

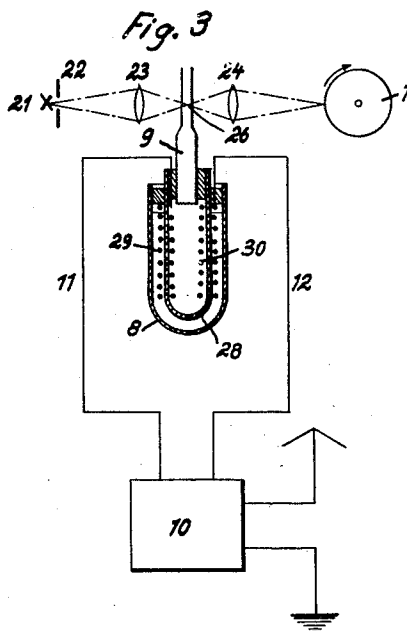
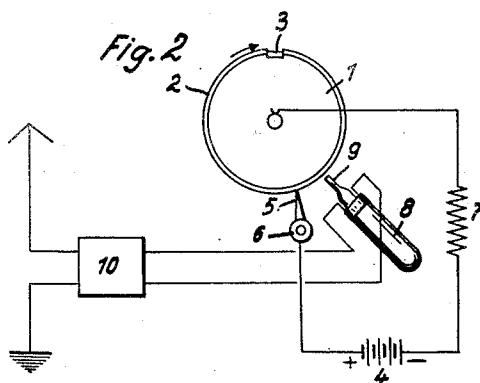
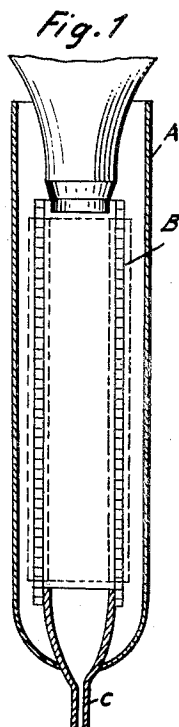
March 17, 1931.

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1,796,584

METHOD OF AND APPARATUS FOR RECORDING ELECTRICAL SIGNALS

Filed Jan. 10, 1930



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METHOD OF AND APPARATUS FOR RECORDING ELECTRICAL SIGNALS

Application filed January 10, 1930, Serial No. 419,922, and in Germany January 24, 1929.

Various methods have been used for recording electrical signals, for instance in telegraphy, in the transmission of pictures, and other recording at a distance, but all are unsatisfactory or complex particularly when they have to deal with the reception of short current impulses in rapid succession.

The present invention includes a new method which consists in employing the current impulses directly in an electro-osmotic apparatus for impulsive delivery of a liquid. The advantages of this arrangement include extremely small inertia, small consumption of energy, and simplicity. The liquid may be coloured or the sheet, for instance of paper, which receives it may be impregnated with substances which give a suitable coloration when dampened with the liquid impelled by the current.

An apparatus working upon this method is illustrated in Figure 1 of the accompanying drawings. Within a glass tube A is arranged an unglazed earthenware tube B which is fitted both inside and outside with electrodes of wire gauze connected with the receiving circuit. Both tubes are filled with a suitable fluid such, for instance, as water or methyl-alcohol. The earthenware tube tapers to a writing point C past which the record sheet (not shown) is drawn. A current impulse causes liquid to pass by electro-osmosis into the earthenware tube and through its writing point.

When at rest the liquid is at the same level on both sides of the diaphragm B. An impulse of current forwards liquid electro-osmotically from the glass vessel A into the earthenware tube B. The level of the liquid within the tube rises even when the current is intermittent; for the backward flow of liquid during an interruption of the current is small compared with the amount introduced electro-osmotically because the difference of pressure driving it is small and the friction in the pores of the earthenware diaphragm B is considerable. Liquid issues from the point in small amounts timed to the current impulses and corresponding in quantity to their strength, and this is trans-

ferred in any suitable fashion to the paper strip moving past the point.

Since there is no electro-osmotic effect in electrolytes and dissociated dye solutions there is some difficulty in directly colouring the receiving strip by the aid of the issuing fluid or setting up a secondary reaction which will cause a coloured deposit. To achieve this purpose inks or electrolytically conducting fluids would be necessary. On the other hand the electro-osmotic effect is especially marked with pure fluids or mixtures of fluids such as water and methyl-alcohol. Further development of the invention makes use of this fact by employing the electro-osmotic control device merely for dampening the recording or receiving surface with the fluid issuing from the jet or writing point, and so producing at spots corresponding with the signals or picture elements to be recorded a conductive path for a local current. This local current can then transform the dampened spots (the paper being suitably chemically prepared) into distinctly visible signal elements or a picture mosaic.

Figure 2 shows a construction of the invention for the transmission of pictures or other rapid recording. 1 is the rotating picture drum around which a dry band of prepared paper 2 is placed and secured upon the drum by the inlaid bar 3. The low frequency control impulses delivered by the receiver 10, which correspond with the picture elements transmitted, are led to the electro-osmotic control device 8. From its writing point or jet 9 small drops of liquid issue in time with the arriving signals and these reproduce the original picture upon the paper band 2 as a mosaic of dampened and undampened spots. For this purpose the cell 8 may contain water with a small addition of methyl-alcohol or the like. After passing the dampening zone the picture is carried through a colouring zone where a conducting pencil 5 operates. This is included in the circuit of a local battery 4, the circuit extending from the positive pole, through the pencil 5, a damp spot on the picture surface 2, the conducting drum 1 and the current limiting resistance 7, to the negative pole.

At all spots dampened by the action of the cell 8 the current passing acts electro-chemically to produce the desired colour reaction which results in a light and shade mosaic picture. Thus the latent dampened area is, as it were, converted into a visible contrast picture, in which even differences of tone may be indicated as the result of the different degrees of dampening of the paper band.

The pencil 5 and cell 8 must of course be moved longitudinally along the drum in order that they may follow a spiral line upon it; such motion may be communicated in known manner by a feed shaft indicated at 6.

According to a further development of the invention the same electro-osmotic device is used for controlling a beam of light. For this purpose suitable optical means are employed to focus the beam upon the liquid column so that the column can affect the intensity of the light by shutting it off or by employing the phenomenon of reflection, diffraction or refraction. A suitable arrangement is shown in Figure 3. The beam from a source of light 21 is limited by a diaphragm 22 and an image of the diaphragm aperture is formed in the tube 26 by a lens 23, the image lying immediately above the meniscus of the liquid. A lens 24 focuses such light as passes upon the rotating recording drum 1. In the vessel 8 there is a porous cell 28 with interior and exterior electrodes 29 and 30 to which the low frequency output circuit of the receiver 10 is connected by lines 11 and 12. The low frequency current impulses which the receiver 10 delivers, and which correspond with the telegraph signals or picture elements transmitted, cause an intermittent rise and fall of the liquid level, which correspondingly cuts off the beam of light from, or lets it pass to, the receiving surface. The liquid may be made coloured so that it is opaque. Or substances which disperse the light may be added to it so that the light encountering the column is diffused instead of reaching the drum. As a rule refraction and reflection suffice to control the intensity of the light upon the receiving surface.

What I claim is:—

1. A method of recording electric signals which consists in employing the transmitted current impulse to produce an electro-osmotic displacement of liquid and causing said displacement to be recorded.

2. A method of recording electric signals which consists in employing the transmitted current impulse to produce an electro-osmotic displacement of liquid and thereby to eject said liquid upon a record surface.

3. A method of recording electric signals which consists in employing the transmitted current impulse to produce an electro-osmotic displacement of liquid and thereby to eject said liquid upon a chemically treated record

surface, and subsequently passing current through parts of said surface so moistened to bring about its coloration.

4. A method of recording electric signals which consists in employing the transmitted current impulse to produce an electro-osmotic displacement of liquid in the path of a beam of light directed upon a record surface.

5. Apparatus for recording electric signals comprising an electro-osmotic cell receiving the signal impulses, and a jet communicating with said cell and delivering liquid upon a record surface.

6. Apparatus for recording electric signals comprising an electro-osmotic cell receiving the signal impulses, a jet communicating with said cell and delivering liquid upon a record surface which is thereby made conductive at the point of delivery, a local source of current, and a circuit connecting said local source with opposite sides of the record surface.

7. Apparatus for recording electric signals comprising an electro-osmotic cell receiving the signal impulses, a jet communicating with said cell, a chemically treated record surface adapted to be rendered conductive by the liquid of said cell, means for traversing said surface past said jet, means for passing current through said record surface where rendered conductive and thereby causing chemical coloration.

8. Apparatus for recording electric signals comprising an electro-osmotic cell receiving the signal impulses, a liquid column communicating with said cell, a light-sensitive record surface and means for traversing the same, and means for projecting a beam of light upon said surface in close proximity to the surface of said liquid column.

9. A method of recording electric signals which consists in subjecting a liquid having an extremely low conductivity to electro-osmosis by means of a current impulse due to the signal whereby said liquid becomes displaced, and causing said displacement to produce a record.

In testimony whereof I have signed my name to this specification.

MAX VOLMER.