March 21, 1939. K. GENSCHMER 2,151,638

RECORDING INSTRUMENT

Filed July 20, 1938

Fig. 1.

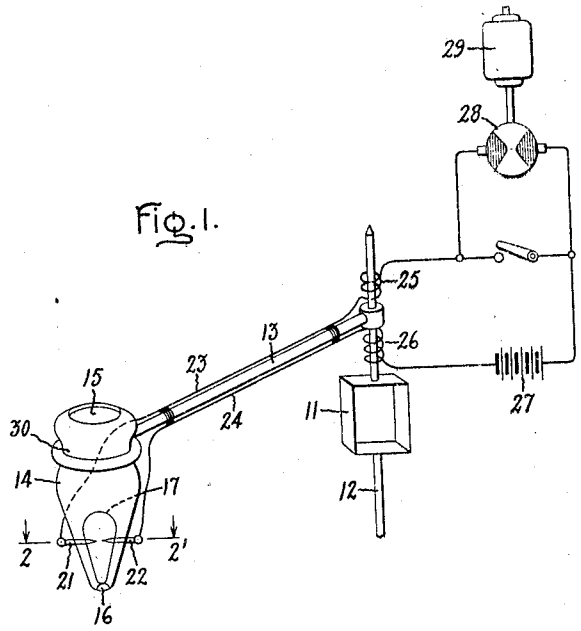


Fig. 2.

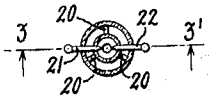
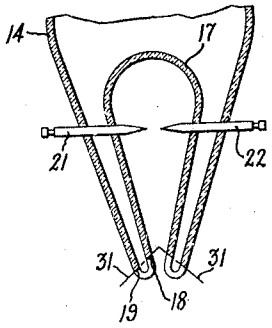


Fig. 3.



Inventor:
Kurt Genschmer,
by Harry E. Dunham
His Attorney.

Search Roc

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UNITED STATES PATENT OFFICE

2,151,638

RECORDING INSTRUMENT

Kurt Genschmer, Berlin-Bohnsdorf, Germany, assignor to General Electric Company, a corporation of New York

Application July 20, 1938, Serial No. 220,403
In Germany July 30, 1937

3 Claims. (Cl. 120—43)

My invention relates to recording instruments and concerns particularly improved marking arrangements for such instruments and methods for producing marking members.

It is an object of my invention to provide a marking arrangement for a recorder which overcomes friction by eliminating contact between the marking member and the moving chart.

It is a further object of my invention to provide a marking arrangement which may be utilized with a highly sensitive instrument and which produces clear, legible records.

It is also an object of my invention to provide a recording instrument combining the advantages of ink type and spark type recorders.

Other and further objects and advantages will become apparent as the description proceeds.

The invention may be understood more readily from the following detailed description when considered in connection with the accompanying drawing, and those features of the invention which are believed to be novel and patentable will be pointed out in the claims appended hereto. In the drawing Figure 1 is a schematic diagram partially in perspective representing one embodiment of my invention. Figure 2 is a view of a cross section of the marking receptacle of Figure 1 cut by the plane 2—2', and Figure 3 is a fragmentary view of a longitudinal section of the marking receptacle cut by plane 3—3' indicated in Figure 2, and illustrating the method of manufacturing a marking receptacle. Like reference characters are utilized throughout the drawing to designate like parts.

In Figure 1 a sensitive recording instrument is represented by its moving element 11, which may be a current carrying coil, for example, and is mounted upon a shaft 12 co-operating with bearings, not shown. The shaft 12 carries also a pointer arm 13 at the end of which is supported a marker 14 in the form of a receptacle for suitable marking material, such as ink. The ink receptacle 14 is in the form of a small tapered glass or a bottle having a filling mouth 15 at the upper end and an orifice 16 at the lower tapered end for depositing marking material. In the lower tapered end of the receptacle 14 a re-entrant wall or hollow bulb 17 is provided having an opening 18, the edge of which is adjacent and substantially within the edge 19 of the lower end of the receptacle 17 (see Figure 3). The wall of the inner bulb 17 and the portion of the outer wall of the receptacle 14 adjacent the edges of the openings 18 and 19 together form a substantially annular orifice represented by numeral 16 in Figure 1. I have found the operation to be improved by having the edge of the opening 18 slightly higher than the edge 19 of the receptacle 14. The bulb 17 may be secured by means of rods 20 (see Figure 2) extending to the outer wall of the receptacle 14.

Means are provided in the hollow space within the re-entrant wall or bulb 17 to produce repeatedly sudden expansion of the air within the hollow space, for example, by ionization. Such means may consist of a pair of electrodes 21 and 22 projecting into the hollow space within the bulb 17. A pair of conductors 23 and 24 are provided which are connected to the electrodes 21 and 22 at one end and are carried along the arm 13 to a suitable source of current. To prevent interference with the deflection of the coil 11 a pair of loosely and oppositely wound helices or spirals 25 and 26 may be provided through which the wires 23 and 24 are connected to a suitable electric energizing circuit. The energizing circuit may consist of a source of current such as a comparatively high voltage battery 27 in series with which an intermittent make-and-break contactor 28 is provided. The make-and-break contactor 28 may take the form of a commutator driven by a constant speed motor 29.

The receptacle 14 for marking material may be composed of a suitable non-corroding viscous material which is rigid at normal temperatures and may be softened at elevated temperatures for the purpose of manipulation, such as glass, for example. The receptacle 14 may be blown from a globule of glass which has been inflated and drawn out to a tapered point approximately in the shape shown. Thereupon, the neck 30 may be formed by softening the material and pressing inward as the receptacle is being rotated in accordance with the common practice known to glass blowers. Likewise, the filling mouth 15 may be formed in the upper end of the receptacle in the usual manner after breaking away from the glass-blower's tube. The re-entrant wall or hollow bulb 17 may be formed by sealing off the lower end of the receptacle by fusion, for example, and while the material is soft, blowing the end of the receptacle inward, for example, by slipping a suction tube over the filling mouth 15. While the material is sufficiently soft, the electrodes 21 and 22 may be inserted in place. If the electrodes 21 and 22 seal suitably to the glass it may not be necessary to provide the rods 20 for holding the bulb 17 in place. The orifice 16 is formed after the wall 17 has been blown inward by cutting off the lower end of the re-

ceptacle 14. This may be done by fusion or any other suitable process. Preferably the edges of the material are so cut as to lie along the cone 31 represented in Figure 3. This makes the edges of the opening 18 of the bulb 17 slightly higher than the edges 19 of the main walls of the receptacle 14, but substantially concentric therewith.

The method of operation of the apparatus will be apparent from the foregoing description as the rotation of the commutator 28 will cause the application of voltage repeatedly to the electrodes 21 and 22, thereby repeatedly ionizing the air in a hollow space within the bulb 17. Each time the air is ionized it expands suddenly causing the expansion of ink or other marking material which has collected at the orifice 16 and across the opening 18 in the bulb 17 and which is held there by capillary attraction and surface tension. It will be understood that the orifice 16 is carried adjacent the surface of a record chart, not shown, and the ink expelled from the orifice 16 is deposited on the record chart in fine, rapidly drying dots which may be placed very close together upon the record chart so as to form a substantially continuous record curve.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention together with the apparatus which I now consider to represent the best embodiment thereof but I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A marking arrangement for recording instruments comprising a receptacle for making fluid and a pair of spark electrodes, said receptacle having an annular orifice and having a re-entrant wall forming a hollow space, the inner edge of said annular orifice being set in from the outer edge of said annular orifice and forming an outlet opening for said hollow space, said electrodes extending into said hollow space and forming a spark gap therein.

2. A marking arrangement for recording instruments comprising a receptacle for marking material with an opening therein, a bulb within said receptacle having an opening adjacent and substantially within said receptacle opening whereby a substantially annular orifice is produced for said receptacle and means within said bulb for producing sudden expansion of air therewithin and expulsion from said orifice of marking material there collected.

3. A method of making an ink receptacle for a recording instrument comprising forming a glass receptacle with a closed tapered end, softening such end of the receptacle, blowing it inward to form a hollow bulb within the receptacle, fastening the bulb within the receptacle and cutting off the material at the end of the receptacle and the bulb to form an annular orifice in the receptacle.

KURT GENSCHMER.