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[54] **GRAPHIC ARTS PROCESS SIMULATOR MODIFIED FOR LETTERPRESS SIMULATION**

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[52] **U.S. Cl.** ..... **178/6,** 178/5.2 R, 178/6.6 B, 178/6.7 R

[51] **Int. Cl.** **H04n 7/18**

[58] **Field of Search** ..... 178/5.2 A, 5.2 R, 6.7 R, 178/6.6 B

[56] **References Cited**

UNITED STATES PATENTS

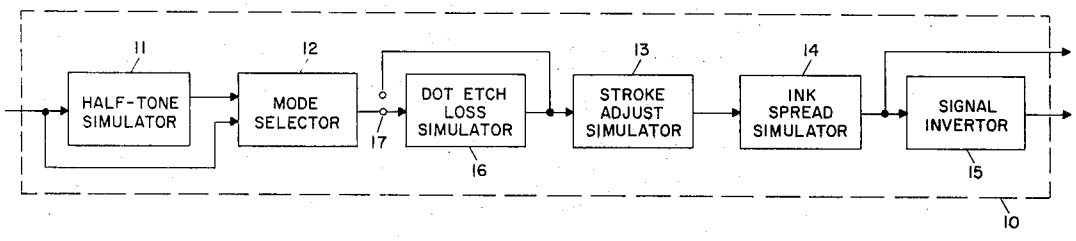
3,123,666	3/1964	Bailey	178/5.2 A
3,128,333	4/1964	Loughlin	178/5.2 A

Primary Examiner—Howard W. Britton

[57] **ABSTRACT**

Disclosed is an improved graphic arts process simulator, which enables accurate simulation of a letterpress graphic arts process. Existing graphic arts process simulators generally include an analog signal processor in which various signal processing elements are used to process an electrical signal representative of a halftone transparency in accordance with the steps of a selected graphic arts process. The improvement described herein is a modified analog signal processor which simulates nonuniformities that normally occur in a letterpress graphic arts process and more specifically simulates the dot etch loss which normally occurs when a printing plate for letterpress printing is made from such a halftone transparency.

3 Claims, 4 Drawing Figures



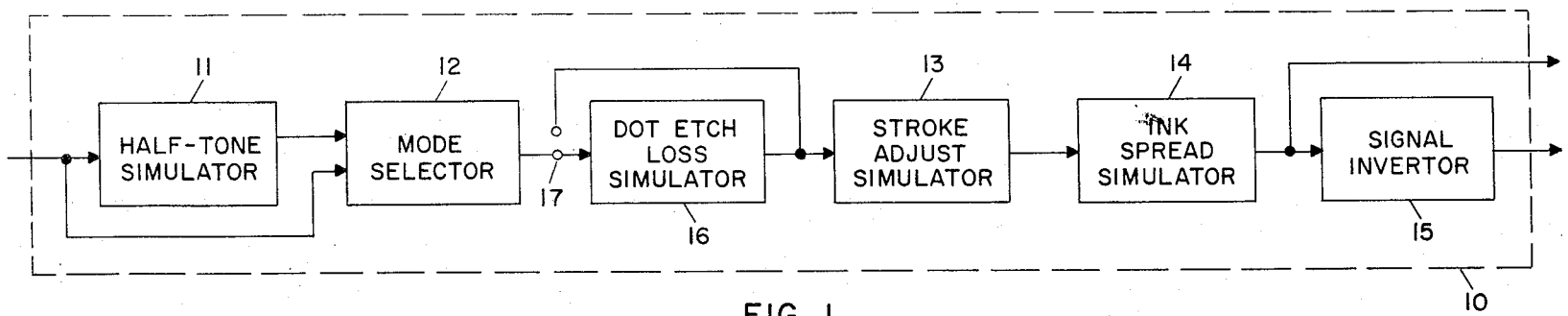


FIG. 1

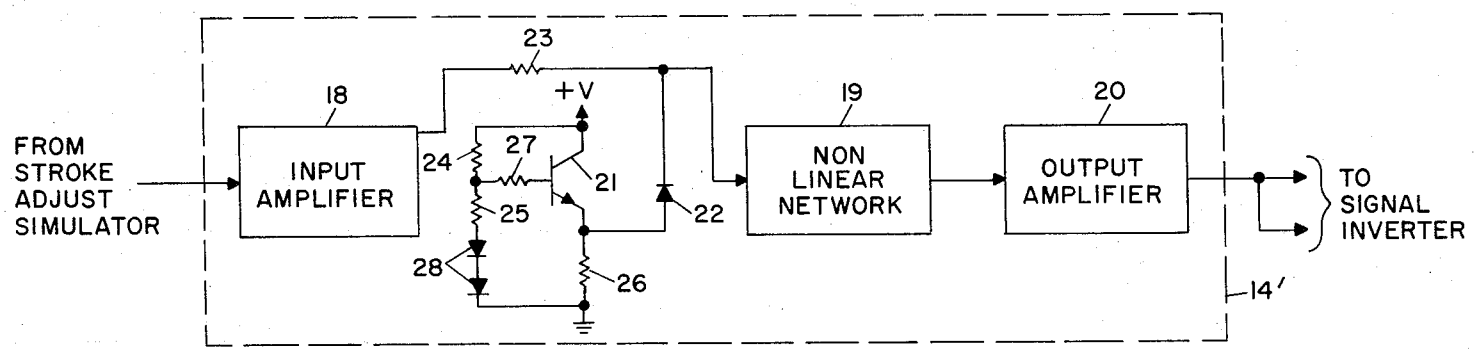
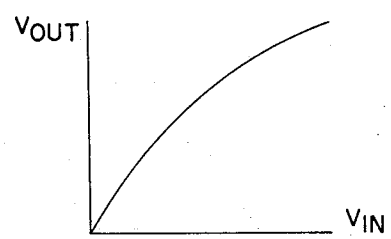
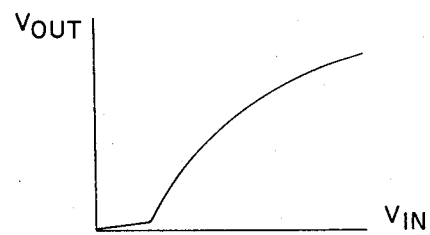


FIG. 2



TRANSFER CHARACTERISTIC WITHOUT DOT ETCH LOSS SIMULATION

FIG. 3



TRANSFER CHARACTERISTIC WITH DOT ETCH LOSS SIMULATION

FIG. 4

GRAPHIC ARTS PROCESS SIMULATOR MODIFIED FOR LETTERPRESS SIMULATION

CROSS REFERENCE TO RELATED APPLICATIONS

This invention refers to and incorporates by reference the material disclosed in copending application Ser. No. 242,867, entitled "Graphic Arts Process Simulation System," filed Apr. 10, 1972, and assigned to the same assignee as the instant application, which in turn, is a continuation of application Ser. No. 874,550 entitled "Graphic Arts Process Simulation System," filed Nov. 6, 1969 and now abandoned.

In the above-mentioned copending application there is described a system which simulates a graphic art process so that the appearance of the final color print, which will result from that process, can be predicted before the expensive and time-consuming task of manufacturing printing plates is undertaken. In this and other graphic arts process simulators there is generally included electronic circuitry which simulates various steps in the printing process. In the copending application this circuitry is located in a portion of the apparatus called the "first analog signal processor." This processor first develops an electrical signal representative of a halftone transparency and then processes this signal in accordance with electronic analogs of the actual steps in a selected graphic arts process to provide output signals which are representative of the actual areas of ink which would be deposited on paper by a printing plate made from that transparency.

In the analog processor of the copending application this last step is accomplished by a "printing simulator," which consists of several signal processing elements each of which has a transfer characteristic that corresponds to a particular step in the actual printing process. The printing simulator, therefore, has an overall transfer characteristic which represents the relationship between dot area on the halftone transparency and the corresponding dot area of ink actually deposited on paper by a printing plate made from that transparency.

The above-mentioned printing simulator assumes that the process of manufacturing a printing plate from a halftone transparency is accurate so that dot area on the printing plate is equal to the corresponding dot area on the halftone transparency. This is, in fact, the case in an offset printing process and thus the above-described apparatus is an accurate simulation of this process. In letterpress printing, however, the printing plates do not accurately depict the halftone from which they are made. Specifically, a letterpress printing plate is made by coating a copper plate with a photoresist material. The photoresist is then exposed to light through the halftone transparency, creating a pattern on the photoresist representative of the transparency. Depending on the type of photoresist used, either exposed or unexposed areas of this pattern are protected from the action of etching solutions. Thus, the pattern is transferred to the copper plate by applying an appropriate etching solution to etch away unprotected areas of copper. However the etching process is not easily controlled and even protected areas of the copper are sometimes partially etched away. This "dot etch loss" may be as great as 20 percent of the protected areas, causing smaller dots to be completely etched away and larger dots to be etched in part. The result is a washing-out effect on the actual print made from the plate, such

that certain tones appear somewhat lighter than they would if the printing plate accurately represented the halftone transparency from which it was made. Since prior art graphic arts process simulators do not take this defect into account, their prediction of the appearance of the actual color print will not reflect its true appearance.

It is, therefore, an object of this invention to provide an analog signal processor which simulates the dot etch loss that occurs when letterpress printing plates are made.

It is a further object of this invention to provide such an analog processor by inexpensively modifying existing analog signal processors such as the type described in the referenced copending application.

SUMMARY OF THE INVENTION

A graphic arts process simulator which includes an analog signal processor wherein there is processed an electrical signal representative of the halftone transparency from which a printing plate is made; in accordance with the invention there is provided an improved analog signal processor capable of simulating a letterpress graphic arts process. The improvement comprises a signal processing element responsive to the electrical signal and having a transfer characteristic proportional to the dot etch loss which normally occurs when letterpress printing plates are made.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a block diagram of the analog signal processor of the referenced copending application modified to embody the present invention;

FIG. 2 is a block diagram of the ink spread simulator of the referenced copending application inexpensively modified to embody the invention;

FIG. 3 illustrates the transfer characteristic of the ink-spread simulator of the referenced copending application prior to the modification of FIG. 2; and

FIG. 4 illustrates the transfer characteristic of the modified ink-spread simulator of FIG. 2.

DESCRIPTION AND OPERATION OF THE INVENTION

In FIG. 1 there is shown an analog signal processor 10 of the type described in the aforementioned copending application but modified to include the present invention. As previously stated, the analog processor accepts signals representative of a transparency from which a printing plate is to be made, and processes the signal in accordance with various steps in the graphic arts process in order to provide output signals from which the appearance of an actual color print can be predicted. It will be recognized that the analog processor may consist of either three or four identical channels in order to simulate a three-color or a four-color printing process. However, only one channel is illustrated in FIG. 1 for clarity and convenience.

Briefly, the input signal to the analog signal processor is a signal representative of either a continuous-tone or a halftone transparency from which it is desired to make a printing plate. If the input signal represents a

continuous-tone transparency, halftone simulator **11** is used to simulate the screening process which will convert the continuous-tone transparency to a halftone transparency. Halftone simulator **11** can be by-passed by mode selector **12** if the input signal already represents a halftone transparency.

Stroke adjust simulator **13**, ink-spread simulator **14**, and signal inverter **15** are signal processing elements which together comprise the printing simulator of the copending application. The function of these signal processing elements is to accept a signal representative of a halftone transparency and process it in accordance with the steps of the actual printing process. For example, ink-spread simulator **14** simulates the tendency of ink deposited on paper to spread to a larger area than it occupied on the printing plate itself. More detailed descriptions of the structure and operation of the above element can be found in the descriptions of likeentitled elements in the copending application.

Up until now what has been described is substantially identical to the analog processor of the referenced copending application and if an offset graphic arts process were to be simulated, in which the printing plate is substantially identical to the halftone transparency from which it is made, the processor would be an accurate analog of that printing process. However, in a letterpress process, the printing plates do not accurately reflect the halftone transparencies from which they are made. As described hereinabove, there is a substantial and undesirable etching away of protected areas of the printing plate (dot etch loss) which causes complete loss of small dots and partial loss of larger dots.

In order to simulate this dot etch loss, element **16** is included in analog signal processor **10** at a point in the signal path where there exists an electrical signal representative of the halftone transparency from which the printing plate is to be made. Also included in processor **10** is a by-pass switch **17**, which can be used to effectively remove dot etch loss simulator **16** from the signal path, when letterpress operation is not being simulated.

Simulator **16** is a signal processing element, for example a nonlinear amplifier, whose transfer characteristic is selected to be proportional to the dot etch loss involved. The amount of dot etch loss depends upon the particular etching solution, photoresist, and printing plate used, and can be easily ascertained by experimentation. Since this loss is essentially uniform over the area of the printing plate, with small dots being completely eliminated and larger dots being partially eliminated, once the amount of loss is determined, an amplifier having an appropriate transfer characteristic can be easily designed. Thus, simply stated, dot etch loss can be simulated by including a nonlinear amplifier, having a transfer characteristic representative of the loss, within analog signal processor **10**, at a point in the circuit where the electrical signal is representative of the halftone transparency.

The above-described embodiment has several advantages in that it uses an independent signal processing element **16** to simulate dot-etch loss, and thus continues the one-for-one correspondence, between elements in the simulator and steps in the actual printing process, described in the referenced copending application. A disadvantage of this embodiment, however, is that it requires the inclusion of a separate nonlinear amplifier in the analog processor, thus increasing its cost.

FIG. **2** illustrates an embodiment of the invention in which an inexpensive modification to the ink-spread simulator presently employed in the analog processor of the copending application, provides a modified analog processor capable of simulating letterpress operation. In FIG. **2** input amplifier **18**, nonlinear network **19** and output amplifier **20**, together comprise the ink-spread simulator disclosed in the copending application, and have a nonlinear transfer characteristic such as that illustrated in FIG. **3**, which simulates the typical ink-spreading nonuniformity that occurs in offset type printing processes. However, the modified ink-spread simulator **14'** of FIG. **2** also includes transistor **21**, diodes **22** and **28**, and resistors **23–27** inclusive. This circuitry introduces additional nonlinearity into the transfer characteristic of the ink-spread simulator, thereby to also simulate the dot etch loss which occurs in the letterpress plate-making process. The resulting modified transfer characteristic is illustrated in FIG. **4**.

Briefly, the circuitry consisting of components **21–27** functions as follows. Diode **22** initially is in a conducting state, preventing current flow into nonlinear network **19** and thus preventing an output signal until the voltage on the cathode of diode **22** rises to a predetermined value. This value is governed by the voltage at the emitter of transistor **21**, which in turn is controlled by the values of resistors **23** through **27** and the two diodes **28**. Thus, as the voltage of the input signal increases to rise, no output occurs (other than than caused by leakage through the diode **22**) until a predetermined input signal voltage is reached, at which time diode **22** stops conducting. As the input signal voltage continues to increase, the output signal voltage will increase in accordance with the nonlinear transfer characteristic of network **19**.

Thus, signal processing element **14'** is capable of simultaneously simulating both the dot etch loss of letterpress plate-making and the ink-spread nonuniformity which occurs in all printing processes. Since this is an extremely simple and inexpensive modification to existing analog processors, it is highly desirable. As in the FIG. **1** embodi-ment, it would be a simple matter to provide a by-pass switch for the added circuitry in FIG. **2** so that both offset and letterpress printing processes can be simulated.

While there have been described what are at present considered to be the preferred embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and it is, therefore, aimed to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a graphic arts process simulator having an analog signal processor wherein there is processed an electrical signal representative of the halftone transparency from which a printing plate is made, an improved analog signal processor capable of simulating a letterpress graphic arts process wherein said improvements comprises:

a signal processing element responsive to said electrical signal and having a transfer characteristic proportional to the dot etch loss which normally occurs when letterpress printing plates are made.

2. In a graphic arts process simulator having an analog signal processor wherein there is processed an elec-

trical signal representative of a halftone transparency from which a printing plate is made and which includes a signal processing element that simulates ink spreading nonuniformities which normally occur in the printing process, an improved analog signal processor capable of simulating a letterpress graphic arts process wherein said improvement comprises:

a modified signal processing element responsive to said electrical signal and having a transfer characteristic that is jointly proportional to said ink spreading nonuniformities and dot etch loss which normally occurs when letterpress printing plates are made.

3. Apparatus in accordance with claim 2 wherein said modified signal processing element comprises a nonlinear amplifier whose transfer characteristic simulates said ink spreading nonuniformities and which further includes a diode for altering said transfer characteristic by an amount which corresponds to and therefore simulates the dot etch loss.

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