move from its original position. The center of the picture area, therefore, will always be reg-

istered, regardless of shinkage or expansion of the film. Further, it will be seen that if the total amount of shrinkage in a vertical direction between the slots 14 and 20 is an amount A, this shrinkage will be automatically divided in such manner that the center line 24 will lie in its original position, while the upper opening 14 will move downwardly a distance equal to one-half A, while the lower opening 20 moves upwardly a similar distance, that is one-half A. Therefore, for any total amount of vertical shrinkage or expansion of the negative, this shrinkage or expansion will be so distributed that the central portion of the picture area remains in the same location and no portion of the picture area will move more than one-half the total amount of the shrinkage. Similarly, side to side shrinkage will take place toward the vertical center line 16, thus the total amount of side to side shrinkage or expansion will be so distributed that the maximum movement of the side edges of the picture area will be one-half of the total amount of the shrinkage across the picture area.

By the use of the present method of registering photographic negatives or other photographic elements, it will be seen that the normally most important portion of the picture area, that is, the central portion, will remain little changed, while the greatest lack of register will take place at the side edges and corners of the picture, this latter portion of the picture normally comprising principally background and in most pictures being of little interest. Further, it is apparent that before lack of registry anywhere in the picture area can become apparent to the eye, the actual shift across the picture area caused by shrinkage or expansion must be twice the resolving power of the eye.

Although the present process has been described as used for registering color separation negatives in a negative carrier, it is apparent that the registration method is of universal application and can be used to advantage wherever it is desired to register flat sheets, particularly if these flat sheets are subject to expansion or contraction.

Having thus described my invention, what I claim as new and useful and desire to secure by Letters Patent of the United States is:

1. The method of registering a flat sheet so as to register a portion thereof relative to a frame, which comprises providing the sheet with generally rectangular openings in three of the margins, said openings being spaced directly outwardly from the center of the portion to be registered, providing a registering frame having pins to fit into said openings, each of said pins individually being of such size and shape as to permit movement of the adjacent side of the portion to be registered toward and away from said pin, but to prevent movement of said sheet at right angles to the aforesaid direction and placing said openings over said pins.

2. The method of registering a sheet-like element, which comprises providing the sheet-like element with a generally rectangular aperture adjacent to each of three of the margins of said sheet, said apertures being spaced approximately 90° apart with reference to the center of the portion of the sheet it is desired to register, said rectangular apertures being longer than wide and having their longer dimensions placed along center lines passing through the portion it is intended to register, providing a registering frame, said frame having three pins adapted to fit into said apertures, said pins fitting said apertures substantially fully across the narrower dimensions of said apertures and comparatively loosely in the direction of the longer dimension of said apertures, and placing said apertures over said pins.

3. A device for registering sheet-like elements, each sheet-like element having elongate apertures located in three of its margins with the longer dimensions of said apertures along center lines passing through the center of the portion of the sheet-like element it is desired to register, comprising a substantially rigid support for said sheet-like element, said support having three projections so disposed as to fit into the apertures in said sheet-like elements when the sheet-like elements are placed over said support, said projections having dimensions parallel to the plane of said support such that they fit the apertures substantially fully from side to side while fitting said apertures comparatively loosely from end to end.

4. A sheet-like element adapted to be registered relative to a support, said support having three pins located substantially 90° apart relative to a central portion of said support, said sheet-like element being provided at three of its margins with apertures so located as to fit over said pins when said sheet-like element is placed upon said support in a certain position, said apertures having dimensions such that they fit said pins comparatively loosely along a line which if projected passes substantially through the center of the portion it is desired to register, and said apertures fitting said pins closely along a dimension at right angles to the last said dimension.

5. In a registering device, the temporary combination comprised of a sheet-like element having an area to be registered and having apertures located adjacent three of the margins of said sheet, each of said apertures having parallel side edges that are parallel and closely adjacent to respective center lines extending outwardly from the central portion of the area to be registered, said center lines being angularly spaced by substantially 90°, and a supporting surface having pins projecting through the apertures in said sheet, said pins fitting said apertures closely across the parallel edges and loosely at right angles thereto.

6. The method of registering a sheet-like element relative to a support, which comprises forming apertures along at least three of the margins of said sheet-like element, each of said apertures being arranged along a center line passing through the center of the portion of the sheet to be registered, said center lines being arranged substantially 90° apart, each of said apertures having parallel side edges along at least a portion of its length, said parallel side edges being parallel to said center lines, providing said support with pins adapted to fit said apertures closely from side to side, and loosely in a lengthwise direction, and registering said sheet relative to said support by placing said sheet upon said support with said pins projecting through said apertures, whereby shrinkage or expansion of said sheet will permit the margins of said sheet to move away from or toward the aforesaid pins without disturbing the location of said center lines relative to said support.

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