

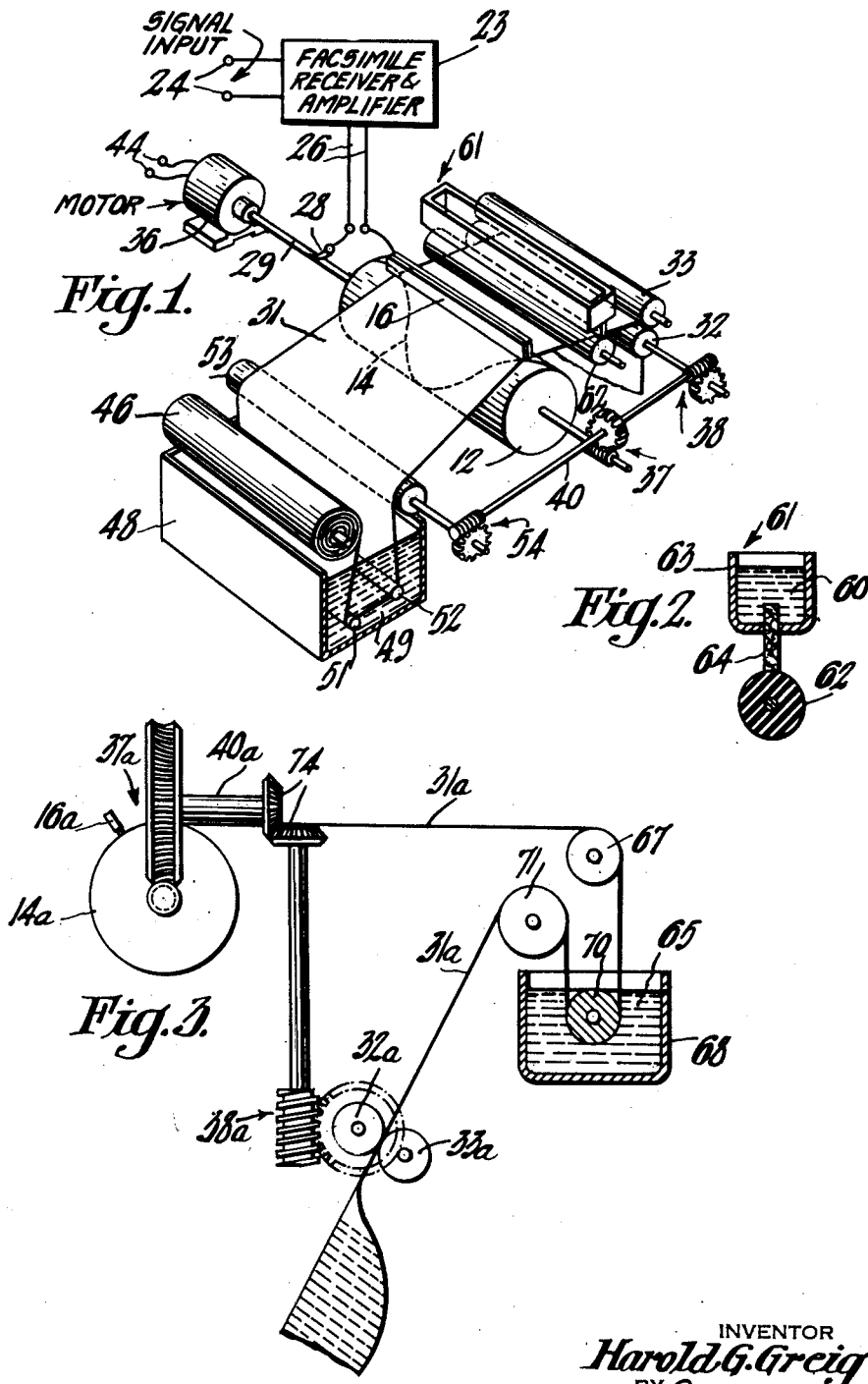
Nov. 25, 1952

H. G. GREIG

2,619,401

ELECTRICAL RECORDING

Filed March 27, 1948



INVENTOR
Harold G. Greig
BY *Chas. C. Thitchell*
ATTORNEY

UNITED STATES PATENT OFFICE

2,619,401

ELECTRICAL RECORDING

Harold G. Greig, Princeton, N. J., assignor to
Radio Corporation of America, a corporation
of Delaware

Application March 27, 1948, Serial No. 17,523

14 Claims. (Cl. 346—1)

1

The present invention relates to electrical recording of marks in the form of images and the like, and, more particularly, although not necessarily exclusively, to novel methods of and means for obtaining marks of records on a record sheet in permanent form.

In accordance with the present invention in a preferred form thereof, a sheet which is moist and electrically conductive is treated by passage of an electric current in sharply defined local areas to render it dry and/or absorbent to liquids in these sharply defined areas. Control of the application of the drying effect through suitable instrumentalities is exercised by generated or derived electrical signals so that records in facsimile of original subject matter may be obtained. Conductivity is imparted to the sheet by impregnation with a suitable wet electrolyte. The sheet in its moist conductive state is treated with a water repellent material which contrasts in color with the unaffected background of the sheet. The material is selected primarily in view of its property of being repelled by the moisture content of the sheet. This material comes into intimate facial contact with or wets the dried areas of the originally moist sheet and is or may be absorbed into the absorbent areas of the sheet to provide a sharply defined and permanently contrasting mark.

Accordingly, an important object of the present invention is to produce sharply defined contrasting marks on a conductive sheet having areas subjected to the operation of a marking instrumentality by treating the sheet with a material which contrasts in color with the sheet background.

A further object is to provide a novel means for introducing a material of a contrasting color into the body of a record sheet in a selective manner so that the contrasting color will appear so strongly in the recorded areas of the sheet as to provide a sharp contrast.

Still another object is to provide a novel system of recording subject matter in facsimile, in the operation of which a latent image is produced and is developed by providing the latent image areas with a contrasting material which is repelled by unrecorded areas of the recording medium.

Other objects and advantages of the present invention will, of course, become apparent and immediately suggest themselves to those skilled in the art to which the invention is directed from a reading of the following specification in connection with the accompanying drawings in which:

2

Fig. 1 is a diagrammatic showing of a system including apparatus embodying the invention;

Fig. 2 is a fragmentary view in elevation of the arrangement of Fig. 1, showing several of the parts thereof in detail; and

Fig. 3 is a diagrammatic showing of a modified recorder designed to operate in accordance with the present invention.

Referring for the present to Fig. 1 of the drawings there is shown, by way of example, a recorder which is suitable for producing marks by passage of an electric current through a recording medium in accordance with facsimile signals. This recorder is generally of the character described in U. S. Patent No. 2,215,806 granted to C. J. Young on September 24, 1940, and also in U. S. Patent 2,384,722 granted to A. Blain on September 11, 1940.

The recorder of Fig. 1 includes modification of the prior art electrical recording arrangements to provide for conveniently obtaining recordings in accordance with the present invention. It will be understood that these recordings may be obtained by means other than those illustrated. Also, the description of the illustrative embodiment to be given hereinafter refers to recording electrical signals by means of a helical recorder, so called, but it will be understood that the electrodes for the application of recording currents to the record sheet may take any desired form. For example, a stylus may be employed which traverses the sheet in a manner to produce complete scanning of the sheet as it is moved through the recording zone.

In the form shown, the recorder comprises a recording drum member 12, provided with a radially projecting helical electrode 14 mounted on its periphery which cooperates with a second electrode in the form of a printer bar member 16. This printer bar member is or may be carried by light pressure producing means, such, for example, as springs (not shown).

Reference character 23 designates a signal or facsimile receiver of any known type which is in communication with a signal input source 24. Signals suitable for recording are applied to the recording electrodes 14 and 16 from the receiver 23 over connections 26. One of the connections may be in communication with a brush 28 which bears on the drum shaft 29, or the frame of the apparatus (not shown) as well as one terminal or connection 26 from the receiver 23 may be grounded to complete the connection to the recording electrodes. It will be understood that the helix 14 is conductively connected to the drum shaft 29.

The record sheet or paper web 31, which is threaded between the printer bar 16 and the helical electrode 14, is, in the illustrative example, drawn through the recording zone by a pressure roller 32 which cooperates with a guide roller 33. One or both of these rollers may be driven by a motor 36 through a speed reducing mechanism such as worm and worm wheel combinations 37 and 38. The worm and worm wheel combination 37 drives a shaft 40 which serves as the mechanical connection for the web drive. The rotatable drum shaft 29 is or may be coupled to the rotor shaft of the motor 36, thereby driving the drum 12. The mechanical connections are indicated schematically and are shown only by way of example, as different forms may be used. The motor 36 may be of the synchronous type connected to an alternating current service connection 44. Where the motor 36 is connected to the same synchronized system as the motor (not shown) which drives the transmitting system, it will not, in general, be necessary to provide separate synchronizing signals. Synchronizing and phasing signals may be generated and transmitted as described in U. S. Patent 2,326,740 granted to Maurice Artzt on August 17, 1943 when desirable or necessary.

The recording web 31 is fed from a supply roll 46 and passes through a tank or tray 48 so as to be wetted by a liquid bath 49, the nature of which will be discussed more in detail hereinafter. The web 31 is guided through the liquid in the bath by suitable means such as idler rollers 51 and 52. Any excess of moisture over that required for carrying out the recording procedure of the invention may be scraped off in any suitable manner. A heated roller (not shown) may also be used for this purpose. As shown, a roller 53 driven by a worm and worm wheel combination 54 from the shaft 40 serves as a guide roller to deliver the web 31 between the recording electrodes. The bath 49 conditions the web 31 by rendering it electrically conductive so that an electric current will pass through it in the recording zone.

Since the elements so far described are well known per se and generally of themselves do not form the particular basis of this invention, they are illustrated herein more or less diagrammatically. Further details of the helical recorder with respect to the paper feeding means and other conventional features are to be found in U. S. Reissue Patent Re. 20,152 granted to C. J. Young on October 27, 1936. The recorder in this last named patent, however, relies on a transfer of marking material to produce marking by vibrating the printer bar rather than an electrical or other processes which depend upon a direct application of electrical effects to the record sheet. Other details of a facsimile recorder employing an electrolytic process for producing marks are shown in U. S. Patent 2,391,765 granted to Maurice Artzt on December 25, 1945.

In accordance with the procedure of this invention, the paper web 31 which has been moistened in the bath 49 is subjected to the action of recording currents passing between the printer bar 16 and the helical electrode 14. The action of the current dries the paper web in sharply defined local areas corresponding to elements of the mark or image which is to be produced. In some cases the paper fibre is exploded locally thus making it more absorbent. The remainder of the sheet or web 31 preferably remains moist and the moisture content may approach physical saturation.

The dry areas can be selectively colored by applying a water repellent color carrier or vehicle, such as oil, grease, wax, or organic solvent. This vehicle can carry a pigment, stain or dye which may be either soluble or insoluble in it. The moist or wet areas of the paper repel the color vehicle while the dry areas are wetted by and may even absorb the coloring medium, thus producing a permanent image on the record sheet.

The water repellent medium may be applied to the moist paper following the recording operation in a number of ways, such, for example, as brushing it on, applying it from a fountain arrangement and scraping off the excess with a doctor blade, or by contacting the paper with an applicator which is kept provided with a supply of the water repellent medium.

In the arrangement of Fig. 1 there is shown an applicator for the color containing vehicle 60 in the form of a web treating device indicated in its entirety by reference character 61 (Figs. 1 and 2) which comprises a roller 62 positioned to contact the web 31 as it comes from the drum 12 and under which it passes into peripheral contact with the driven roller 32 or other equivalent propelling device. The roller 62 may be formed of rubber, compressed fiber, or the like, which will transfer the vehicle in a desired quantity to the web 31. A driven steel roller which dips in a bath of the vehicle is also suitable. The roller is preferably driven so that its periphery moves against the direction of paper travel. Such a roller is well known in the art and is referred to as a "kissing" roller.

As shown in Fig. 2 an elongated tank 63 is positioned above the roller 62 and is provided with a pad 64 of absorbent material which extends through a suitable slot in the bottom of the tank 63 into contact with the liquid 60 therein, which is the color carrying vehicle mentioned above. Any suitable arrangement (not shown) may be used for supporting the tank 63. The absorbent pad 64 is in contact with the periphery of the roller 62 so that the vehicle 60 containing coloring matter will be applied to the paper web 31 as it is drawn beneath the roller. It will be understood that the pad 64 may be replaced by a fountain arrangement for spraying the vehicle 60 directly on the web. The roller 62 may then be omitted.

The bath 49 is an aqueous solution of an electrolyte, such as sodium chloride or ammonium chloride. The paper web may be treated with a colloid, such as, for example, glue, gelatin, gum arabic, or gum tragacanth. The colloid can be applied to the paper from a water solution before it is used for recording purposes or it may be added to the electrolyte in the bath 49.

The current density between the electrodes 16 and 14 is preferably higher than that employed in the recording methods of the patents noted above. The flow of recording current may produce one or two changes in the physical state of the recording paper containing the electrolyte solution which are useful in practicing the invention. The first change is the creation of sharply defined dried areas in the moist or wet paper where the current has passed through it. The second change which is coextensive with the first in area, is in the nature of creation of a surface of increased absorbing power. Both of these effects or changes are based upon the generation of heat by passage of recording current. The creation of areas of

5

increased absorbing power is brought about by an internal change in the fibrous body of the sheet including, possibly, a change also in any filler, binder size, or coating. The internal change is brought about either by rupture of the cellulose fiber itself due to generation of heat and expansion of entrapped moisture or by the disruption of the paper sizing or binder by the same mechanism, or by a combination of the two. The recording paper with the dried and/or absorbent areas produced thereon by passage of the recording current is brought in a moist condition under the roller 62, or its equivalent, mentioned above. The water repellent vehicle applied to the paper is absorbed in the dried areas and is repelled in the moist areas. As a result, the recording contrasts sharply with the paper background and, depending upon the choice of coloring matter such as a pigment or a dye, the contrasting marks may have any desired color.

The excess vehicle may be removed by a doctor blade device (not shown) or by the application of absorbent material, such as, for example, blotting paper. The excess may also be washed off by water. An emulsifying agent, a soap or detergent may be added to the water.

Several examples of procedures which were followed to obtain recordings in accordance with the invention will now be set forth: In one instance, the bath 49 contained 3 percent sodium chloride plus 0.75 percent gum tragacanth in water. The liquid composed of the vehicle and the coloring matter was prepared by dissolving an oil soluble black dye in kerosene. In the example, oil containing the coloring matter was applied by brushing on the solution of the coloring matter in kerosene. The excess of vehicle and coloring matter was removed by blotting it with absorbing paper.

Another recording was prepared in the same manner as the foregoing, except that the sheet was washed with soap and water following the brushing operation.

Another recording was prepared by applying directly to the water wet recorded sheet a grease base pigment carrying printing ink. Excess ink was removed by a soap and water wash.

Other recordings were prepared in accordance with the invention by the arrangement shown in Fig. 1 of the accompanying drawings.

Fig. 3 shows a modified arrangement of the apparatus of Fig. 1 for applying the pigment or an oil soluble coloring matter in its water repellent vehicle to the web 31A. The recording apparatus and paper drying equipment may be the same as that shown by Fig. 1 of the drawings and, therefore, similar reference characters will be used for like parts with the suffix (A) added. The web 31A is subjected to treatment in a liquid bath 65 after being acted on by the helix 14A and the printer bar 16A. The liquid bath 65 is conveniently contained in a tank or reservoir 68, and the web 31A is guided through the bath by idler rolls 67, 70 and 71. The web is propelled through recording apparatus by a driven feed roll 32A and an idler 33A. The drive is imparted to the roll 33A by a worm and worm wheel combination 38A, which is driven from the shaft 40A through a set of beveled gears 74. It will be understood that any other driving arrangement may be employed.

In the apparatus of Fig. 3 of the drawings, the exposed surface which has been contacted by the printer bar 16A and is considered the face of

6

the recording sheet, is untouched by the idler rolls 67 and 70. After treatment in the bath 65 this exposed face passes over the roller 71 which may, if desired, have absorbent properties.

From the foregoing, it is believed that the operation of the arrangement of Fig. 3 for producing finished recordings will be understood by those skilled in the art.

I claim:

1. The method of producing marks which combine to represent an image upon the surface of a recording sheet, comprising passing an electric signaling current through said sheet in successive elemental areas, said current being of a magnitude to produce a physical change in each elemental area receiving said current, and following the application of signaling current by treating the sheet with coloring matter capable of causing each area subjected to physical change by the current to present an appearance which contrasts with the background of the sheet.

2. The method of producing marks which combine to represent an image upon the surface of an absorbent recording sheet, comprising passing an electric signaling current through said sheet in successive elemental areas, said current being of a magnitude to produce drying of each elemental area receiving said current, and following the application of signaling current by treating the sheet with coloring matter capable of causing each dried elemental area to present an appearance which contrasts with the background of the sheet.

3. The method of producing marks which combine to represent an image upon the surface of a moist absorbent recording sheet, comprising passing an electric signaling current through said sheet in successive elemental areas, said current being of a magnitude to cause each elemental area receiving said current to be oil receptive, and following the application of signaling current by treating the sheet with oily matter having a contrasting appearance with respect to the background of the sheet.

4. The method of claim 3 wherein said oily matter comprises an oil with which is combined a pigment.

5. The method of claim 3 wherein said oily matter comprises an oil soluble black dye dissolved in kerosene.

6. The method of producing marks which combine to represent an image upon the surface of a liquid absorbent recording sheet, comprising passing an electric signaling current through said sheet in successive elemental areas, said current being of a magnitude to cause each elemental area receiving said current to be oil receptive, following the application of signaling current by treating the sheet with oily matter having a contrasting appearance with respect to the background of the sheet and thereafter removing the excess of oily matter.

7. The method of claim 6 wherein said excess of oily matter is removed by contact with an absorbent material.

8. The method of producing marks which combine to represent an image upon the surface of an absorbent recording sheet, comprising applying moisture to the absorbent recording sheet, passing an electrical signaling current through said sheet in successive elemental areas, said current being of a magnitude to cause drying in each elemental area receiving said current, and thereafter applying coloring matter in an oily vehicle to the sheet, said coloring matter acting

upon the combined dried areas to provide a contrasting image.

9. The method of producing marks which combine to represent an image upon the surface of an absorbent recording sheet, comprising applying an electrically conductive liquid to the absorbent recording sheet, passing an electrical signaling current through said sheet in successive elemental areas, said current being of a magnitude to cause drying in each elemental area receiving said current, and thereafter applying coloring matter in an oily vehicle to the sheet, said coloring matter acting upon the combined dried areas to provide a contrasting image.

10. The method of continuously producing marks which combine to represent an image upon the surface of a moving absorbent recording web, comprising applying moisture to the absorbent web, passing an electrical signaling current through said moving web in successive elemental areas along adjacent scanning lines, said current being of a magnitude to cause drying in each elemental area receiving said current, and thereafter applying coloring matter in an oily vehicle to the moving web, said coloring matter affecting the combined dried areas to provide a contrasting image.

11. The method of producing marks which combine to represent an image upon the surface of an absorbent recording sheet, comprising applying an electrically conductive liquid composed of an electrolyte and a gum dissolved in water to the absorbent recording sheet, passing an electrically signaling current through said sheet in successive elemental areas, and thereafter applying an oily matter to said sheet having a contrasting appearance with respect to the background of the sheet.

12. A facsimile recorder of the type comprising a recording drum and means for passing a record sheet relative to said drum and moving said sheet so that the sheet and drum have at least tangential peripheral contact, means for applying a liquid to said sheet, means for passing

a recording current through said sheet in restricted elemental areas at the point of contact with said drum under the control of received signals, and means for treating the sheet to produce marks comprising a device for applying an oily marking substance to the sheet.

13. A facsimile recorder comprising means for supporting and moving a record sheet, means for providing said sheet with a moisture content, means for applying signaling currents through said moist sheet in accordance with signals representing the scanning of a subject, and means for applying coloring matter to said sheet after subjecting it to the operation of said recording means.

14. Facsimile recording apparatus comprising means to supply a traveling recording web with a liquid electrically conductive material, means to propel said treated web through a recording zone, and means for treating said web with a marking material which is repelled by the moisture applied to said web and which remains on said sheet in the recorded areas thereof, comprising a reservoir for containing said material, and an applicator for said material in contact with said traveling web.

HAROLD G. GREIG.

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