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ROCKING ACTION BALL BUMPER

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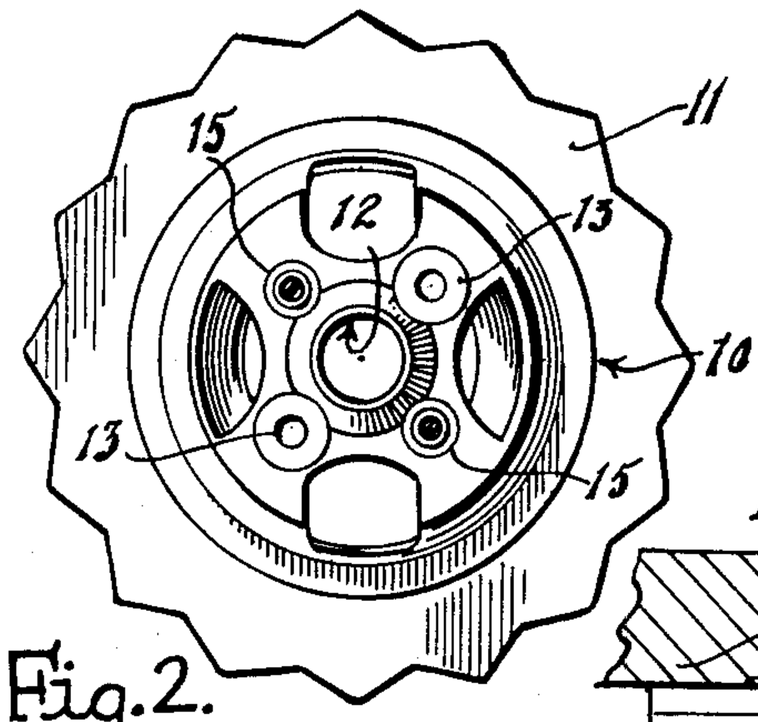

Fig.2.

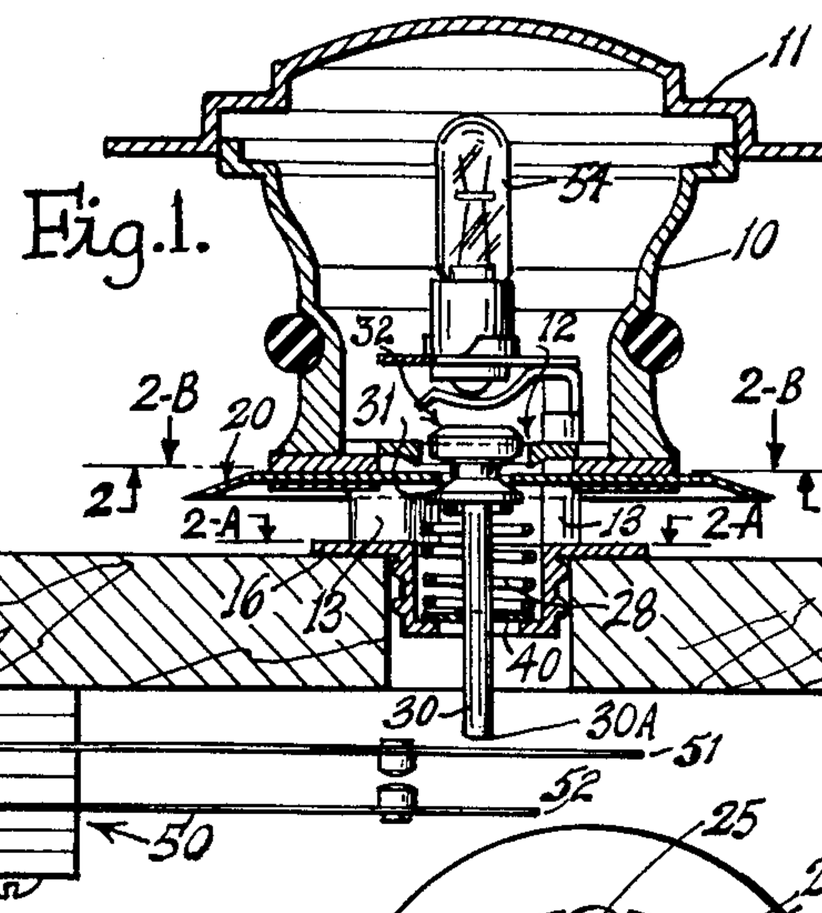

Fig.1.

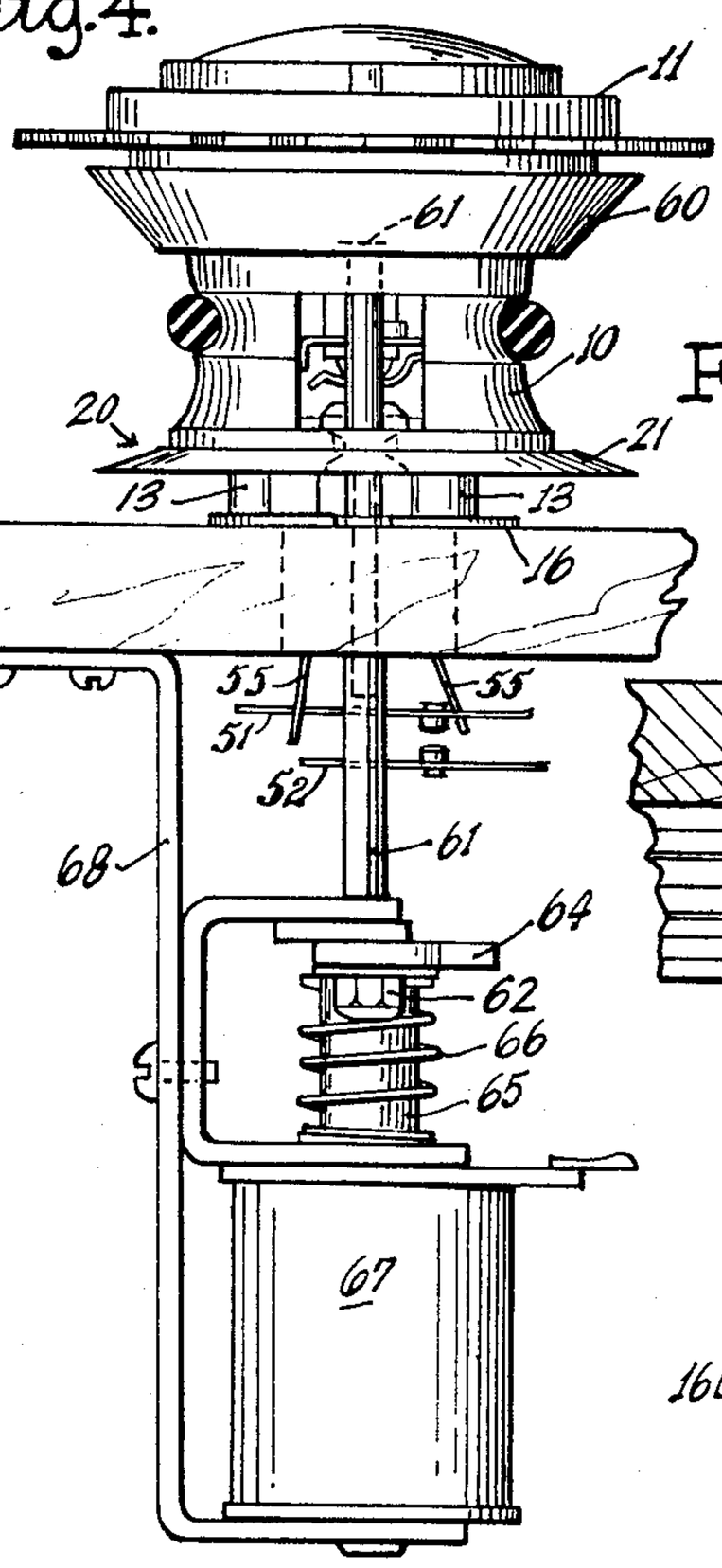

Fig.4.

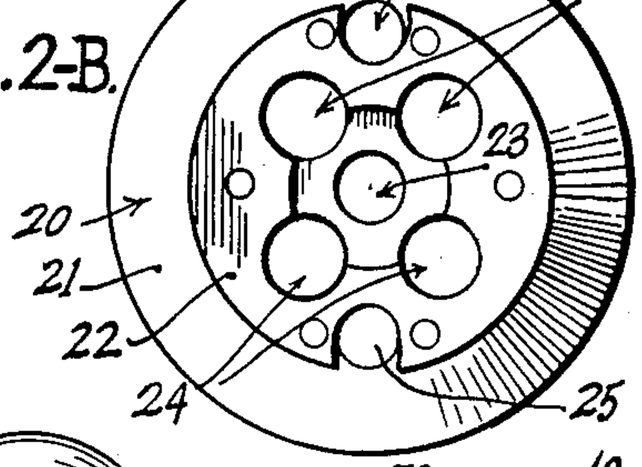

Fig.2-B.

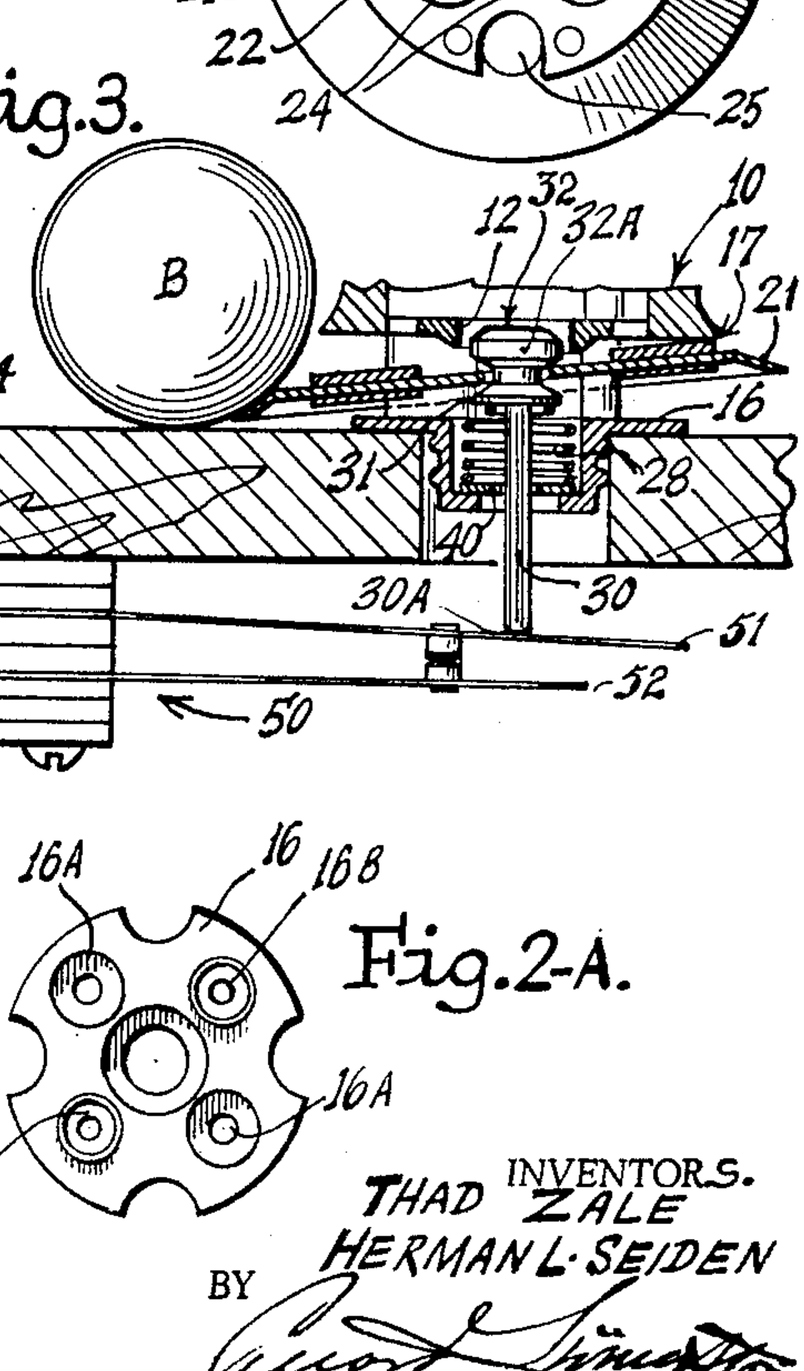

Fig.3.

Fig.2-A.

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ROCKING ACTION BALL BUMPER

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This invention relates to improvements in ball bumpers of the rocking wafer type used in ball-rolling games and characterized principally in that such bumpers consist of an upright post or pillar structure adapted to stand on a ball-rolling board as a target or obstacle, there being a wafer or disc-like member at the bottom of the post close to the surface of the board so that a ball approaching the bumper will roll onto the wafer or disc and rock the same downwardly a short distance for the purpose of actuating a score switch by some form of operating connection between the wafer and the switch.

The switch arrangements utilized with this type of bumper assume a variety of forms, some being electrically more or less a part of the wafer and bumper structures themselves, while others depend upon a finger projecting from the wafer to the switch to actuate the latter when the wafer is rocked or tilted by a ball. The present improvements relate to the latter type of equipment and have as their principal objective the provision of a switch-actuating means in the form of a short plunger for actuating the usual blade switch, and means operatively interconnecting the plunger through a loose connection with the wafer, such that the latter may rock or tilt when struck by a ball in the usual manner and will transmit a displacing force to the plunger which does not move in the usual angular or rocking or swinging manner heretofore common with all such bumpers, but is caused to move in a linear displacement to actuate the switch, with a consequently more positive, and more reliable switching action than results from the prior constructions in which the wafer finger or rod must move sidewise or at an angle with the rocking of the wafer, the sensitivity of the bumper in these respects being improved without any change in the degree of movement needed.

A further advantage of the improved wafer and plunger construction and action is the fact that it is readily adaptable to a previously known and extensively used bumper construction requiring only minor additions, without change in the basic bumper construction.

Additional aspects of novelty and utility reside in the details of the construction and operation of the preferred embodiment of the improvements described hereinafter in view of the annexed drawing, in which:

FIG. 1 is a vertical sectional detail of the improved bumper mounted on a ball rolling board shown in fragmental section with a score control switch depicted in elevation;

FIG. 2 is a bottom plan view of the bumper body looking up along lines 2—2 of FIG. 1;

FIG. 2–A is a top plan view of the spring-seating cup which forms the base for the bumper body, the view being taken along lines 2–A—2–A of FIG, 1;

FIG. 2–B is a top plan view of the rockable ball wafer or disc, as seen along lines 2–B—2–B, FIG. 1;

FIG. 3 is a sectional operational detail based on parts of FIG. 1 to illustrate the disc and switch plunger action;

FIG. 4 is an elevational view of a modified form of bumper and is similar to that of FIG. 1 but taken from the opposite side thereof with the switch means shown fragmentally.

Referring to FIG. 1, the basic bumper post structure comprises an upright hollow body section **10** molded from plastic and surmounted by a removable cap **11**, these

parts being rather thin-walled and generally translucent for illumination from within.

Formed integrally with the bottom of the main body section **10**, as viewed in FIG. 2, is a slightly pendant, plunger-head guiding collar **12** (see also FIG. 3), together with two bored and diametrically spaced studs **13** serving as vertical spacers and adapted to rest upon the top flange of a plastic, cup-shaped spring seating member or well **16**, the top face of which is seen in FIG. 2–A, and which is adapted in turn to seat in a hole in the ball-rolling board **14**.

The bottom or foot of the bumper body **10**, as seen in FIG. 2, is also provided with another pair of bored, diametrically-spaced studs **15** which, however, are lower and smaller in diameter than the footing studs **13**; and the top face of the spring seat **16** is provided with a pair of shallow depressions **16A** which seat the studs **13**, as well as a pair of tubular sleeves **16B** which have a friction fit with the smaller studs **15** in the assembled condition of the device as viewed in FIGS. 1, 3, and 4. The bumper is held in position on the board **14** by means of screws (not seen) passing through the bores of the large footing studs **13**, whereas stiff connecting wires **55** from the lamp means **54** pass through the bores in studs **15** for connection in any of the various lamp control circuits (not shown) well known in the art.

The space afforded between the foot of the bumper body and the spring seating cup **16** provides sufficient elevation above the ball-playing field or board to permit rocking motion to a ball wafer or disc **20**, which is normally spring-centered in the positions shown in FIGS. 1 and 4, but which, when engaged by a ball in the manner shown in FIG. 3, can rock for the purpose of actuating certain switch means to be described, the wafer preferably being made of metal and having oversize clearance holes for the studs **13** and **15** and other appendages to be explained.

The ball-rocked disc or wafer **20**, as seen in FIG. 2–B, is preferably made of metal and has a circumambient sloping edge or skirt **21** for engagement by a ball approaching from any direction. The top face **22** of this wafer is provided with a central opening **23** surrounded by four equally spaced passage holes **24**, together with two more diametrically spaced holes **25** used only in conjunction with the form of bumper shown in FIG. 4.

The four equally-spaced holes **24** are made considerably oversize for the free accommodation of the four molded studs **13**, **15**, in such manner as to permit free rocking displacement of the wafer from any angle of attack by the ball, the two remaining holes **25** being for the passage of the actuating rods of certain reprojecting mechanism to be described.

As viewed in FIG. 1, a helical compression spring **28** is fitted into the well of the seating cup **16** and bears up against the underside of a radially protuberant and circumambient head formation **31** formed preferably as an integral part of a switch-operating plunger or pin **30**, molded from an insulative plastic material and having a lower portion **30A** projecting downwardly through the bottom of the spring seating cup, together with a short upper portion extending upwardly through the central opening **23** in the wafer and surmounted by another circumambient radial protuberance and head **32** spaced axially above the first such protuberance a distance to permit free rockability of the disc **20** relative to the plunger rod or pin portion while causing opposite marginal portions of the disc about the central hole **23** to bear respectively against the upper and lower protuberance portions in the manner illustrated in FIG. 3, whereby to exert an elevational displacing force on the plunger as the result of impingement of the ball –B– upon the skirt of the disc.

It is to be understood that all parts of the bumper construction above-described, with the exceptions noted hereafter, are old and in general use in the art, the exceptions alluded to relating to the linear-reacting switch actuating means comprising the plunger 30 with the circumambient protuberances 31, 32 spaced apart axially at the upper end of the plunger rod or pin for a loose coupling action with the ball disc, together with the guiding collar formations 12 in the foot of the bumper body for constraining the upper head portions 32 to a substantially linear travel, and the guiding wafer or insert 40 seating in the bottom of the spring well for the like purpose of constraining the lower portions of the rod or pin 30 to substantially linear displacement responsive to rocking action of the wafer between the two head portions 31, 32, it being noted that the spring 28 acts directly against the lower pin head porion 31 which in turn thrusts up against the disc 20 to elevate the latter to its normal position.

The upper head portion 32 is provided with a cylindrical face portion 32A, best seen in FIG. 3, for freely-movable guided gliding action against the inner surfaces of the pendant collar formation 12 on the floor of the bumper body 10 in moving from the position of FIG. 1 to that of FIG. 3, the entire cooperative assembly of disc, plunger, and linear guiding means 12, 32A, and 40 having such an empirical loose fit as to make the rocking disc action easy and sensitively responsive to engagement by a ball on the one hand, while at the same time minimizing useless lost motion in converting the angular movement of the disc to useful linear displacement of the plunger to actuate the switch means 50.

The improvements are also readily incorporated in the so-called and widely used reprojecting type of wafer bumper, illustrated in FIG. 4, which employs the identical basic bumper post, wafer, and footing structure as that described in view of FIG. 1, with the addition of reprojecting mechanism in the form of an inverted, metal, frusto-conical annulus 60 constituting a wedge supported on a pair of diametrically opposite legs 61 (only one of which is seen in FIG. 4) depending through holes in the ball board for attachment by nuts 62 to a crossbar 64 fixed on the head of a solenoid plunger 65, which is normally elevated by spring means 66 from the bore of an electromagnetic solenoid 67 suspended by bracket means 68 from the under-side of the board in alignment with the vertical axis of the bumper post structure.

The legs 61, which depend from the reprojecting annulus, are of a diameter to pass freely through the pair of holes 25 in the ball disc while permitting free rocking action of the latter, and the switch blades 51, 52 project in between such legs for cooperation with the linear actuating pin means 30—30A without change from the arrangement of FIG. 1.

As a result of the action of the spring 66, the reprojecting annulus or wedge member 60 is elevated to a normally raised position in a spaced relation above the wafer 20, such that when a ball, as in FIG. 3, strikes the bumper structure and particularly the wafer, it will be in position to be engaged by the reprojecting wedge 60 and energetically repelled from the bumper as a result of an abrupt downward stroke of the wedge responsive to energization of the solenoid 67, caused, for instance, by closure of the switch means 50 or some circuit means (not shown) controlled thereby, or by other arrangements well-known in the art.

Prior bumpers of the wafer type have employed some form of elongated switch contact rod more or less rigidly attached to the wafer and forced into engagement with another stationary contact member or switch actuating member, the movement of all such rods or pins being angular and multiplied at the lower ends in proportion as the rod is long with diminishing contact force as the length increases. Such constructions are particularly prone to produce poor and fluttering electrical contact in response to light and transient engagements of the ball with the rocking disc; and in most cases the switch means has been essentially a part of the bumper, and switch characteristics, such as contact pressure, resiliency of the central rod attached to the wafer, etc. were fixed, and completion of electrical wiring to the switch was dependent upon placement of the bumper in operative position on the board.

The disclosed improvements afford a better switch action by reason of the positive, linear motion of the switch-actuating rod, the minimal movement of which positively opens the switch, with all degrees of displacement thereafter, whether in response to a light or heavy ball impact, producing the same kind of switch response. The arrangement also permits use of switch mechanism which is separate form the bumper and independent wiring with selectable spring contact pressures and gapping. Fluttering contact operation is substantially eliminated, and the switch action is sufficiently positive and consistent, for example, to permit direct electrical pulsing of associated equipment without the use of relays, if desired.

These several advantages inherent in the disclosed improvements are achieved by simple changes and additions in the prior construction contrived in a manner to retain all of the beneficial operative and structural features thereof with a minimal alteration and expense.

We claim:

1. In a ball bumper, a wafter structure providing a linear actuating force for the switch means and comprising, namely: a wafer member having a central opening; an elongated switch-actuating pin fitting loosely at its upper end in said opening in such manner that the wafer can tilt relative to the axis of the pin when engaged by a ball, said pin having circumambient radially-extensive protrusions spaced apart axially near its upper end and radially larger than the diameter of said opening whereby the pin is loosely captured therein; spring means urging the pin into a normally elevated position and said pin urging the wafer into a normal position in a plane substantially at right angles to the pin axis; and means circumambient of upper and lower end portions of the pin constraining the same to a linear movement responsive to a tilting of the wafer from normal position as aforesaid, the lower end of said pin being exposed for operative engagement with a desired switch-actuating member.

2. In a ball bumper, switch-actuating means in the form of a disc having a central opening of predetermined diameter, an elongated switch-actuating plunger projecting downwardly through said opening substantially at right angles to the plane of the disc, and of a diameter to fit loosely in the opening, said plunger having a pair of radially-extensive and circumambient enlargements adjacent an end thereof which is disposed in said disc opening, said enlargements being spaced apart axially of the length of the plunger and respectively disposed on opposite sides of the disc and radially greater in diameter than the diameter of said disc opening so that the plunger is loosely captured in said disc opening, the spacing between said enlargements axially of the plunger being such that a predetermined tilting of the disc from a normal plane substantially at right angles to the axis of the plunger will cause impingement of portions of the disc adjoining said opening with said enlargements whereby a force resulting from such tilting will be transmitted to the plunger to act in a direction generally along the axis thereof; and guide means spaced apart along the axis of the plunger and situated respectively on opposite sides of said disc and having free fit with the plunger to constrain the movements thereof to substantially rectilinear reciprocation in response to a predetermined minimal rocking movement of the disc.

3. In a ball bumper of the type having a body portion adapted to stand upright on a ball-rolling board and a ball-rocked circular plate at its foot more or less concentric of the upright axis of said body and adapted to be spring-urged into a normal position in a plane substantially

at right angles to said axis to be rocked or tilted therefrom by impingement of a ball against exposed peripheral marignal portions of the plate, improved switch-actuating means cooperable with said plate and comprising, namely: a plunger and means guidedly mounting the same for linear displacement along said axis with an upper portion thereof projecting through a central opening of predetermined diameter in said plate and further provided with a pair of axially-spaced-apart circumambient and radially enlarged protuberances near said upper portion each lying at an opposite side of said plate and sufficiently larger radially than said opening to capture said plunger loosely therein, the axially-spaced distance between said protuberances being only such as to permit said plate to be tilted from said normal position by a ball an amount to cause the plate to bear down upon the lower one of the protuberances sufficiently to impart a responsive displacement to the latter, which displacement is constrained to a substantially linear resultant travel by reason of guidance of the aforesaid mounting means; spring means acting upon said plunger urging the same toward the plate to cause the lower protuberance to bear against the plate and elevate the same to said normal position; said plunger having a portion opposite from said protuberances exposed for operative engagement with a switch-actuating means movable collinearly of the plunger.

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