

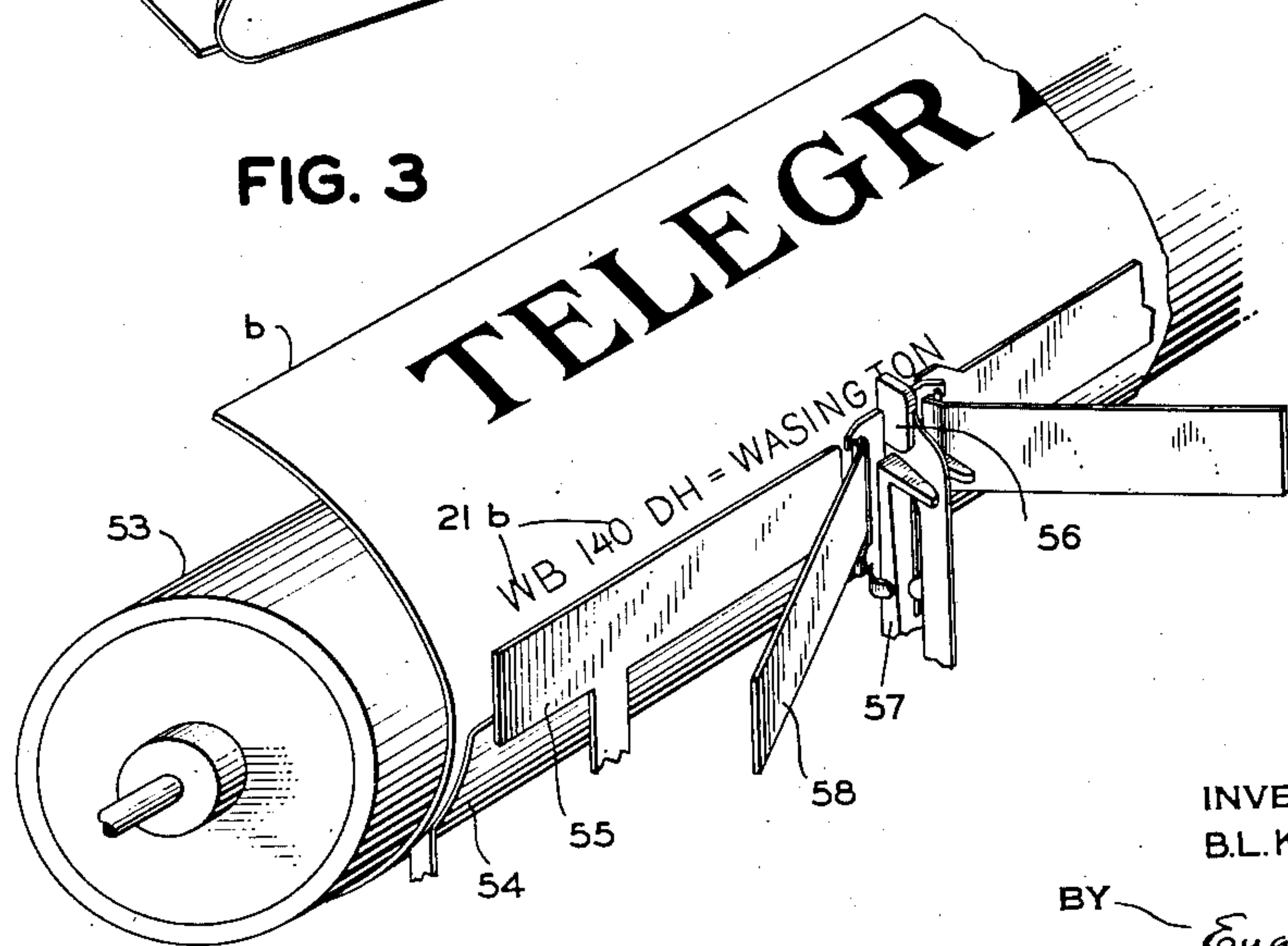
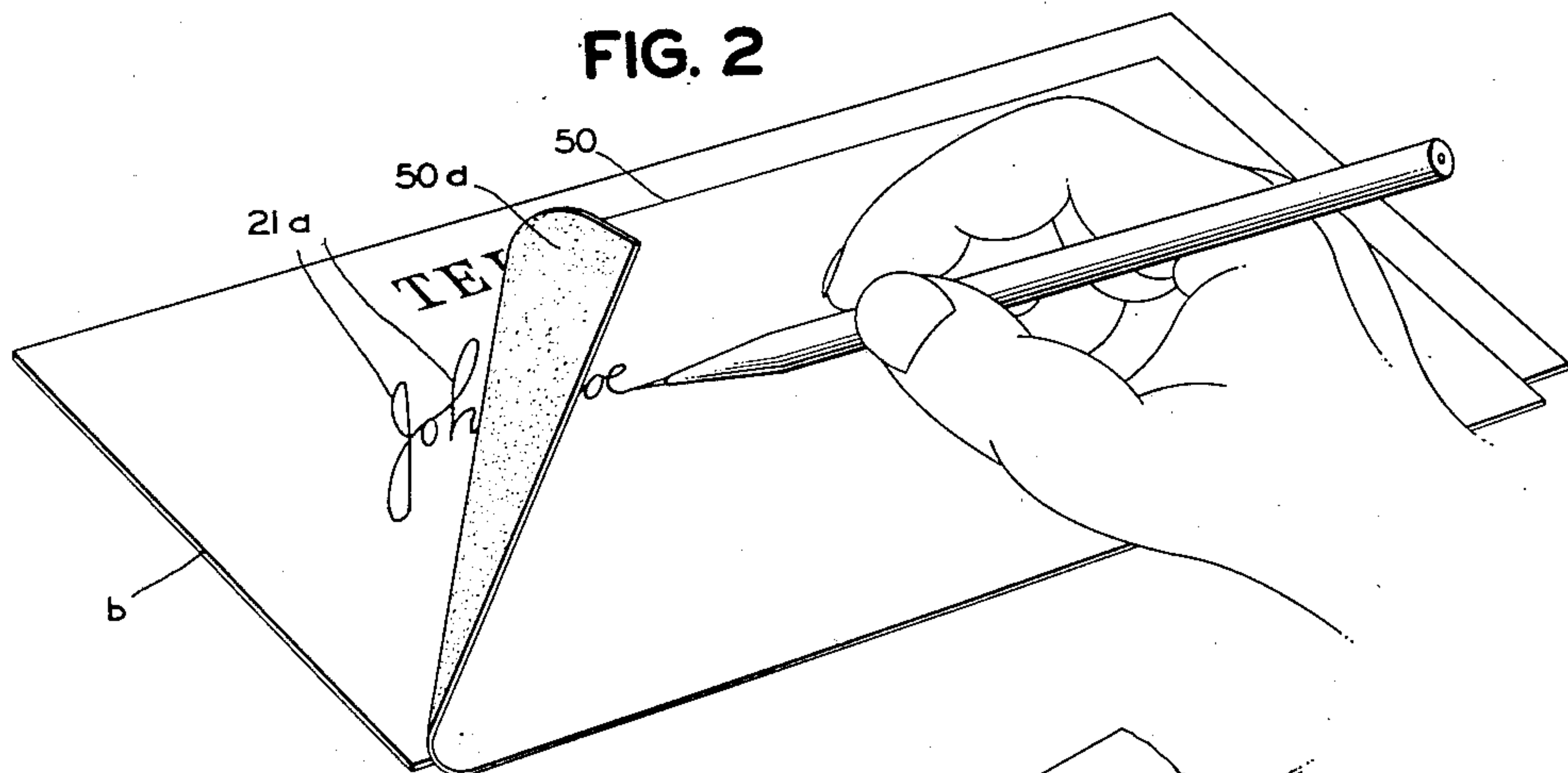
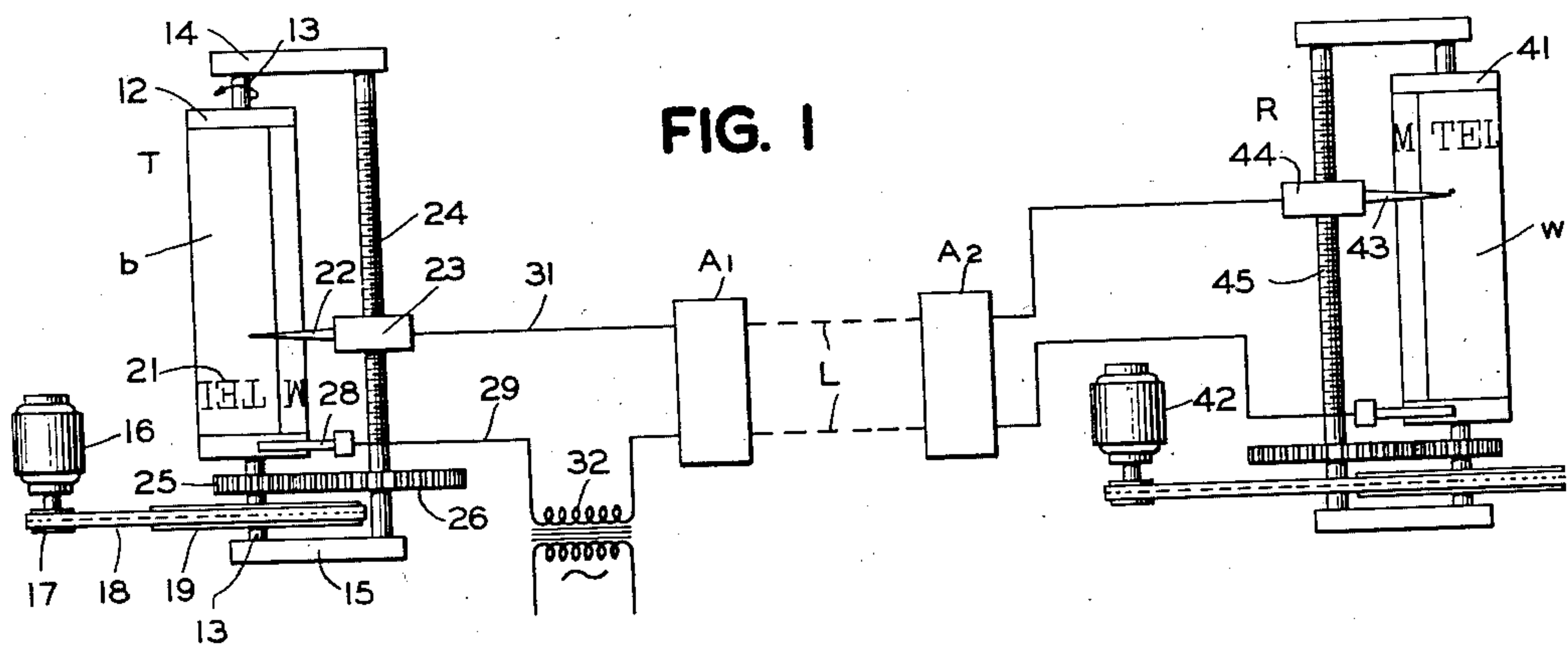
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TELEGRAPHIC TRANSMISSION OF INTELLIGENCE

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TELEGRAPHIC TRANSMISSION OF INTELLIGENCE

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This invention relates to telegraphic transmission of intelligence, and particularly to telegraph and facsimile systems for the transmission of telegrams and other subject matter written, 5
sketched or printed on, or otherwise applied to, a sheet, plate or other carrier medium.

The invention is particularly applicable to a transmitting system in which the various letters, characters or other component parts of the message or other subject matter to be transmitted are composed of electrically conductive areas which, when scanned by an electrode in a signal circuit, produce electrical effects for reproducing the subject matter at a receiving station. The invention is also applicable to a receiving system 15
in which the incoming signals are recorded by the application of electrical potentials to a prepared sheet or other recording medium in such manner as to mark the same in response to the received signals. 20

An object of the invention is to increase the accuracy of the signals transmitted in a system of the foregoing character.

Another object is to produce a sharper definition of subject matter transmitted and recorded in facsimile. 25

A further object is to provide a more suitable substance for forming on a carrier medium conductive areas which delineate the subject matter so as to enable signals to be transmitted in accordance therewith and/or for treating the medium on which the received signals are recorded. 30

Additional objects and advantages will be apparent from the following description, taken in connection with the accompanying drawing, in which: 35

Fig. 1 schematically illustrates a facsimile system embodying transmitting and recording means in accordance with the invention;

40 Fig. 2 shows one method of writing on a telegraph blank the conductive characters comprising the subject matter to be transmitted; and

Fig. 3 illustrates how the conductive characters comprising a message may be typed on a telegraph blank for transmission. 45

The message or other subject matter to be transmitted comprises areas of a conductive layer or coating, for example, the letters or words of a telegram, separated by areas which are substantially nonconductive, as the blank portions of the paper sheet on which the telegram is written or typed. The conductive areas usually are separate individual areas varying through a wide range of sizes from a minimum useful size upward, which minimum useful size may, in the case of printed or written matter, be regarded as 50
a dot for a small letter "i" or a period.

In accordance with one method of transmitting signals representative of the subject matter, an area of such subject matter is disposed upon or 60

brought near a conductive surface of appreciable size, such as a metallic plate, with the conductive surface areas spaced from the larger surface or plate by a dielectric substance, as the paper of the telegraph blank. In this manner, each of the individual conductive areas of subject matter, together with the plate, form the two armatures of a small condenser which, when suitably connected to a signal circuit having impressed thereon a source of varying potential, will cause a flow of current in the signal circuit. When the metallic plate is connected to one leg of the circuit, and an electrode or stylus connected to another leg of the circuit is disposed in opposed position to the plate and arranged to engage the image surface of subject matter between it and the plate, and relative movement between the stylus and subject matter is effected in such manner as to produce scanning action, the individual conductive areas of the subject matter are successively connected to the signal circuit to cause flow therein of electrical currents or groups of oscillations or impulses representative of or in accordance with the signals to be transmitted. These signal currents preferably are amplified or are caused to modulate or control other currents to provide increased signal strength, and are transmitted to a receiving station to there reproduce, in facsimile or otherwise, the subject matter at the transmitting station. 20
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Referring now to Fig. 1 of the drawing, there is shown a transmitter T comprising a rotatable metallic cylinder 12 carried by a centrally disposed driving shaft 13 which is journaled in frame members 14 and 15. In transmitting signals the cylinder is rotated, in the direction indicated by the arrow, by any suitable means, such as an electric motor 16, preferably of the alternating current synchronous type, which is connected in the illustrative form shown by a driving pulley 17 and a belt 18 to a driven pulley 19 keyed to the shaft 13. To prevent slippage, the pulleys have pins thereon which are received in slots in the belt, as indicated. 35
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The characters or images 21 comprising the subject matter, for example, a telegram to be transmitted, may be written, typed, or otherwise applied, by means of the conductive substance hereinafter disclosed, on a nonconductive sheet b, for example, a telegraph blank, after which the sheet is wrapped once around the metallic cylinder 12 in the manner shown in the figure and releaseably secured to the cylinder in any desired manner, as by spring clips (not shown) carried by the cylinder. A scanning electrode or stylus 22, whose point bears on the surface of the paper sheet b, is supported by a travelling carriage 23 adapted for movement longitudinally along a rotatable shaft 24 screw-threaded throughout the greater part of its length, the 60

shaft being rotated, by driving gears 25 and 26 keyed to the shafts 13 and 24 respectively, whenever the cylinder 12 is rotated. Thus, the stylus 22 is caused to traverse the cylinder in a longitudinal direction (away from the observer as viewed in Fig. 1) as the cylinder rotates, the pitch of the thread on the shaft 24 determining the extent of longitudinal traverse of the stylus during each rotation of the cylinder. In this manner the stylus point will describe a helical path as it moves over the surface of the telegraph blank and thus produce a scanning action. 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 travelling carriage 23 may be manually returned to starting position.

The foregoing method of obtaining a scanning movement per se is well known, as are various other methods of scanning a given field, and it is to be understood that any of the known methods of scanning suitable for the purpose may be employed in lieu of the foregoing method described.

The metallic cylinder 12 is electrically insulated from its associated apparatus, an electrical connection to the cylinder being made by means of a stationary brush or other contact member 28 which bears against the cylinder and electrically connects the cylinder to one leg 29 of the signal circuit hereinafter described. The other leg 31 of the signal circuit is connected to the scanning electrode 22 which remains in contact with the sheet b.

A varying potential, which in the arrangement illustrated is obtained from a source 32 of alternating current, is continuously applied through the leg 29 of the signal circuit to the cylinder 12. The frequency of the alternating current may vary within wide limits, depending upon the purpose for which the system is employed, the desired rate of scanning or speed of operation, the constants of the line L over which the subject matter is transmitted, and other factors. In the illustrative circuit shown, the frequency of the alternating current supply 32 is preferably of the order of 2500 cycles. The circuit from the alternating current source 32 includes the metal cylinder 12 which forms one plate of a condenser; the other leg 31 of the signal circuit is connected to the input of a thermionic amplifier A1. The alternating current circuit is completed, whenever the scanning electrode 22 engages a conductive area on the sheet b, through the electrode 22, conductor 31, the input circuit of the amplifier A1, and return to the alternating current source 32.

When the electrode or stylus 22 engages a conductive area of the subject matter to be transmitted, for example, one of the letters of the telegram, the capacitance effect between the conductive substance of such letter and the metal cylinder 12 causes electrical oscillations to be impressed upon the input circuit of the amplifier A1, and when the stylus 22 moves off the conductive surface of the letter, the alternating current circuit is substantially interrupted so that signal oscillations are no longer impressed upon the input circuit of the amplifier. The signals are suitably amplified in the amplifier and then pass over a line L to a receiver R.

At the receiving end the recording may be accomplished by any of various known methods suitable for the purpose. The embodiment illustrated in Fig. 1 shows one method of recording

in which a paper web w is mounted upon a rotatable cylinder 41 of substantially the same diameter as the cylinder 12 of the transmitter T. The cylinder 41 is rotated in synchronism with the sending cylinder 12 in any suitable manner, as by means of an alternating current synchronous motor 42 or other kind of motor which is kept in step with the sending motor 16 by any of the many known methods of maintaining synchronism. The web w is preferably impregnated or treated with the conductive substance hereinafter disclosed and also with a substance such that the application of electrical potential thereto, for example, to cause passage of current therethrough, produces color changes or other marking effects in the substance or the web to record the subject matter transmitted. In the illustrative form shown, the incoming signal currents are conducted to the web w by means of a scanning stylus 43 arranged with its point in continuous contact with the web, the stylus being mounted on a carriage 44 resting upon a threaded shaft 45 rotated with the cylinder 41. The threaded shaft in combination with the rotation of the cylinder produces a scanning action of the stylus 43 in the manner described with reference to the transmitter. If desirable or necessary, the incoming signals may be repeated and amplified in the amplifier A2, in a manner well known in the art, to translate the signals into suitable current pulses to produce the received image. When synchronism of the rotating parts and the scanning movements of the styli at the sending and receiving stations is properly maintained, the image upon the blank b at the transmitter will be reproduced upon the web w at the receiver as scanning proceeds.

While the foregoing type of transmitter is preferably employed, other forms of transmitters known in the art which produce electrical signals in accordance with conductive areas disposed on a carrier medium may be employed. For example, the transmitting arrangement disclosed in the patent to F. M. Short, No. 587,336, issued August 3, 1897, may be employed, which arrangement employs two styli and depends for its operation upon current flow between the styli whenever a conductive area of metallic ink on the blank m is contacted by both styli. Similarly at the receiving station, any of the various known systems for recording the incoming signals may be employed in lieu of that shown.

Various conductive substances have heretofore been employed to form the letters or characters of the subject matter to be transmitted. For example, carbon paper and typewriter ribbons have been employed to produce conducting characters on the carrier medium; these have serious defects, however, in that the characters made by certain forms of carbon paper and typewriter ribbons are almost completely dielectric or are not sufficiently conductive to give the desired results. This is also true, to a somewhat lesser extent, of colloidal graphite in which the various carbon particles appear to be insulated from each other by the wax or other non-aqueous medium in which they are dispersed. India ink and ordinary lead pencil have been found to be satisfactory in some respects and completely unsatisfactory in other respects. Also, the various carbon blacks which are commercially available frequently are found to be nonconductive or not sufficiently conductive to give good results.

In accordance with the invention, I employ a different type of substance for forming the con-

ductive areas of the subject matter to be transmitted, the constituents of the substance comprising an electrolyte dissolved in a suitable non-aqueous solvent therefor to form a substantially non-aqueous and non-volatile solution of high conductivity and low hygroscopicity, and preferably including a finely divided or comminuted absorptive or adsorptive substance capable of retaining a sufficient amount of the electrolytic solution at the surface of the carrier sheet to insure good surface conductivity and prevent dissemination of the solution and attendant blurring of the subject matter.

Among the electrolytes suitable for the purpose are potassium iodide, sodium nitrate, sodium formate, sodium benzoate, sodium bromide, iron chloride and metal-nitrobenzene sulphonic acid, potassium iodide being preferred because of its relatively high specific conductivity in solution (a saturated solution of potassium iodide in triethylene glycol has a conductivity of approximately 1/230 mho at ordinary room temperatures) and also because it does not have any appreciable discoloring effect upon the paper ordinarily employed for writing the message.

As a solvent for these electrolytes I employ an alcohol having a vapor pressure less than 0.1 millimeter of mercury at 25° C., preferably one of the polyhydric alcohol group, such as triethylene glycol, diethylene glycol, propylene glycol and butylene glycol, triethylene glycol being preferred. All of the foregoing polyhydric alcohols are substantially non-aqueous and non-volatile. Since these solvents are non-aqueous, they do not appreciably soften the fibres of the paper or other carrier medium employed, and furthermore, do not dry out or form a skin or crust of any kind on the carrier medium, either of which conditions is disadvantageous. Moreover, the solutions formed by the foregoing solvents are stable, i. e., they are substantially non-volatile and are not decomposed on exposure to the atmosphere, light, or temperatures up to 90° C. which are well above working temperatures, and even though exposed to substantially higher temperatures, they do not decompose although they may volatilize slightly.

Also, the viscosity of these solutions remains within suitable limits over a wide range of temperatures from -10° C. to above 100° C., and over a long period of time, so that the solutions become neither too hard nor too mobile in service. The solutions thus embody the advantages of high conductivity usually present only in an aqueous electrolyte, without having the disadvantages of the volatile character of an aqueous electrolyte.

The foregoing solvents and the solutions formed thereby are not objectionably hygroscopic and therefore do not absorb appreciable moisture from the atmosphere, so that the solutions do not become aqueous in service. Each of the foregoing solvents is less hygroscopic than glycerine which is a polyhydric alcohol but which for various purposes will be found objectionable on account of its high hygroscopicity.

The relative proportions of the electrolyte and solvent preferably are such that a saturated solution at ordinary temperatures is obtained. For saturation, potassium iodide should comprise 19 to 21 percent of the solution, and may comprise up to 25 percent; when using sodium nitrate 16 to 18 percent will produce saturation; and with sodium formate and sodium benzoate

8 to 11 percent usually is required; although practical results may be obtained with as little as 5 percent of the above named electrolytes. It is not essential to heat the solvent when adding the electrolyte, although heating will expedite the process.

For certain uses it may be found desirable to add to the alcohols other substances such as glycol bori-borate and/or thio-glycol which tend to further reduce or minimize the hygroscopicity of the alcohols. When both of these other substances are used with an alcohol such as triethylene glycol and the three are used in equal parts, a solvent having the various desired characteristics above mentioned will be obtained.

Desirable results have also been obtained by the addition to any of the foregoing solvents of certain acids such as oxalic, tartaric, citric, and malic, these acids tending to decrease both the hygroscopic character, and any tendency toward volatilization, of the alcohols. When using malic acid, for example, 25% by weight of the acid has been found to give satisfactory results in this respect.

Each of the foregoing electrolytic substances produces letters, characters, or other component parts of the subject matter to be transmitted, of relatively high conductivity, and therefore greater accuracy of the signals transmitted, and a sharper definition of the reproduced signals in the receiver, is obtained because the instant the scanning electrode engages one of the characters composed of such substances, an electrical effect of an amplitude sufficient to reach or exceed the threshold value of the input circuit of the amplifier A1 is produced, whereas with characters which are not sufficiently conductive, the threshold value of the signals produced usually is not reached until some time after the scanning electrode has first engaged the character so that a signal of shorter duration results, and the definition of the reproduced subject matter in the receiver is deleteriously affected.

It is highly desirable to prevent dispersion of the electrolytic solution which when applied to paper or other porous carrier medium penetrates the medium, and leaving the surface thereof, results in less conductive characters. I have found that the addition of a finely divided or comminuted absorptive or adsorptive substance which is capable of retaining a sufficient amount of the electrolytic solution at the surface of the carrier medium, obviates or minimizes this dissemination. Any suitable material which has the property of absorbing the electrolytic solution and which tends to hold or pull the solution at or to the surface of the paper or other carrier medium may be employed. Excellent results have been obtained by the use of a colloidal clay of the bentonite type, fuller's earth or carbon black. If it is desired to use the conductive substance for marking purposes, a suitable dye such as magenta or methyl violet may be employed with the colloidal clay or fuller's earth. For certain purposes carbon is preferred to clay for two reasons, viz., the carbon by reason of its conductive nature increases the conductivity of the electrolytic solution, and the carbon is of value because of its color which may be used as an index of the conductivity of the characters produced. The advantage of this is that in commercial use, when the characters produced by the electrolytic substance which contains carbon become somewhat light in color, it will be known that the conductivity has decreased, which

decrease in conductivity is substantially in direct proportion to the shade of the substance and the characters formed thereby.

As shown in Fig. 2 of the drawing, the conductive compound may be applied as a coating 50a to one side of a sheet or other carrier medium 50, and when this sheet is laid on a telegraph blank b with the coating 50a against the blank, a message, sketch, or other subject matter may be applied to the telegraph blank in the form of conductive areas of the character hereinbefore described, after which the blank may be placed on the drum 12 of the transmitter shown in Fig. 1 and the subject matter comprising the characters 21a transmitted in the manner above stated. As shown in Fig. 2, the message or sketch may be applied to the sheet b by means of a pencil or other pointed member which writes or traces the subject matter on the sheet 50, the subject matter being transferred to the sheet b by means of the conductive coating 50a generally in the manner that a copy may be made with carbon or other marking paper.

A suitable formula for a conductive substance adapted to be applied to the sheet 50 comprises five parts of glycol boric-borate, six and one-half parts of a saturated solution of potassium iodide in triethylene glycol, three-fourths part oxalic acid, and three parts carbon black, all parts being by weight.

Fig. 3 is a fragmentary view of a typewriter in which the blank b is placed adjacent the platen 53, the blank passing between the platen and a paper guide 54 and a line guide 55. The conductive compound is applied to a carrier medium, such as a typewriter ribbon or tape 58, by impregnating or otherwise treating the same therewith, and the letters or characters are struck by typebars 56 which pass between a typebar guide member 57 to strike the typewriter ribbon against the sheet b and impress thereon the characters carried by the typebars. The resulting typed message may be sent by the transmitter T in the manner above described.

A suitable formula for a conductive substance for impregnating a typewriter ribbon is as follows: seven and one-half parts of glycol boric-borate, seven and one-half parts of a saturated solution of potassium iodide in triethylene glycol, one part oxalic acid, ten parts thio-glycol, twelve parts malic acid, and seven and one-half parts carbon black, all parts being by weight.

For the purpose of recording the message or other information received in the receiver R, Fig. 1, the web w, which may comprise paper, or other suitable carrier medium, preferably is impregnated or otherwise treated with an electrolytic substance in accordance with the invention. For example, sodium nitrate dissolved in triethylene glycol has been found to be a satisfactory impregnating medium for paper. The web w preferably is treated with a chemical substance which will change color or produce other effects upon the application thereto of electrical potentials to produce a marking effect on the web thereby to record the received subject matter, various of which substances are known in the art. When sodium nitrate and triethylene glycol are employed as the electrolytic solution, I prefer to add lead thio-sulphate as a coating over the prepared paper, which substance has been found to give excellent results. Since the electrolytic substance with which the web w is treated has a relatively high conductivity, this results in a sharper definition of the sub-

ject matter recorded because the passage of marking current through the web is facilitated.

For brevity in the specification and claims, the expression "transmission of intelligence" is employed in a generic sense and includes receiving and recording intelligence as well as transmitting the same; wherever the context permits the term "carrier medium" includes the sheet or other medium on which the conductive substance which forms the component parts of the subject matter is applied for transmitting, the web or other medium on which the received subject matter is recorded, and the sheet, ribbon or other medium which is coated, impregnated or otherwise treated with the conductive substance for applying the same to the transmitting medium; and the term "absorptive" as used in the claims includes either the absorptive or adsorptive property of a substance.

Various other substances having properties similar to those of the substances specifically mentioned herein, and various other embodiments of the invention, will occur to those skilled in the art and, therefore, the particular substances and embodiments disclosed herein are to be considered in an illustrative sense rather than in a limiting sense.

I claim:

1. The method of preparing subject matter for derivation of signals which comprises forming on a carrier medium the various letters, characters or other component parts of the subject matter from areas of a substantially non-aqueous conductive substance comprising an electrolyte and a glycol.

2. The method of preparing subject matter for derivation of signals which comprises forming on a carrier medium the various letters, characters or other component parts of the subject matter from areas of a conductive substance comprising an electrolyte and a glycol, and utilizing a finely divided absorptive substance to substantially retain the electrolytic solution on the surface of said carrier medium.

3. The method of preparing subject matter for derivation of signals which comprises forming on a carrier medium the various letters, characters or other component parts of the subject matter from areas of a conductive substance comprising an electrolyte and a glycol, and utilizing a finely divided absorptive conductive substance to substantially retain the electrolytic solution on the surface of said carrier medium and to increase the conductivity of said letters, characters or other component parts of the subject matter.

4. The method of preparing subject matter for derivation of signals which comprises the steps of dissolving an electrolyte in a glycol, adding a finely divided absorptive substance to the solution for absorbing and retaining such solution on the surface of a porous carrier medium, and applying the resultant substance to said carrier medium to form the various letters, characters, or other component parts of the subject matter.

5. In a system for the telegraphic transmission of intelligence, a carrier medium having applied thereto a substantially non-aqueous conductive substance, the constituents of said substance including an electrolyte and a glycol.

6. In a system for the telegraphic transmission of intelligence, a carrier medium having applied thereto the various letters, characters, or other component parts of the subject matter to

be transmitted comprised of areas of a substantially non-aqueous conductive substance, the constituents of said substance including an electrolyte and a glycol.

5 7. In a system for the telegraphic transmission of intelligence, a carrier medium having applied thereto the various letters, characters, or other component parts of the subject matter to be transmitted comprised of areas of a substantially non-aqueous conductive substance, the constituents of said substance including an electrolyte and a glycol, and an absorptive material on a surface of said carrier medium for retaining on said surface a substantial amount of the electrolytic solution comprising the subject matter to be transmitted.

8. A substantially non-aqueous conductive solution for application to a carrier medium to enable the production of electrical effects for telegraphic transmission of intelligence, the constituents of said solution comprising an electrolyte and a glycol.

9. A substantially non-aqueous conductive solution for application to a carrier medium to enable the production of electrical effects for telegraphic transmission of intelligence, the constituents of said solution comprising an electrolyte and a glycol, said electrolyte comprising 5% to 25% by weight of the solution and said glycol comprising 75% to 95% by weight of the solution.

10. A substantially non-aqueous conductive solution for application to a carrier medium to enable the production of electrical effects for telegraphic transmission of intelligence, the constituents of said solution comprising an electrolyte and a glycol, said electrolyte and glycol being present in such proportions as to produce a substantially saturated solution.

11. A substantially non-aqueous conductive solution for application to a carrier medium to enable the production of electrical effects for telegraphic transmission of intelligence, the constituents of said solution comprising an electrolyte and a glycol.

12. A substantially non-aqueous conductive substance for application to a carrier medium to enable the production of electrical effects for telegraphic transmission of intelligence, the constituents of said substance including an electrolyte and a glycol, and a finely divided material dispersed throughout said substance, said material having the property of retaining a substantial amount of the electrolytic solution on the surface of said carrier medium.

13. A substantially non-aqueous conductive substance for application to a carrier medium to enable the production of electrical effects for telegraphic transmission of intelligence, the constituents of said substance including an electrolyte and a glycol, and a finely divided conductive material dispersed throughout said substance, said material having the property of retaining a substantial amount of the electrolytic solution on the surface of said carrier medium.

14. A substantially non-aqueous conductive substance for application to a carrier medium to enable the production of electrical effects for telegraphic transmission of intelligence, the constituents of said substance including an electrolyte and a glycol, a finely divided material dispersed throughout said substance, said material having the property of retaining a substantial amount of the electrolytic solution on the sur-

face of said carrier medium, and a coloring agent for said conductive substance.

15. A substantially non-aqueous conductive solution for application to a carrier medium to enable the production of electrical effects for telegraphic transmission of intelligence, the constituents of said solution comprising potassium iodide dissolved in triethylene glycol.

16. A substantially non-aqueous conductive solution for application to a carrier medium to enable the production of electrical effects for telegraphic transmission of intelligence, the constituents of said solution comprising potassium iodide dissolved in triethylene glycol, and a substance miscible with the triethylene glycol and having the property of reducing the hygroscopicity of said solution.

17. A substantially non-aqueous conductive solution for application to a carrier medium to enable the production of electrical effects for telegraphic transmission of intelligence, the constituents of said solution comprising potassium iodide dissolved in triethylene glycol, and a substance miscible with the triethylene glycol having the property of increasing the viscosity of said solution such that the solution will not be too mobile in service.

18. A substantially non-aqueous conductive solution for application to a carrier medium to enable the production of electrical effects for telegraphic transmission of intelligence, the constituents of said solution comprising sodium nitrate dissolved in triethylene glycol.

19. A substantially non-aqueous conductive substance for application to a carrier medium to enable the production of electrical effects for telegraphic transmission of intelligence, said substance being composed of substantially 7½ parts of glycol bori-borate, 7½ parts of a solution of potassium iodide in triethylene glycol, 1 part of oxalic acid, 10 parts of thio-glycol, 12 parts of malic acid, and 7½ parts of carbon black, all of said parts by weight.

20. A substantially non-aqueous conductive substance for application to a carrier medium to enable the production of electrical effects for telegraphic transmission of intelligence, said substance being composed of substantially 5 parts of glycol bori-borate, 6½ parts of a solution of potassium iodide in triethylene glycol, ¾ part of oxalic acid, and 3 parts of carbon black, all of said parts by weight.

21. A transfer medium for producing conductive marks on paper by a transfer method comprising a material treated with a substantially non-aqueous conductive substance comprising an electrolyte and a glycol.

22. The inventions defined by claim 21 wherein said transfer medium is a ribbon of fabric suitable for use in a writing machine.

23. The inventions defined in claim 21 wherein said transfer medium is a paper sheet usable in the manner of "carbon paper".

24. The method of forming an electrically conductive fibrous sheet upon which materials may be applied capable of a color change upon application of an electrical potential thereto, comprising treating a fibrous sheet with a conductive substance having as constituents thereof a solution comprising an electrolyte and a glycol.

25. The combination of claim 24 wherein said conductive substance is substantially colorless.

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