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ELECTROGRAPH USING FOR PLURALITY OF ELECTRODE DEVICES
HAVING A THERMOPLASTIC FILM AS A RECORDING MEDIUM

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Fig. 1

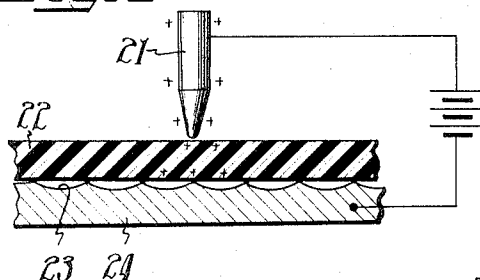


Fig. 2

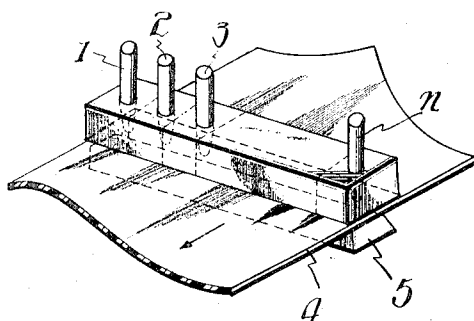


Fig. 3

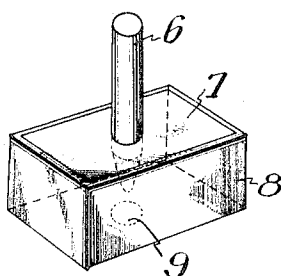


Fig. 4

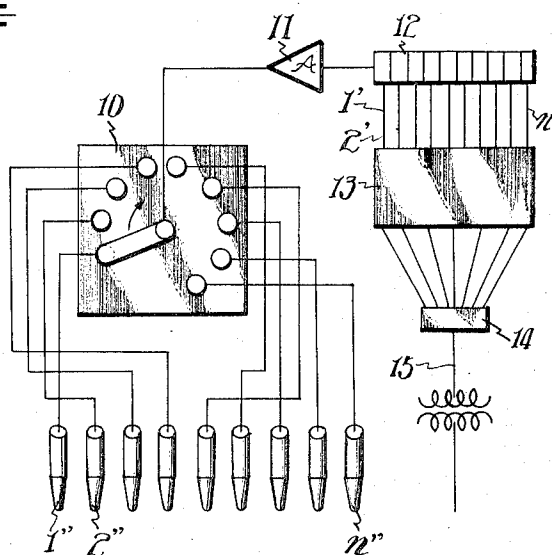
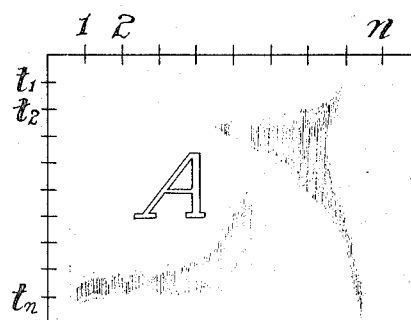


Fig. 5



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ELECTROGRAPH USING FOR PLURALITY OF ELECTRODE DEVICES HAVING A THERMOPLASTIC FILM AS A RECORDING MEDIUM

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There are already various recording devices for various uses. The present invention relates to electrograph using for plurality of electrode devices having a thermoplastic film as a recording medium wherein the recording needle part is improved so that recording may be more effective at a higher speed.

FIGURE 1 is an explanatory view of a mechanism of a recording medium.

FIGURE 2 is a magnified explanatory view of a recording part according to the present invention.

FIGURE 3 is a magnified perspective view of an element of a recording needle part.

FIGURE 4 is an electric wiring diagram of a device of the present invention.

FIGURE 5 is an explanatory view showing correlations between the recording needles and records in FIGURE 4.

In a recording medium of a high molecular structure in which such substance of a comparatively low resistance value as paper is not used for a supporting base, such phenomenon as a bound electric field will occur.

Such bound electric field is that, for example, in case a layer of a simple thermoplastic film is made a self-supporting recording medium, it will be electrically charged in such state as is shown in FIGURE 1. First of all, the mechanism in FIGURE 1 shall be explained. In the drawing, 21 is an electrode for applying an electric charge, 22 is a recording membrane and 23 is an air gap formed between a back electrode 24 and the recording membrane 22.

In such state, an electrostatic capacity made in the air gap 23 is represented by the formula:

$$C=Q/V \quad (1)$$

or generally

$$C=\frac{\sum_0 S}{d} \quad (2)$$

wherein C is an electrostatic capacity made in the air gap 23, V is a voltage, d is a distance of a minute space existing between the recording membrane 22 and the electrode and S is an area of an electrode plate facing the minute space.

From the Formulas 1 and 2, there is led the formula:

$$V=\frac{dQ}{\sum_0 S}=Kd \quad (3)$$

wherein

$$K=\frac{Q}{\sum_0 S}$$

$$Q=\sum_{n=1}^{\infty} q_n$$

$$S=\sum_{n=1}^{\infty} S_n$$

Further, as the minute area S is made in any place in the medium which is made of an insulator, it may be considered that the minimum unit forms one condenser individually.

Now, in such state, if the medium is optionally taken out, d in the Formula 3 will be in the direction of an

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infinity and therefore the voltage V will become very high. Such electric field is called a bound electric field. By such bound electric field, various disturbances will be caused in records. In eliminating such bound electric field, it is effective to apply a back surface treatment. What is also to be noted in recording is the destruction of insulation by air. It is caused by an electric charge of about 1×10^{-9} c. lb. Further, there is a defect that, in high speed recording, the recording needle can not be brought into contact with the thermoplastic film.

An object of the present invention is to provide an electrograph using for plurality of electrodes device having a transparent thermoplastic film as a recording medium wherein the above mentioned defects are eliminated and the medium can be more incrementally electrically charged.

An embodiment of the present invention shall now be explained in detail with reference to the drawings.

FIGURE 2 is a magnified view of a recording medium and a multineedle recording part. In the drawings, 1, 2, 3 . . . n are respective recording head belonging to needles. Each recording head is formed as in FIGURE 3. 4 is a recording membrane coated on the back surface with a so-called antistatic agent. For such antistatic agents are adapted, for example, those of the following trade names:

Grim (produced by B. T. Babbitt Co.), 4% Carbowax-1% Telsitol (produced by Union Carbide & Carbon Co.), 1% Armac T (produced by Armaux Co.), H-145 (produced by Du Pont), D-Start B (produced by Roxbury Chemical Works), Colcort (produced by Japan Colcort Co.), Rogostat R-2018 (produced by Bee Chemical Co.), Dust Free Cleaner (produced by Park Chemical Co.) and Electrosol (produced by M. J. Ainsworth).

Generally, such surface active agent as sodium stearate or an intermediate partly of a silicon film having a specific resistance of less than 1×10^{10} can be used substantially for the purpose.

For the recording membrane 4 coated on the back surface with such substance as is mentioned above is used a single layer of a thermoplastic film of a high molecular structure treated on the front surface with such electrolytic substance as, for example, sodium carbonate to improve increment of electrostatic-charge deposition so that the transparency may not be impaired.

For example, such polymers as polyethylene, polypropylene, polystyrene and polyvinyl alcohol can be applied as adapted substantially for this purpose.

The recording membrane 4 of such structure is inserted so that a negative electrode 5 may be in contact with the back surface of the membrane and the recording needles 1, 2, 3 . . . n may be at a slight clearance of 10 to 100 μ from or in contact with the front surface of the recording membrane 4 and is fed at any required speed synchronized with the recording speed. Further, said recording needles are connected to a distributor 20 as in the electrostatic printing diagram in FIGURE 4 so as to be respectively charged in response to the information at the transmitting end. Said distributor 10 is connected to a synchronous motor directly or through such mechanical means as couplings or gears. The number of revolutions of said motor is so kept as to be correlative with the scanning speed of the receiver.

FIGURE 3 is a magnified view of only one of the multiplex recording needles 1, 2, 3 . . . n. 6 is an electrode needle selected usually to be of a thickness having a required resolving power. For a record having a resolving power of 5 per min. is adapted an iron or Phosphor bronze wire having a diameter of about 0.2 mm.-0.05 mm. 7 is an insulative substance for which is adapted anything of a breakdown voltage of more than 2000 v. However, taking the problem in processing into consideration, polyethylene and the like is adapted. But, as it has

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a distributed capacity of plate to needle 6, it is necessary to properly select its size with respect to a shield case 3 which can be easily formed of an iron coated plate and the like. At the end of the shield case 8 or in the part facing the recording membrane 4 is made a fine hole 9 so that the tip of the recording needle 6 may be faced in air. The shape of said hole 9 is usually square. But, depending on the charged state at the time of moving, any other proper shape may be adapted. The concentration of charge is more influenced by the shape of said hole 9 than by the diameter of the needle.

FIGURE 4 is an electric wiring diagram according to the present invention. 15 is a transmitting line. 5 or 6 units of telegraphic signals come by being transmitted through said transmitting line 15 and are converted to signals by a memory circuit 13 corresponding to 5 unit signs of each in a relay matrix circuit 14. Such converted signals are converted to signals of 1', 2', 3' . . . n' and are connected directly to the multi-needle layer. But, in some case, they can be converted to series signals through a series parallel converting circuit 12 in FIGURE 4 and can be multiplexly recorded. 11 is a boosting amplifying circuit in which a voltage of 800 to 2000 v. is usually obtained. It can be easily made by any well known method.

In the operation of an embodiment of the present invention formed as described above, the signals coming by being transmitted through the transmitting line 15 are distributed in the relay matrix circuit 14 and are led to the memory circuit 13 so as to be converted to required signals of respective words, for example, signals corresponding to a lateral direction or a feeding direction. These signal outputs give the electrodes of 1'', 2'', 3'' . . . n'' output signals as signals corresponding to the words at respective time points. These signals are usually led as parallel signals to the respective boosting amplifiers 11 to be amplified and boosted and impress high voltage pulses on the respective electrodes 1, 2, 3 . . . n. However, in such case, each boosting amplifier 11 requires only a length (in mm.) of the recording membrane 4× resolving power. Now, for example, if the width of the recording membrane is 200 mm. and the resolving power is 5 per min., 1000 amplifying circuits will be required. As a method of eliminating the above disadvantage, as shown in FIGURE 4, the series parallel converting circuit 12 and the distributor 10 can be inserted to make one high voltage amplifying circuit. As in the above, if a high voltage is impressed on one or more of the multineedle elements corresponding to input signals, the recording needles will give electrostatic charges on the recording membrane 4 through the fine holes 9. The electric potential in the shield case 8 is maintained in agreement with that of the electrode 5. Thus, when the recording

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needles 1, 2, 3 . . . n are made positive, the potential in the shield case drops to zero or to a negative value. It is usually desirable to make such charge positive. But, either of positive and negative charges may be used depending on the charged direction of the visible fine powder deposited in the developing process and the pretreated state of the film on the surface of the recording medium. A visible substance is deposited on the thus electrically charged part so as to be a visible image. The image can be easily fixed with a solvent and heat. For example, in case polyethylene is used for the recording medium, fixing can be favorably made by using acetone for the solvent and keeping the fixing tank temperature at about 55 to 80° C. In the present invention, as an effective charging method is adopted, not only high speed recording but also better records can be obtained and the resolving power can be elevated to 20 per mm. Further, as the medium is transparent, if such method of combining the present invention with an offset press using a zinc plate as a base is used, a favorable efficient print will be able to be made. As electric signals are used in the present invention, manuscripts to be printed can be easily prepared at a remote place and the troubles of transporting such printed matters as newspapers can be saved. Further, as the recording medium is made of a transparent substance, if it is utilized for weather charts or the like, momentarily varying states will be able to be easily compared and investigated by overlapping the charts.

What is claimed is:

1. In electrograph apparatus a plurality of electrode devices and a transparent thermoplastic film as a recording medium the combination comprising multiplex recording needles; insulation coated on each needle; a shield case having a hole made in the part facing said recording medium for each needle interposed between the needles and the medium and enclosing a portion of each needle.

2. The apparatus of claim 1 further comprising insulation on said shield case such that said case functions as a condenser between the needle and the film.

3. The apparatus of claim 1 wherein said recording medium comprises a single membrane.

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