Nov. 7, 1939. J. E. COOK 2,179,084

METHOD AND APPARATUS FOR ANIMATED AMUSEMENT DEVICES

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Fig. 1.

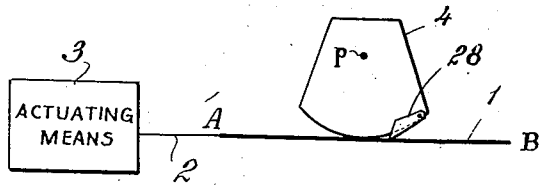


Fig. 2.

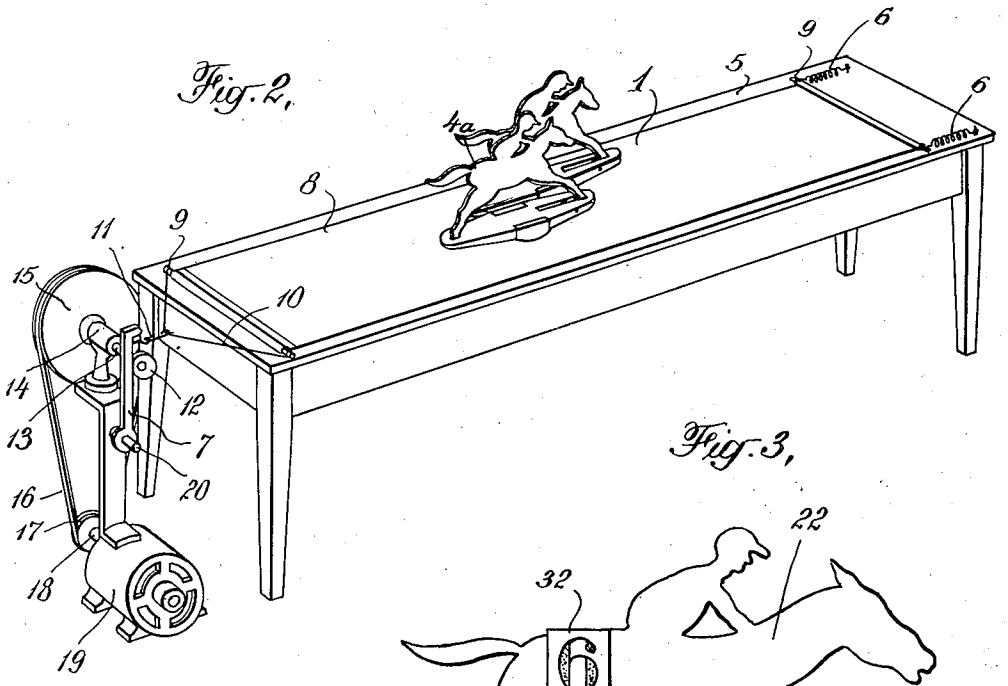
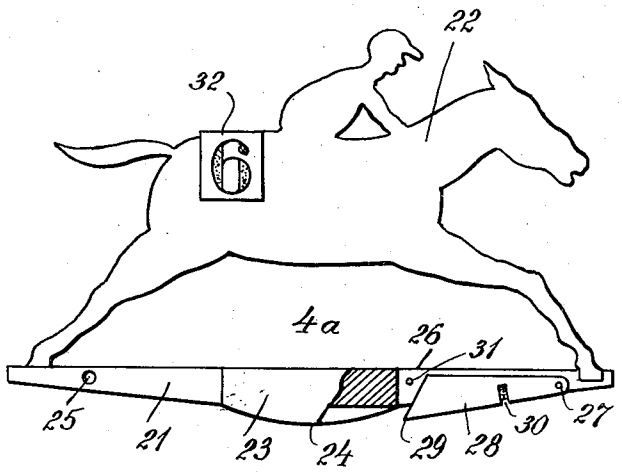


Fig. 3.



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METHOD AND APPARATUS FOR ANIMATED AMUSEMENT DEVICES

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16 Claims. (Cl. 273—86)

The invention relates to display and amusement devices and more particularly to that class of such devices which are commonly described as animated and in which the displayed objects are made to resemble and to have movements similar to or suggestive of the movements of living or mechanically mobile objects.

In the class of devices to which the present invention is addressed, numerous forms in which individual displays are directly actuated through a mechanical linkage by a motor device which may be either mechanical or electrical have been proposed and are in common use. Devices in accordance with my invention, however, differ from such directly actuated devices in that the displays are indirectly actuated and in that the motions which they acquire are determined in large measure by the construction of the displays themselves and by their mechanical nature. Thus, for example, a single actuating mechanism may produce numerous different motions of several different displays simultaneously, and the motions which any one display acquires will depend upon its mechanical properties.

In further contradistinction with respect to directly actuated display devices, a particular display in accordance with my invention will acquire different motions at different times, depending upon the relations of its own free motions to the motion which tends to be communicated from the actuating mechanism, so that in an embodiment of my invention I may have several displays each executing different motions at any one instant. Additionally, at any instant, I may have some displays moving relatively more rapidly than others, although at some later instant those that formerly were in relatively rapid motion may now be moving relatively slowly, and those that formerly moved relatively slowly may now be moving rapidly.

In accordance with the invention, the displays or pieces rest upon, but are not otherwise attached to, an oscillating or reciprocating surface. Each piece is therefore capable of motion relative to the surface. Additionally, each piece is constructed so that it may have an oscillating motion of its own, and includes one or more elements which are so mounted upon the piece that they may have certain motions relative to the piece. Through the coaction of these three motions, one of the surface, one of each individual piece as a whole, and one of an element attached to each piece, I secure an uncertainty as to the complete motions which will be communicated to each of the pieces by the oscillating surface. This is an essential feature and a principal advantage of my invention.

One advantageous and interesting embodiment of my invention simulates a race, for instance of horses, and I shall describe such an embodiment in connection with the detailed description thereof. Race games employing oscillating surfaces and having pieces capable of rocking motion on the surfaces, or having pieces not capable of such rocking motions but including fixed projections to engage the surface, have been previously proposed. In some of these earlier devices, motion of the pieces along the surface is secured by lack of symmetry in the motion of the surface, and is described as being due to impulse or momentum. In devices according to my invention, however, the motion of the surface is substantially symmetrical, so that any object having a smooth bottom placed upon the moving surface will remain substantially stationary. In other of the earlier devices, a symmetrical motion of the surface is employed, but the pieces are not arranged to have any motion except motion along the surface, and this is secured by fixed projections on their bottoms which continuously engage the surface to drive the pieces in one direction but not in the opposite direction.

In the earlier devices above referred to, in order to secure some variation in the motion of the pieces, which would otherwise move with great uniformity, obstructions are provided in or on the surface to impede the progress of the pieces along the surface. According to my invention, however, no such obstructions are employed, a much more natural and interesting irregularity in the progress of the pieces along the surface being secured by the construction of the pieces themselves, so that each receives irregular and varying actuation from the surface.

As pointed out above, I employ three different oscillatory motions. As will be more fully described hereinafter, it is essential that these three oscillatory motions be suitably related in frequency, in order that they may properly coact to secure the desired result. In the earlier devices above referred to, only one oscillatory or reciprocating motion is usually employed, and where two motions are employed they do not coact to produce any irregularity or variability in the progress of the pieces along the surface. Thus no question of the relation between the frequencies of plural oscillatory motions arises in these earlier devices.

It is an object of my invention, therefore, to provide a mechanical arrangement or system

which may be readily applied to a wide variety of display and amusement devices to produce simulations of numerous natural and mechanical motions with apparent irregularity of such motions through lack of any direct mechanical linkage to the common actuating means, yet with adequate if not complete control of such motions.

It is also an object of my invention to produce irregular motions of plural displays or pieces through coaction between the natural motions or any individual piece and of its elements and the driven and predetermined motion of the actuating means. It is similarly an object of my invention to produce different motions of each of several pieces from the motion of a single actuating means, or of plural actuating means.

These and other objects and advantages of my invention will be apparent from the following explanation and from the description of an illustrative embodiment of the invention taken in connection with the accompanying drawing, in which:

Fig. 1 illustrates certain mechanical principles employed in the invention;

Fig. 2 is a perspective view of a complete illustrative embodiment of the invention; and

Fig. 3 is a detail showing the construction of an individual piece of the type employed in the embodiment of Fig. 2.

Referring to Fig. 1, the line AB represents a surface 1, which may be horizontal, as shown, or may be inclined to the horizontal at any desired angle, within limits. To the surface 1, there is communicated through a link 2 from a driving or actuating means 3 a reciprocating motion. A body 4 rests upon or is arranged to bear against the surface 1 but is not fixedly attached thereto, the only connection being due to the friction resulting from its weight or that portion of its weight which is supported by the surface 1.

The body 4 is so constructed that it may rock or oscillate around a virtual center at the point *p*, which, in general, will be determined by the profile of its bottom. The frequency which the body 4 has in its rocking or oscillatory motion depends upon its weight and the distribution of that weight about the center *p* and both of these factors may be varied to control the natural frequency of the oscillatory motion.

The frequency of the reciprocating motion communicated to the surface 1 by the actuating means 3 may be readily controlled by choosing an electrical or mechanical motor having a certain speed and, if necessary, speed reducing or increasing belting or gearing to secure the desired speed. Additionally, if required, the motor may be provided with speed control by which its speed may be electrically or mechanically varied within limits to secure the desired relation between the frequency of the reciprocation of surface 1 and the natural frequency of the body 4.

It will be apparent that if the surface 1 is actuated at a frequency which is substantially identical with the natural frequency of the body 4, the latter will tend to oscillate or rock continuously around its center *p*, without, however, acquiring any motion in either direction along the surface 1. If the surface 1 be actuated at a frequency different from the natural frequency of the body 4, the latter will at first tend to oscillate about its center *p* synchronously with the surface 1 but will soon depart from such synchronism and may, after a certain interval of time, tend to momentarily come to rest.

If the surface 1 is a rigid surface it may be actuated entirely from one end as shown. If, however, the surface 1 is the surface of a piece of fabric or paper or other non-rigid sheet material, it will require to be driven from both ends and to be subjected to a sufficient tension to maintain it in mechanical closure with the driving means. The drive at one end, however, may consist only of one or more springs which tend to keep the surface in tension and therefore cause it to behave as a rigid surface.

Whether the surface be rigid or non-rigid, it will, for obvious reasons, require to be supported in the desired position by a suitable table or platform adapted to exert a minimum of frictional restraint upon its required reciprocating motion.

The reciprocating motion of the surface 1 is preferably sinusoidal in nature, that is, the surface 1 is preferably moved in such a way that it completes its forward and backward motions in equal times, its velocity in one direction, at any portion of its travel in that direction, being substantially the same as its velocity in the opposite direction, the surface 1 acquiring its greatest velocity in either direction at the center of its travel in that direction.

It will be apparent that if the motion of the surface 1 is such that its velocity in one direction reaches a value materially greater than its velocity in the opposite direction, a condition may exist in which any body in contact with the surface will tend to acquire a translatory motion in the direction of the slower movement of the surface 1, due to the fact that the more rapid motion of the surface 1 is of sufficient velocity to overcome the friction of rest between the body and the surface, and thus permit the surface 1 to move under the body without producing any appreciable motion thereof. Such non-sinusoidal motions have been previously employed in race games to secure motion of the pieces by "impulse" or "mometum," and are to be avoided in carrying out the preferred form of my invention. I do not wish to be limited, however, to purely sinusoidal motion of surface 1, a small deviation from the simplest motion being sometimes inherent in the selected actuating means. When, therefore, in the claims, I refer to reciprocating motions, it should be taken to mean motions which are of a sufficiently sinusoidal nature to secure the inherent advantages of such motions in a substantial degree.

Still referring to Fig. 1, the body 4 has a face or members in contact with the surface 1 of sufficient area or enclosing sufficient area so that when the surface 1 is not moving, the body 4 will be in stable equilibrium. This face is, or supporting members are, curved in the direction of motion of the surface 1 to permit the body 4 to oscillate, the construction preferably being such that the location of its center *p* does not change. Stated in other words, the center of curvature of the curved face at the bottom of the body 4 should preferably be the point *p*, the curved face or members being extended at either end in flat or less curving configuration, so as to restrain the oscillatory motion of the body 4 between definite limits.

Arranged in the body 4 there is a pawl 28, pivoted to swing freely in a plane at right angles to the surface 1 and parallel to the reciprocating motion of the surface, and so positioned and shaped that the pointed end thereof will engage the surface 1 when it is moving in one direction but will not engage when the surface 1 is moving in the opposite direction. The pawl 28 has a

natural frequency of its own relative to the other portion of body 4, and this frequency is determined by the size, shape and weight of the pawl and the point about which it is pivoted, and will, in general, be substantially higher than the frequency of the oscillating motion of the body 4 as a whole.

The frequency of the pawl may be varied by mounting it at the end of a spring member, or by merely designing it so that when it is thrown out of engagement with the surface, it will move upwardly and then downwardly in a suitable time interval, again coming into contact and possible engagement with the surface at the desired instant. In this last-mentioned arrangement, the time interval during which the pawl is out of contact with the surface will depend upon how violently the pawl is thrown upward by the motion of the surface, thus introducing another element of uncertainty in the performance of the piece.

By combining the effect of a difference in frequency between the body 4 and the surface 1 with the effect of a difference in frequency between the body 4 and the pawl 28, it is possible to secure a definite but varying tendency toward propulsion of the body 4 in one direction along the surface while it continues to oscillate more or less continuously about its center p during such translatory motion. It is to be noted that the body 4 will move in either direction along the surface 4 depending upon the position in which it is placed upon the surface, and may be caused to reverse its direction of translation by merely turning it around.

In order to insure translation of the body 4 along the surface 1 in a substantially straight line, it is preferable that its bottom be made in the form of curved rails or rockers, one at either side.

It will be apparent that each of these causes of motion above described is completely under control in the design of any practical embodiment of my invention, that each may be utilized in varying degree, and that the resultant actual motion of the body 4 is capable of great variation and apparent complication and may be made to simulate a great variety of intricate natural and mechanical motions.

It will be understood that plural bodies 4 may be placed upon, and will be simultaneously actuated by motion of the surface 1, and that, in general, each will be differently actuated, with the result that a most interesting and attention-arresting variety will be achieved. The plural bodies 4 may be closely alike, or they may differ from one another in design and decoration and in the free motions of which each is capable.

It will also be understood that each such body 4 may be a simple display, or may be an assembly of several parts some of which are arranged to have independent free motions different from the motions of the major portion of the display but actuated thereby.

From the above it will be clear that my invention provides a method for securing irregularity in the propulsion of the body 4 along the surface 1 by reciprocating the surface 1 sinusoidally, by causing the surface to oscillate or rock the body 4, and by effecting vibration of the pawl element 28 as a result of the combined effect of the reciprocating motion of the surface and the oscillatory motion of the body, so as to secure intermittent and irregular engagement with the surface. It will also be clear that these three motions, namely of reciprocation, of oscillation and of vibration, or at least two of them, are preferably of different frequencies in order to enhance the irregularity of propulsion of the body 4 along the surface 1.

Additionally it will be understood that while I have referred to the motion of the surface 1 as reciprocating, to the motion of the body 4 as oscillating and to the motion of the pawl element 28 as vibratory, each of these motions partakes of the nature of the others. It is true that the motion of the surface 1 is translatory motion, whereas the motions of the body 4 and of the pawl element 28 is best described as angular motion, but I use the words "reciprocation," "oscillation" and "vibration" and their corresponding adjectives discriminately in the interest of clarity, and I do not wish to be understood to imply any differences between the three motions other than those herein pointed out.

Referring now to Fig. 2 which illustrates a particular embodiment of my invention which I have chosen for illustrative purposes, 5 is a table or platform of length considerably greater than its breadth upon which is stretched between springs 6 at one end and a cam-follower 7 at the other end a webbing 8 having a top surface 1 upon which rests one or more bodies 4a each constructed to resemble a horse and jockey. It is apparent that the bodies 4a could equally well be constructed to resemble dogs or sailboats or motors cars or human runners or any of a number of other interesting and attractive objects, and that they may be suitably decorated by printing, lithographing, painting or in any suitable manner to heighten the resemblance.

The webbing 8 may be of any suitable material having a fairly rough surface. One material which has been found to be particularly suitable because of its freedom from stretch and its strength and light weight is the webbing commonly employed to cement together sections of carpet. At either end of the webbing 8 there is a rod 9 around which the end of the webbing is securely fastened, for example by stitching or cementing, and to which springs 6 at one end and a bridle 10 at the other end respectively are attached.

Bridle 10 connects through link 11 to cam-follower 7 which rides upon eccentric cam 12 and is kept in contact therewith by springs 6. Cam 12 is mounted upon shaft 13 which rotates in journals 14 and carries pulley 15 which in turn is driven by belt 16 from pulley 17 on the shaft 18 of motor 19.

Cam 12 as shown is a simple circular eccentric and therefore communicates to follower 7 a substantially sinusoidal motion since follower 7 is pivoted on spindle 20 which may be at some distance from shaft 13. One end of webbing 8 therefore receives a nearly sinusoidal motion. When webbing 8 is of considerable length, springs 6 must be adjusted to exert a suitable tension upon webbing 8, as otherwise the entire length of the webbing will not have a substantially sinusoidal motion, with the result that bodies 4 will move much more readily toward springs 6 than away from them.

It will be understood that instead of a cam, such as 12, a crank and connecting rod may be employed, with a rocker arm similar to cam-follower 7, or with suitable guides at the end of the connecting rod to which the webbing 8 is attached.

Referring now to Fig. 3, it will be seen that

body 4a of Fig. 2 comprises a base 21 and a jig-sawed horse and jockey of plywood 22 mounted in mortises in base 21. At either side of base 21 are small rockers 23 also of plywood and extending slightly below the base so that the body 4a rests upon their lower curved surfaces, 24. Base 21 extends beyond rockers 23 and therefore arrests the rocking motion of body 4a and maintains it between limits, so that the total angle through which body 4a may rock is only about 15°. Due to the irregular outline of horse and jockey 22, body 4a may require to be counterweighted with lead bars 25 so that when at rest upon a level surface, the top of base 21 will also be level.

Base 21 has a saw-kerf 26 in which rides on pin 27 a triangular pawl 28, preferably of metal, whose rearward end 29 is shaped to engage surface 1 of Fig. 2 more or less positively in one direction but to ride freely on surface 1 in the opposite direction. Pawl 28 is restrained in its contact with surface 1 by adjusting screw 30, so that during a portion of the rocking motion of body 4a it is lifted out of contact with surface 1. Pawl 28 is prevented from moving upwardly out of saw-kerf 26 by pin 31.

When plural bodies 4a are employed upon surface 1 of Fig. 2, each may be identified by number 32 which may be interchangeable and removably attached to body 4a. In an alternative construction the jockey is made removable and carries the identifying number.

At either end of webbing 8 of Fig. 2 a small platform, not shown, may conveniently be employed to hide the drive mechanism at one end and the springs at the other end, and upon which the bodies 4a may be placed when not in use. Along either side of table 5, a guard rail, not shown, may also be conveniently added, to prevent bodies 4a from being urged off of webbing 8 during their motions. This guard rail should preferably project slightly over the edge of webbing 8.

It will be apparent that by virtue of the various motions possible in accordance with my invention, bodies 4a will appear to gallop along webbing 8 of Fig. 2 as though it were track, and that due to the momentary and irregular combinations of the various motions, any one body 4a will proceed at varying speeds, sometimes rapidly and sometimes slowly, so that when several bodies 4a are employed a very realistic simulation of racing horses is achieved. Moreover, after bodies 4a have been allowed to traverse webbing 8 in one direction, they may be caused to return to the opposite end by merely turning them around.

In building an embodiment such as that shown in Fig. 2, it will be found convenient to make the webbing about two feet wide and twenty feet long. The throw of the cam 12 may be about three-eighths of an inch and this motion will be increased by the cam-follower 7 so that the actual motion of the webbing 8 will be approximately five-eighths of an inch. A smaller motion of the webbing may be employed if it is desired to have the displays 4a move more slowly along the webbing. The displays, constructed approximately as shown in Fig. 3, may be about 12 inches long and will travel the length of the webbing in about thirty seconds. The motor 19 may be of one-third horsepower and may run at 1750 revolutions per minute, with a four-to-one speed reduction through pulleys 17 and 15, so that the frequency of oscillation of the webbing will be approximately 437 per minute. Slower speeds may be employed, but any great reduction, say to as low at 200 per minute, may cause the displays to move bodily backward and forward with each oscillation of the webbing. Higher speeds may also be used but a limit is soon reached above which it becomes impossible, with reasonable power and a reasonable tension on the webbing, to produce uniform motion thereof throughout its length.

With regard to the frequency relations between the reciprocation of the webbing 8, the oscillatory motion of the body 4a, and the vibrations of the pawl 28, it should be noted first that these frequencies will normally not be, and should not be the same. If they differ by only a relatively small amount, for example, by 10 percent, the motions of the several displays or pieces along the webbing will be very irregular, and an adequate variability of the motions may be achieved with much greater differences between the three frequencies. Thus the frequency at which the pawl 28 jumps up and down as it makes contact with the reciprocating webbing may advantageously be from one-half to one-third the frequency of the motion of the webbing, and the frequency of oscillation of the complete piece 4a may be from one-fourth to one-eighth of the frequency of the motion of the webbing. Increasing either the weight or the dimensions of the complete piece 4a, or of the pawl 28, will lower their natural frequencies. For any particular pieces the speed of the driving motor, and consequently the frequency at which the webbing reciprocates, may be varied to determine the frequency which will produce the most desirable degree of variability in the motions of the pieces.

It will be understood that it is desirable to make the several pieces that are to be used in competition with one another as closely alike mechanically as possible, so that the only irregularity in their performance is caused by the novel construction in which three motions combine to produce variability.

For the pivoted pawl 28 there may be substituted a leaf spring member securely fastened to the body 4a at one end and free to vibrate into and out of contact and engagement with the webbing at the other end. This equivalent construction may be advantageous where the pieces are quite large. On the other hand, if the pieces are quite small it may be necessary to increase the weight of the pawl, by adding relatively heavy pieces of metal near its free end, in order to insure that it will make engaging contact with the webbing, and in order that its frequency will be sufficiently low relative to the frequency of reciprocation of the webbing. In general, the smaller the pieces the higher will be their natural oscillation frequency, and the higher will be the frequency at which the webbing may be operated.

By utilizing pawls 28 at either end of each piece 4a, a very short webbing may be employed and a very compact machine built. In this case, each piece is urged alternately but irregularly and variably forward and backward and will not move more than a small distance along the webbing in either direction in a reasonable interval of time. Thus if several pieces are started in alignment, as at the start of a race, they will soon begin changing positions, and, if the webbing is stopped after an interval, will be in an array similar to that existing at the end of a race. In this form, as in the simpler forms previously described, means for automatically stopping the motion of the webbing may easily be applied.

Those skilled in the design of display and amusement devices will at once perceive many new and equally interesting embodiments of my invention, since its possibilities are almost limitless. For example, surface 1, instead of being as shown in Fig. 2, may be a circular surface and may have angular reciprocating motion instead of rectilinear reciprocating motion. Similarly, surface 1 may consist of several portions some of which have rectilinear and some angular reciprocating motion so that bodies 4 may be caused to repeatedly traverse the complete surface in a manner similar to that achieved in the circular type just mentioned.

These and other possible forms are within the scope of my invention, which is to be taken as limited only by and to the extent indicated by the appended claims.

Having thus described my invention, what I claim is:

1. In combination, a surface, means for imparting to said surface a forward and backward reciprocating motion, and a body in contact with but otherwise free to move upon said surface, said body being of such configuration that it may have an oscillatory angular motion in a plane normal to said surface, and including an element arranged to vibrate in a plane normal to said surface and relatively to the remainder of said body and to intermittently engage said surface when in contact therewith and during the forward phases of said reciprocating motion, to urge said body in a forward direction, said motions being so related to said vibration as to produce a substantial variation in the forward motion of said body, said element comprising a pawl pivoted at the lower forward end of said body and extending rearwardly for approximately one-third the length of said body.

2. In combination, a surface, means for imparting to said surface a reciprocating motion, and a body in contact with but otherwise free to move upon said surface, said body being of such configuration that it may have an oscillatory angular motion in a plane normal to said surface and including a vibrating pawl pivoted at the lower forward end of said body and extending rearwardly for approximately one-third the length of said body and terminating in a point shaped to engage said surface during forward phases of the motion thereof whereby the reciprocating motion of said surface tends to produce translation of said body in a forward direction along said surface, said motions being so related to said vibration as to produce a substantial variation in the forward motion of said body.

3. In combination, a surface, means for imparting to said surface a reciprocating motion, and a body in frictional contact with but otherwise free to move upon said surface, said body including a vibrating pawl pivoted at the lower forward end of said body and extending rearwardly for approximately one-third the length of said body and terminating in a point shaped to engage said surface during forward phases of the motion thereof whereby the reciprocating motion of said surface tends to produce translation of said body in a forward direction along said surface, said motions being so related to said vibration as to produce a substantial variation in the forward motion of said body.

4. In combination, a surface, means for supporting said surface in a desired position, means for imparting to said surface a reciprocating motion, a body in contact with but otherwise free to move upon said surface, said body being of such configuration that it may have an oscillatory angular motion in a plane normal to said surface, and including a pawl pivoted at the lower forward end of said body and extending rearwardly for approximately one-third the length of said body and being of such configuration as to vibrate in a plane normal to said surface and relatively to the remainder of said body and to engage said surface when in contact therewith and during the forward portions of the said reciprocating motion, the frequency of said reciprocating motion being so related to the frequency of said oscillatory motion as to produce substantial variation in the forward motion of said body.

5. In combination, a surface, means for supporting said surface in a desired position, a body in contact with but otherwise free to move in at least one path upon said surface, said body being of such configuration that at least a portion thereof may have an oscillatory angular motion of a definite frequency with respect to said surface and in a plane normal thereto, and including an element arranged to vibrate relatively to the remainder of said body in a plane normal to said surface and to engage said surface when in contact therewith and during the forward portions of the said reciprocating motion, said element comprising a pawl pivoted at the lower forward end of said body and extending rearwardly for approximately one-third the length of said body, and means for imparting to said surface a reciprocating motion of frequency so related to the frequency of said oscillatory motion and the frequency of said vibratory motion as to produce substantial variation in the forward motion of said body.

6. In combination, a piece of sheet material, a table for supporting said sheet in a substantially horizontal position, an actuating mechanism for imparting to said sheet a substantially sinusoidal horizontal forward and backward reciprocating motion relatively to said table, and one or more bodies resting upon and supported by but otherwise free to move relatively to said sheet, each of said bodies including a pawl pivoted at the lower forward end thereof and extending rearwardly for approximately one-third the length thereof and terminating in a point adapted to lightly engage said sheet during forward phases of the motion thereof, for producing substantially continuous but appreciably varying translation of said body in the direction of the forward phases of the reciprocation of said sheet.

7. In combination, a piece of sheet material, a table for supporting said sheet in a substantially horizontal position, an actuating mechanism for imparting to said sheet a substantially sinusoidal horizontal reciprocating motion relatively to said table, one or more bodies resting upon and supported by but otherwise free to move relatively to said sheet, each of said bodies being constructed to permit oscillatory angular motion thereof in a vertical plane and each including a vibrating pawl pivoted at the lower forward end of said body and extending rearwardly for approximately one-third the length of said body and terminating in a point shaped to engage said sheet during forward phases of the motion thereof for causing said reciprocating motion to produce translation of said bodies in a forward direction along said sheet, said last-mentioned means being so related to said reciprocating and

angular motions as to produce substantial variation in the translation of said bodies.

8. In combination, a piece of sheet material, a table for supporting said sheet in a substantially horizontal position, an actuating mechanism for imparting to said sheet a substantially sinusoidal horizontal forward and backward reciprocating motion relatively to said table, one or more bodies resting upon and supported by but otherwise free to move relatively to said sheet, each of said bodies being constructed to permit oscillatory angular motion thereof in a vertical plane, and including an element arranged to vibrate relatively to the remainder of said body in a plane normal to said sheet and to engage said sheet when in contact therewith and during the forward portions of said reciprocating motion, said element comprising a pawl pivoted at the lower forward end of said body and extending rearwardly for approximately one-third the length of said body, the frequency of said reciprocating motion being substantially higher than the frequency of said oscillatory motion, said motions being so related to said vibration as to produce a substantial variation in the forward motion of said bodies.

9. In combination, a piece of sheet material, a table for supporting said sheet in a substantially horizontal position, an actuating mechanism for imparting to said sheet a substantially sinusoidal horizontal forward and backward reciprocating motion relatively to said table, one or more bodies resting upon and supported by but otherwise free to move relatively to said sheet, each of said bodies being constructed to permit oscillatory angular motion thereof in a vertical plane, and including an element arranged to vibrate relatively to the remainder of said body in a vertical plane and to engage said sheet when in contact therewith and during the forward portions of the said reciprocating motion, said element comprising a pawl pivoted at the lower forward end of said body and extending rearwardly for approximately one-third the length of said body, the frequency of said reciprocating motion being from four to six times the frequency of said oscillatory motion, said motions being so related to said vibration as to produce a substantial variation in the resulting forward motions of said bodies.

10. In combination, a piece of sheet material, a table for supporting said sheet in a substantially horizontal position, an actuating mechanism for imparting to said sheet a substantially sinusoidal horizontal forward and backward reciprocating motion relatively to said table, one or more bodies resting upon and supported by but otherwise free to move relatively to said sheet, each of said bodies including a pawl pivoted at the lower forward end of said body to freely move relatively to said body in a vertical plane and extending rearwardly of said body for approximately one-third the length thereof and terminating in a point adapted to engage said sheet when in contact therewith, and during the forward portions of said reciprocating motion, said motion being so related to the movements of said pawl as to produce said substantial variations in the resulting forward motions of said bodies.

11. In combination, a piece of sheet material, a table for supporting said sheet in a substantially horizontal position, an actuating mechanism for imparting to said sheet a substantially sinusoidal horizontal reciprocating motion relatively to said table, one or more bodies resting upon and supported by but otherwise free to move relatively to said sheet, each of said bodies including a pawl pivoted at the lower forward end of said body to permit vibratory angular motion thereof relatively to the remainder of said body and in a vertical plane, said pawl extending rearwardly of said body for approximately one-third the length thereof and terminating in a point adapted to engage said sheet during forward phases of the motion thereof, the frequency of said reciprocating motion being substantially higher than the frequency of said oscillatory motion, said three motions being so related as to produce substantial variation in the resulting forward motions of said bodies.

12. An animated race game including a track, a webbing upon said track, a motor and mechanism for imparting to said webbing a forward and backward reciprocating motion, plural pieces resting upon said webbing each shaped and decorated to simulate a mobile object, each shaped to permit said device to rock upon said webbing and each including a pawl pivoted at the lower forward end of said piece to vibrate freely in a vertical plane and extending rearwardly of said piece for approximately one-third the length thereof and terminating in a point adapted to engage said webbing when in contact therewith, and during the forward portions of the reciprocating motion thereof, said reciprocating motion, said rocking motion and said vibration being so related as to produce substantial variations in the resulting forward motions of said pieces.

13. In an animated amusement device, plural pieces each having length greater than width and a bottom curved in the direction of said length, and each including an element pivoted at the lower forward end of said piece and extending rearwardly of said piece for approximately one-third the length thereof and terminating in a rearwardly directed point, and means for intermittently engaging said points to propel said pieces in one direction parallel to their length, said means being so related to said pieces as to produce substantial variations in the resulting forward motions of said pieces.

14. In an animated amusement device, plural pieces each adapted to rock and each including a pawl pivoted at one end and near the bottom of said piece whereby said pawl is adapted to vibrate relatively to said piece, and means for causing said pieces to rock and said pawls to vibrate, said means being so related to said pieces as to produce substantial variations in the resulting forward motions of said pieces.

15. In an animated amusement device, plural pieces each adapted to rock and each including a pawl pivoted at one end and near the bottom of said piece and extending toward the other end of said piece for approximately one-third the length thereof, whereby said pawl is adapted to vibrate relatively to said piece, said pawl terminating in a point directed toward said other end of said piece, and means which intermittently engages said points to cause said pieces to rock and said pawl to vibrate and to thereby propel said pieces in a direction parallel to said rocking motion, said means being such as to produce substantial variations in the resulting forward motions of said pieces.

16. An animated amusement device comprising a horizontal track of length much greater than its width and having a surface member arranged to permit slight sinusoidal forward and backward lengthwise motion thereof, a driving mechanism

for imparting said motion to said surface at a rate of the order of ten oscillations per second, plural substantially identical pieces resting upon but otherwise free to move upon said surface, each of said pieces including a body extending vertically and lengthwise of said track when placed thereupon, curved members extending lengthwise of said body at the bottom thereof, and a pawl pivoted at the forward end of said curved members so that it may swing in a vertical plane and extending rearwardly of said piece for approximately one-third the length thereof and being so shaped at its rearward end as to tend to engage said surface only during forward motion thereof and to be thrown vertically upward and out of engagement with said surface during rearward motion thereof, said piece being of such configuration and weight that it tends to rock upon said curved members at a rate less but not greatly less than the rate at which said track surface is oscillated by said driving mechanism, and said pawl being of such weight and configuration that when thrown out of engagement with said surface it tends to return to and to reengage said surface after an interval greater than that corresponding to a single complete oscillation of said surface.

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