

[72] Inventor **Miron Padowicz**  
 Kohlfurter Str. 41-43, Berlin 36, Germany

[21] Appl. No. **31,676**

[22] Filed **Apr. 24, 1970**

[45] Patented **July 6, 1971**

[32] Priority **Dec. 24, 1969**

[33] **Germany**

[31] **G 69 50 517**

3,496,641 2/1970 Mills..... 33/27 L

*Primary Examiner*—Harry N. Haroian  
*Attorney*—Karl F. Ross

[54] **APPARATUS FOR TRACING RANDOM GEOMETRICAL FIGURES**  
 10 Claims, 6 Drawing Figs.

[52] U.S. Cl. .... 33/27 L

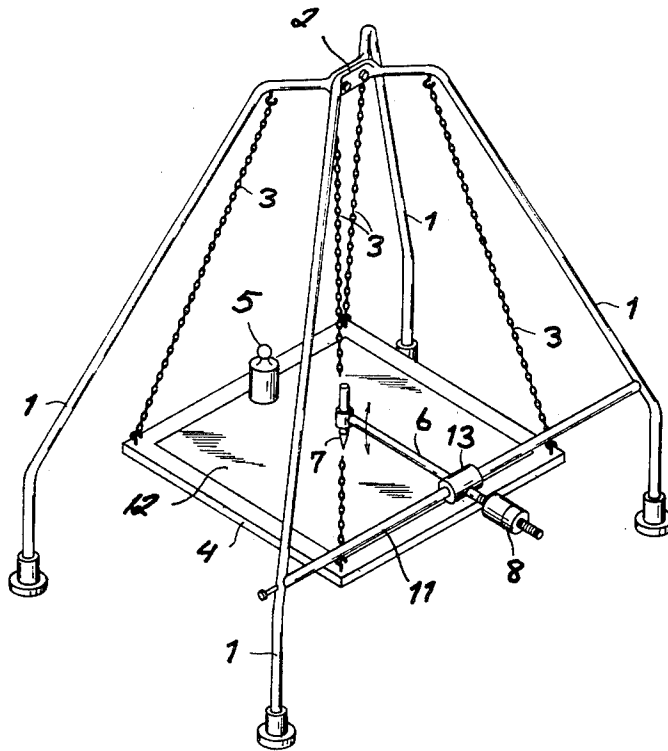
[51] Int. Cl. .... B43I 11/06,  
 B43I 9/20

[50] Field of Search ..... 33/27

[56] **References Cited**  
 UNITED STATES PATENTS

898,599 9/1908 Pearce..... 33/27 L

**ABSTRACT:** A flat support, suspended at three or more points from a frame so as to be freely swingable in two dimensions, carries a sheet on which a marker pen or other drawing tool bears under light pressure. When the support is set in eccentric motion with reference to the polygon of its suspension points, as by being laterally displaced along a line offset from the center of that polygon, it carries out a generally elliptical rotation about the suspension axis at a rate corresponding to its natural frequency and with a certain precession whereby a variety of convoluted figures can be drawn on the sheet by the stationary tool. The variety may be enhanced by eccentrically loading the support, or by placing the sheet on a motor-driven turntable mounted on the support.



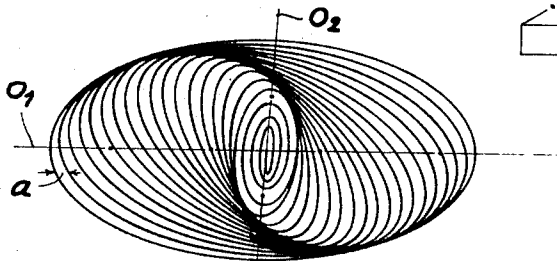
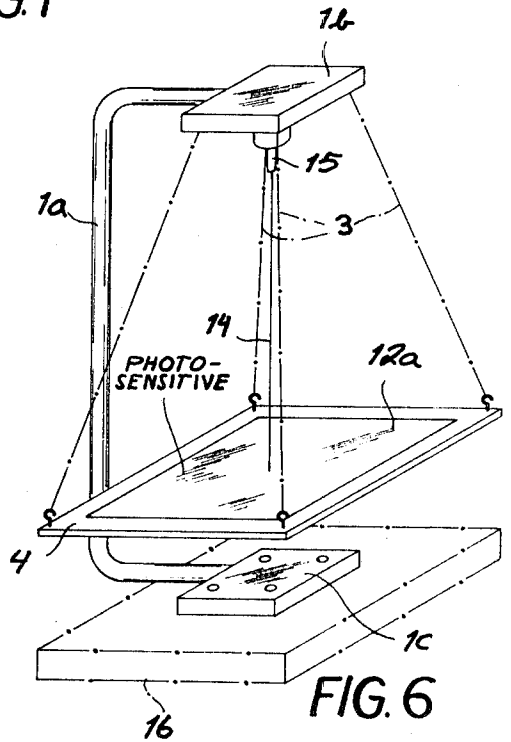
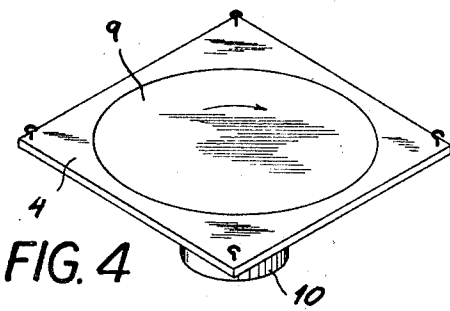
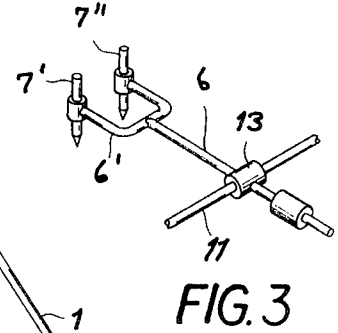
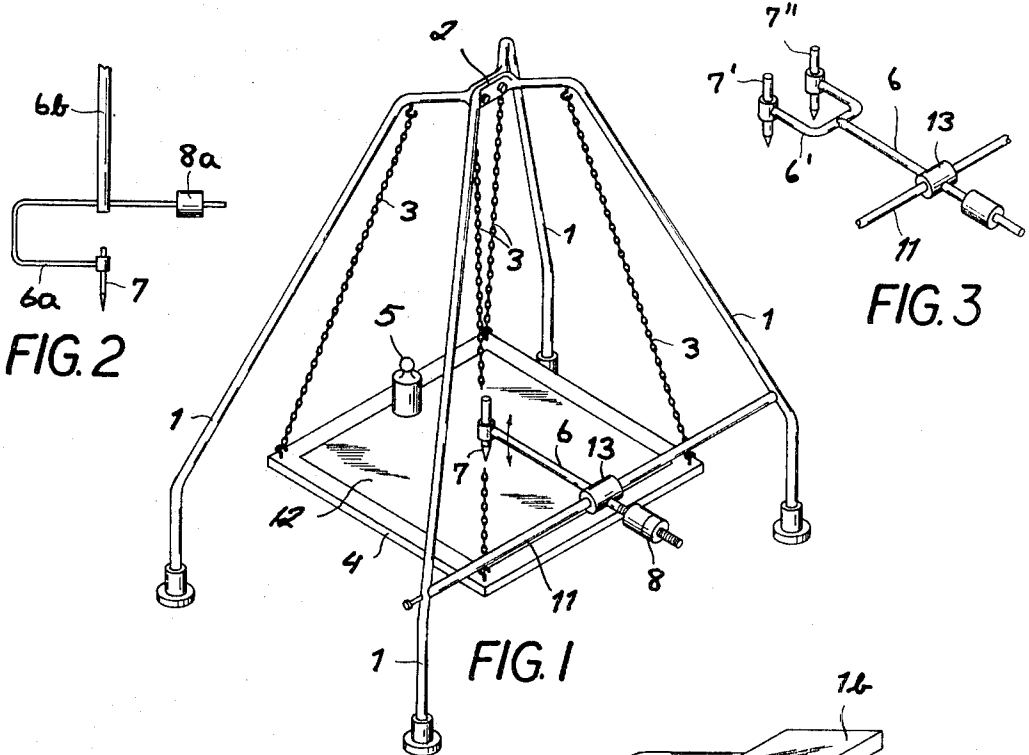


FIG. 5

Miron Padowicz  
INVENTOR.

BY

Karl G. Ross  
Attorney

## APPARATUS FOR TRACING RANDOM GEOMETRICAL FIGURES

My present invention relates to an apparatus for tracing random geometric figures, of convoluted shape, for the purpose of amusement or for the creation of esthetic effects.

The general object of my invention is to provide an apparatus of this type which, without appreciable effort on the part of the user, will draw a virtually infinite variety of designs on a sheet of paper or other marking surface.

A more specific object is to provide an apparatus for the tracing of figures which, without following an exactly predictable or reproducible pattern, may have selected basic configurations imparted to them by the skill of the user.

I realize the aforesaid objects, in accordance with the present invention, by the provision of a generally planar support for a marking surface which is substantially horizontally suspended from a frame on three or more points defining a triangle, rectangle or other polygon, the members of the frame being sufficiently spaced from the support to let the latter swing freely in two dimensions in a damped periodic motion about the center of the polygon. A tracing implement, such as a pencil or a marker pen, is mounted on the frame in a more or less fixed position, usually with freedom of limited vertical displacement to bear under light pressure upon the marking surface; for this purpose the pin or other drawing tool may be carried on a swingable or resiliently deformable holder which, in an advantageous embodiment, is an arm pivoted on a horizontal cross brace of the frame and provided with a counterweight nearly balancing the weight of the tool. The principle of my invention may also be realized, however, without physical contact between a tracing or scribing implement and a marking surface, as with a point source of light whose beam is trained upon a photosensitive film which is subsequently developed.

When the user displaces the suspended support from its quiescent position and then releases it with a slight push in a direction offset from the center of the polygon, the support will revolve about that center in a generally elliptical and progressively decreasing orbit with a certain precession whereby a multiplicity of convolutions of progressively changing radius and orientation are traced on the marking surface. If the color of the marking tool is varied during the swing, or if the same procedure is repeated with differently colored implements, a multicolor pattern of artistic merit will be produced. Naturally, two or more drawing tools of the same or different colors may be simultaneously trained upon the marking surface. A further dimension, as it were, may be added to the resulting picture if the marking surface is rotated on its support, independently of the swing of the latter, by a continuously or intermittently driven turntable.

The frame, which advantageously is collapsible or bolted together for quick disassembly, may comprise four legs positioned generally in line with the diagonals of a rectangle defined by the suspension points of the support. This construction allows the support to be swung out between any two adjoining legs and to follow a relatively wide orbit without striking the frame.

A certain asymmetry of the mounting and/or the weight distribution of the support and its load helps insure the eccentricity of the initial pendulum swing and therefore the two-dimensional excursion of the support from the suspension axis. Such an asymmetry can be brought about and altered at will, in accordance with another feature of my invention, by the simple expedient of eccentrically positioning a weight on the support surface or suspending it from its underside. Thus, the support could be made at least in part of ferromagnetic material whereby one or more relatively massive magnets can be readily attached to it at any number of locations.

The relationship between the mass of the load support and the effective length of its suspension system should be so related, according to the well-known pendulum law, that the natural frequency of the oscillating system is on the order of

one cycle per second, especially if the tracing element is a pencil, pen or other marker physically contacting a drawing surface. Fiber-tipped marker pens, which do not require much contact pressure, are particularly useful for this purpose. As the damping factor increases, the number of convolutions drawn by the apparatus in one continuous tracing operation is reduced; it is therefore desirable to make the contact pressure between the tool and the marking surface as low as possible.

My invention will be described in greater detail hereinafter with reference to the accompanying drawing in which:

FIG. 1 is an isometric view of an apparatus embodying the invention;

FIG. 2 is an elevational view of a modified tool holder for an apparatus otherwise similar to that of FIG. 1;

FIG. 3 is an isometric view of another modified tool holder;

FIG. 4 is an isometric view of a modified support, including a turntable, usable in the apparatus of FIG. 1;

FIG. 5 shows a tracing made by the apparatus of FIG. 1; and

FIG. 6 is a further isometric view illustrating another modification.

The apparatus shown in FIG. 1 comprises a preferably portable frame consisting of four bent legs 1 forming part of two frame halves which are bolted together at 2 and can be separated for transportation and storage. Suspended from the top of the frame, by means of highly flexible chains 3, in a plate-shaped support 4 for a sheet 12 of drawing paper. Though the support 4 has been shown as flat, it could also be given a slight (e.g. downwardly convex cylindrical) curvature.

The lower ends of the legs 1 are approximately aligned with the diagonals of the rectangular plate 4 in its quiescent state and are spaced sufficiently from the corners of that plate to allow the same to orbit with a large radius about the geometric center of the structure without striking any part of the frame. Two of these legs are spanned, at a level slightly higher than that of plate 4, by a cross brace 11 on which an arm 6 is freely pivotable with the aid of a sleeve 13 for limited oscillation in a vertical plane as indicated by an arrow A. Sleeve 13 is prevented by stops not shown from shifting laterally along the rod 11.

One end of arm 6, overlying the center of the quiescent plate 4, is fitted with a drawing tool 7 such as a nylon-tipped marker pen, the tip of this tool resting on the surface 12. A counterweight 8 on the opposite end of arm 6 is adjustable for the purpose of nearly balancing the weight of tool 7 so that the latter bears upon the sheet 12 with minimum pressure. The support 4 is shown eccentrically loaded by weight 5, e.g. of 100 to 2000 grams, which can be freely positioned thereon.

To start the tracing of a FIG., the user may first depress the projecting end of arm 6 to lift the marker 7 off the sheet 12 whereupon the supporting plate 4 can be displaced and released in the aforesaid manner. FIG. 5 illustrates a representative trace produced on the sheet by the marker 7, the convolutions of that FIG. being generally elliptical and of progressively decreasing radius with the spacing  $a$  determined by the above-described damping factor. It will be noted that these convolutions also undergo a precession, here clockwise, with the widest loops generally symmetrical about a major axis  $0_1$  and the narrowest loops converging on a major axis  $0_2$  substantially perpendicular thereto.

In FIG. 2 I have shown the tool 7 mounted on an elastic wire loop 6a balanced by a counterweight 8a, the loop being secured to a rigid vertical rod 6b centrally depending from the top of the frame. The contact pressure is here determined by the resiliency of the holder 6a and can be adjusted by varying the width of the loop.

In FIG. 3 I have shown two marking tools 7', 7'', e.g. of different colors, carried on a bifurcate extension 6' of arm 6.

FIG. 4 shows the supporting plate 4 fitted with a turntable 9 on the shaft of a motor 10 secured to the underside of the plate. A sheet of drawing paper, not shown in this Figure, is placed on that turntable to undergo continuous or intermittent rotation while being marked by the tool 7.

FIG. 6 illustrates the possibility of placing a photosensitive sheet 12a on the swingable plate 4 in the path of a beam of visible or invisible light 14 trained upon it from a frame-supported, stationary source 15. As further shown in this FIG., a modified frame 1a comprises a single yoke-shaped, preferably tubular standard terminating in an overhanging upper plate 1b and a confronting lower plate 1c, the former serving as an anchor for the suspension chains 3 whereas the latter can be bolted to the upper surface or the underside of a base such as a tabletop 16 (shown in phantom lines). Such a frame construction may, of course, also be used in the embodiment of FIG. 1.

Naturally, the suspension chains 3 could be replaced by cords, threads, thin wires and other sufficiently flexible links. These links 1 should be so designed as to attenuate any unwanted oscillatory spin of the supporting platform 4 about a vertical axis which may initially superimpose itself upon the generally elliptical revolution. For this purpose, the truncated pyramid defined by the links 1 should have a relatively broad minor base at the top, with sides preferably ranging in length between about one-half and one-fourth of the corresponding sides of the major base at the bottom and with an appreciable downward divergence of adjoining links. The angle included between any of these links and the vertical, with the system at rest, preferably lies between about 10° and 30°. This divergence stabilizes the platform against erratic swinging and causes it to tilt slightly from its horizontal position when off center so that the marking tool 7 is raised only slightly as compared with the vertical shift it would have to undergo with a parallelogrammatic suspension. The presence of one or more weights 5 increases the spin inertia of the system whereby the platform tends to revolve about the frame axis, as desired, rather than rate about its own axis; for the purpose of suppressing these gyrations, therefore, the weight or weights may be centered on the support unless they are also intended to deform the trace.

In a typical embodiment tested in practice, the chains 1 were 40 cm. long and were anchored to the frame at the corners of a rectangle measuring 12+8.5 cm.; the junctions between the links and the support 4 were the corners of a square with a side of 28 cm. The support, loaded at its center by a suspended weight, weighed about 1 kg. Such a system has a natural frequency of slightly more than 1 cycle per second.

It will be apparent that a tool holder similar to sleeve 13 could also be mounted on one of the legs 1 of FIG. 1, or on the single leg of frame 1a of FIG. 6, and that in this case the position of arm 6 would be horizontally adjustable by swinging about that leg so that the tool 7 could be moved out to register initially with the corners rather than the center of sheet 12, or with some intermediate location. Sleeve 13 of FIG. 1 may, of course, also be adjustably mounted on its rod 11 to enable the

tracing of eccentrically located Figures.

Finally, the links 3 could be made part of a continuous single chain, wire or cord, passing through four holes at the corners of platform 4 and through as many holes at the corners of upper plate 1b (FIG. 6), held in position by friction to allow for a levelling of the platform even in the presence of a not exactly horizontal frame-supporting surface.

I claim:

1. A tracing apparatus comprising a frame, a generally planar support for a marking surface suspended substantially horizontally from said frame by at least three flexible elements anchored thereto at points defining a polygon, said support being freely swingable in two dimensions, and a scribing implement mounted substantially fixedly on said frame above said support and trained upon said marking surface for producing random geometrical figures thereon upon execution of a damped periodic motion of said support about the center of said polygon.
2. An apparatus as defined in claim 1, further comprising eccentric loading means for said support.
3. An apparatus as defined in claim 1 wherein said scribing implement comprises a drawing tool with a yieldable holder exerting light pressure upon said marking surface.
4. An apparatus as defined in claim 3 wherein said holder comprises an arm limitedly oscillatable in a vertical plane.
5. An apparatus as defined in claim 4 wherein said arm is provided with a fulcrum at an intermediate point and carries said tool at one end, further comprising a counterweight near the opposite end of said arm nearly balancing the weight of said tool.
6. An apparatus as defined in claim 1 wherein said support is provided with a motor-driven turntable adapted to carry said marking surface.
7. An apparatus as defined in claim 1 wherein said frame comprises a plurality of legs interconnected at the top and spaced apart at the bottom, said support being suspended between said legs with substantial clearance therefrom.
8. An apparatus as defined in claim 7 wherein the number of said legs is four and said frame is substantially rectangular, said legs being generally aligned with the diagonals of the rectangle.
9. An apparatus as defined in claim 8 wherein a pair of adjoining legs of said frame are provided with a cross brace, said scribing implement being mounted on said cross brace with freedom of limited vertical displacement.
10. An apparatus as defined in claim 1 wherein said frame comprises an upright with a lower termination securable to a base and an upper termination overhanging said base, said elements being suspended from said upper termination.

55

60

65

70

75