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RECORDING SYSTEM

Filed May 19, 1955

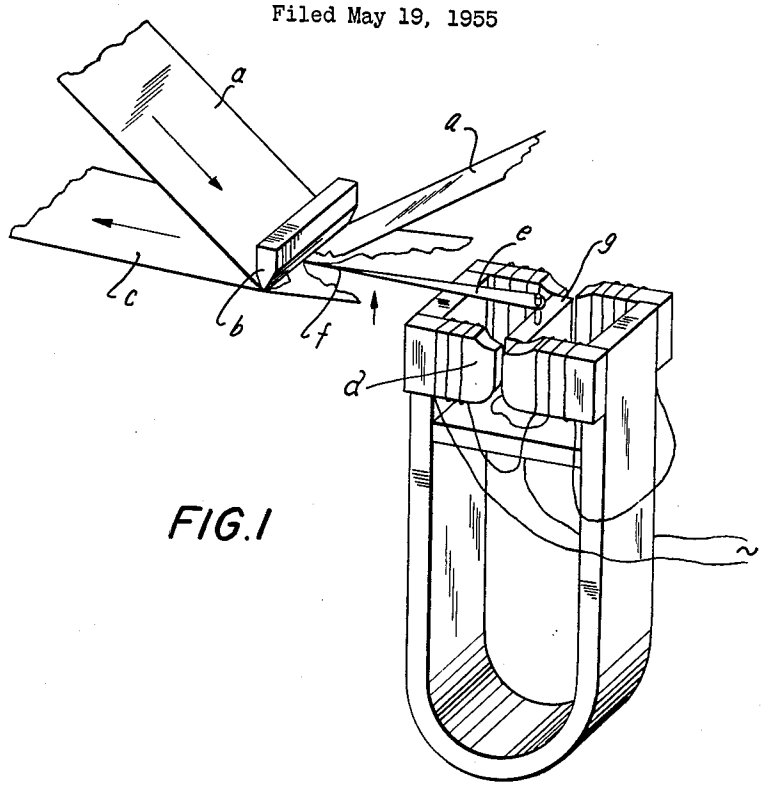


FIG. 1

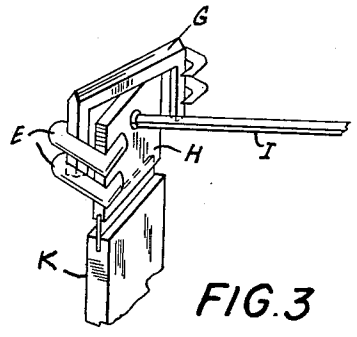
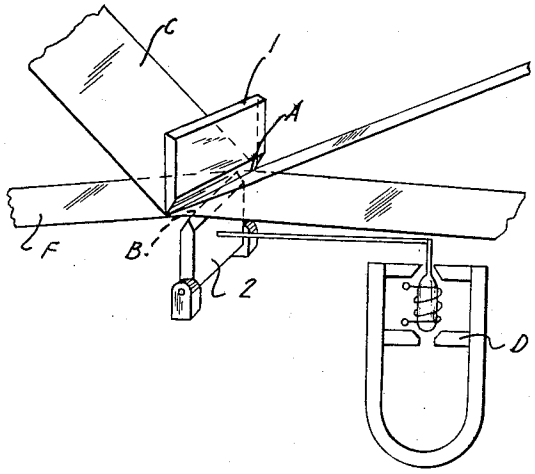


FIG. 3

FIG. 2



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RECORDING SYSTEM

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The present invention relates to a recording system for registering oscillations and the like, by means of which graphs may be recorded on a moving strip-shaped record medium. As a known system of this type the so-called ink recorder may be mentioned. The advantage of such systems as compared to oscillographic recording with photographic evaluation lies, as is well-known, in a considerable simplification of the whole manipulative process. However, the ink recorder, too, is operated in a relatively complicated way. Furthermore, operating with writing ink involves disadvantages because of the necessary handling of the ink which may be spilled and smeared. Other disadvantages are the following: The recordings form relatively thick lines or, when very fine capillaries are used, incorrect results are obtained. Furthermore, conventional recorders do not obtain a linear but only an arcuate recording, since a design which is sufficiently simple for practical purposes always operates with angularly oscillating recording pointers. Besides, the upper frequency limit is substantially narrowed partly by the weight of the oscillating parts, partly by the ink.

The present invention avoids all these disadvantages. This is accomplished by using solid coloring matter, for recording and by employing a device which is geometrically arranged in such a manner that an extraordinarily thin recorded graph is obtained and arcuate recordings are avoided. At the same time, the oscillating parts may be made so light that the upper frequency limit can be raised considerably. According to a further embodiment of the invention, the upper frequency limit is further raised by reducing the amplitude of the moving parts relative to the recording amplitude.

The following description refers to the drawing in which:

FIG. 1 is a schematic perspective view of one embodiment of the invention; FIG. 2 is a schematic perspective view of another embodiment; and FIG. 3 is a perspective view of a detail of a modified embodiment.

Referring first to FIG. 1, the strip of paper *a* which is the medium for the recording, is drawn by means of a conventional drive arrangement in a sharp angle across a knife edge *b*. A strip *c* having a layer of coloring matter, for example ordinary carbon paper, such as is used for making copies on a typewriter serves as a medium for marking the recording medium *a* and is also passed across the knife edge *b* under the recording strip and preferably in the opposite direction, but in an nearly stretched condition, so that it slides past the recording strip *a* while being slightly pressed against it. The recording arm *e* which is controlled by an electromagnetic system *d* is urged against the carbon paper *c* with a slight pressure. At the point opposite to the knife edge *b* the recording arm *e* also carries an edge member *f* which accordingly oscillates approximately perpendicularly to the edge *b*. When the electromagnetic system *d* which is of a known design is excited and thus the armature turns about its axis *g*, the edge *f* will accordingly slide forth and back on the edge *b* and, on the point of contact, will press the marking strip *c* against the recording paper at the point of contact where crossing edge *b*. According to the sharpness of the edges, a more or less thin line is obtained on the paper. All other structural elements of the arrangement, such as the driving device, the details of

the electromagnetic system etc., do not need any further description, since such devices are sufficiently well known. It will be easily understood by a person skilled in the art that the recording pointer which is the only element moving at a large amplitude may, by suitable selection of material and of appropriate dimensions, have but a minimum of mass which must be moved for the purpose of recording. Thus it is possible to record relatively large amplitudes with a small control force. The avoidance of arcuate recording lines follows from the use of the two straight edges, since the point of edge contact will be located on the chord of a circle drawn about the pivot point of the pointer *e*. With the small angles under consideration here, the resulting error in the proportionality of the amplitudes may be either neglected or avoided by suitably shaping the pole pieces of the recording system.

In order to further reduce the inertia of the oscillating mass, which depends on the moving mass *m* and on the speed of movement V in accordance with the formula

$$\frac{mV^2}{2}$$

the speed of the moving edge is reduced in the embodiment of FIG. 2. Since V is quadratic members of the formula expressing inertia, its decrease is especially effective. This principle is employed in the embodiment illustrated in FIG. 2. The edges A and B of two members cross, edge A being exactly perpendicular to the direction of advance of the recording strip C. The strip of paper C is drawn in an acute angle across the edge A by means of a known driving device. Edge B is offset relative to edge A by a certain angle and is moved by a magnetic system D. The color ribbon F is drawn across the edge B by means of the driving device.

When the edge A is drawn a distance of several millimeters to the right by the effect of the electro-magnetic system D, the point of contact between the two edges travels from the shown center position toward the right to a much greater distance which depends upon the selected angle between the edges. Because of the slight pressure of the two edges against each other, the colored marking paper will thus leave a mark on the recording paper when moving. When the armature of electromagnetic means D is then shifted to the right, the contact point of the two edges will accordingly travel to the left. Thus by moving the edge A a small distance an enlarged registering amplitude is obtained, and the transmission ratio will depend upon the angle which is formed by the two edges. By means of suitable design it has become possible to make the edge member G shown in FIG. 3 mechanically so light that the abovementioned amplitude may be obtained with a relatively small actuating force at a higher frequency than obtained previously. In addition thereto, a resilient pressure between the edges is effected according to the invention as is shown in FIG. 3. The edge member G has the shape of a U. At the legs it is fixed by parallel members E to a supporting part H which is oscillated by a connecting rod I and turned about a spring lamella located in the center of rotation and mounted on a support K. Thus, as a consequence of the small mass of the edge member G, a sufficiently high natural frequency is assured at a small controlling force.

In practice it is possible to realize a recording amplitude of about 20 mm. with an edge amplitude of ±2 mm. This means that the movable mass needs to oscillate at only one tenth of the amplitude of a system according to FIG. 1. This in turn means that, at the same frequency and the same amount of power the mass of the movable system may be a hundred times the mass of the system according to FIG. 1. It will be easily understood that a hundred times the mass is by no means re-

quired for the movable parts of the system according to FIG. 3 so that the resulting difference may be employed for raising the frequency limit.

Within the scope of the present invention a large number of variations as to distribution in space etc. can, of course, be made. For example, the system of the invention is especially suited for recording on self coloring wax paper. When recording with carbon paper one may, for the purpose of economy, considerably raise the speed of the carbon paper with regard to the speed of the record paper. In this case the movement in opposite direction may be foregone, since the sufficient mutual friction is obtained already by the difference of the rate of movement. Instead of the described electromagnetic system, which is preferably employed, one can also use an electrodynamic system, e.g. similar to that used for ink recorders or to that of electrodynamic loudspeakers. Likewise, the pointer may be driven by non-electric systems, such as pressure sensitive boxes or bi-metal-compensators. All these combinations and modifications are within the scope of the present invention, provided that they use the basic principle of the invention.

What I claim is:

1. A recording apparatus comprising, in combination, a fixedly mounted first member having an edge portion; a second member having a portion movably arranged adjacent said edge portion of said first member and being normally urged towards said edge portion; a recording medium; means for moving said recording medium past said edge portion in a given direction transverse to said edge portion and with a given velocity between the same and said movable portion of said second member; medium marking means; means for moving said medium marking means past said edge portion between the same and said movable portion and in a direction opposite to said given direction and being urged toward said edge portion and said recording medium by said movable portion of said second member at least at contact point along said edge portion whereby said medium marking means marks said recording medium at said contact points.

2. A recording apparatus comprising, in combination, a first member having a substantially lineal edge portion;

a second member having a portion movably arranged adjacent said edge portion of said first member and being normally urged towards said edge portion; a recording medium; means for moving said recording medium past said edge portion in a given direction transverse to said edge portion and with a given velocity between the same and said movable portion of said second member; medium marking means; means for moving said medium marking means past said edge portion between the same and said movable portion in a direction opposite to said given direction and with a velocity different from said given velocity and being urged toward said edge portion and said recording medium by said movable portion of said second member at least at a contact point along said edge portion whereby said medium marking means marks said recording medium at said contact point.

3. A recording apparatus comprising, in combination a first member having a first lineal edge portion; a second member having a second lineal edge portion and arranged adjacent said first member and being normally urged toward said first member so that said lineal edge portions thereof contact each other at a contact point, said second member being movably arranged with respect to said first member so that said contact point between said edge portions moves along the same when said second member is moved; a recording medium; medium marking means; and means for moving said recording medium and said medium marking means past said members between said lineal edge portions thereof whereby said recording medium and said medium and said medium marking means are urged together at said contact point between said lineal edge portions so that said recording medium is marked at said contact point.

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