(No Model.)

A. A. OUTERBRIDGE.

PUZZLE BALL.

No. 446,535. Patented Feb. 17, 1891.

Fig. 1.

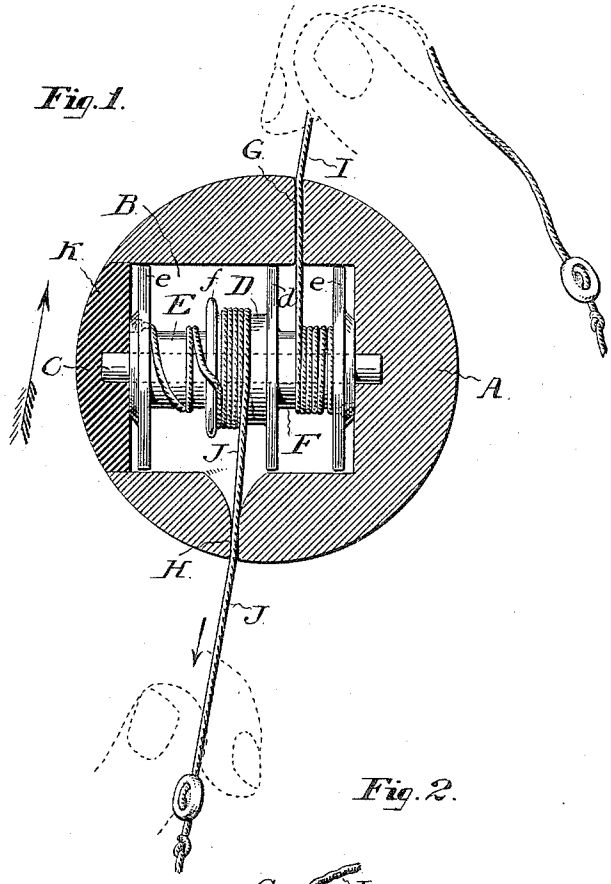
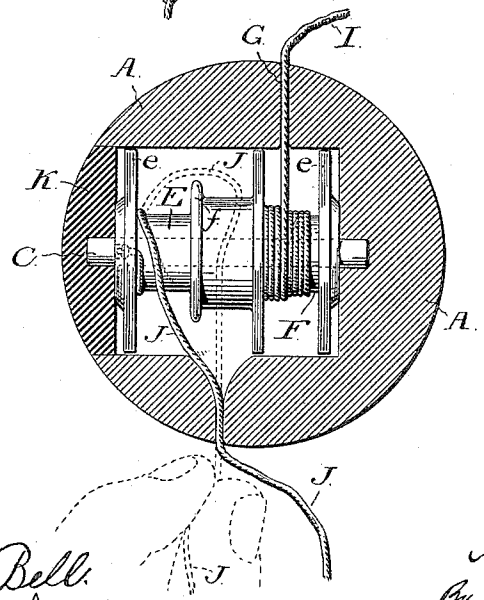


Fig. 2.



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UNITED STATES PATENT OFFICE.

ALBERT A. OUTERBRIDGE, OF PHILADELPHIA, PENNSYLVANIA.

PUZZLE-BALL.

SPECIFICATION forming part of Letters Patent No. 446,535, dated February 17, 1891.

Application filed December 20, 1889. Serial No. 334,399. (No model.)

To all whom it may concern:

Be it known that I, ALBERT A. OUTERBRIDGE, of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Mechanical Toy, whereof the following is a specification, reference being had to the accompanying drawings.

My invention consists in providing the toy usually known as the "obedient ball" with certain features adapted to enhance the puzzling behavior of the ball in the following respects: As heretofore constructed such balls have either been mounted upon a string conducted through the body of the ball by a zigzag passage, so that the descent of the ball along the string could be checked by tightening the latter, or, as described in Letters Patent of the United States No. 213,642, dated March 25, 1889, said balls have been provided with a differential drum having cords wound in opposite directions upon said differing portions, whereby the ball could be either permitted to descend or made to mount the string at the will of the operator. My present invention relates to this latter construction; and it consists in so modifying the drum as to permit the cord to be thrown off and onto the differential portions thereof at the will of the operator. Thus said drum can be rendered temporarily inoperative or its "obedience" restored by a manipulation so slight as to escape detection—a feature which greatly adds to the interest of the apparatus as a trick or puzzle.

In the accompanying drawings, Figure 1 represents a central vertical section through a toy ball, within which the working parts of the invention are concealed. Fig. 2 is a similar view illustrating the method of manipulation by which the above-mentioned capacities of the device are developed.

In said drawings, A represents a ball, preferably of wood or light material and of a convenient size for handling.

A cavity B extends inward from one side of this ball some distance past its center, said cavity being preferably cylindrical in form and axially symmetrical to a diameter of the ball. The outer or open end of this cavity is closed by a plug K, which fits snugly therein, and the outer periphery of the plug should coincide with that of the remainder of the ball. A spindle or shaft C extends lengthwise with said cavity, and upon said spindle is freely mounted a drum or spool consisting of two end portions E and F of similar diameter, and an intermediate portion D of larger diameter than the others. Instead of the spindle running through the spool, the spool may be made with journal-bearings.

Flanges *e e* are formed at each end of the drum, and intermediate flanges *d* and *f* are formed at each side of the central portion D thereof. The depth of the flanges *e e* and *d* is such as to fit snugly while rotating freely within the cavity B, while the flange *f* is of comparatively small depth and is rounded, as shown, in order to minimize the wear on a cord arranged to pass over it, for the purpoes which will be hereinafter described.

On opposite sides of the ball, and preferably in the relation illustrated in the drawings, are formed two holes G and H, which lead into the cavity B, the inner end of the hole H being flared or laterally enlarged, as shown. Through these holes are passed two cords I J, which are independently coiled upon different portions of the drum. The cord I is attached to and coiled upon the portion E of the drum, while the cord J is attached to the other end portion F of the drum, as shown, so as normally to coil thereon, the coils being in an opposite direction to those of the cord I. By reason of the low flange *f* between the portions F and D of the drum the cord J, though still attached to the portion F, can be carried across said flange and be coiled on the large central portion D of the drum, as shown in Fig. 1. Assuming this to have been done, (either in the original adjustment of the cords or by means which will presently be described,) if the cords be held slack the ball will slide freely in either direction along what appears to be a single cord passing directly through it; but if the cord be held taut in a vertical position, (cord J below and cord I above,) as shown in Fig. 1, (the hands of the operator being of course farther apart than is there indicated,) and a strain be put upon the cords the cord J will, owing to the differential action of the parts E and D of the drum, cause the drum to rotate as the cord unwinds from the larger portion D, and simultaneously the cord I will

thereby be wound upon the smaller portion E, thus compelling the ball to run up the cord I against gravity and without apparent cause. If the cords be then slackened slightly, the ball will descend by gravity, unwinding the cord I from the portion E of the drum, and simultaneously rewinding the cord J upon the large portion D, so that the operation of rising and falling can be repeated continuously. It is immaterial to the result whether both cords be held in the hands and be alternately stretched and slackened or whether either cord be attached to a fixed point and the strain be put on the other. In either case the effect is the same—viz., the ball will rise as the strain is put on and will fall as the strain is relaxed. The differential action of these two portions of the drum will, when the ball is caused to ascend, require a greater length of cord to be unwound from the larger drum D than is wound up upon the smaller drum E, such excess being proportional to the difference in the circumference of the two drums, and, conversely, when the ball descends more cord will be wound upon the portion D than is unwound from the portion E; but this apparent lengthening and shortening of the cord is but slight compared to the space traversed by the ball, and can readily be masked by slight movements of the hands and wrists of the operator. The relation between the circumference of the portion D and that of the portion E is adjusted with reference to the amount of power required to conveniently raise the weight.

It will be observed that the outer ends of the openings G and H on the surface of the ball are at opposite ends of a diameter of the ball, so that the appearance is that of a single cord passing directly through the ball, on which when slack the ball runs freely in either direction.

Thus far the operation of the device is similar to that described in the Letters Patent above referred to; but I will now proceed to specify the action of the parts which constitute my improvement.

The cord J was stated to have been attached in the original construction of the ball to the end portion F of the drum and to have been thence carried across the low flange *f* onto the central portion D of larger diameter and then wound thereon. If now the ball be raised or slid along the cord I as far as it will go, that portion of the cord J which was coiled upon the larger drum D will thereby be completely unwound, so that it will necessarily clear the flange *f*, and by then allowing the ball to descend the cord J will be wound upon the end portion F of the drum. As this end portion is similar in diameter to the other end portion E, the leverage due to differential circumferences no longer exists and the strain is neutral. Hence the ball will refuse to move upward. It will, however, descend on either cord, and it may be checked in such descent by a slight strain on the cords. Thus if the exhibitor, after making the ball rise and fall a number of times, allows it to pass toward the end of the cord I to its limit, he thereby (quite unobserved) completely unwinds the cord J, so as to throw it off the drum, and if he then hands it to the observer with the request to imitate the rising movement the latter will find it impossible to do.

To cause the cord J to be again wound upon the central drum D, so as to renew the capacity of the ball for moving up, I proceed as follows: First, let the ball slide along the cord I to its limit; then pull cord I for about an inch; then push cord J into the ball for about an inch and a half, giving it a slight twist after it is so pushed in; then pull cord I quietly for a short distance and let the ball slide down along cord J, when cord J will have been rewound on the larger drum, and the ball will be in condition to rise on tightening the cords.

A reference to Fig. 2 will explain the manipulation just described. The pushing of the cord J into the ball forms a slack or loop within the cavity B, as illustrated by the dotted lines, which loop has a tendency to drop over the low flange *f*, whereby the cord J comes into position, when the cord I is pulled, to rewind upon the large drum D. The repeated coiling of the cord J on the drum seems to give it a tendency when slack to drop over the flange *f*; but should it fail to do so the desired result can be insured by giving the cord a slight twist close to the ball after pushing it in, and also by holding the ball in such a position that the portion D of the drum is below the portion F thereof, in which position gravity will aid the springing over of the cord. This operation can be performed quickly, and if cleverly masked, so as to avoid appearance of special manipulation of the cord for a purpose, it is almost impossible for an observer to discover the method by which the ball has again regained its capacity for riding up and down the cord at will. The ball can again be thrown out of working order by simply holding up the cord J and allowing the ball to slide to its limit toward the end of the cord I. It will be observed that the cord J may be originally attached to the larger drum D, instead of the drum E, so that its normal condition would be to coil on the part D, in which case, to defeat the capacity of the ball for rising, the cord J would have to be thrown off D by means similar to those above described in order to make it coil on the smaller drum E.

While I do not claim, broadly, the use of a differential drum in connection with a toy ball or other device, I do not wish to be understood as limiting my claim to the precise form of inclosure which constitutes the housing for the moving parts. Thus, for instance, instead of a ball, any other object—such as a box, a nut-shell, or the figure of an animal or bird—may be substituted. I therefore use the word "housing" to comprehend broadly any structure or object adapted to support

the working parts of the invention and conceal them sufficiently to render the apparatus a puzzle.

I claim—

1. The combination of a movable housing, a differential drum consisting of two distinct portions of similar diameter and a third portion of a different diameter, and a pair of cords connected with different portions of said drum, respectively, and adjusted so as to be wound in opposite directions thereon, said cords being suitably arranged to pass freely through the housing, and one of said cords being arranged with such relation to two differential portions of said drum as to be capable of being wound on either of said portions at will, substantially as set forth.

2. The combination of a movable housing, a differential drum journaled therein, said drum having two distinct portions of similar diameter and a third portion of a different diameter, separating flanges between said portions, one of said separating flanges being of comparatively slight depth, and a pair of cords respectively connected with different portions of said drum and adjusted so as to be wound in opposite directions and to pass freely through the housing on opposite sides, the entrance and passage of one of said cords being so arranged with reference to said low flange as to permit said cord to be thrown over it and coiled on portions of the drum on either side thereof at the will of the operator, and the entrance and passage of the other cord being so arranged as to permit it to coil only on the remaining portion of the drum, substantially as set forth.

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