

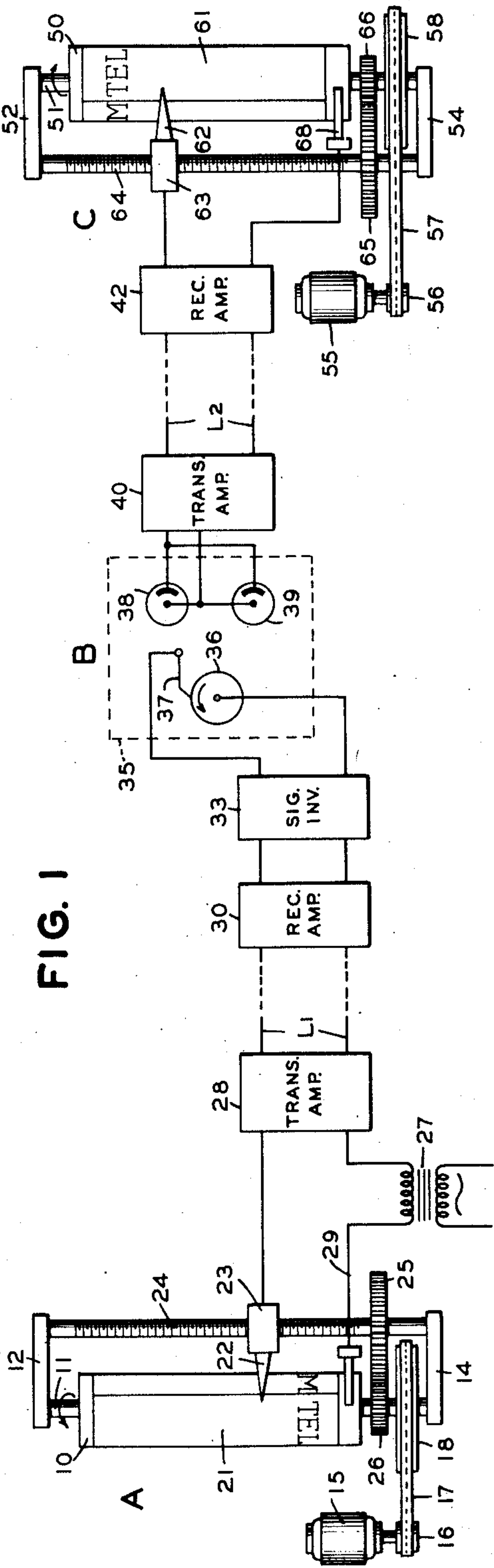
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B. L. KLINE

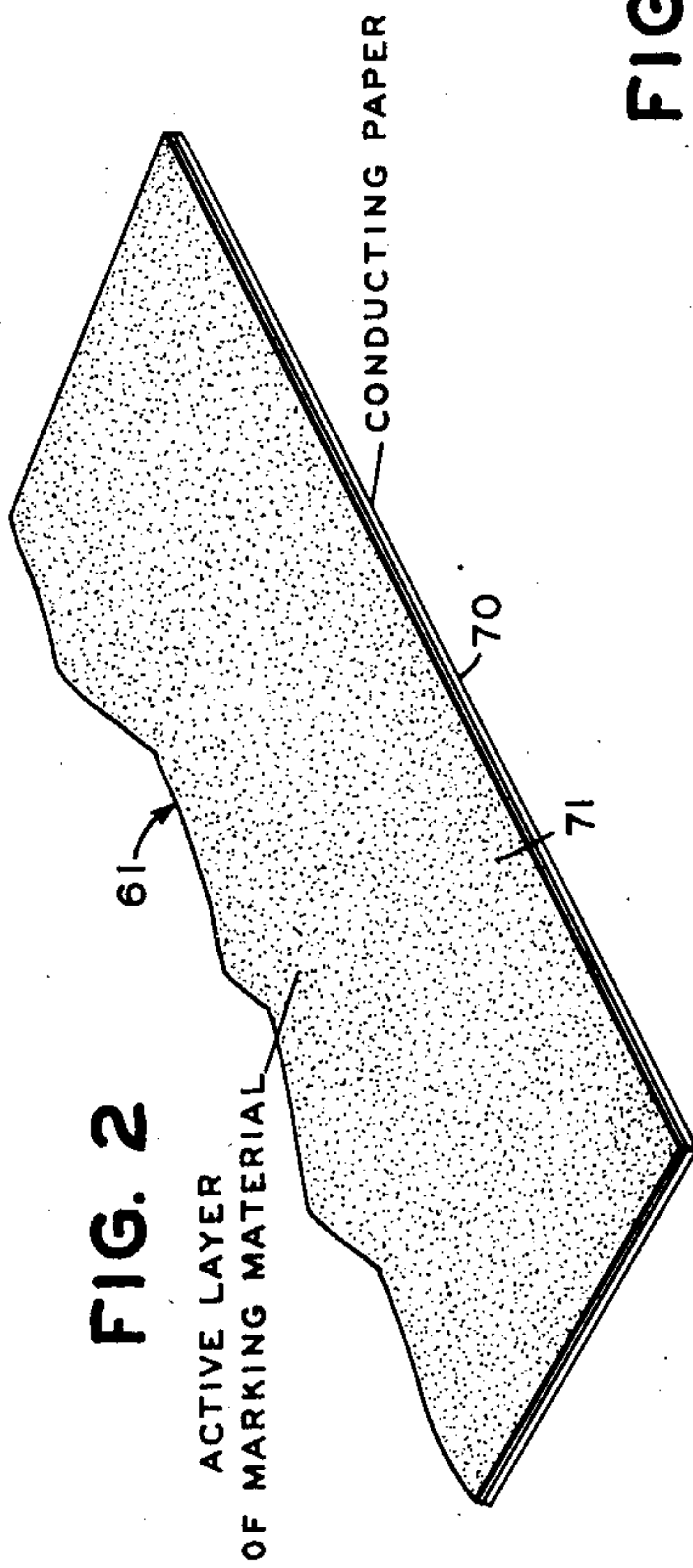
2,528,005

ELECTROSENSITIVE RECORDING BLANK

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ACTIVE LAYER
OF MARKING MATERIAL

CONDUCTING PAPER



363

INVENTOR
B. L. KLINE

BY

W. F. Pessoon
ATTORNEY

UNITED STATES PATENT OFFICE

2,528,005

ELECTROSENSITIVE RECORDING BLANK

Bernard L. Kline, Manhasset, N. Y., assignor to
The Western Union Telegraph Company, New
York, N. Y., a corporation of New York

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6 Claims. (Cl. 204—2)

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This invention relates to an electrosensitive recording blank and more particularly to an improved electrosensitive blank on which various kinds of subject matter may be recorded by means of telegraph facsimile or other types of electrical signals which are applied to selected elemental areas of the recording blank by means of an electrical stylus that scans the surface of the blank for applying the signals to selected areas thereof.

Facsimile communication systems are now extensively utilized by commercial telegraph companies and also by various firms and business houses for the transmission and reproduction in facsimile of telegrams, pictures, maps, drawings and other message subject matter. In such systems the transmitting blank is scanned either by optical or electrical pickup means, depending upon the character of the transmitting blank, for generating the facsimile signals in known manner. Reception of the messages commonly is effected on dry electrosensitive recording blanks of the type disclosed in Kline Patent No. 2,251,742, issued August 5, 1941. Such a blank comprises a base sheet of paper which is impregnated with a conductive substance, preferably carbon black, so that the sheet is sufficiently conductive to pass readily the marking currents applied by the receiving stylus to the recording blank. An electrosensitive marking coating principally composed of lead thiosulphate is applied to the underlying conductive sheet, which coating is changed to lead sulphide in those elemental areas to which the marking currents are applied as the blank is scanned by the recording stylus during reception of a facsimile message.

The lead-thiosulphate coated blank represented a substantial advance over the electrolytic and other prior art types of facsimile recording blanks, and has become a standard blank for use in facsimile systems for a variety of types of services; it does, however, have several undesirable characteristics which heretofore have been regarded as substantially unavoidable in this type of blank. For example, the lead thiosulphate coating produces a gray background instead of white, and when titanium dioxide or other whitening agents are added to the coating in an effort to produce the desired white background, some loss of definition of the recorded characters is observed and in addition excessive smoking and an objectionable amount of fumes have resulted during recording operations. Moreover, a spreading of the marked areas beyond the proper boundaries of the characters or other subject matter is

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often encountered when recording on a lead thiosulphate blank, which results in a smoky fringe similar to a halation about the characters except that it is dark instead of light, and causes a smudged appearance of the recorded message. This appears to be due to a slight charring of the surface of the coating or to a tarnishing effect at the boundaries of the recorded characters, as hereinafter set forth. The undesired fringe effects become cumulative with facsimile retransmission from a receiving blank, and in systems in which it is desirable or necessary to thus repeat a facsimile message through one or more relay offices the cumulative effects of the spreading or smoky halation prevents the final recorded copy from having a clean-cut appearance. Further, under certain recording conditions the spark under the stylus causes the paper blank to smolder, which smoldering once started may continue until the entire recording blank is destroyed.

One of the objects of the invention is to provide a recording blank which is remarkably free from the above objections. The electrosensitive marking coating provides a good white background and with a lighter-weight coating than that heretofore possible; the blank records with much less smoke and greatly reduced spark at the point of stylus contact, and is substantially non-toxic in operation; the blank is not subject to smoldering; recording may be effected with lower voltages than those required for recording on lead thiosulphate and similar blanks; no smoky fringes about the recorded characters are noticeable and this enables facsimile relay operations to be performed without cumulative effects which would produce a smudged appearance of the message, so that the message as recorded in the final station is clean-cut in appearance and acceptable for direct delivery to the customer or addressee; and the marking coating is sufficiently white and opaque so that it can successfully be tinted to any desired color even when the coating is applied to a black carbon-bearing conductive paper base.

While obviating the disadvantages of the prior lead thiosulphate and similar blanks, the instant blank retains all of the advantages of the aforesaid prior blanks; it may be stored under normal conditions for long periods of time without any substantial deterioration and is ready for use at all times; no supplementary development or other treatment of the recording blank is necessary apart from the reception of the signal impulses to record elements during the normal process of recording; it is a dry blank which operates in the absence of moisture; it is capable of record-

ing at an extremely fast rate and with very sharp definition; is not adversely affected by exposure to light or air; and is adapted for use with conventional commercial facsimile recording apparatus of a comparatively simple character.

Other objects and advantages will appear from the following detailed description of a preferred embodiment of the invention, taken in connection with the accompanying drawings, in which—

Fig. 1 illustrates diagrammatically a facsimile system embodying transmitting and receiving stations with an intermediate repeating station, the system being of the type in which a recording blank in accordance with the present invention is adapted to be used;

Fig. 2 is a perspective view of one form of recording blank embodying the invention; and

Fig. 3 is a view, in elevation, of a modified arrangement of the recording blank.

Referring now to Fig. 1 of the drawings, there is shown a facsimile transmitting station A, a facsimile receiving station C, and an intermediate facsimile relay station B. The transmitter at station A may comprise either optical or electrical pickup devices, both of which are well known in the facsimile art; for simplicity an electrical pickup device is illustrated. The transmitter comprises a rotatable metallic cylinder or drum 10 carried by a centrally disposed driving shaft 11 which is journaled in frame members 12 and 14. During transmission of signals the cylinder is rotated, in the direction indicated by the arrow, by any suitable means such as an electric motor 15, preferably of the alternating current synchronous type, which is connected in the illustrative form shown by a driving pulley 16 and a belt 17 to a driven pulley 18 keyed to the shaft 11. To prevent slippage, the pulleys have pins thereon which are received in slots in the belts, as indicated. Transmission may be effected in any suitable manner, for example, as described in Kline Patent No. 2,229,091, issued January 21, 1941, in which the transmitting blank has conductive characters on a non-conductive background, or as described in my copending application, Serial No. 5,568, filed January 31, 1948, in which the transmitting blank has non-conductive characters on a conductive background. In such arrangements a scanning electrode or stylus 22, whose point bears on the surface of a blank 21 bearing the characters comprising the message, is supported by a traveling carriage 23 adapted for longitudinal movement longitudinally along a rotatable shaft 24 screw-threaded throughout the greater part of its length, the shaft being rotated by driving gears 25 and 26 keyed to the shafts 11 and 24, respectively, whenever the cylinder 10 is rotated. Thus, the stylus 22 is caused to traverse the cylinder in a longitudinal direction as the cylinder rotates, the pitch of the thread of the shaft 24 determining the extent of longitudinal traversal of the stylus during each rotation of the cylinder and hence the number of scanning lines per inch. In this manner the stylus point will describe a helical path as it moves over the surface of the telegraph blank 21 and thus produces a scanning action. The transmitting blank is wrapped once around the metallic cylinder 10 in the manner shown in the figure and is releasably secured to the cylinder in any desired manner, as by elastic retaining bands such as shown in Wise et al. Patent 2,255,868, issued September 16, 1941.

After the blank has been scanned, it is taken off the cylinder and another blank placed thereon

for sending another telegram, means being provided whereby the traveling carriage 23 may be manually returned to its starting position. The foregoing method of obtaining a scanning movement per se is well known, as are various methods of electrically or optically scanning a given field for producing signals in facsimile transmission systems, and it is to be understood that any of the known methods of producing signals by means of optical or electric scanning devices suitable for the purpose may be employed. The transmitting apparatus includes a transmitting amplifier 28 which is interconnected by a communication circuit L1 to the receiving amplifier 30 of the intermediate relay station B. If desired, the transmitted signals may have a carrier frequency component introduced by the transformer 27 which is connected in a series lead 29 from the transmitting drum 10.

At station B, if the signals incoming over line L1 were generated at station A from a transmitting blank having insulating characters on a conductive background the signals may be inverted by means of a signal inverter 33 so that the message recorded on the receiving blank at station B will be a positive copy of the message on the transmitting blank 21. Various of the known types of vacuum tube signal inverters may be employed. The facsimile repeating equipment at station B, diagrammatically shown within the dotted rectangle 35, may comprise send-receive apparatus such as disclosed in Wise et al. Patent No. 2,315,361, issued March 30, 1943. A metallic cylinder 36, which carries an electro-sensitive recording blank like the blank 61 at station C and made in accordance with the instant invention, is scanned by an electrical recording stylus 37 when signals are being received from station A. When synchronism of the rotating parts at stations A and B is properly maintained in any of the various ways known in the art, the message or image upon the original transmitting blank 21 will be reproduced in facsimile upon the receiving blank on the drum 36. Upon completion of the reception of the message, the recording stylus 37 is turned out of engagement with the recording blank and the latter is then scanned by optical pickup apparatus to relay the message to station C. The retransmitting equipment includes photocells 38 and 39 which provide an optical pickup in the retransmitting side, two photocells being used in order to effect picture reversal and to transmit a positive copy of the message in the manner disclosed in Wise Patent No. 2,176,442, issued October 17, 1939.

The signals generated by the optical pickup means pass through a transmitting amplifier 40 and thence over line L2 to the receiving amplifier 42 at station C. The amplified signals are applied to a recording stylus 62. The scanning mechanism of the recorder at station C is similar to that of the transmitter at station A, and comprises a rotatable metallic cylinder or drum 50 carried by a centrally disposed driving shaft 51 journaled in frame members 52 and 54. During reception of signals the cylinder is rotated, in the direction indicated by the curved arrow, by a synchronous motor 55, driving pulley 56, belt 57 and driven pulley 58 keyed to the shaft 51. The recording stylus 62, whose point bears on the surface of the recording blank 61, is carried by a traveling carriage 63 which moves along a threaded shaft 64 rotated by gears 65 and 66 to effect scanning of the blank as the incoming signals are received. Thus, the recorded blank 61 is a positive facsimile copy of the message on

the original transmitting blank 21, which copy is suitable for direct delivery to the customer or addressee.

A recording blank 61 embodying the invention is shown in its simplest form in Fig. 2 of the drawings in which reference numeral 70 represents a sheet of fibrous material, which may be ordinary paper although highly calendered paper is preferred since it results in a smoother surface over which the recording stylus can travel without contact bounce or variation in contact resistance. Applied to the surface of the paper is an adhesive coating or film 71 which comprises a marking substance in accordance with the present invention. The sheet 70 may be made conductive either by impregnation with an electrolyte or by having a finely divided metal powder or finely divided carbon such as carbon black uniformly distributed throughout the pulp from which the paper sheet is rolled, so that signal marking current in the stylus circuit can flow through the sheet to the underlying metal platen, such as the cylinder 50 shown in Fig. 1, on which the sheet is placed during a recording operation. Various examples of such electrolytes and conducting powders are disclosed in Kline Patent No. 2,425,742, issued August 19, 1947. Preferably, finely divided carbon is employed to make the sheet 70 conductive. The thickness of the paper will depend upon the kind of stock used, for example, the thickness may vary from .0015 inch for tissue to .003 inch for ticker stock which comprises ordinarily manila paper. The degree of conductivity of the sheet 70 is not critical, but must be sufficiently high to cause the recording stylus current readily to pass through the sheet. For example, a suitable degree of conductivity of a carbon impregnated sheet is such that if a metal plate is positioned under the sheet and an electrode whose area of contact surface is .5 sq. cm. is pressed on the upper surface of the sheet with a pressure of approximately 500 grams, the electrical resistance of the paper is approximately from 42 to 58 ohms. The resistance of papers impregnated with electrolytes will be found to be higher and may be as high as several times that of the carbon impregnated paper. It will be appreciated by those versed in the facsimile art that the necessary conductivity of the sheet 70 may vary within considerable limits and yet produce suitable marking effects, depending upon various factors such as the voltage of the recording stylus current, the thickness of the paper 70, the speed at which the recorder is to operate, and the frequency of the marking current in the stylus circuit when alternating current is employed.

In accordance with the instant invention, I have discovered that cuprous thiocyanate is especially suitable for use as the marking coating or film 71. There are two copper thiocyanates, the cupric and the cuprous; the cupric is black in color while the cuprous has a very clear bluish-white color. One method of making cuprous thiocyanate suitable for use in the blank of the instant invention is to take the commercially available cupric sulphate or blue vitriol and in solution reduce it to the cuprous form with a suitable reducing agent, such as sulphur dioxide. The cuprous thiocyanate is formed in this solution by the addition of a soluble thiocyanate such as the thiocyanate of sodium, potassium or ammonium. Care should be taken to completely reduce the copper solution to avoid the danger of production of even a very small amount of the cupric form which would decrease the whiteness of the fin-

ished product. The filtered and washed material is dried and dispersed in a coating medium such as a lacquer for application to the conductive base sheet. Commercially it is not the practice to wash the copper thiocyanate with sufficient care to remove all water soluble by-products of the reaction including all traces of acid. Unless this care is taken, the salts or acids will cause deterioration of the coating lacquer and an increase in viscosity or even a gel to make it unusable for commercial coating. This extreme care in washing need not be taken if a blank is made by incorporating the copper thiocyanate in the upper surface portion of the black paper web during the process of manufacture so that it becomes an integral part of the sheet.

The cuprous thiocyanate provides a marking coating that results in a good white background, instead of the grayish background heretofore obtained in recording blanks, and with a lighter-weight coating than that heretofore possible; .45 gram of cuprous thiocyanate coating material per square foot of surface is sufficient to provide the same opacity of coating, when applied to a black carbon bearing paper sheet, as is produced by .85 gram of lead thiosulphate coating material per square foot of surface area, and a coating of .75 gram of cuprous thiocyanate coating material per square foot of surface gives a blank substantially as white as commercial office stationery. The recording voltage required in the case of the instant blank is much lower than that required for lead thiosulphate and similar coated blanks, for example, a potential of approximately 160 volts normally is required to be impressed upon the stylus for suitable recording on a lead thiosulphate coated blank, whereas the cuprous thiocyanate blank records with a potential of approximately 100 volts applied to the stylus. The blank of the instant invention records with much less smoke and greatly reduced spark at the point of the recording stylus, and is not subject to smoldering regardless of any sparking which may occur, even when recording with direct current at low speeds. Moreover, there is no residual odor in the cuprous thiocyanate blank; such odors have generally been associated with blanks having coatings in which chemical change occurs to effect marking, and these odors in most cases have proved objectionable. Due to the lower voltage required for penetrating the marking coating of cuprous thiocyanate, the matching circuit impedance for the recording blank may be much lower than that required for lead thiosulphate blanks, and a darker mark is recorded with less power with the cuprous thiocyanate coating.

When a lead compound coating, such as lead thiosulphate, Pb_2SO_3 is subjected to partial decomposition to form lead sulphide, PbS , as in marking electrosensitive recording blanks, only half of the sulphur in the molecule is utilized, the other half being discarded. Similarly, when lead thiocyanate, $Pb(SCN)_2$, is employed as the marking coating in an electrosensitive recording blank, the partial decomposition of this compound to form lead sulphide, PbS , results in only half of the sulphur in each molecule being utilized. It is obvious that there is one free sulphur atom liberated for each molecule of lead compound in the coating wherever a mark is produced. Chemical tests indicate that this waste sulphur in the smoke causes tarnishing of the adjacent lead thiosulphate or lead thiocyanate coating and hence causes darkening in these areas with consequent smudging around the characters.

Similarly, tests indicate that the tendency of a coated blank to smolder may be related to this same chemical effect, although positive verification of this is difficult and applicant does not wish to be bound as to the precise phenomenon involved. Smoldering is especially serious in the case of low speed recording blanks, such as those employed for charts in recording meters and cardiographs, since they usually involve a continuous signal which affords more opportunity for ignition of the blank. The hazard of smoldering is, however, not limited to slow speed recording blanks; it also occurs at times in high speed telegraphic service. For instance, the necessity for fans in hot or humid weather creates drafts which sometimes cause a smoldering facsimile blank of the prior type to burst into open flame with the consequent fire hazard. Both lead-thiocyanate and lead-thiosulphate coated blanks show a tendency to smolder and usually will smolder if ignited by the recording spark or any other means such as contact with a lighted cigarette. In both of these cases it is believed that the free sulphur resulting from their partial decomposition to lead sulphide stimulates the smoldering which causes further partial decomposition and release of more sulphur in adjacent areas of the sheet, which smoldering may continue until the entire sheet is consumed.

In the case of cuprous thiocyanate, CuSCN , when subjected to partial decomposition under the action of the marking currents, there is formed either cuprous sulphide, Cu_2S , or cupric sulphide, CuS , both of which are black in color and produce a recorded marking. In the event that the conditions are such that cupric sulphide is formed under the action of the marking current, only carbon and nitrogen have been removed from the cuprous thiocyanate molecule, and neither carbon nor nitrogen affects the adjacent areas around the characters and hence there is no discoloration and smudging. In the event that the conditions are such that cuprous sulphide is formed under the action of the marking currents, there is only one free sulphur atom liberated for each two molecules of cuprous thiocyanate and hence the amount of waste sulphur in the smoke is reduced to an extent as to substantially eliminate smudging of the adjacent cuprous thiocyanate coating. When alternating current is used for recording it is a reasonable assumption that the final products are both cuprous and cupric sulphides, in which case the amount of free sulphur liberated would be only one-quarter of that liberated from the foregoing lead compound coatings. If direct current is employed for marking, it may be expected that either all cupric or all cuprous sulphide will be formed depending upon the polarity of the marking current. In either of the above cases, whether cupric sulphide or cuprous sulphide is the final product, there is substantially no cumulative smudging effect and clean-cut characters are reproduced in the final copy even though the subject matter has been retransmitted from a like blank one or more times by optical facsimile scanning methods for relaying a message.

Extensive tests made with cuprous-thiocyanate coated paper have shown that such blanks do not support smoldering; in fact, if they are lighted by an open flame so that smoldering is started, the smoldering ceases as soon as the flame is removed or extinguished, and this even though the blanks are subjected to drafts of air at the time they are lighted. Thus, even under adverse conditions, if smoldering should be started it im-

mediately ceases due apparently to the chemical behavior of the cuprous thiocyanate upon decomposition thereof.

Due to the lower signaling voltage which may be employed with cuprous thiocyanate, there is also less likelihood of any charring of the coating around the characters, and this facilitates the production of clean-cut characters. With a blank in accordance with the instant invention, it is possible to record a continuous signal and produce a sharper line than has heretofore been possible. A coating of cuprous thiocyanate is sufficiently opaque that it may be tinted to any desired color and yet cover the black underlying carbon coating, and it is unnecessary to add whitening agents to the coating to increase its opacity and produce a white background where desired.

Fig. 3 is a view of a recording blank embodying a conductive paper sheet 70 having coatings 71 and 71' of cuprous thiocyanate on opposite sides thereof, whereby the blank is adapted to record on both sides at different times, respectively, and hence each blank may be used for two different messages, thus materially reducing the cost of using such recording blanks. In the use of such a blank, recording usually is effected by means of alternating current of suitable frequency, for example, 2500 cycles, and in this case the conductive paper 70 and the under coating 71' which is resting on the metallic cylinder 36 or 50 of Fig. 1, together with the cylinder, act as electrical condenser elements. When the sheet on the recording cylinder is scanned, the stylus 37 or 62 will mark the upper coating 71, but the lower coating 71' will remain undisturbed since it is in intimate contact over a large peripheral area of the cylinder 36 or 50, thus reducing the current density below that required to cause marking of the surface 71'. Even though the coating 71 has a very high electrical resistance, displacement currents are passed therethrough at the frequencies ordinarily employed for alternating current recording, due to the condenser effect produced by the conductive sheet 70 and the cylinder 36 or 50 spaced therefrom only by the thickness of the coating 71'. After a message, picture or other record has been produced on the surface 71, a record may be made on the opposite side 71' merely by reversing the sheet and placing the previously recorded side 71 in contact with the recording cylinder 36 or 50.

Inasmuch as the material in the coating 71 to be reduced or converted represents the load of the electrical marking current, the resistance of the recording material should be concentrated in that region. In order to provide a permanent record, the cuprous thiocyanate may be suspended in a vehicle or binder of cellulose derivative lacquers, hydrocarbon resins, shellac dissolved in alcohol, or other suitable binder, the marking compound being uniformly distributed in finely divided form throughout the binder. Since the electrical breakdown strength of the entire coating is to be maintained at a uniform value, with the variations in reduction or conversion of the marking material being controlled by the intensity of the signaling currents or potentials, the thickness of the coating should be maintained at a substantially constant value throughout the useful area of the record. The coating is applied as a very thin film, the surface layer preferably being of the order of .00008 to .00015 of an inch.

As above stated, the white cuprous thiocyanate is reduced or converted by the application there-

to or passage therethrough of the signaling potentials or currents to a black copper sulphide, this change in color at the points to which the signaling energy is applied providing a sharp contrast with the unchanged portions of the coating which have not been affected by the signaling potentials or currents. The thickness of the coating should be just sufficient to mask the underlying conductive base material for supplying a good background for the recorded subject matter.

The marking potential applied to the coating by the stylus may be just below the marking value so that superimposed signal potentials will provide the differential necessary for effective operation. Recording may be effected either with direct or alternating currents including frequencies ranging into the carrier spectrum. Due to the opacity and whiteness of the coating it may readily be tinted to produce any desired color of background. For example, the copper thiocyanate may be tinted with from 1½% to 3%, by weight, of a suitable dye to produce any of a large number of different shades or colors.

In the illustrated embodiment of the invention the entire body of the paper base 70 is made conductive, but if desired only its surface need be conductive. This may be obtained by coating the sheet 70 with a suitable conducting substance, such as finely divided carbon, incorporated in a suitable binder, for example, synthetic resins commonly used in lacquers, such as cellulose nitrate, or water soluble materials such as casein, starch and polyvinyl alcohols. Also, a layer of metal foil may be used in lieu of the carbon layer. In such case the electrode 68 shown in Fig. 1 is placed in contact with the marginal edge of the conductive surface of the recording blank instead of being in contact with the metallic drum 50, thereby to complete the recording stylus circuit.

It will be appreciated that other substances or compounds may be embodied in the marking coating in addition to the cuprous thiocyanate, although in general it will be found that the cuprous thiocyanate alone will be most suitable for recording purposes.

What is claimed is:

1. An electrosensitive recording blank comprising a body portion, said body portion having, over the recording surface of the blank, a surface layer of a recording medium comprising cuprous thiocyanate in an amount sufficient to produce marking effects on selectable elemental areas of said recording surface upon application of an electrical signaling potential to said areas.

2. An electrosensitive recording blank comprising a body portion, said body portion having in intimate contact therewith, over the recording surface of the blank, a coating of a recording medium comprising cuprous thiocyanate in an amount sufficient, upon application of an electrical signaling potential to selected elemental areas of the recording surface, to form a compound of contrasting appearance with respect to adjoining areas of said surface.

3. An electrosensitive recording blank com-

prising an electrically conductive support, said conductive support having in intimate contact therewith, over the recording surface of the blank, a coating of a recording medium comprising cuprous thiocyanate and a binder, said cuprous thiocyanate being in sufficient quantity to produce a color change in selectable elemental areas of said recording surface when electrical signaling potential is applied to said selectable areas of said recording surface, so as to produce a record by the signaling potential applied thereto.

4. An electrosensitive recording blank comprising an electrically conducting support, said support containing finely divided carbon uniformly dispersed throughout the body of said support to render the same conducting, said conductive support having in intimate contact therewith, over the recording surface of the blank, a coating of a recording medium comprising cuprous thiocyanate, whereby when electrical signaling potential is applied to selected elemental areas of said recording surface of the blank a color change will occur in said selected areas of said recording surface so as to produce a record by the signaling potential applied thereto.

5. An electrosensitive recording blank comprising an electrically conductive fibrous support having a calendered surface, said calendered surface of the conducting support having in intimate contact therewith, over the recording surface of the blank, a coating of a recording medium comprising cuprous thiocyanate, whereby when an electrical signaling potential is applied to selected elemental areas of said recording surface of the blank a color change will occur in said selected areas of said recording surface so as to produce a record by the signaling potential applied thereto.

6. An electrosensitive recording blank having at least a surface portion thereof comprising an electrically conductive support formed by finely divided carbon uniformly dispersed throughout said surface portion to render the same conducting, said conductive surface portion having in intimate contact therewith, over the recording surface of the blank, a coating of a recording medium comprising cuprous thiocyanate applied to said surface in the amount of approximately one-half to three-quarters gram per square foot of recording surface area, whereby when electrical signaling potential is applied to selected elemental areas of said recording surface of the blank a color change will occur in said selected areas of said recording surface so as to produce a record by the signaling potential applied thereto.

BERNARD L. KLINE.

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The following references are of record in the file of this patent:

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Number	Name	Date
2,294,149	Kline et al.	Aug. 25, 1942
2,425,742	Kline	Aug. 19, 1947

Certificate of Correction

October 31, 1950

Patent No. 2,528,005

BERNARD L. KLINE

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 6, line 58, for " Pb_2SO_3 " read PbS_2O_3 ;
and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of January, A. D. 1951.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.