

Oct. 5, 1943.

E. G. FASSEL

2,331,113

PHOTOGRAPHIC RECORDING METHODS

Filed April 10, 1939

3 Sheets-Sheet 1

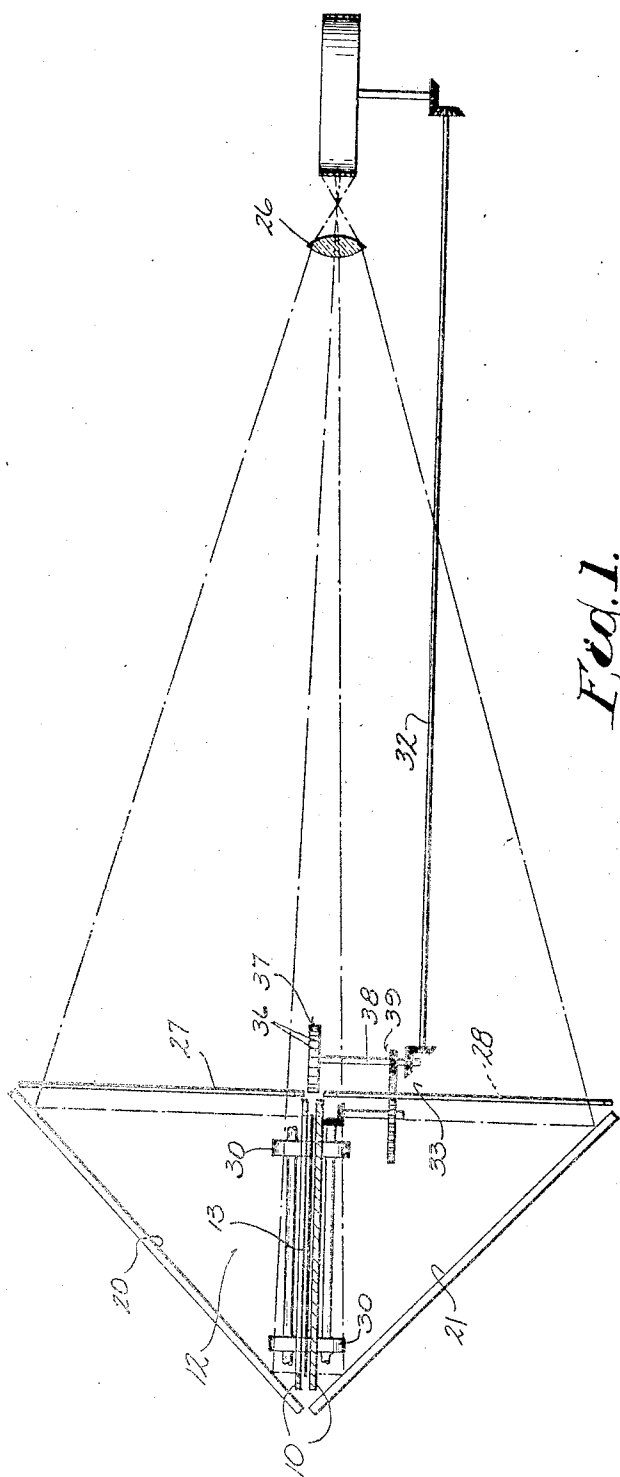


Fig. 1.

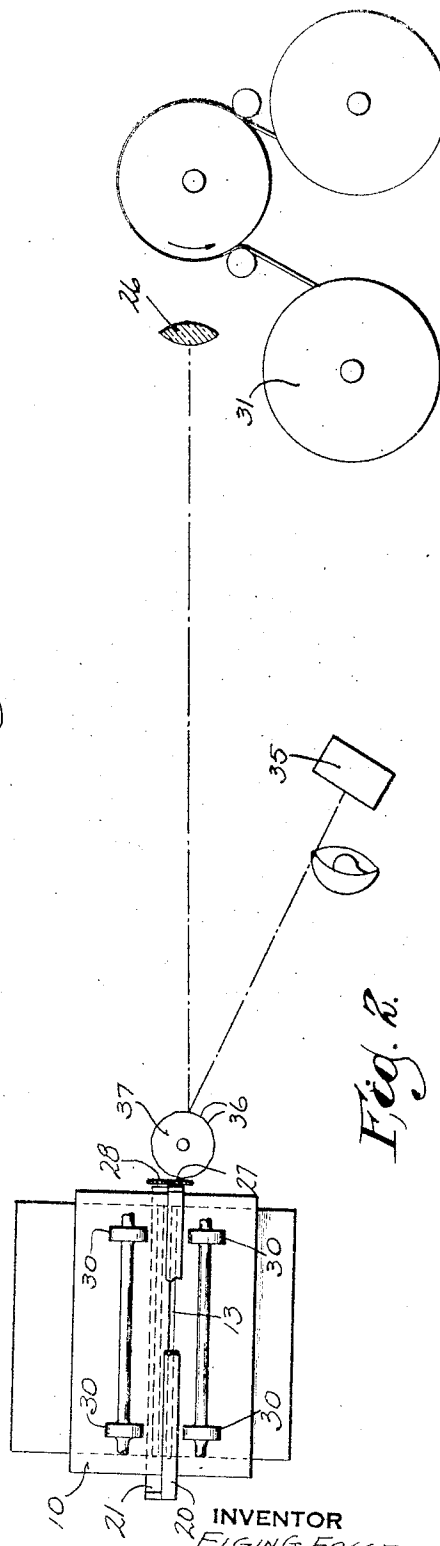


Fig. 2.

INVENTOR
ELGIN G. FASSEL
BY
Wheeler, Wheeler & Wheeler
ATTORNEYS.

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3 Sheets-Sheet 2

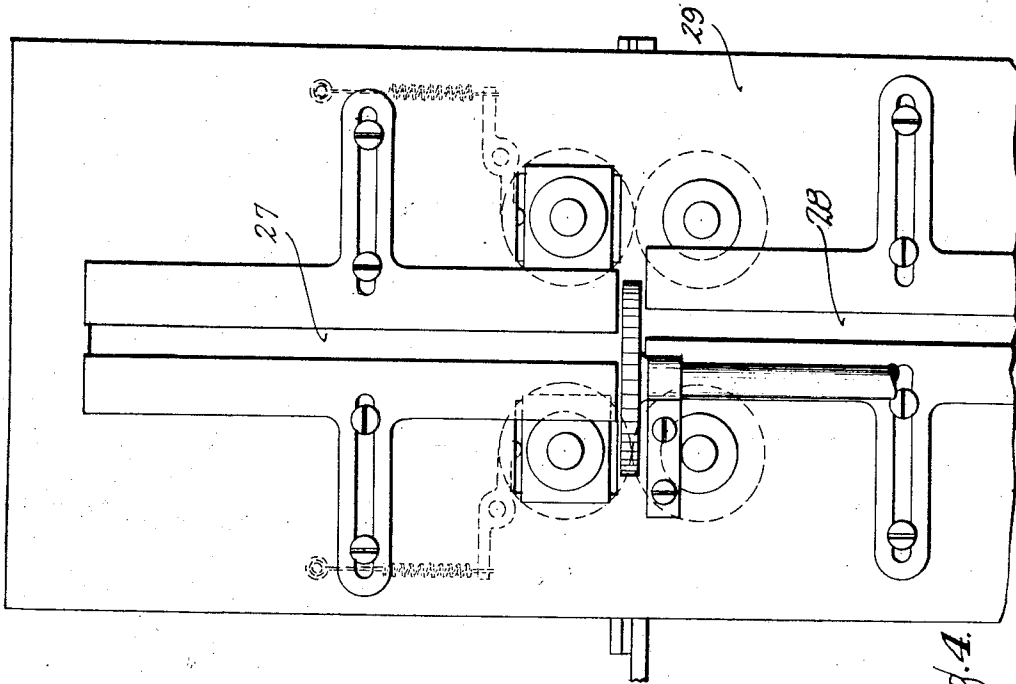


Fig. 4.

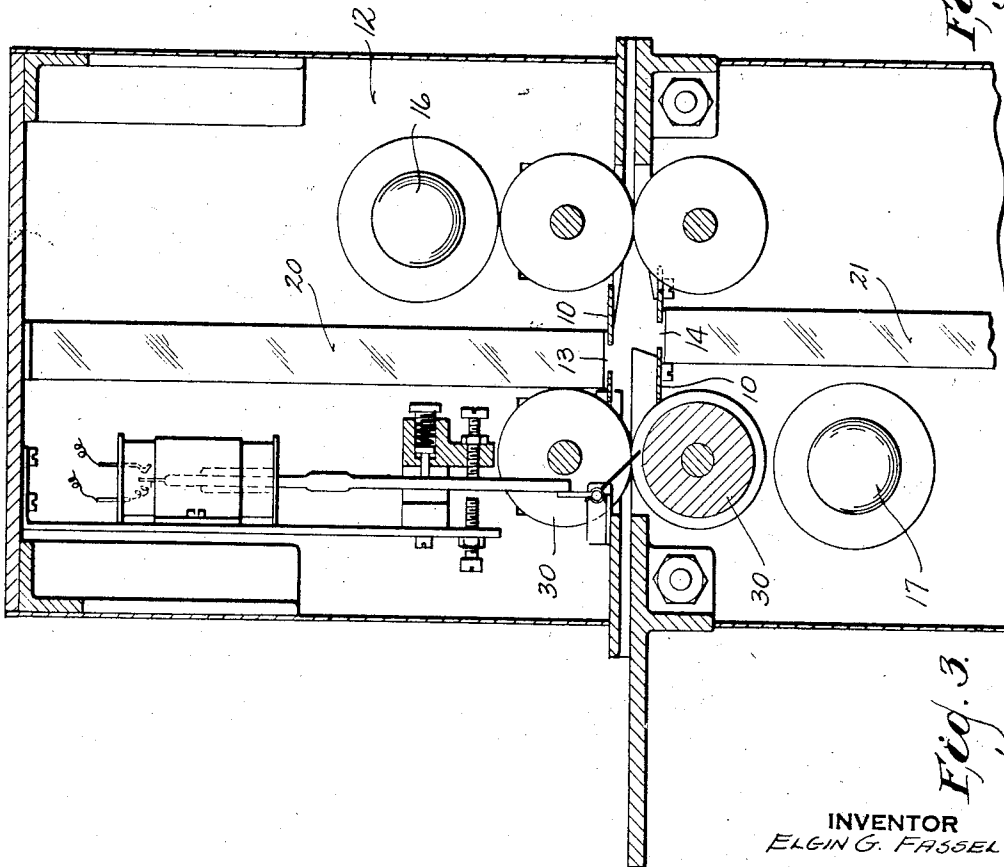


Fig. 3.

INVENTOR
ELGIN G. FASSEL

BY
Wheeler, Wheeler & Wheeler
ATTORNEYS

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3 Sheets-Sheet 3

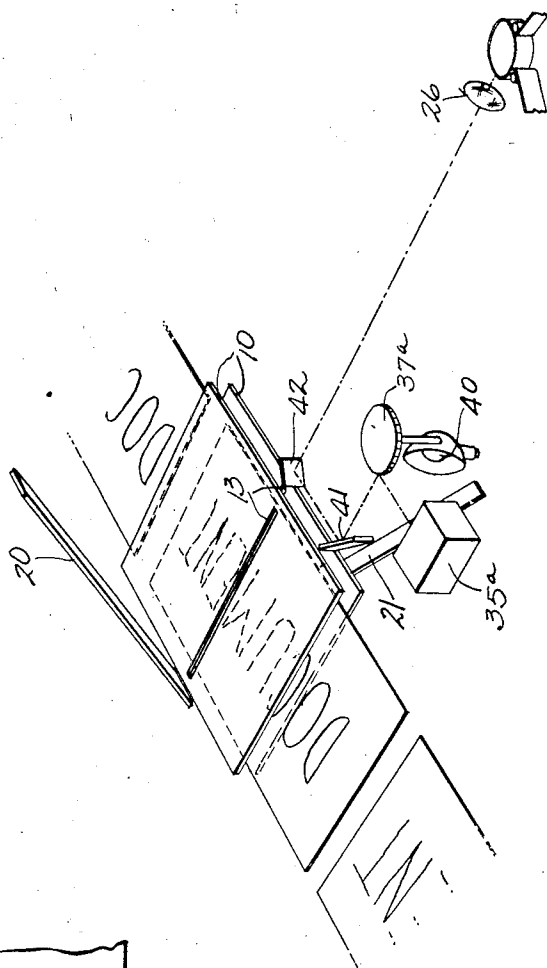


Fig. 8.

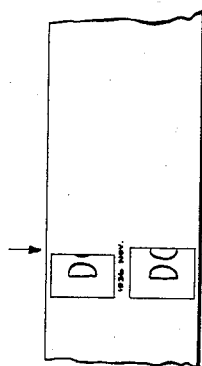


Fig. 5.

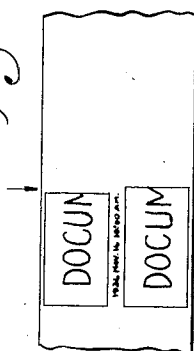


Fig. 6.

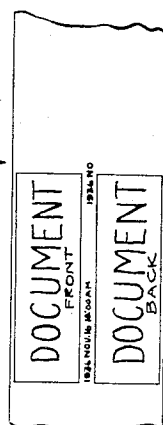


Fig. 7.

INVENTOR
ELGIN G. FASSEL

BY

Wheeler, Wheeler & Wheeler
ATTORNEYS

UNITED STATES PATENT OFFICE

2,331,113

PHOTOGRAPHIC RECORDING METHOD

Elgin G. Fassel, Milwaukee, Wis.

Application April 10, 1939, Serial No. 267,028

3 Claims. (Cl. 88—24)

My invention relates to improvements in photographic recording methods, with particular reference to the production of either temporary or permanent records at minimum expense for production and storage.

This application is in part divisional and in part a continuation of my former application, Serial No. 116,326, filed December 17, 1936, for improvements in Photographic recording equipment and method, the method claims having been withdrawn from that application pursuant to requirement for division.

One object of my invention is to provide satisfactory means for protecting a filing system against loss of documents temporarily removed from their files.

My object is to provide means whereby duplicate records may be reproduced, preferably in miniature, and in a manner to require minimum storage space, whereby a permanent record may be made of all original documents in the system, or temporary records may be made of documents temporarily withdrawn from the main filing system. The temporary miniature records may be destroyed when all of the original documents of any given group have been returned to the main filing system.

An ancillary object is to provide a method whereby such duplicate records may be reproduced without obscuration by document supporting means, such, for example, as the fingers of the operator, mechanical gripping devices, or glass panels between which the documents are placed preparatory to a photographing operation. If documents having printed or written matter in close proximity to their margins are supported by ordinary means while being photographed, portions of such printed or written matter may be obscured by the fingers of the operator or mechanical clamping devices. If the documents are in motion between glass panels it is difficult to avoid a certain degree of so-called "glare," and the glass quickly becomes scratched or discolored. Also, the panels tend to accumulate dust, and in the production of miniature records to be read through a microscope obscuration resulting from any one of these causes is extremely objectionable and may, in certain cases, completely defeat the purpose of the record.

The term "documents" as herein used includes record cards, deeds and other instruments of transfer, checks and vouchers, leaves taken from books and other publications, and all similar printed and written or recorded matter.

My improved method is peculiarly adapted to the requirements of banks and insurance companies, where many documents serve a temporary purpose and may contain printed or written matter on both sides of a card or sheet of paper. Also, documents are frequently temporarily withdrawn in groups and the photographic reproductions require to be correlated and identified in such a manner that the miniature record may show both sides of each document by paired photographs on the same strip of film, which provides a record of the obverse and reverse sides of all documents relating to a group withdrawn at any particular time, or by a single individual.

In the drawings:

Figure 1 is a diagrammatic illustration in side elevation of apparatus that may be used in carrying out my improved method.

Figure 2 is a plan diagram with portions of certain elements broken away to reveal elements that would otherwise be concealed.

Figure 3 is a sectional view of a chamber provided with a feedway for the documents to be photographically recorded, the section being taken on a vertical plane intersecting said chamber from front to rear and exposing the feedway.

Figure 4 is an elevation of said chamber as viewed from the side occupied by the camera.

Figures 5, 6 and 7 are illustrations, each showing a section of film or tape substantially equal in length to that of one of the complete miniature photographs and illustrating successive stages in production of the photograph.

Figure 8 is a diagrammatic illustration, in perspective, showing modified means for photographing a clock operated time index upon a strip of film or tape, between pictures of the obverse and reverse sides of the document.

Like parts are identified by the same reference characters throughout the several views.

By my improved method I progressively photograph the obverse and reverse sides of a continuously moving document or series of documents upon a continuously moving film or strip of sensitized material. While so doing, I control the rate of movement of the film with reference to the rate of movement of the documents, and also with reference to the size of the photographs as compared with the originals, whereby a series of documents arranged in line, either end to end or side by side, will occupy a much longer space than the miniature photographs of the same document on the film and in the same relationship.

I photograph the respective sides of each document upon the same section of film, in transversely spaced relationship on opposite sides of an imaginary longitudinally extending line, and between them I intermittently photograph a time index or clock dial. All photographs thus simultaneously produced will be transversely separated or spaced from each other whereby to occupy different areas of the same section of film, i. e., a length of film equal or substantially equal to the length of the photograph of either face of the document.

I prefer to employ an optical system for panoramically projecting and photographing images of the obverse and reverse sides of each moving document with the aid of a lens or lenses, which reduce the size of the image to about one-twenty-second ($\frac{1}{20}$) of the diameter of the original document. To avoid confusion of images and obscuration of the photograph, I prevent the rays of light illuminating one surface of the document from penetrating the document and reaching an area of the opposite surface which is being simultaneously photographed. To accomplish this, I may employ opaque documents or documents having at least one ply of opaque material. In either event, both sides of such a document may be simultaneously photographed as to identical zones or areas directly opposite each other.

But inasmuch as ordinary documents are not sufficiently opaque to prevent confusion of images of the respective sides, I prefer to expose, illuminate and photograph transversely extending, or directly opposite, zones of the obverse and reverse sides in an order of sequence. This may be accomplished by exposing, illuminating and photographing a given zone on one face of the document while the opposite face of the same zone or section of the document is not being illuminated or photographed.

Except during the initial and final stages of the passage of the document through the photographic field, I photograph both sides of the document simultaneously, although the area which is being photographed on one side may be in advance of the corresponding area on the other side when non-registering areas are being illuminated and photographed. Therefore, if the document permits penetration of light rays, I prefer to commence illuminating and photographing one side before commencing to illuminate and photograph the other side, and to proceed in that order throughout the length of the document.

But, notwithstanding the fact that the photographing of one surface may commence a little earlier than the photographing of the other surface, the sensitized strip will have advanced in the meantime so that the photographing of both surfaces may start from the same transverse line on the film, and the photographs of the opposite surfaces will not be staggered but will occupy the same length of film, i. e., a length equal to the length of either photograph.

Both photographs may be taken through the same object glass, as diagrammatically illustrated in Figure 1, and by taking the photographs panoramically, the exposure zones for the respective surfaces of the document may be made very narrow, thereby eliminating the necessity of providing supports for the documents at the points where it is exposed, i. e., in the photographic fields of the respective surfaces. This is a very important feature of my improved method, since the document may be adequately supported at

points where it is not exposed, thereby avoiding obscuration of any portion of the surface photographed by the fingers of the operator, by clamping devices or by glass plates, such as have formerly been used to support a document. Glass plates are subject to scratching and to accumulations of dust. The light rays tend to become scattered to a certain extent and to thus obscure the image, whereas by my improved method complete and clear photographs of both surfaces of the document may be obtained.

The paired photographs appearing on the strip may be sufficiently separated to allow a time indicator or index to be concurrently photographed in the space between the photographs of the opposing surfaces of the document. For example, a clock operated time indicating device or index disposed at one side of the field of vision may have its image reflected by a suitable mirror through the same object glass and focused upon the strip along its longitudinal center line. This index may indicate the time, the month and the year as well as the time of day, and by thus having a photograph of time indicating numerals or symbols appear between the pictures of the obverse and reverse sides of each document in a given group, all of the documents may be identified as composing a single group photographed within a given period of time. Inasmuch as a series of 20 or 30 documents may be successively photographed in the above manner within an interval of but a few seconds, the miniature record thus produced will show that all of the photographs were produced at substantially the same time.

In Figure 8 I have diagrammatically illustrated means whereby such a time index may be located at one side of the field of vision and images thereof reflected to the object glass of the camera.

As indicated in Figures 2, 3 and 8, I prefer to pass the documents A, B, C, etc., in a sequence through a feedway having opaque walls 10, adapted to hold and guide the documents in a horizontal plane through a viewing chamber 12. Within the viewing chamber the top and bottom walls of the feedway are transversely slotted, with the slots in the respective walls offset from each other along the line of document travel.

For example, the slot 13 would expose the top surface of the leading end of document A before the corresponding bottom surface is exposed through the slot 14 in the bottom wall of the feedway. The portion exposed through the top slot 13 may be illuminated from any source of light, preferably by means of a lamp 15, which may be so located that the rays of light will pass to the exposed portion of the document along oblique lines directed away from the area occupied by the slot 14 in the bottom wall of the feedway.

Similarly, a lamp 17 below the feedway may be located to illuminate the lower face of the document exposed through the bottom slot 14. This lamp 17 is also so located that its rays of light will reach the exposed portion of the lower face of the document along lines which do not intersect the upper face of the document in that portion exposed through the slot 13.

As above stated, the slots in the feedway extend transversely. They are so narrow in the direction of the line of document travel that sheets of tissue paper require no support while crossing these slots, the other portions of the sheets being adequately supported by the opaque walls of the feedway. Therefore, as above ex-

plained, the photograph will not be obscured by fingers of the operator or equivalent document clamping or conveying devices, or by scratched or dust covered panes of glass, or by so-called "glare," such as results from the use of supporting glass plates illuminated from opposite sides and tending to refract and diffuse or scatter light rays.

Obliquely placed mirrors 20 and 21 converge toward a line at one side of the feedway and are offset from each other in correspondence with the offset slots 13 and 14, the mirror 20 extending upwardly from said line over the feedway slot 13, and the mirror 21 extending downwardly from another portion of said line underneath the slot 14.

Preferably the mirrors will have a width but little greater than that of the slots with which they are in registry, and they may be placed at an angle of 45 degrees to the plane in which the documents move, whereby to reflect images of the documents to the object glass of a camera provided with a de-magnifying lens or group of lenses 26, beyond which a strip of sensitized tape may be fed through the camera casing at the proper focal distance from the lens.

The images on the mirrors 20 and 21 are reflected to the camera through vertically disposed slots 27 and 28 in a screen 29 interposed between the mirrors and the camera, said screen preferably comprising one wall of the viewing chamber. This slotted screen sharply defines the images projected from the mirrors to the camera, (Figure 4).

Feed rollers 30 may be employed for actuating the documents through the feedway at a given rate of speed and rollers or sprocket members 31 may be employed to feed the tape through the camera box. These mechanisms may be connected by any suitable means, such as shafting 32 and gearing 33, whereby the motion of the film may be regulated in correspondence with the motion of the documents and the degree of de-magnification. It is immaterial to the method herein disclosed from what source of power the mechanism may be driven, and therefore the driving mechanism is omitted from the illustration.

As illustrated in the diagram shown in Figure 1, the pictures of the obverse and reverse sides of the document are offset upon the tape in spaced relation to each other, i. e., on opposite sides of the longitudinal center line of the tape, and they occupy a length of tape substantially equal to the dimension of either one of the pictures, as measured along the film axis.

This offsetting of the images is due to the angle at which the rays of light from the obliquely disposed mirrors enter the lens, and also to the curvature of the lens or group of lenses, whereby these rays are directed to the proper areas on the tape.

Between the pictures of the obverse and reverse sides of each document photographed, a space of substantial width remains to receive the photograph of an identification clock or equivalent device for correlating all the documents in the group with a group of pictures taken during any specified period.

I prefer to employ a clock operated index 35 as a means for identifying all pictures in the group and correlating the pairs of photographs with each other. It is not essential to the invention herein disclosed whether the clock merely indicates the time of day, or whether it

indicates the day of the month and the year as well. Therefore the clock index 35 is illustrated conventionally.

A set of mirrors 36 may be mounted tangentially on the periphery of a wheel 37, carried by a vertical shaft 38 which is slowly rotated by mechanism indicated at 39 connected with the shaft 32. The wheel is located substantially in the horizontal plane which includes the feedway through which the documents travel, and it is sufficiently close to the feedway to avoid interference with the rays of light projected to the camera by the mirrors 20 and 21.

As the wheel 37 rotates, the mirrors 36 are successively brought into position to reflect an image of the clock to the object glass of the camera while one of the documents is being photographed. The driving mechanism is so timed that at least one photograph of the clock will be produced on the tape simultaneously with the production of a pair of photographs of the obverse and reverse sides of the document then in transit through the viewing chamber.

In Figure 8, I have illustrated another arrangement whereby the mirror carrying or faceted wheels may be located at one side of the so-called line of sight. A clock operated time index is conventionally indicated at 35a in Figure 8. It is illuminated by a lamp 40, and its index is reflected to a faceted wheel 37a, which in turn periodically reflects the images to fixed mirrors, as indicated at 41 and 42. These are so positioned as to direct the image to the center of the object glass of the camera. With the exception of mirror 42, all elements of the time indicating equipment are laterally offset from the image carrying light rays emanating from the viewing chamber. The assembly is sufficiently compact to preserve the focal distance.

Various other arrangements of reflecting equipment may be employed to carry out my improved method, as will be obvious to those skilled in the art to which this invention pertains.

As above stated, in the general description of my method, I prefer to produce the pictures on the film or sensitized strip in miniature. Therefore, it will be understood that I employ a camera equipped with a lens so focused as to greatly reduce the size of the image as compared with the objects photographed. In one form of apparatus employed for carrying out my improved method, I produce paired miniature photographs of the respective sides of ordinary record cards used by an insurance company, in which the photographs are only one-twenty-second ($\frac{1}{22}$) of the diameter (width and length) of the original card or document. Such photographs are examined with the aid of a microscope or equivalent magnifying device.

I am thus able to produce and store in a cabinet 37 inches in height, $17\frac{1}{2}$ inches in width and 17 inches deep, photographic records of 1,500,000 policy record cards, 6 inches in width and $6\frac{1}{4}$ inches in length, as kept in the main files of an insurance company. Inasmuch as each photographic record of an individual group contains pictures of both the sides of the card, the total number of photographs so stored is double the number of cards, i. e., 3,000,000 photographs.

While I prefer to panoramically photograph the obverse and reverse sides of documents by illuminating and exposing non-registering zones of the respective sides as above described, I may employ opaque documents, or documents having an opaque ply interposed between the surfaces

carrying written, printed or pictorial matter. If the documents are opaque, the photographing of the respective sides may commence simultaneously, in which case the top and bottom walls of the feedway may have the exposure slots located in the same vertical plane. In that event, the exposed surfaces may be illuminated without danger of having light rays intersect the document in a manner to obscure or confuse the images. However, inasmuch as ordinary documents are printed upon paper or cardboard readily penetrated by light rays, I prefer to offset the exposure slots and take the photographs in the manner as described herein.

Documents comprising leaves taken from a book will be ordinarily fed through the photographic field with each printed line transverse to the line of travel. The lines will therefore be photographed successively, and the miniature record will be read by passing the film longitudinally under the microscope in a direction to expose the lines successively.

Documents containing matter written or printed as illustrated in Figure 7, will be read by passing the film under microscope in a direction at right angles to its movement when reading book records, and both sides of an individual document may be simultaneously and completely exposed for examination. Documents which are reversed end for end when making notations or when printed, should be fed through the photographic field with the lines of printed or written matter parallel with the line of travel, the side edges of these documents being opposed in the feedway instead of having the end edges opposed when photographing book leaves.

In feeding the documents through the photographic field, it is not necessary that they should be in edge-to-edge contact or in any definite spaced relationship to each other. To avoid waste of film they should be in reasonably close proximity to each other. The photographs can be taken with such rapidity that the documents may be moved at high speed through the photographic field and a large number of photographs made within a few seconds. Therefore the spacing of the documents is a minor factor in determining the time required for producing a complete record of all the documents of a given group.

I claim:

1. A method of producing a photographic record of a document, said method consisting in simultaneously advancing a document and a strip of sensitized material at correlated speeds along opposite sides of a camera lens, illuminating successive portions of the opposite faces of the document, which portions are offset longitudinally in the direction of document travel, and directing light from the illuminated offset portions of the opposite faces of the document through said lens upon said strip in the course of its correlated movement, while protecting

against light transmission through the document those portions of its opposing faces from which reflected light is directed to said sensitized strip.

2. The method of producing photographic records of documents, which method consists in continuously advancing a strip of sensitized material upon a predetermined path in the field of a lens, and continuously advancing successive documents in series upon a predetermined path in a plane substantially medial and at right angles with reference to the path of said strip and at the opposite side of the lens therefrom and at a rate panoramically correlated with the rate of strip advance, illuminating portions of the opposite surfaces of successively advancing portions of said documents in areas respectively offset along the path of document advance, and directing reflected light from the respectively offset illuminated areas of successive portions of successive documents through said lens upon laterally adjacent portions of said strip, whereby the images of opposite faces of said documents are panoramically registered in correlated positions upon said strip, while protecting those successive portions of said documents from which light is directed to said strip against light transmission through the document.

3. The method of continuously producing photographic records of successive documents, which method consists of advancing a strip of sensitized material on a predetermined path, excluding therefrom substantially all light except such as is received through a lens adjacent said path, said strip being moved operatively in the field of said lens to receive images projected therethrough, advancing successive documents at the opposite side of said lens at a speed panoramically correlated to the speed of said strip and upon a path substantially disposed in a plane medial with respect to said strip and normal thereto, illuminating portions of the opposite faces of the advancing document with substantially equal brilliance, excluding from each portion so illuminated, all confusing rays from the opposite side of the document, and directing light concurrently reflected on opposed faces of said document through said lens from opposite sides of the document, whereby the images of light reflected by said documents in movement are panoramically projected into correlated laterally adjacent positions on said strip at opposite sides of said plane, and simultaneously directing on to said strip in association with the adjacent images of the opposing faces of each document a beam of light from a time piece, said beam being correlated as to rate of movement to the movement of said strip, whereby to register thereon as a means of identifying the respective documents with reference to the time of their reproduction.

ELGIN G. FASSEL.