Feb. 23, 1954

O. C. BREWSTER

2,670,206

ROLLING-BALL RACING GAME

Filed July 13, 1949

Fig.1.

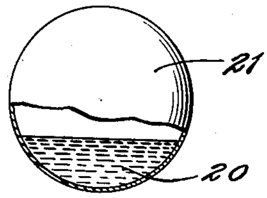


Fig.2.

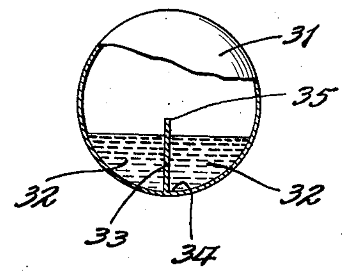


Fig.3.

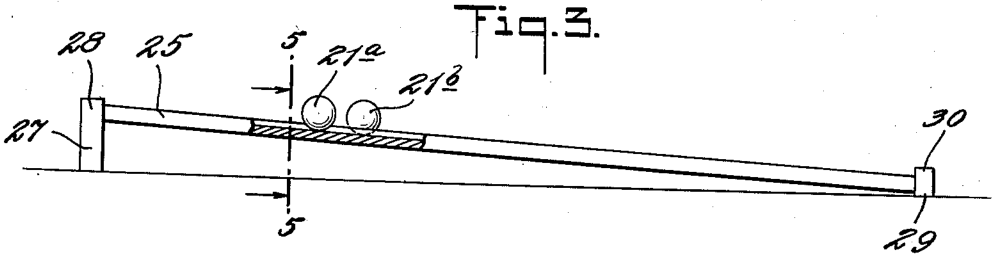


Fig.4.

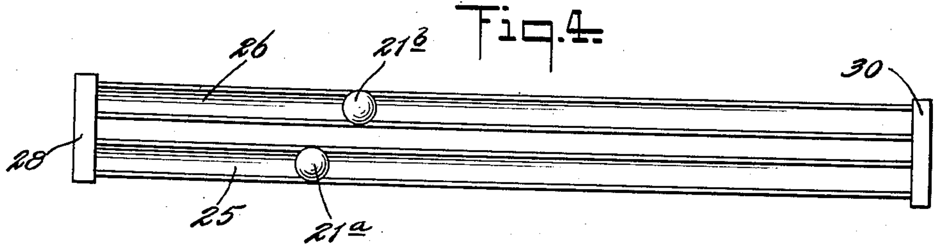
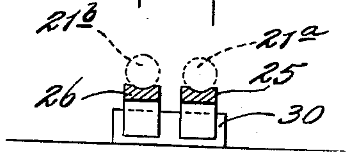


Fig.5.



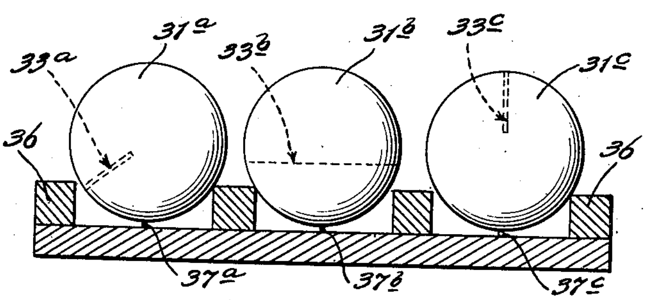


Fig.6

INVENTOR
OSWALD C. BREWSTER
BY
Davis Hoxie & Faithfull
ATTORNEY

Patented Feb. 23, 1954

2,670,206

UNITED STATES PATENT OFFICE

2,670,206

ROLLING-BALL RACING GAME

Oswald C. Brewster, Litchfield, Conn.

Application July 13, 1949, Serial No. 104,420

2 Claims. (Cl. 273—86)

1

This invention has to do with rolling-ball racing games or amusement devices.

Useful and amusing effects may be obtained in a rolling-ball game by means of a light, hollow ball which is retarded in its motion by reason of containing a free mass of fluent material which exerts a frictional drag on the interior wall. As the ball in motion tends to carry the mass upward and around with it against the gravitational tendency of the free mass to remain at the bottom of the ball, the fluency of the free material lets the gravitational force operate to return it toward the bottom. This gives a tumbling back or refluxing. There is a tendency to create an equilibrium of forces under which the mass as a whole would be held in position on the rear wall somewhat above the bottom while the ball rotates past it, giving slip but with a frictional drag. This tendency to "hang" in a true equilibrium position is not always or necessarily fully realized, and varies with the forward speed of the ball. The friction material is so chosen, however, as to frictional properties and amount, that at ordinary speeds of rotation the centrifugal force is not predominant and the material does not ride around with the surface which it initially engages.

In the accompanying drawings,

Figure 1 is a view, partly in section to disclose the interior, of a ball embodying the invention and used in the racing game here disclosed.

Figure 2 is a similar view of a modified form of ball.

Figure 3 is a side elevation, partly in section, of an apparatus for a rolling-ball racing game employing the ball of Figure 1.

Figure 4 is a plan view of the same apparatus.

Figure 5 is a sectional view on the line 5—5 of Figure 3.

Figure 6 is a sectional view of a modified apparatus for a rolling-ball racing game especially adapted for use with the ball of Figure 2.

A first example, providing an improved racing game or amusement device, is a hollow ball 21 containing in a free state a small amount of viscous liquid 20, the viscosity of which varies with its temperature, with resultant variation in frictional drag. This ball has no interior baffles or obstructions to the movement of the fluid. The ball itself is of light construction exemplified by a standard table tennis ball.

An example of a suitable viscous liquid is a hydrocarbon oil consisting of 3 parts of SAE No. 140 oil and 1 part of SAE No. 10, the quantity being about one-third the volume of the ball. Other oils or syrups, equivalent in viscous drag, may be used, the chief precaution to be observed for best results being that the liquid should be one which will retain its properties with respect to viscosity, fluency and friction under whatever conditions of permeability by air or by liquid components the material of the ball presents.

2

For this racing game, I provide two or more inclined runways 25, 26 (Figures 3–5) of some two feet in length with a stop 30 at the bottom to make a common finish line. These runways are mounted on supports 27, 29 of different height to give the desired inclination. Identically made balls 21a, 21b are placed one in each runway and released simultaneously. They roll slowly down to the finish line under the force of gravity opposed by the frictional drag of the viscous fluid within.

With identical balls, and exactly equal quantities of the same viscous liquid in each, the balls would roll at the same speed if the liquid in all were at the same temperature so as to have the same frictional effect. Usually there is some chance difference and two balls picked at random and handled casually will usually differ somewhat in speed, making it possible to produce the semblance of a race. The greatest element of interest for the contestants is obtained however when they take advantage of the fact that the frictional effect varies quite markedly with the temperature of the viscous liquid. Thus, if each contestant warms up his ball before the race, as by breathing on it or rubbing it in the hands or on the clothing, the viscosity of the liquid and hence its retarding effect are altered, although not by enough to cause the balls to roll freely or even at a rapid pace. The result is to make the outcome in most instances uncertain to the end, while making it possible for the contestants to influence the result.

With the balls described, containing the particular oil, I incline the runways at about 7° from the horizontal. This angle varies with balls of different weight and degree of retardation. Too steep an inclination gives acceleration to a speed at which the frictional effect is diminished and the balls all "run away." It adds to the interest, however, if the inclination is close to the borderline so that occasionally, near the end of the run, one of the balls does spurt ahead by reason of reaching a condition in which the viscous mass ceases to flow backward with its major retarding effect. The desirable thing is to incline the runways enough so that the balls do not regularly attain a speed that would give this "run away" condition. The "run away" is caused by the speed being greater than that at which the viscous liquid can flow back toward the bottom of the ball, so that it tends to cover the inside of the ball with a more or less uniform weight of liquid.

Other rolling ball racing games may be created or improved through adaptation of the inventive idea to the particular situation, with appropriate selection of the type and amount of fluent frictional material constituting the free mass within the ball. Likewise, the hollow ball may be other than of the table tennis species, but it must be light enough so that the internal frictional drag substantially diminishes the forward momentum. The material of the mass should be non-caking to maintain its condition productive of the amount of friction initially determined as proper.

A second example, giving a greater element of uncertainty for the players, is disclosed in Figures 2 and 6. The ball **31** contains a viscous fluid **32** which frictionally retards the rolling of the ball as in the first example. What may be called the normal retarding action of the fluid **32**—as it tends to ride up with the surface of the ball but constantly flows back under the force of gravity—is variously modified by a fixed projection or vane within the ball, in consequence of which the frictional retarding effect is varied during each rotation of the ball. The extent and the pattern of this variation depend on the position of the vane in relation to the axis of rotation, which depends in turn on how the ball is initially placed on the track. Since the ball is opaque the player cannot see the vane, and therefore the position of the vane relative to the axis of rotation is a matter of chance. It is most improbable that two balls would be placed with their vanes in identical positions so as to give identical variations of the normal retarding action.

By a further improvement, involving a special co-action with the track, illustrated in Figure 6, the position of the vane relative to the axis is varied during the progress of the ball. This further variation is also of uncertain character, and is dependent chiefly on the position of the vane at the start of roll, which is a matter of chance in the initial placement of the ball on the track, as already stated.

In the form shown here, the vane **33** is a flat piece of cellophane fastened by an adhesive to the inner surface of the ball and extending across the interior space in the plane of the center but at one side of the center. The vane may be varied in size, shape and mounting. For example, it may be in contact with the wall all along one edge (**34**), that edge being curved to fit the curvature of the wall, so as to form an inward projection from the wall with a free edge (**35**) toward the center, as shown here; or it may be generally rectangular, fitting the wall only at two ends, with free transverse edges, one toward the center and one toward the wall. The wide extent of the possible modifications in size, shape and mounting of the vane will be evident from the following analysis of the action of the particular form taken for illustration.

Assume first that the ball is so placed initially on the track that the vane lies in a vertical plane which is at a right angle to the line of travel and which therefore passes through the axis of rotation. Assume further that the fluid is partly in front and partly behind the vane, and that the vane extends above the level of the fluid. As the ball starts its first revolution, the vane rides

up carrying some of the fluid with it, thereby creating a retarding moment greater than would exist if the fluid were carried up by viscous friction alone. After about a quarter turn, the fluid carried up flows over the vane and, falling to the bottom, has a normal retarding action which adds to that of the other part. As the vane comes again to the bottom it blocks the reflux of the fluid ahead of it and so again increases the retarding action. As a result the frictional retarding action is varied from a low value to a maximum, and the ball has a marked variation in speed during each revolution.

The pattern of this variation depends on the size, shape and mounting of the vane, for any given initial position of the ball on the track. For example, if the vane does not extend inward so far, then as the vane sweeps down into the fluid and starts its upward course it has less retarding action than a vane which carries more liquid up. The same is true if there is an opening in the vane or a space between its outer transverse edge and the wall.

The minimum of variation in the retarding action during a revolution occurs if the vane initially lies in a vertical plane through the line of travel. The vane then slices through the fluid, so to speak, when passing through the bottom of its circle of motion. There is some variation of the frictional effect because the vane increases the surface area in contact with the fluid, but the variation is both more gradual and of lesser degree than when the vane is at a right angle.

These two extremes are but two of the many positions which the vane can occupy in relation to the axis of rotation, depending on how the ball is placed on the track. Intermediate positions put the vane at an angle to the axis and produce different patterns of variation in the frictional retarding action of the fluid. The intermediate positions occur most of the time. In a race between two balls with identical vanes (and of course identical in other respects), it will almost never happen that the vanes will be in the same position relative to the axis of rotation; and it is even less likely that if they coincide in that respect they will also be in phase in their actions on their respective bodies of fluid. Hence it is an extremely rare event that two balls roll with the same pattern of variation in speed due to the vanes. While one will almost invariably have its vane in a position which interferes more with the frictional retarding action than does the vane of the other ball, and while that conduces to a higher average rate of roll, this advantage is unknown to the players and does not make itself readily apparent to the observer as the race proceeds. The balls change speed, gain and lose relatively, and give the effect of uncertainty until the finish.

The further improvement, involving a coaction with the track to vary the position of the vane relative to the axis as the race proceeds, introduces a further element of uncertainty. Without it, each ball substantially repeats in each revolution the pattern or cycle of change in retarding action that is inherent in the position of its vane relative to its axis of rotation. By giving the ball, as it proceeds, a slight rotation about another axis generally normal to that of which its rolling motion occurs, the position of the vane is changed and with it the pattern of change in the retarding action. Thus, in a race, the ball which initially has a pattern favorable to a higher average speed than the other one has may have its advantage increased or decreased as the race proceeds. When this lateral rotation is in turn dependent on the position of the vane, it is not the same for both of any two balls except in the extremely rare event that both have their vanes initially in the same positions relative to the axis of rotation.

One means of imparting a shift in the vane position relative to the axis of rotation is shown in Figure 6. There each track has two side rails **36** and a center rail formed as a bead **37** running lengthwise midway between the side rails. The side rails are so spaced that the ball at any instant can touch only the center rail and one side rail, clearing the other side rail and giving always a two-point support. Very slight lateral tilting or rotation is necessary to shift the ball to the other side rail, and such a shift occurs upon a slight shift in the proportions of fluid lying on the two sides of the center rail. Since the ball is in contact with the center rail and one or the other side rail at all times (except for the very brief time of movement from one side rail to the other), its axis of rotation is always tilted in one direction or another. Thus, considering the center ball in Figure 6, in contact with the left hand rail, the axis of rotation is tilted downward to the right on a line parallel to the two points of contact. If now the ball is rolling away from the observers, the frictional liquid will be dragged upward and to the right. Since the ball is tilted only slightly to the left, a small amount of liquid drawn to the right will overbalance the system in that direction and cause the ball to tip over against the right hand rail. This however tilts the axis of rotation downward to the left and causes the same process of overbalancing to occur in the reverse direction. The ball therefore repeatedly changes its axis of rotation as it rolls, and this change at random positions of the vane results in even greater changes in speed during a race, and makes the outcome quite unpredictable.

It will be evident that modification of the size, shape and mounting of the vane will modify the pattern of change in the retarding action inherent in each vane position relative to the axis of rotation. By choice of the vane in these respects one can cause the ball to have more or less gradual changes in retarding action during a revolution, and also a greater or lesser extent of change. For identically vaned balls, the element of uncertainty in the race arises from (1) the chance position of the vane relative to the axis, as determined by its initial placement on the track; (2) the sidewise shift of fluid during the race, causing that vane position to change; (3) the relative viscosities of the fluids, as determined by any warming-up of the balls by the players before the race; and (4) the somewhat non-uniform normal action of the frictional fluid even with balls as nearly identical as possible in respect of

quantity of fluid from the same source and in respect of the construction of the sphere itself.

In the preferred form, there is a single vane at one side of the center of the ball, so that during a part of the revolution it has a maximum effect in varying the normal action of the fluid and during another part it has a minimum effect. Various double acting or plural vane arrangements are possible to give more than one maximum effect per revolution, and a more complex pattern of variation. The basic idea however is retained of providing a transverse vane which, as the ball revolves, engages the fluid variously to vary its normal action and so give a varying frictional retardation.

This application in part contains subject matter described in my application Serial Number 3,803 filed January 22, 1948 and now abandoned.

I claim:

1. For a game employing a rolling-ball game, a light hollow ball, of the nature of a table tennis ball, having a free mass of viscous liquid friction material occupying substantially less than the volume of the ball, and a transverse vane fixed within the ball and operative to engage the said mass variously and so vary the frictional action of the fluid during a revolution of the ball.

2. A rolling-ball racing game comprising two or more inclined tracks and identical light hollow balls, of the nature of a table tennis ball, for the several tracks, each ball having a free mass of viscous liquid friction material occupying substantially less than the volume of the ball, and a transverse vane fixed within the ball and operative to engage the said mass variously and so vary the frictional action of the fluid during a revolution of the ball; and each track having two side rails and a center rail, the side rails being so spaced that a ball resting on the center rail can touch but one side rail at a time while slightly clearing the other side rail, whereby as the fluid mass shifts weight laterally the ball moves from one side rail to the other.

OSWALD C. BREWSTER.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
973,595	Wahlin	Oct. 25, 1910
1,627,517	Littleford	May 3, 1927
2,219,074	Guillou	Oct. 22, 1940
2,225,213	Gammeter	Dec. 17, 1940
2,426,915	Bains	Sept. 2, 1947

FOREIGN PATENTS

Number	Country	Date
83,235	Germany	Nov. 23, 1895
372,315	Germany	Mar. 26, 1923
734,679	France	Aug. 8, 1932
758,471	France	Nov. 3, 1933
511,655	Great Britain	Aug. 22, 1939