Nov. 19, 1968 J. E. STALDER ET AL 3,411,848

CODER-EXPOSER

Filed June 16, 1966 4 Sheets-Sheet 1

Fig. 1

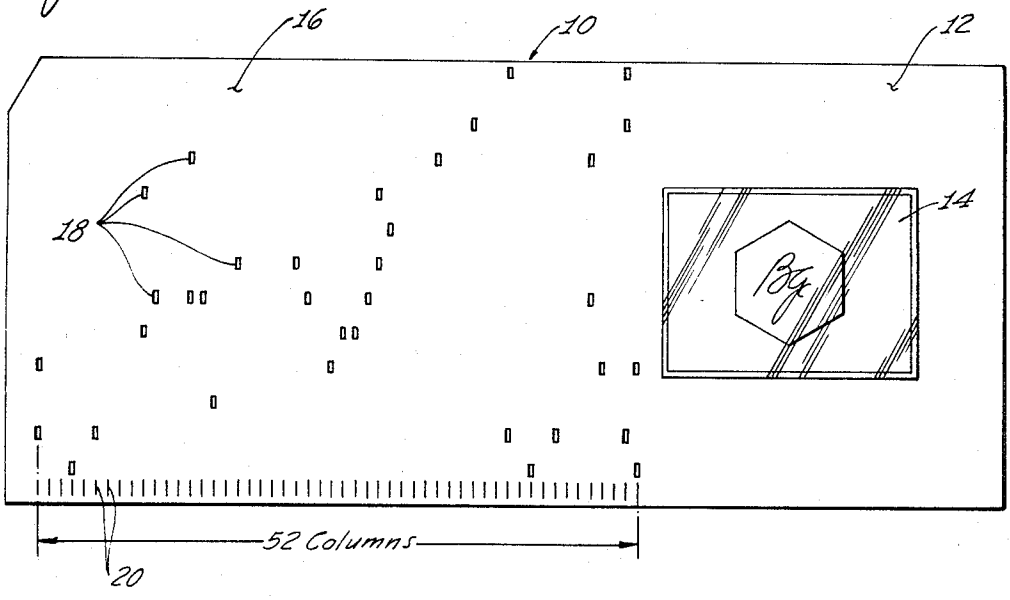
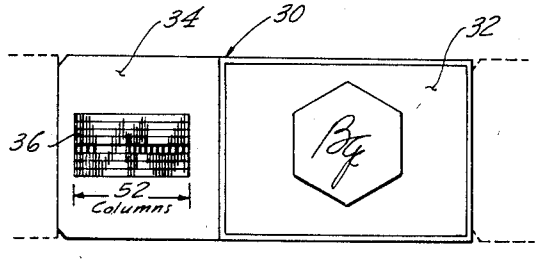


Fig. 2



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Fig. 3

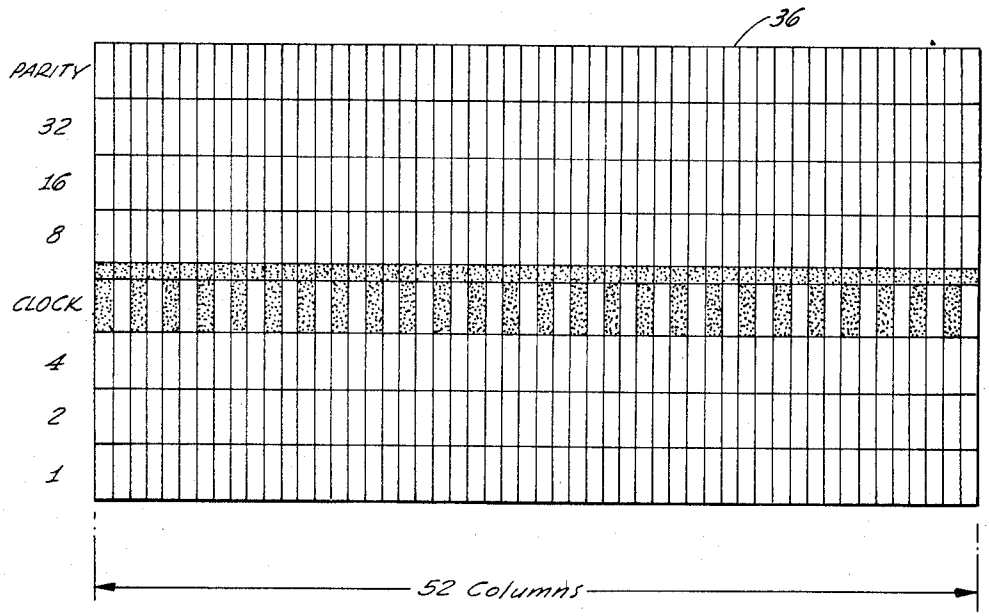
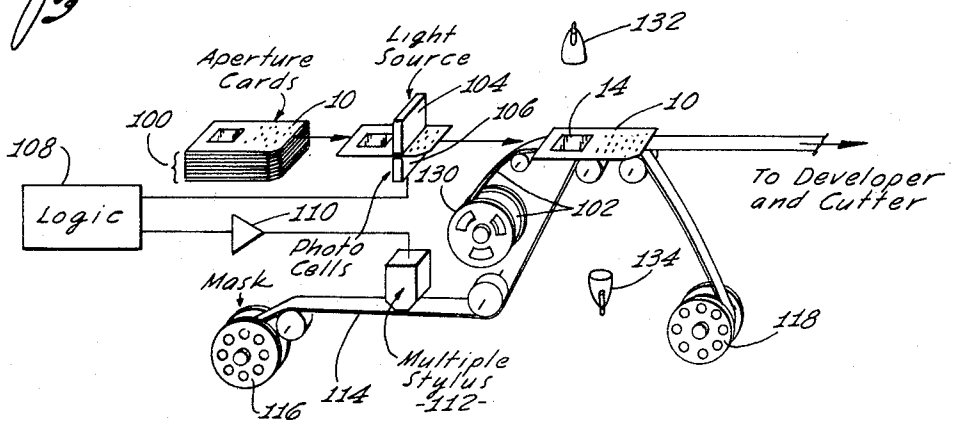
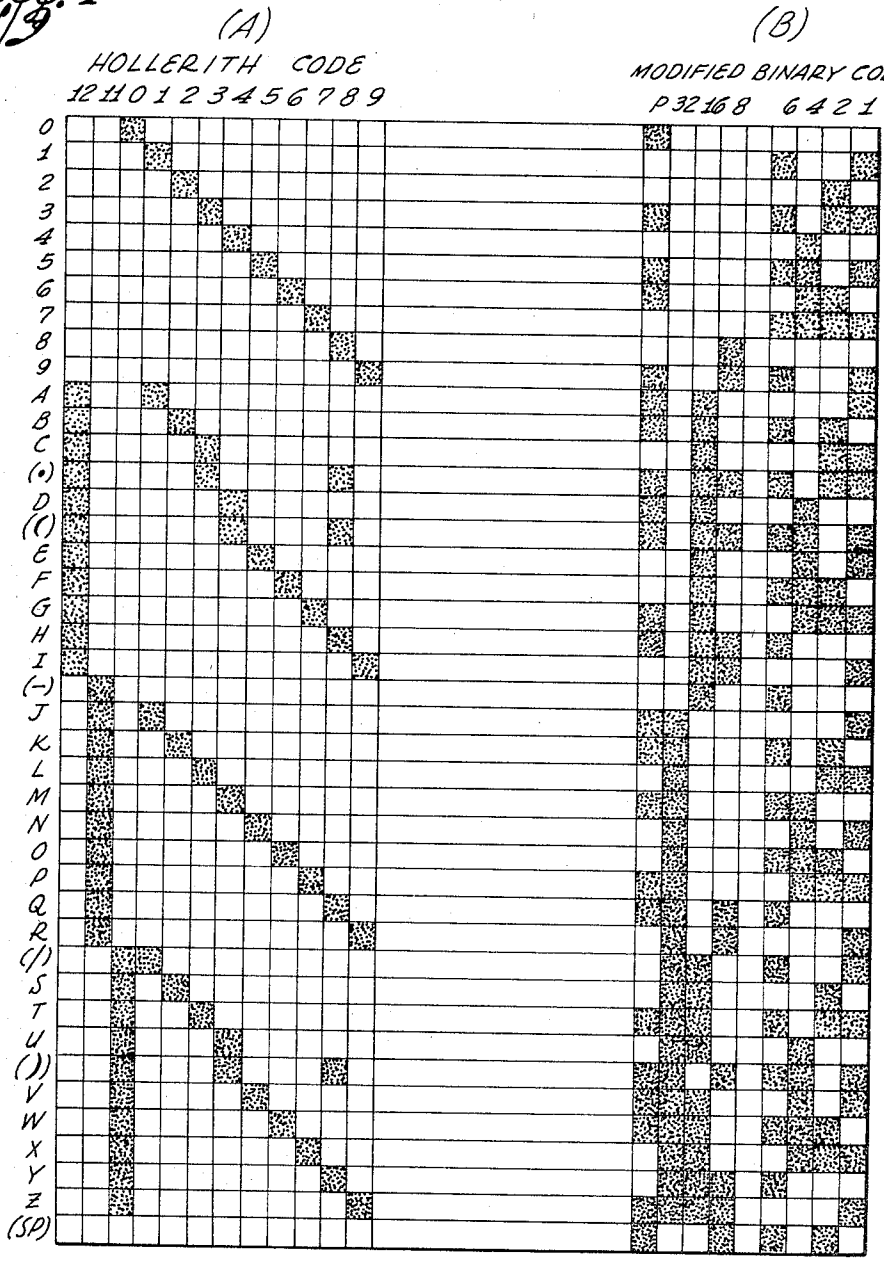


Fig. 5



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Fig. 4



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Filed June 16, 1966 4 Sheets-Sheet 4

Fig. 6

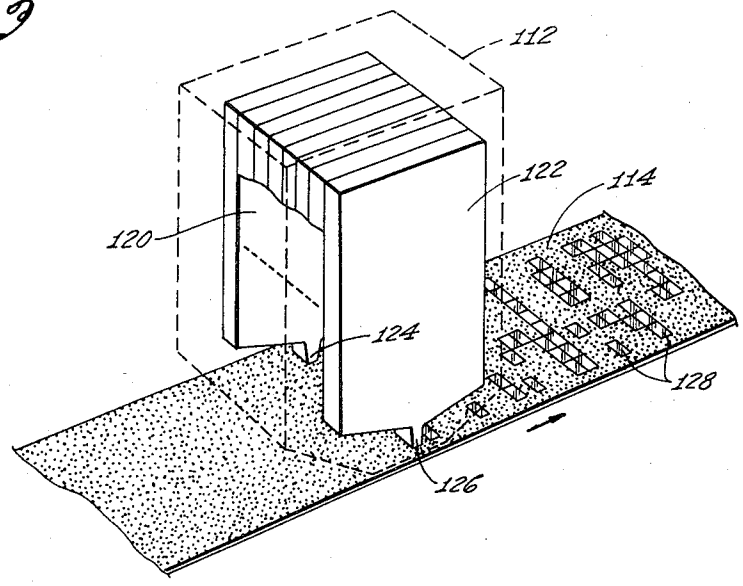
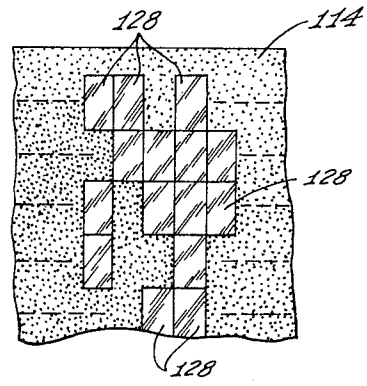


Fig. 7



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United States Patent Office 3,411,848
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3,411,848

CODER-EXPOSER

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Filed June 16, 1966, Ser. No. 557,965
12 Claims. (Cl. 355—89)

This invention relates to an apparatus for coding information and with a recording of the coded information by the exposure of a photographic film. More specifically, this invention relates to an apparatus for producing a photographic recording medium having the information recorded on the photographic recording medium in the form of variable transmission characteristics.

The information recorded on the photographic recording medium of the present invention is generally transferred from information such as digital information which has been recorded on punch cards. The present invention, therefore, pertains to an apparatus for reproducing coded information such as digital information contained on punch cards, converting such reproduced coded information from the punch cards into a more efficient coding system and recording the converted coded information onto a photographic recording medium. The photographic recording medium of the present invention may, in addition, contain information such as analog information and the particular embodiment of the invention described in this application does provide for the recording of additional information such as analog information on the photographic recording medium.

Modern businesses rely to a large extent on the use of systems which store information and which provide for an efficient retrieval of the stored information. One of the commonest types of information retrieval systems now in use stores the information on punch cards. The conventional punch card information retrieval systems have the information recorded by punching out portions of the card in representation of the information and with the particular punched-out portion determined in accordance with a predetermined code. The information is now stored on the punch card and the information may be retrieved by scanning the punch card by any one of a number of conventional scanning systems.

There are many problems associated with the use of punch card information retrieval systems. For example, as business techniques rely to a greater extent on information retrieval systems, greater amounts of information must be stored and this in turn produces an increasing storage problem. Conventional punch cards are bulky and inefficient in the use of their storage capacity versus size and it is desirable to store information on a storage medium which is smaller and more efficient in the use of its storage capacity versus size. In addition, equipment for handling conventional punch cards operates at relatively slow speeds since the conventional punch cards are bulky and easily damaged. It is desirable to use a storage medium which is capable of being handled at greater speeds. Another problem with conventional punch cards is that the punch cards generally provide for a storage of digital information and cannot store analog information. For example, it may be desirable to provide a storage medium which stores both analog and digital information and wherein the digital information provides an identification for and a description of the analog information. The digital information may also be used to provide for the retrieval of the analog information.

Since it is desirable to provide both analog and digital information on a single storage medium it has been proposed that a standard punch card may be improved by providing an area on the punch card for supporting a film chip. An illustration of such an improved punch card, which is referred to as an aperture card, may be found in copending application Ser. No. 427,345, filed Jan. 22, 1965, in the name of Clark R. Miller and assigned to the assignee of the instant application.

The aperture card which is shown in the copending application Ser. No. 427,345 contains a punch card portion and an area with a cut-out to receive a film chip. The film chip may contain analog information such as a schematic, charts, drawings, etc. The analog information is recorded photographically on the film chip and the film chip may be used to produce an enlarged copy of the analog information or the film chip may be used to project the analog information onto a screen. The punch card portion of the aperture card includes digital information which is recorded using a predetermined punch card code. Usually the digital information represents information which may provide identification or details of the analog information recorded on the film chip and the digital information is used during the search procedure to provide identification of the aperture card.

The advantages of such an aperture card as described above are apparent in that the aperture card may include the desired analog information but the aperture card is handled using standard punch card handling equipment. Since the standard punch card handling equipement is generally available, the use of the aperture card for storage may be advantageous in that existing equipment can be upgraded to store and retrieve analog and digital information which is recorded on the film chip and punch card portions of the aperture card.

The aperture card is described above, although an improvement over normal punch cards still has many of the same drawbacks as are found with the normal punch card. For example, the aperture card in common with the normal punch card is bulky, easily damaged and limited in the speed at which it may be handled by the normal punch card handling equipment and techniques. In addition, the film chip portion of the aperture card is easily damaged by the punch card handling equipment. It would be desirable to completely eliminate the disadvantages of the punch card by using a storage medium which is smaller, lighter, and which can be more quickly handled than the normal punch card or aperture card.

One proposed storage medium is a photographic film which may include both analog and digital information. For example, one portion of the photographic film storage medium would correspond to the film chip portion of the aperture card described above. A second portion of the photograph film storage medium would contain information corresponding to the punch card portion of the aperture card described above. Although the photographic film storage medium would store the same information as the aperture card, the photographic film storage medium is smaller and ligher and, therefore, stores information more efficiently. In addition, the photographic film storage medium, being smaller and lighter than the aperture card or punch card, can be processed quicker than the aperture card or punch card.

Since large numbers of aperture cards and punch cards are already being used, it is desirable to provide means for transferring the information from these aperture and punch cards to the photographic film storage medium so that the information can be transferred in an efficient manner. In particular, it is desirable that the means for transferring the information from the aperture and punch cards to the photographic film be automatic and operate at a rapid speed.

As the information is transferred from the aperture

card it is necessary to transfer the film chip portion of the aperture card directly to the photographic film storage medium. This is a relatively simple transfer operation since the film chip portion of the aperture card is merely disposed adjacent to the photographic film storage medium and a contact print is made.

It is more difficult, however, to transfer the information contained on the punch card portion of the aperture card to the photographic film storage medium. It is not possible to merely make an optical representation of the punch card information. If such an optical representation were made using a contact print operation, the photographic film storage medium would have to be as large as the aperture card and this, of course, is undesirable. If the punch card portion of the aperture card is optically reduced for transfer to the photographic film storage medium, this is not successful since the information on the punch card when reduced increases the difficulty of detection. This is because the punched-out areas on the punch card portion of the aperture card are spaced relatively far from each other, and the reduction of the punch card portion of the aperture card produces very tiny spots of information. It is, therefore, desirable to squeeze all the punched-out areas together so as to provide for an optimum storage density. Although this squeezing is impossible with a punch card since there must be material between the punched-out areas, the squeezing is possible with a photographic film storage medium since the photographic representation of the information uses variable light transmission characteristics of a continuous substrate.

The present invention, therefore, includes the reproduction of the information on a punch card or a punch card portion of an aperture card with a subsequent transfer of such information to a photographic film storage medium and with a provision for an optimum storage of the information on the photographic film storage medium. Since it is necessary to both reproduce the information from the punch card and to record this information on the photographic film storage medium, it is desirable to use an efficient coding system when recording the information on the film chip. Punch cards currently in use, use an inefficient coding system, designated as the Hollerith code, which was developed when punch cards were originally introduced. The present invention, therefore, provides for a transfer of information from a punch card to a photographic film with a conversion from the normal punch card code to a more efficient coding system.

Since the apparatus of the present invention is to be used to transfer information from great numbers of punch or aperture cards to photographic film, the transfer apparatus should be relatively simple and foolproof so as to eliminate costly breakdowns in the equipment. It is relatively easy to read the punch card information and to convert such information to a more efficient coding system using standard logic circuits. A major problem is how to transfer the converted information to the photographic film. The simplest way in which to transfer information to a photographic medium such as the photographic film of the present invention is to expose the photographic film through a contact printing process. For example, the transfer from the film chip portion of the aperture card to the photographic film storage medium is accomplished through a contact print process, as indicated above.

In order to provide a contact print of the converted information from the punch card or punch card portion of the aperture card it is necessary to produce a mask in accordance with the converted information for use in making the contact print. Specifically, the mask should have translucent and opaque portions in accordance with the converted information. It is possible to design a mechanical structure which it itself constitutes a mask and which is controlled in accordance with the

converted information from the punch card or punch card portion of the aperture card. However, such a mechanical structure would be very complex and difficult to build.

The present invention provides for a mask for use in making a contact print on the photographic film storage medium wherein the mask is an intermediate transfer medium which receives the converted coded information from the logic circuitry and stores such information as variable transmission characteristics. The photographic film is then placed adjacent the intermediate transfer medium and the photographic film is exposed in accordance with the variable transmission characteristics of the intermediate transfer medium. The intermediate transfer medium is disposed of as waste after it is used to provide the transfer of the information to the photographic film storage medium.

The intermediate transfer medium is recorded by striking the intermediate transfer medium with a multiple stylus unit which is driven in accordance with the converted information from the logic circuitry. The specific material used for the intermediate transfer medium may be of the type which experiences a reduction in optical density when subjected to pressure. One form of this material which is currently in use is a pressure sensitive coated flexible plastic, such as "Mylar," which is used in the graphic arts to produce transparencies from letterpress equipment. The intermediate transfer medium also may be a total transfer carbon paper generally of the type used in electric typewriters and wherein a translucent backing material is covered with carbon material. When the carbon paper is struck, the carbon material is substantially completely transferred from the carbon paper to a second surface. Such a total transfer carbon paper would also provide for the reduction in optical density so as to produce the mask used to provide a contact print on the photographic film storage medium.

The present invention, therefore, provides a system for transferring the information recorded on a punch card or the punch card portion of an aperture card to a photographic film storage medium and using an intermediate transfer medium to produce a mask in accordance with the information and with the mask used to make a contact print of the information on the photographic film storage medium. A clearer understanding of the invention will be had with reference to the drawings wherein:

FIGURE 1 is an illustration of a prior art aperture card including a portion supporting a film chip and a portion for receiving punch card information;

FIGURE 2 is a photographic film storage medium of the present invention including a portion for receiving the same information as the film chip portion of the aperture card of FIGURE 1 and including a portion for receiving information corresponding to the information contained on the punch card portion of the aperture card of FIGURE 1;

FIGURE 3 is a detail drawing of the area of the photographic film storage medium of FIGURE 2 for receiving information corresponding to the information contained on the punch card portion of the aperture card of FIGURE 1;

FIGURE 4*a* illustrates the Hollerith code currently in use with conventional punch cards;

FIGURE 4*b* illustrates a modified binary code which may be used in place of the Hollerith code of FIGURE 4*a*;

FIGURE 5 is a schematic diagram of a system for transferring information from the aperture card of FIGURE 1 to the photographic film storage medium of FIGURE 2;

FIGURE 6 is a detail view of the multiple stylus of FIGURE 5 in combination with the intermediate transfer medium of FIGURE 5; and

FIGURE 7 is a detail view of the intermediate transfer

medium after it has passed by the multiple stylus of FIGURES 5 and 6.

In FIGURE 1 an aperture card **10** includes first portion **12** for receiving a film chip **14**. The film chip **14** may store either analog or digital information, but the film chip **14** is generally used for the storage of analog information. The analog information may be in the form of schematics, drawings, charts, illustrations, etc. The aperture card **10** also includes a second portion **16** for receiving punch card information. The punch card information includes punched out areas **18** which represent particular digital information. The punch card information is generally arranged along a series of columns **20** and in a normal punch card the number of columns total eighty from one end of the card to the other. Since the aperture card **10** of FIGURE 1 uses the portion **12** of the aperture card **10** for the film chip **14**, some of the columns are eliminated. In our particular example the punch card **10** includes in the punch card portion **16** a total of fifty-two columns.

As can be seen in the aperture card **10** of FIGURE 1, the punch card portion **16** stores the punched information **18** in a generally inefficient manner since there must be a space between each punched-out area **18**. The material between each punched-out area **18** must be sufficiently great so that the material will not easily rip. It would be desirable to reproduce the information contained on th epunch card portion **16** of the aperture card **10** in a more efficient manner by eliminating the spacing between the punched-out areas **18**.

FIGURE 2 illustrates a photographic film storage medium **30** which stores the same information as that stored on the aperture card of FIGURE 1. The photographic film storage medium **10** of FIGURE 2 occupies a much smaller space than that of the aperture card **10** of FIGURE 1 and in particular the photographic film storage medium **30** of FIGURE 2 occupies approximately one-fifth the area of the aperture card **10** of FIGURE 1. The photographic film **30** includes a first portion **32** which is equal in size to the film chip **14** of the aperture card **10** of FIGURE 1. The portion **32** of the photographic film **30** is designed to store the same information as is stored on the film chip portion **14** of the aperture card **10** of FIGURE 1. The photographic film **30** of FIGURE 2 also includes a second portion **34** which has an area **36** to store information representing the information recorded in the punch card portion **16** of the aperture card **10** of FIGURE 1. The informational area **36** may also include fifty-two columns to correspond to the information of FIGURE 1. As an example, the informational area **36** of FIGURE 2 may be arranged in a pattern as shown in FIGURE 3.

In FIGURE 3 the informational area **36** is shown broken down into fifty-two columns. The columns correspond to the fifty-two columns of the punch card information of the aperture card **10** of FIGURE 1. Each column has eight bits where six bits correspond to the values 1, 2, 4, 8, 16, 32, and where the additional bits represent a clock and a parity. The coding system used for the storage of information in the pattern of FIGURE 3 is generally of a modified binary type. FIGURES 4*a* and 4*b* illustrate the conventional punch card Hollerith code and the modified binary code used with the present invention. Since the information is to be transferred from the punch card to the photographic medium, it is desirable to convert to a more efficient coding system when the information is stored on the photographic medium.

FIGURE 4*a* illustrates the conventional Hollerith code used with punch cards and which is inefficient in that it requires twelve bits to represent the numerals 0 to 9, the alphabet and certain punctuation marks. The shaded portions in FIGURE 4*a* represent a punched-out area of a conventional punch card. FIGURE 4*b* illustrates a modified binary code which uses eight bits to not only represent the same information as the twelve bits of the Hollerith code represents but in addition includes a clock pulse and a parity bit. The parity bit is used so that the number of bits exclusive of the clock pulse is always odd so as to provide for a check on errors in the recording of the information. The shaded areas of FIGURE 4*b* represent a translucent portion of the photographic image included in the information area **36** of the photographic film **30** of FIGURE 2. The conversion of the Hollerith code of FIGURE 4*a* to the modified binary code of FIGURE 4*b* may be readily accomplished using conventional logic circuitry.

In FIGURE 5 a block diagram of a system according to the present invention is shown for transferring information from a plurality of aperture cards **10** in a stack **100** to discrete areas along a photographic film storage medium **102**. Individual ones of the stack **100** of aperture cards **10** may be transferred to a reading station by any conventional card handling technique. As the aperture card **10** moves into and through the reading station a light source **104**, which includes a plurality of twelve individual lamps, produces light energy towards the information arranged in columns on the aperture cards **10**. A plurality of photocells **106** is disposed beneath the aperture cards **10** and the photocells **106** correspond in position to the individual lamps in the light source **104**. There is a single photocell for each light source.

The light sources and photocells are arranged along lines corresponding to the twelve bits present in each column of the aperture card. If a punched-out area is present in any particular column, the light penetrates through the card and is received by an individual one of the photocells **106**. The photocells **106**, therefore, produce on-off signals corresponding to the reception of light energy. The signals from the photocells **106** are applied to logic circuitry **108**. The logic circuitry may be of a conventional type so as to provide for a conversion of the Hollerith code shown in FIGURE 4*a* to a more efficient type of coding system. For example, the logic circuitry **108** may convert the Hollerith code to a modified binary coding system shown in FIGURE 4*b*. It is to be appreciated that the coding system shown in FIGURE 4*b* is illustrative only and that other coding systems may be used. If desired, the Hollerith coding system of FIGURE 4*a* may be used for the storage of information on the photographic film shown in FIGURE 2, but it is to be appreciated that the Hollerith type of coding system is inefficient. It would be desirable, however, even if the Hollerith code were used for the storage of information on the photographic film of FIGURE 2, that the information be compacted so that there is little or no room between adjacent bits of information.

The output from the logic circuitry **108** is applied through a driving amplifier **110** to a multiple stylus **112**. The multiple stylus **112** includes a plurality of stylus elements that are controlled to strike a mask material **114**. The individual stylus elements are part of an electromagnetic structure which controls the movement of the individual stylus elements in accordance with input electrical signals from the amplifier **110**. A clearer understanding of the multiple stylus **112** will be had with reference to FIGURE 6. In addition, a multiple stylus unit as shown in copending application Ser. No. 435,651, filed Feb. 26, 1965, in the name of Glenn A. Reese and Donald H. Westermeier, entitled "Multispot Transducer" and assigned to the assignee of the instant application, may be used for the multiple stylus **112**. The mask material **114** is unreeled from a payout reel **116** and taken up by a takeup reel **118**. The mask material **114** is of the type that provides for a reduction in optical density upon an increase in pressure against the mask material. As the multiple stylus produces an increase in pressure against the mask material **114** in accordance with the signals from the logic circuitry **108**, particular areas of the mask material **114** experience a reduction in optical density in accordance with the signals from the logic circuitry **108**.

FIGURE 6 provides a clearer explanation of the operation of the multiple stylus **112**. The multiple stylus **112** includes a plurality of individual stylus elements represented by the end stylus elements **120** and **122**. All the individual stylus elements as represented by the end stylus elements **120** and **122** include tip portions as represented by the tip portions **124** and **126**. The representative stylus members **120** and **122** are electromagnetically activated as explained in the copending Reese et al. application so as to control the movement of the stylus members **120** and **122** downward towards the mask material **114**. As the tip portions **124** and **126** of the stylus elements strike the mask material **114** the mask material experiences a reduction in optical density in accordance with the pressure.

The material used for the mask material **114** may be of several types. For example, a material sold under the trademark Cronapress by the Du Pont Company may be used for the mask material **114** or a material sold under the trademark Thermofax Type 128 by the 3M Company may be used for the mask material **114**. Both of these materials have a relatively high ratio of optical density before and after the application of pressure.

For example, the Du Pont Cronapress material has an original optical density of 70% and experiences a reduction in optical density to 30% after a sufficient impact from the stylus members. The 3M Thermofax Type 128 material experiences a reduction in optical density from 32% to 12% after a sufficient impact from the stylus members. The 3M Thermofax Type 128 material is heat sensitive in addition to being pressure sensitive and is commonly used to provide transparencies from the 3M Thermofax copying machines. The Du Pont Cronapress material is generally used in the graphic arts industry so as to provide transparencies from normal letterpress equipment.

In addition to the use of the 3M Thermofax Type 128 and the Du Pont Cronapress materials, it is possible to use a total transfer carpon paper for the mask **114**. Such total transfer carbon paper is generally used with electric typewriters to provide a substantially total transfer of the carbon material. It is obvious that a suitable mask material **114** may be constructed by providing a transparent substrate for the total transfer carbon paper.

FIGURE 7 illustrates a detail view of the mask material **114** after being struck by the tip portions represented by the end tip portions **124** and **126** of the stylus members **120** and **122**. As can be seen in FIGURE 7, the areas **128** represent areas of reduced optical density. The areas of reduced optical density **128** of the mask material **114** lie in fifty-two rows with each row containing eight bits as shown in FIGURE 3.

In FIGURE 5 the photographic film storage medium material **102** is contained in a continuous strip and is wound on a payout reel **130**. The photographic film material is preferably a diazo film which is sensitive to ultraviolet light. Since the photographic film **102** is sensitive only to ultraviolet light it may be handled using safe lights so as to eliminate the necessity of complete darkness surrounding the apparatus of FIGURE 5. In addition, the diazo film **102** is generally of a type which has very high resolution which is desirable for providing an optium reproduction quality from the photographic film **102**.

The photographic film material **102** is exposed at the same time with the information from the film chip portion **14** of the aperture card and from the intermediate transfer mask **114**. This may be seen in FIGURE 5 wherein the film chip portion **114** of the aperture card **10** is disposed adjacent one side of the photographic film material **102**. The aperture card **10** has been moved successively from the stacked position to the read position and finally to the exposure position. In addition, the mask material **114** has been recorded by the multiple stylus **112** and disposed adjacent the other side of the photographic film **102**. The aperture card **10**, the photographic film material **102** and the mask material **114** are then maintained in a fixed position for a period of time necessary to properly expose the photographic film material **102**.

The exposure of the photographic film material **102** is accomplished through a pair of light sources **132** and **134**. The light sources **132** and **134** produce ultraviolet light so as to provide a proper exposure of the photographic film material **102**. The photographic film material **102** therefore receives a contact print from the film chip portion **14** of the aperture card **10** when the light source **132** is energized. In addition, the photographic film material **102** receives a contact print of the information recorded on the mask material **114** when the light source **134** is energized. When the light sources **132** and **134** are deenergized, the photographic film material **102** is advanced to present the next portion of the photographic film material for exposure and, in addition, the next aperture card and the next portion of the mask material **114** are both advanced so as to provide for the proper exposure of the photographic film material **102**.

The exposed photographic film material **102** is further processed by being developed using normal photographic techniques and may be then cut into a plurality of individual photographic film storage mediums. The aperture cards are returned to a storage area so that they may be used at some later time. The mask material **114** is disposed of as waste material.

The apparatus of FIGURE 5 may, therefore, be characterized as a coder-exposer since it reproduces information from a punch card or an aperture card, converts the coding of the information from a Hollerith code to a modified binary code and records the converted information on an intermediate transfer medium. The apparatus of FIGURE 5 then stores the converted information from the intermediate transfer medium and may also store information from a film chip portion of an aperture card onto a photographic film storage medium. The information is stored on the photographic film storage medium by exposing the photographic film storage medium to produce contact prints from the film chip portion of the aperture card and the intermediate transfer medium. It is to be appreciated that the invention has been described with reference to a particular embodiment but it is possible to make various modifications and adaptations of the invention. The invention, therefore, is only to be limited by the appended claims.

What is claimed is:

1. A system for transferring information recorded on a first storage medium to a photographic film, including

first means operatively coupled to the first storage medium for producing an output signal in accordance with the information recorded on the first storage medium,

an intermediate transfer medium having a variable optical density,

second means operatively coupled to the first means and the intermediate transfer medium and responsive to the output signal from the first means for producing changes in the optical density of the intermediate transfer medium in accordance with the output signal, and

third means operatively coupled to the intermediate transfer medium and the photographic film for exposing the photographic film in accordance with the optical density of the intermediate transfer medium.

2. The system of claim **1** wherein the information recorded on the first storage medium is digital information recorded using a first particular code, and wherein the first means includes means for replacing the first particular code with a second particular code.

3. The system of claim **1** wherein the intermediate transfer means is sensitive to pressure and wherein the second means applies pressure to the intermediate transfer means to produce the changes in optical density.

4. A system for transferring information recorded in a

first predetermined pattern on a first storage medium to a photographic film, including

first means operatively coupled to the first storage medium and responsive to the information recorded in the first predetermined pattern for producing an output signal having characteristics in accordance with the information recorded in the first predetermined pattern,

a masking material having variable optical density,

second means operatively coupled to the first means and the masking material and responsive to the output signal from the first means for producing variations in optical density in a second predetermined pattern in the masking material in accordance with characteristics of the output signal, and

third means operatively coupled to the masking material and the photographic film for exposing the photographic film through the masking material for recording the second predetermined pattern on the photographic film.

5. The system of claim **4** wherein the first and second predetermined patterns are different.

6. The system of claim **4** wherein the masking material is sensitive to pressure and wherein the second means applies pressure to the masking material to produce the variations in optical density.

7. A system for transferring information recorded in accordance with a punched pattern on a punch card to a photographic film, including

readout means operatively coupled to the punch card for producing an output signal in accordance with the punched pattern on the punch card,

an opaque masking material having permanent variations in optical density in accordance with applied pressure,

a multiple stylus operatively coupled to the readout means and the masking material and responsive to the output signal from the readout means for applying pressure on the masking material in accordance with the output signal to produce a mask having opaque areas and areas of decreased optical density, and

means operatively coupled to the mask and to the photographic film for exposing the photographic film through the mask.

8. The system of claim **7** wherein the punched pattern on the punch card is recorded in accordance with a Hollerith code and wherein the readout means and the multiple stylus includes means for converting the Hollerith code to a binary code.

9. The system of claim **7** wherein the photographic film is sensitive to ultraviolet light and wherein the means for exposing includes a light source for producing ultraviolet light.

10. A system for transferring information from an aperture card including a portion containing a prerecorded film chip and a portion containing a punched pattern to a photographic film, including

first means operatively coupled to the punched portion of the aperture card for producing an output signal in accordance with the punched pattern,

an intermediate transfer medium having a variable optical density,

second means operatively coupled to the first means and the intermediate transfer medium and responsive to the output signal from the first means for producing changes in the optical density of the intermediate transfer medium in accordance with the output signal to provide a mask,

third means operatively coupled to the aperture card, the photographic film and the intermediate transfer medium for aligning the film chip portion of the aperture card with a first portion of the photographic film and for aligning the mask portion of the intermediate transfer medium with a second portion of the photographic film, and

fourth means operatively coupled to the third means for exposing the first portion of the photographic film through the film chip portion of the aperture card and for exposing the second portion of the photographic film through the mask portion of the intermediate transfer medium.

11. The system of claim **10** wherein the punched pattern on the aperture card is recorded in accordance with a Hollerith code and wherein the first and second means provide for a conversion of the Hollerith code to a binary code.

12. The system of claim **10** wherein the film chip portion of the aperture card and the mask portion of the intermediate transfer medium are aligned on opposite sides of the photographic film.

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