March 10, 1942. A. N. GOLDSMITH 2,275,898

MICROFACSIMILE SYSTEM

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Fig. 1

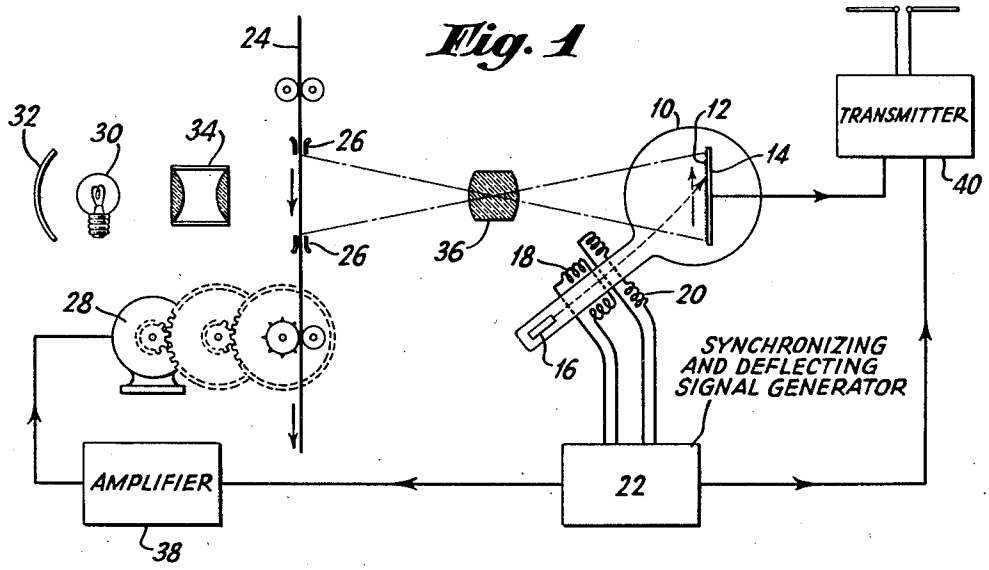
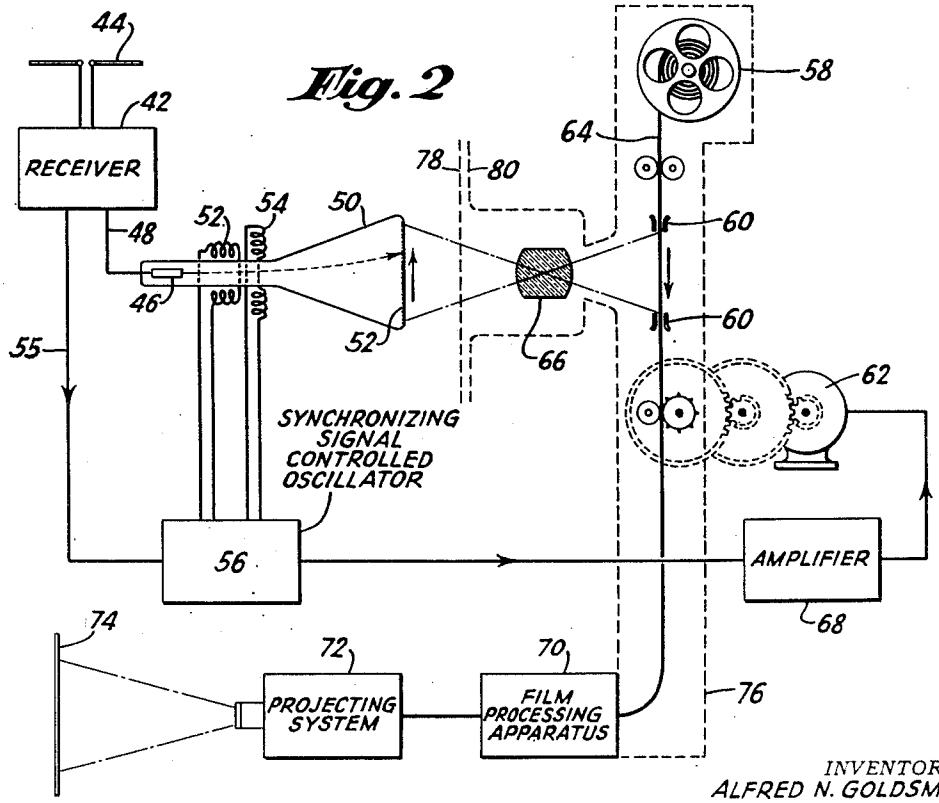


Fig. 2



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MICROFACSIMILE SYSTEM

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Fig. 3

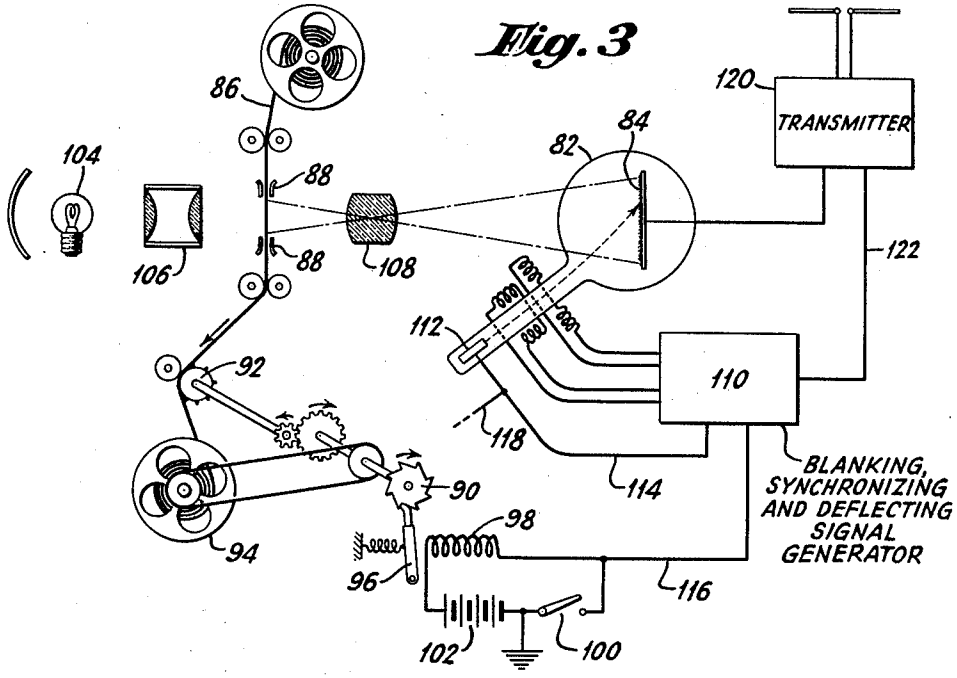
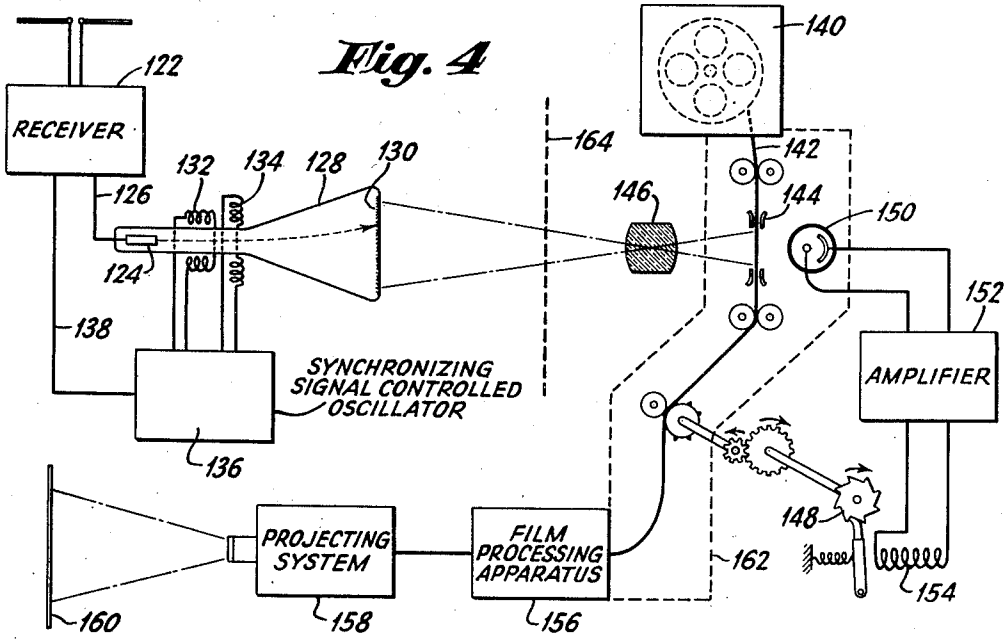


Fig. 4



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UNITED STATES PATENT OFFICE

2,275,898

MICROFACSIMILE SYSTEM

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Application August 22, 1939, Serial No. 291,296

6 Claims. (Cl. 178—6.7)

This invention relates to a method of and means for transmitting sketches, written or printed subject matter in order that it may be received in facsimile, and more particularly to the reception and recording of such facsimile subject matter on a photosensitive material which may be used later, directly or after photographic development or printing, to provide an image source from which an enlarged projected image may be produced.

In present facsimile systems it is ordinarily customary to transmit the facsimile subject matter and to receive the same at a facsimile receiving apparatus in substantially its original size and directly readable form. Such recordings are generally made on a current-, light-, or heat-responsive recording paper.

Such facsimile receivers, of course, require considerable recording material or paper at a corresponding cost and the facsimile reproductions occupy considerable space after having been received. Quite frequently it is desirable to inspect the recorded facsimile material some time after its reception, and accordingly, adequate means must be provided for conveniently storing the recordings and rendering individual portions thereof readily accessible. Furthermore, some recording papers which have heretofore been used have the undesirable characteristic of fading or gradually losing the recording which has been received thereon with the result that in time the facsimile recording may actually become illegible. Moreover, in view of the physical dimensions of present-day facsimile recordings the transmission and reception of a single sheet of material may occupy considerable time particularly if relatively narrow transmission frequency band widths are to be used. In such systems the transmission may occupy from one to twenty minutes or more for each page (50 to 100 square inches) of copy transmitted. Under these circumstances the amount of material or subject matter which may be transmitted in a given time period is materially limited.

Furthermore, in previously used facsimile systems special facsimile transmitting and receiving apparatus is necessary, which apparatus is designed solely for the purpose of transmitting or receiving facsimile material and cannot be used for any other purpose.

It is therefore one purpose of the present invention to provide a facsimile device which will produce facsimile recordings on a light sensitive material or surface, the recorded material being materially reduced in physical dimension, and being in a form which cannot be directly used (that is, visually read or understood).

It is still another purpose of the present invention to provide a facsimile system in which the time required to transmit and record each copy (e. g., one page of text or drawings) is reduced to a very small fraction of the time heretofore required.

Still another purpose of the present invention resides in the provision of a new and improved facsimile transmitting system in which cathode ray apparatus is used with the advantage that the time for transmitting each copy may be materially reduced.

A further purpose of the present invention is the provision of a facsimile system in which the received subject matter may be conveniently stored in a relatively small space and may be permanent in nature so that the copy may be inspected at any desired future time by means of a projection or enlarging device.

It is still another purpose of the present invention to provide a facsimile system in which apparatus similar to that used for television purposes may be used, and in fact, in which presently available television apparatus may be adapted to the transmission and reception of facsimile material without the addition of a very considerable amount of apparatus.

Still another purpose of the present invention resides in the provision of a facsimile system in which the received material is recorded in such a reduced manner as to be properly termed "micro-facsimile" inasmuch as the individual elements or letters of the received material are considerably too small to be directly readable, and graphical material is too small to be readily or completely comprehensible.

Still another purpose of the present invention resides in the provision of a micro-facsimile system in which the height of individual letters or words is reduced to an amount less than approximately 0.03 inch (corresponding to 0.003 times the normal viewing distance of 10 inches).

Another purpose is to record as a unit, with controlled changeover or advance or feed of the recording material, either a line, a column, a page, or other desired division of the transmitted material.

Other purposes and advantages of the present invention will become more apparent to those skilled in the art from a reading of the following specification and claims, particularly when considered in connection with the accompanying drawings wherein:

Figure 1 represents schematically one form of facsimile transmitting device;

Figure 2 represents a form of facsimile receiving apparatus which may be used in connection with the transmitter shown in Figure 1;

Figure 3 shows a modified form of a facsimile transmitter; and

Figure 4 shows a receiver for receiving the facsimile signals transmitted by the apparatus shown in Figure 3.

Referring now to the drawings and particularly to Figure 1 thereof, a facsimile transmitting device is shown in which a cathode ray analyzing or transmitting image tube **10** is used, the tube being similar in function to the present-day television transmitting image tube. This tube includes a light responsive mosaic electrode **12** with which cooperates a conducting signal plate **14**. The light responsive mosaic **12** is composed of a great number of minute light responsive elements which are insulated one from another in order that these elements may assume a predetermined potential charge in accordance with the light values projected thereon. For removing the potential charges a cathode ray beam generating means **16** is provided, which generating means is shown schematically. For deflecting the cathode ray beam in a vertical direction a magnetic coil **18** is provided and to produce horizontal deflections of the cathode ray beam another coil **20** is used. These coils are energized by appropriate voltages of predetermined wave form and frequency so that the cathode ray beam may be caused to scan the light responsive side of the mosaic electrode **12** in order that signals representative of the light image projected on the mosaic electrode **12** may be produced at the signal plate **14**. The coils **18** and **20** are energized by the synchronizing and deflection signal generator **22** in a manner well known in the art.

The images which are projected on the light responsive mosaic electrode **12** are derived, for example, from a film **24** which is provided with a plurality of images having no sequential motional relation matter to be transmitted by facsimile. This film may be of the type ordinarily used for moving picture projection work except that the individual images do not represent portions of a complete sequence depicting the various stages of motions of persons or objects but instead represent "still" photographs of the programmed subject matter. The film **24** is passed through a film gate **26**, the film being moved by means of the motor **28**. The motor preferably operates through a reduction gear arrangement in order that the motor may operate at a relatively high speed while the film is continuously transported through the film gate at a relatively slow speed.

A source of light **30** is provided with which cooperates a reflector **32**. The light from the source **30** is concentrated upon the film gate **26** by means of a condensing lens **34** in order that substantially parallel beams of intense light may be projected upon the film which is present in the film gate. The image which is present on the film is then (generally in enlarged form) projected upon the light responsive electrode **12** and brought to focus on that electrode by means of lens **36**.

It will be noticed that since the motor **28** rotates continuously the film **24** is moved through the film gate **26** in a continuous manner and at a constant rate of speed. Since the speed of film movement must be accurately controlled, an amplifier **38** is connected to the synchronizing and deflection signal generator **22**, the amplifier affording a voltage of such a wave form and frequency as will maintain the speed of operation of the motor **28** constant and in phase with, or in constant relation to, the scanning sequence of the cathode ray beam. The picture signals as developed at the signal plate **14** as well as the synchronizing signals are supplied to a transmitter **40** where these signals are further amplified and where a carrier frequency is modulated in order that the picture signals and synchronizing signals may be transmitted in a manner well known in the art.

The deflection frequencies which are applied to the deflecting coils **18** and **20** may be of any desired reasonable frequency but if television operation speeds are to be used, as may frequently be convenient, then the horizontal deflection of the cathode ray beam will be at the rate of 13,230 deflections per second according to present American practice, whereas the vertical deflection of the cathode ray beam will operate at 60 deflections per second. Since the frequency of alternation of conventional power distribution systems is 60 cycles per second, the vertical deflection of the cathode ray beam may be readily synchronized with the frequency of the power supply system. Furthermore, if this situation exists then the speed of the motor **28** may be readily controlled and, in fact, the motor may take the form of a synchronous motor fed from the power supply system, the amplifier **38** being omitted or replaced by a phase shifting device in order that the motor may be caused to progress or retrogress with respect to the frequency of the power supply. The film **24** may be moved through the film gate at any reasonable speed and such a speed may be at the rate of approximately one frame per second. If this is done then each frame of the film will be scanned an average of 60 times by the scanning cathode ray beam.

The receiving apparatus is shown in Figure 2 and comprises a receiver **42** which is supplied with energy from an appropriate antenna system **44**. The receiver selects and rectifies the modulated carrier which is transmitted from the transmitting apparatus and produces as a result of such rectification the varying picture signals, which picture signals are applied to the control electrode of a cathode ray beam generating means **46** by means of conductor **48**. The cathode ray tube **50** in addition to including a cathode ray beam generating means also includes beam deflecting means **52** and **54** which operate to deflect the cathode ray beam in vertical and horizontal directions respectively. The received synchronizing signals are supplied by means of conductor **55** to the synchronizing signal controlled oscillator **56** in order that the horizontal and vertical deflections of the cathode ray beam in the receiving tube **50** may be synchronized with the deflections of the cathode ray beam in the transmitting tube **10**. At the receiver is provided a supply of unexposed light responsive film or other suitable photo-sensitive material **58** which is fed through a film gate **60**, the movement of the film being controlled in accordance with the speed of rotation of the motor **62**. The receiving tube **50** is provided with a fluorescent or luminescent screen **52** which will produce light when the cathode ray beam generated in the tube is projected thereagainst. Since the cathode ray beam is

modulated in accordance with the received picture signals and since the beam operates in synchronism with the operation of the beam in the transmitting tube a facsimile reproduction of the image projected on the transmitting mosaic 12 will be produced on the fluorescent or luminescent screen 52. Light from the screen 52 is then projected and focused upon the unexposed light responsive film 64 which is present in the film gate 60 by means of a lens system 66. Normally the image produced at the film is smaller than the image produced at the screen 52 of the receiving tube 50.

Since the image which is projected on the television transmitting mosaic moves continuously in the directions indicated by the arrow in view of the corresponding continuous movement of the film 24, the image produced at the screen 52 of the receiving tube 50 will also move at the same relative rate. In order that substantially stationary images may be produced on the moving film 64 (that is, images which move at the same rate as the film and are not displaced relative thereto during exposure), it is necessary that the film be transported through the film gate at a rate corresponding to the rate at which the film 24 is moved at the transmitting apparatus. For synchronizing motion of the films at the transmitter and receiver, and for assuring that an undistorted image will be exposed on the film 64, amplifier 68 is provided which operates in response to the received synchronizing signals. The amplifier controls the speed of operation of the motor 62. Alternatively, as explained above, it is sometimes equally feasible to connect the motor directly to the power supply source.

After the film 64 has been exposed to focused images of the light images which are produced on the screen 52 of the cathode ray tube 50 the film is then transported to a film processing apparatus 70 where the usual developing and fixing processes or any special and suitable modification thereof are carried out. After the film has been properly processed and dried the film may be immediately stored or it may be directed to a projecting system 72 where the individual images are projected on a viewing screen 74. Alternatively it may be viewed directly in an enlarger of the microscope type. In the projecting apparatus the film is naturally moved in an intermittent manner in order that each successive frame of the film may be projected upon the screen 74 for any desired and convenient time. The film between the supply roll 58 and the processing apparatus 70 must be shielded from extraneous light and for this purpose a light shield 76 is shown schematically in dotted lines.

Since the operating frequencies of the transmitting and receiving tubes correspond to the operating frequency of the corresponding tubes in a television system it is natural that a television system may be used as the transmitting and receiving means for the facsimile material. If the television receiver is of the type wherein the image is produced on a fluorescent or luminescent screen 52 which is directly viewed by the observer then the lens system 66 must be provided in order to focus the image on the film 64. If, however, a television receiving tube of the projection type is provided at the television receiving apparatus then the lens 66 may sometimes be omitted since an equivalent element will be provided in the television receiver and can sometimes be adjusted according to the arrangement of Figure 2. Accordingly, a direct viewing television receiver may be used for the reception of facsimile reproductions through the addition of the apparatus shown to the right of the dotted line 78 whereas if the television receiver is of the projection type then sometimes only such apparatus as is shown to the right of the dotted line 80 need be supplied.

Since the system is for the purpose of producing micro-facsimile reproductions of some particular subject matter and since the height of the individual characters or letters is not intended to exceed 0.03 inch (0.8 mm.) and will generally fall much below this value, it is quite feasible that the film 64 be of the 16 mm. width. The images which are produced on the film will therefore be too small to be directly readable, yet these images will be perfectly legible and usable when projected on a screen 74 by means of the projecting apparatus 72 or when otherwise viewed with suitable enlargement. Further, any desired position of film 64 may be used to make permanent and readable enlargements.

In Figure 3 is shown a modified form of a facsimile transmitting system in which the film or material bearing the subject matter to be transmitted is moved intermittently, rather than continuously and at a uniform rate as in Figure 1. In Figure 3 the transmitting tube is shown at 82 and may be similar to the tube 10 described above. A light responsive mosaic electrode 84 is provided with which is associated a signal plate. A film or other picture carrier 86 bearing the subject matter to be transmitted and recorded by facsimile is passed through the film gate 88. The film is moved in a step-by-step manner by means of a ratchet mechanism 90 which is so connected to the driving sprocket 92 as to produce a movement of one frame of the film for each step of the ratchet. The ratchet also affords a turning movement for the take-up reel 94. The armature 96 of the ratchet 90 is moved by means of the electro-magnet 98 which is energized through the operation of the switch 100 from the source of potential 102. Each operation of the switch 100 will therefore cause an operation of the ratchet mechanism to progress the film 86 through the film gate by an amount equal to one film frame. A light source 104, a mirror or reflector, and two lens systems 106 and 108 are also provided for illuminating and projecting light images of the film images upon the mosaic electrode 84 in a manner similar to that described above in connection with Figure 1.

For energizing the deflecting means for the cathode ray beam a blanking, synchronizing and deflecting signal generator 110 is provided. This device causes proper deflections of the cathode ray beam in both horizontal and vertical directions in order that the light responsive electrode 84 may be scanned. It will be noticed that the apparatus represented at 110 is also connected by means of conductor 114 to the electron gun structure 112 which produces the cathode ray beam, this conductor 114 being connected to the control electrode of the electron gun beam generating means. The purpose for this connection is to bias the cathode ray beam to cut off during intervals when the film is being moved through the film gate in order that no facsimile signals will be transmitted during this interval. The blanking and deflection signal generator 110 is connected to control switch 100 by means of conductor 116 so that, when the switch 100 is closed for moving the film, an impulse will be supplied to the apparatus 110 which in turn will bias the

control electrode of the tube 82 to cut off to prevent any formation of an electron beam during the time of movement of the film. The power supply for the cathode ray tube 82 as well as for the remaining portion of the system is not shown since any appropriate source of supply may be used. A conductor 118 is, however, shown connected to the control electrode 112 since a normal bias must be applied to the control electrode in order that a beam of uniform and desired intensity may be normally produced.

The facsimile picture signals which are produced at the signal plate of the mosaic electrode 84 as a result of the scanning operation are applied to a transmitter 120 to which are also applied synchronizing signals by way of conductor 122. The picture signals and the synchronizing signals are then further amplified and are used to modulate a carrier frequency which is subsequently transmitted.

The receiving apparatus to be used in connection with the transmitter shown in Figure 3 is represented at Figure 4 and includes a receiver 122 for receiving (selecting) and detecting the picture and synchronizing signals which are transmitted from the transmitting device 120 shown in Figure 3. The detected facsimile picture signals are applied to the control electrode of the cathode ray beam generating means 124 by means of conductor 126, the cathode ray beam and generating means being located in the receiving tube 120. This receiving tube may be similar to the receiving tube 50 shown in Figure 2 and may include a fluorescent or luminescent screen 130. For deflecting the cathode ray beam in vertical and horizontal directions in synchronism with the deflections of the cathode ray beam in the transmitter, a pair of deflecting coils 132 and 134 are provided which are controlled by the synchronizing signal controlled oscillator 136. This oscillator is in turn controlled by the received synchronizing impulses which are applied to the synchronizing controlled oscillator 136 over conductor 138.

At the receiver is positioned a supply roll 140 of unexposed light responsive film or other suitable photo-sensitive material 142 which film is passed through the film gate 144. A lens system 146 is provided for focusing the images which are produced on the fluorescent or luminescent screen 30 upon the film 142 which is present in the film gate. For transporting the film through the film gate in an intermittent manner a ratchet mechanism 148 is provided which moves the film an amount equivalent to one film frame for each operation of the ratchet (or any other desired portion of a frame in accordance with the movement of film 86 in Figure 3 for each operation of ratchet 90). The movement of the film 142 is synchronized with the movement of the film 86 in the transmitter by a light responsive device 150 which responds to the presence or absence, or diminution or increase of light upon the light responsive film 142. During the transmission of a facsimile copy the presence of the light upon the cell 150 through the use of the amplifier 152 causes the coil 154 to remain de-energized. When, however, the film 86 is moved at the transmitter the cathode ray beam at the transmitting tube 82 is biased to cut off so that no picture is transmitted. Accordingly, no light will be present at the film gate 144 in the receiver, and as a result no light will strike the responsive cell 150. The absence of light at the cell causes operation of the amplifier 152 which results in an energization of the electromagnet 154 to operate the ratchet 148. Then, when a new film frame is placed in position for transmission at the transmitter a new and unexposed film frame is in the film gate at the receiver in order to receive the next transmitted facsimile copy. Light-sensitive cell 150 may be optically coupled to the film image in the gate 144 or to the fluorescent scren image 130 in any usual way, either directly, through mirrors, or through lenses. If desired, a small portion of the image area 144 or 130 (e. g., a corner) may always be transmitted and received as a bright area, and may be focused on cell 150 so that the disappearance momentarily of the said bright area will positively affect the output of 150.

After the film has been exposed the film is transported to a film processing apparatus 156 where the usual developing and fixing processes are carried out, or any modification as required by the use of special photo-sensitive surfaces requiring gas development, or hot-water wash-off development with following dye imbibition, or other suitable processes. The film may then be stored or passed directly to a projecting system 158 where the individual images on the film 142 may be projected upon a viewing screen 160. The light sensitive film 142 must be protected from any amount of extraneous light capable of fogging it in its movement from the supply roll 140 to the film processing apparatus 156 and such protection is afforded by means of the light wall 162 which is shown by dotted line in the figure. A dotted line is used since the light wall or shield would no doubt surround the entire apparatus in actual practice.

The deflection of the cathode ray beams in the transmitting tube 82 and in the receiving tube 128 may be at a rate corresponding to the rate of deflection of the cathode ray beam in presently used television systems and if such is the case then available television transmitters and receivers may be used for the transmission of microfacsimile images. As explained above in connection with Figure 2, if a television receiver of the direct viewing type is available then only such apparatus as is shown to the right of the dotted line 164 need be supplied in order to receive facsimile reproductions and if a television receiver of the projection type is available then the additional lens system 146 may in some instances be omitted.

As explained above, the present invention is primarily for the purpose of producing microfacsimile reproductions in which case the film 142 would probably be of 16 mm. in width since it is desired that the subject matter contained on the film be so small as to be illegible, the height of the individual lines or letters not exceeding 0.03 inch. It has been found that if subject matter of this size is used the angle subtended at the eye at a normal viewing distance is such that the letters are too small to be conveniently readable.

From the above it may be seen that convenient and commercially applicable systems have been devised for the transmission of facsimile subject matter in which the subject matter is recorded on a relatively small recording medium, the facsimile reproductions being too small to be directly usable. Furthermore, through the use of these systems and through the use of electronic scanning and recording devices, facsimile copy may be transmitted at a rate of the order of one sheet per second which is considerably faster than

present-day facsimile systems. Furthermore, in view of the use of electronic means for recording the received facsimile material and through the use of minification of the produced image at the receiver the detail available on the recording film is sufficient to afford a recording of printed or typewritten subject matter in a very continuous form. When the individual frames of the recorded film are enlarged the individual frames of the film then become legible and usable.

Obviously the rate of transmission may be in accordance with the capabilities of the transmitting and receiving systems and the speed of transmission of the film **24** through the transmitter shown in Figure 1 may be increased as the capacity of the transmitter and receiver are improved and likewise, the rate of operation of the circuit closure **100** in the transmitter shown in Figure 3 may also be increased in order to transmit pictures at a rate of one per second or even higher. The operation of the switch **100** shown in Figure 3 may under these circumstances be closed by some motor mechanism in order that uniform time of transmission will be devoted to each film frame. Since the movement of the film in the receiver shown in Figure 4 is synchronized with the movement of the film in Figure 3 by the presence or absence of the transmitted picture no other synchronizing means need be supplied.

Although it is indicated in the drawings that the subject matter to be transmitted, and to be recorded in micro-facsimile fashion, is derived from a film record, it is obvious that such a source of subject matter is not entirely essential The subject matter to be transmitted might, for instance, be derived from individual sheets or from portions of printed or written copy, the subject matter appearing either on translucent material (such as film) or on a substantially opaque material of any type. Where the subject matter appears on an opaque or non-light transparent material, an image of the original subject matter may be directed on the light responsive electrode of the transmitting image tube by reflection, in which case the source of light is directed upon the side of the copy which bears the subject matter or legends to be transmitted.

The recordings produced by the device shown and described herein may actually resemble the appearance of micro-film recordings of pictures, sketches, drawings, etc., such as are frequently used in libraries where the storage space for such materials is considerably limited.

The recordings which are made in accordance with the present invention are preferably placed on positive light responsive film which has a grain size of less than $\frac{1}{10000}$ths of an inch. When such film is used, the individual characters of the recording may be easily reduced to a size materially less than the size which could be directly read without exceeding the limits of the film as determined by the grain size. Furthermore, when the recordings are placed on positive film, a positive image is then produced at the viewing screen when light is projected through the micro-facsimile recorded material. It is possible, however, to use a negative film for the reception of the facsimile material, since negative film, although not as close grained as positive film, is still capable of receiving micro-facsimile recordings which may be enlarged to an extent which will permit an inspection of the recorded material. The size of the grain in a negative film is at least as small as $\frac{1}{3000}$ths of an inch. Ordinarily, when negative film is used, a negative image is caused to appear on the screen of the receiving tube in order that, after processing the film, a positive image will appear thereon.

Various alterations and modifications may be made in the present invention without departing from the spirit and scope thereof, and it is desired that any and all such modifications be considered within the purview of the present invention except as limited by the hereinafter appended claims.

I claim:

1. A micro-facsimile system comprising means for producing a series of picture signals representative of the subject matter to be transmitted, means for moving the subject matter through the transmitter at a uniform relatively slow rate, means for producing horizontal and vertical synchronizing signals, means for rapidly and cyclically scanning substantially each element of the subject matter to be transmitted at a relatively rapid rate in bi-dimensional directions so that each element of the subject matter is scanned a relatively large number of times during its passage through the transmitter to produce the series of picture signals, a receiver responsive to the series of picture and synchronizing signals, means for transmitting the series of picture signals and the horizontal and vertical synchronizing signals from the first named means to the receiver, means at the receiver for rapidly and cyclically reproducing a correspondingly large number of light images of the subject matter, a light responsive recording medium at the receiver, means for projecting the produced light images on the recording medium in minified form, and means for continuously moving the recording medium through the receiver at a uniform relatively slow rate commensurate with the rate of movement of the subject matter through the transmitter, whereby a micro-facsimile recording of the subject matter may be produced on the recording medium.

2. A micro-facsimile system comprising means for producing a series of picture signals representative of the subject matter to be transmitted, means for moving the subject matter through the transmitter at a uniform relatively slow rate, means for producing horizontal and vertical synchronizing signals, means for rapidly and cyclically scanning the subject matter to be transmitted at a relatively rapid rate in bi-dimensional directions so that the subject matter is repeatedly scanned a relatively large number of times during its passage through the transmitter to produce the series of picture signals, a receiver responsive to the series of picture and synchronizing signals for reproducing the subject matter, means for transmitting the series of picture signals and the produced horizontal and vertical synchronizing signals from the first named means to the receiver whereby light images of the subject matter may be rapidly and cyclically produced at the corresponding relatively rapid rate, a light responsive recording medium at the receiver, means for projecting and focusing reduced images of the produced light images on the recording medium, and means for continuously moving the recording medium through the receiver at the relatively slow rate in synchronism with the rate of movement of the subject matter through the transmitter, whereby a micro-facsimile recording of the subject matter may be produced on the recording medium, the height of the individual characters of the recording being less than .03 inch.

3. A micro-facsimile system comprising transmitter means for producing a series of picture signals representative of the subject matter to be transmitted, means for moving the subject matter through the transmitter at a relatively slow uniform rate, means for producing horizontal and vertical synchronizing signals at the transmitter, means for rapidly and cyclically scanning substantially each element of the subject matter to be transmitted at a relatively rapid rate in bi-dimensional directions so that each element of the subject matter is scanned a relatively large number of times during its passage through the transmitter to produce the series of picture signals, a receiver responsive to the series of picture and synchronizing signals, means for transmitting the series of picture signals and the produced horizontal and vertical synchronizing signals from the transmitter to the receiver whereby a plurality of light images of the subject matter may be rapidly and cyclically produced at a correspondingly relatively rapid rate, a light responsive recording film at the receiver, means for projecting and focusing the produced light images on the recording film in minified form, means for continuously moving the recording film through the receiver at the relatively slow uniform rate commensurate with the rate of movement of the subject matter through the transmitter, whereby a micro-facsimile recording of the subject matter may be produced on the recording film, the height of the individual characters of the recording being less than .03 inch, and means for projecting enlarged images of the recorded images on a viewing screen.

4. A micro-facsimile recording system comprising means for producing a series of picture signals representative of the subject matter to be transmitted, means for producing horizontal and vertical synchronizing signals, means for repeatedly and cyclically scanning substantially each element of the subject matter at a relatively rapid rate a large number of times to produce the picture signals, a receiver responsive to the series of picture signals and the produced synchronizing signals, means for transmitting the series of picture signals and the horizontal and vertical synchronizing signals from the first named means to the receiver whereby a correspondingly large number of light images of the subject matter may be repeatedly and cyclically produced at the said relatively rapid rate, a light responsive recording material at the receiver, means for projecting the produced light images on the recording material in minified form whereby a micro-facsimile recording of the subject matter may be produced, and means responsive to the presence of light images at the receiver for feeding unexposed recording material to a position to receive the transmitted image.

5. A micro-facsimile recording system for transmitting individual and unrelated areas of subject matter comprising means for producing a series of picture signals of each area representative of the subject matter to be transmitted, means for producing horizontal and vertical synchronizing signals, means for rapidly and cyclically scanning substantially each element of each individual area of the subject matter a plurality of times to produce the series of picture signals, a receiver responsive to each series of picture signals and the produced synchronizing signals for reproducing the subject matter, means for transmitting each series of signals and the horizontal and vertical synchronizing signals from the first named means to the receiver to produce a corresponding plurality of light images of each individual and unrelated area of the subject matter, a light responsive recording material at the receiver, means for projecting reduced images of the produced light images on the recording material whereby a micro-facsimile recording of the subject matter of each individual area may be produced, and means responsive to the presence or absence of a produced light image at the receiver for feeding a length of the unexposed recording material into position for image recording.

6. A micro-facsimile recording system comprising transmitter means for producing a series of picture signals representative of the subject matter to be transmitted, means for producing horizontal and vertical synchronizing signals at the transmitter, means for rapidly and cyclically scanning the subject matter at a relatively rapid rate to produce the series of picture signals, a receiver responsive to the series of signals for reproducing the subject matter, means for transmitting the series of picture signals and the horizontal and vertical synchronizing signals from the transmitter to the receiver whereby light images of the subject matter may be rapidly and cyclically produced at the corresponding relatively rapid rate, a light responsive recording film at the receiver, means for projecting the rapidly and cyclically produced light images on the recording film in reduced form whereby a micro-facsimile recording of the subject matter may be produced, means responsive to the presence or absence of a light image at the receiver for controlling the movement of the recording film, and means for projecting enlarged images of the recordings on a viewing screen.

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