

[54] **INDICATORS FOR INDICATING
ACCELERATIONS IN SPORTS EQUIPMENT
WHICH ARE SWUNG IN USE**

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[58] Field of Search 273/183, 186, 194, 162,
273/26

[56] **References Cited**

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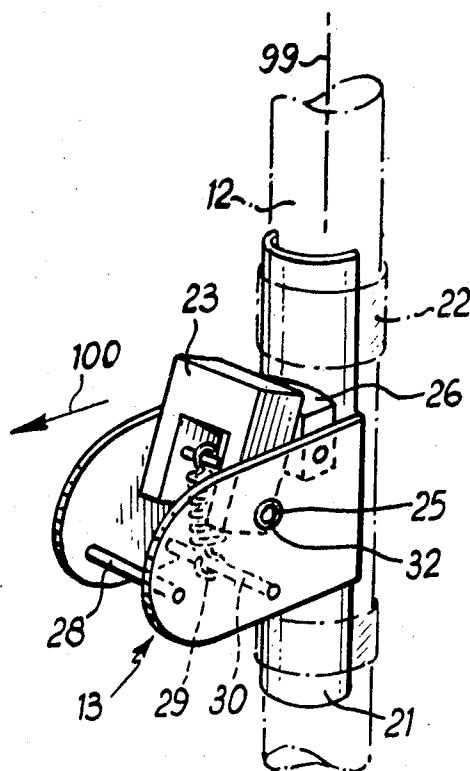
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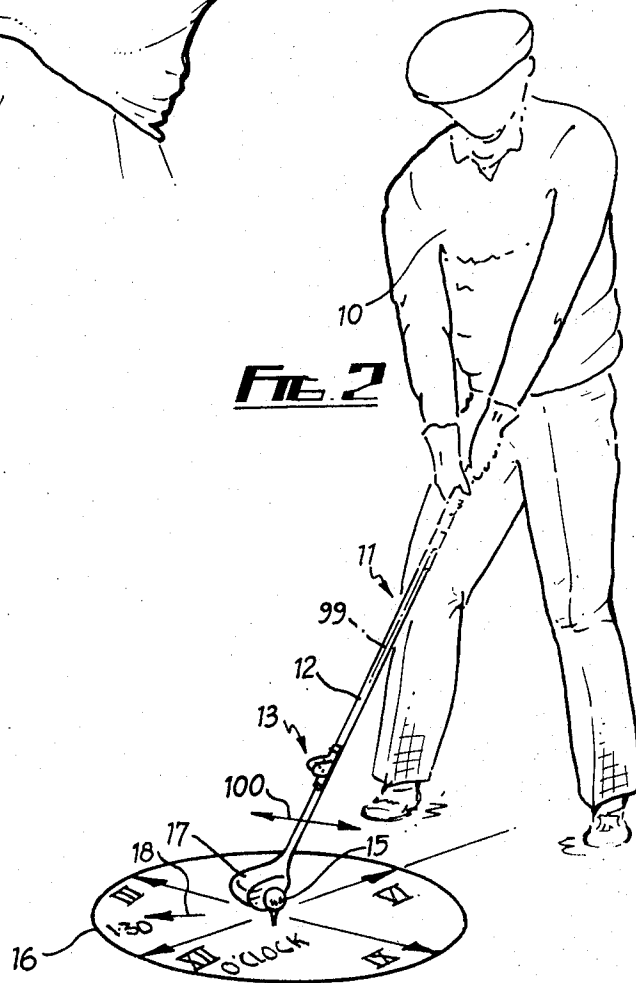
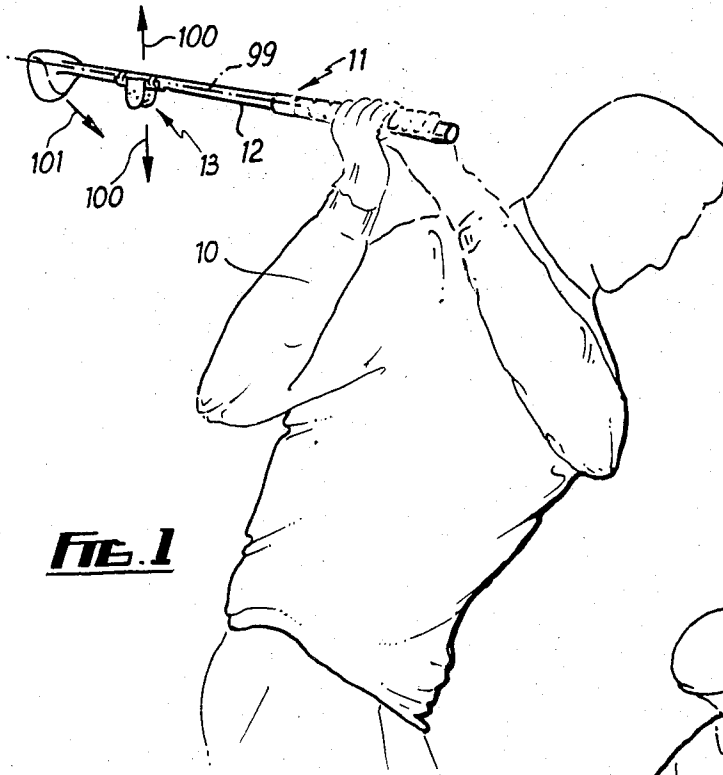
Primary Examiner—George J. Marlo
Attorney, Agent, or Firm—Larson, Taylor & Hinds

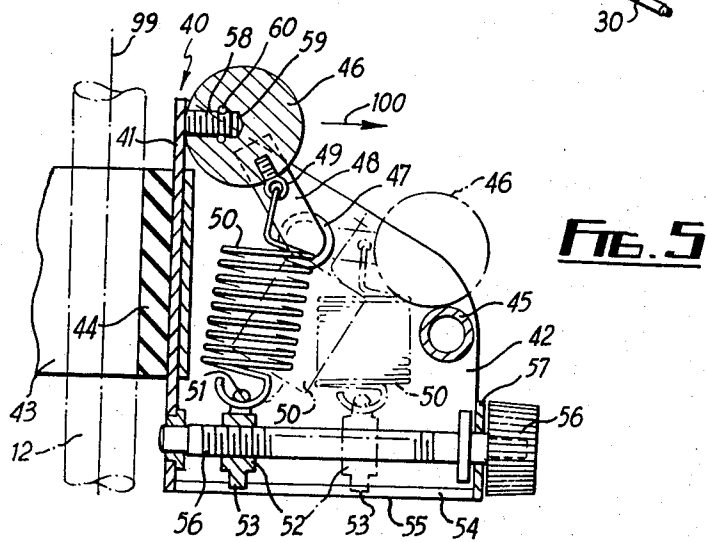
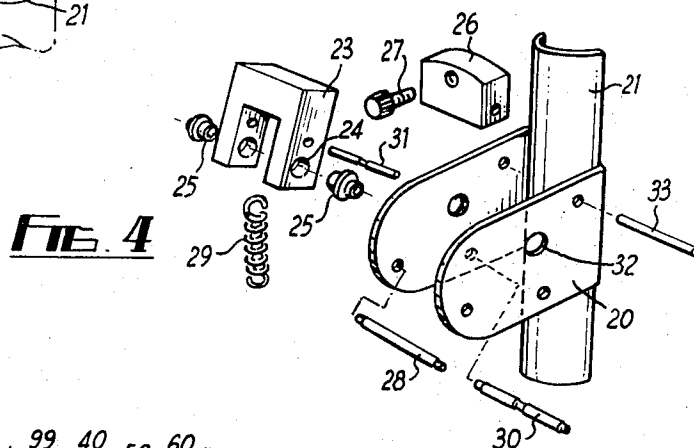
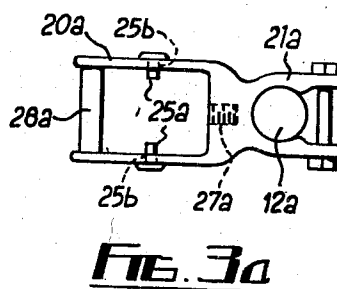
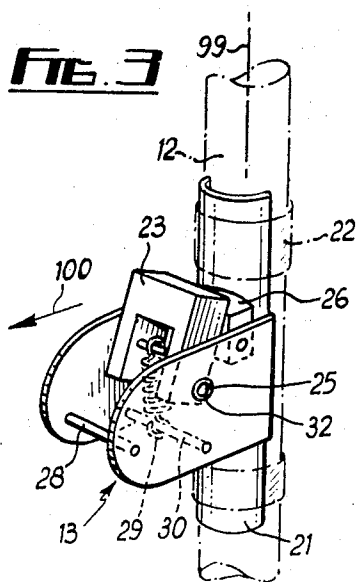
[57] **ABSTRACT**

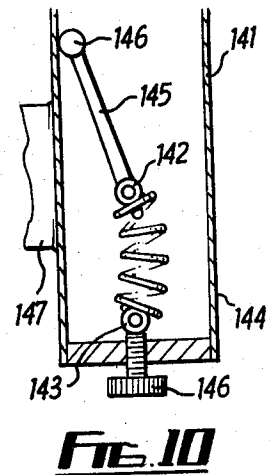
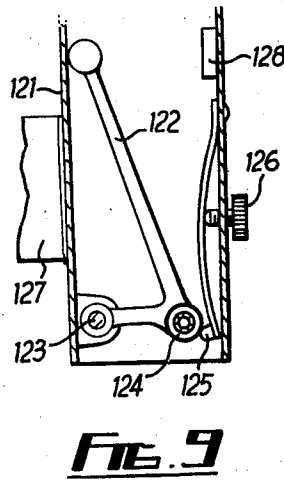
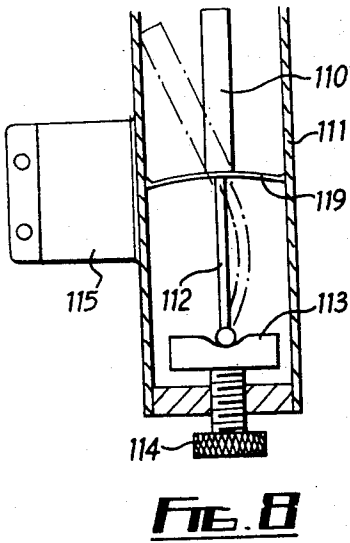
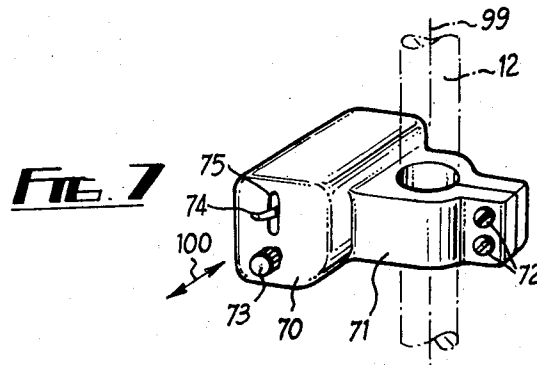
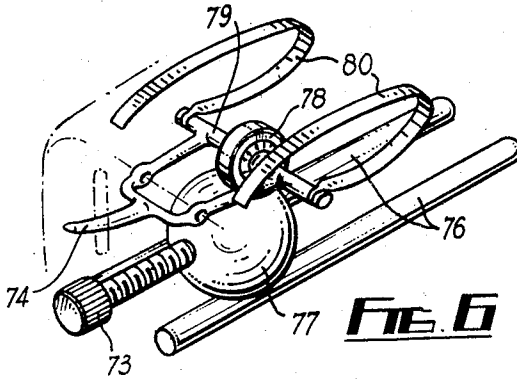
A lightweight indicator appendant to a golf club, or other sports equipment involving a swinging action in use, gives to the user of club an indication of any lack of smoothness of his swing during the actual making of the swing. The indicator is arranged to be responsive to accelerations of the shaft in directions transverse to the axis of the shaft. The indicator has a threshold level of operation and when the threshold is exceeded a movable part is actuated to produce mechanically, such as by impact between movable and fixed parts, an audible signal.

8 Claims, 11 Drawing Figures









INDICATORS FOR INDICATING ACCELERATIONS IN SPORTS EQUIPMENT WHICH ARE SWUNG IN USE

BACKGROUND OF THE INVENTION

This invention relates to sports equipment, such as golf clubs, which involve a swinging action in use and the invention provides an indicator which can be made appendant to the equipment, and which can indicate to the user of the equipment, whilst making the swing, certain features of his swing; that is, there is immediate feed back of information to the user of the equipment.

The nature of the swing of a golf club has been extensively discussed and written about and the ideal swing is eternally sought but rarely achieved. It is the applicant's view that a player can swing more effectively when transverse accelerations (that is, club head accelerations in directions at right angles to the axis of the shaft) applied to the golf club are properly controlled and to this end the present invention provides an indicator which is responsive to transverse accelerations.

The concept of measuring transverse acceleration of a golf club to analyse swing is known and in this respect U.S. Pat No. 3,226,704 to Petrash and U.S. pat No. 3,270,564 to Evans are mentioned. However, the design of known equipment suffers from certain disadvantages. Certain known equipment tends to be too massive and hence, when attached to a standard club, it grossly affects swing weight. Other known equipment tends to be complex and hence costly and does not provide immediate feed-back of information but requires a study, after the swing is completed, of a record made during the swing. The design of certain known equipment also tends to lack robustness so as to be unable to accept the repeated high shock loads each time a ball is struck.

SUMMARY OF THE INVENTION

It is one object of the invention to provide an indicator of simple construction which can be made appendant to an ordinary golf club and later removed without affecting the club in any significant way, thus avoiding the need for a special club.

It is also an object of the invention to provide an indicator of small mass and size so that, when appended to a club it does not affect the feel of the club to a significant degree.

It is also an object of the invention to provide an indicator which produces immediate feed back of an audible signal during the course of the swing and which is consistently sensitive to a predetermined threshold transverse acceleration level but robust to withstand shock loads when a ball is struck.

It is also an object of the invention to provide an indicator which does not require supplementary devices indirectly associated with the club to interpret its performance.

The invention provides, in combination with the shaft of an article of sports equipment which is swung in use, a lightweight indicator for indicating predetermined acceleration of the shaft, said indicator comprising a body part, a movable member part movable in the body part in response to accelerations of the shaft in directions transverse to the axis of the shaft during the swinging of the shaft, a stop member for arresting the movable member part, means on the body part for secure and

demountable attachment of the indicator on said shaft and means for controlling the movement of said movable member part so that it moves, at a threshold level of the transverse acceleration, from a first rest position, through a neutral equilibrium position to a second rest position at said stop member and thereby produces mechanically an audible signal on impact with said stop member.

BRIEF DESCRIPTION OF THE DRAWINGS:

FIG. 1 shows an indicator according to the invention in use to detect forcing at the top of a swing of a golf club;

FIG. 2 shows the relative orientation of said indicator on the golf club;

FIG. 3 is a perspective view of said indicator;

FIG. 3a is a sectional plan view of a modification of FIG. 3;

FIG. 4 is an exploded view of FIG. 3;

FIG. 5 is a sectional elevation of an alternative form of indicator;

FIG. 6 is a perspective view of another alternative form of indicator;

FIG. 7 is an external view of the indicator of FIG. 6;

FIGS. 8, 9 and 10 are diagrammatic views of other forms of indicator.

DESCRIPTION OF PREFERRED EMBODIMENTS

In FIG. 1 a golfer 10 is shown holding a golf club 11 at the top of an upswing. The club has securely attached to the shaft 12 thereof a lightweight indicator 13. The axis of the shaft 12 is represented by the numeral 99. The direction of acceleration transverse to the shaft is represented by the arrows 100. The direction in which the toe of golf club head 14 points is represented by arrow 101.

In FIG. 2 the golfer 10 is shown addressing the ball. An imaginary clock face 16 is presented in which 9 o'clock represents the intended line of flight of the ball 15 and 12 o'clock represents the direction in which the toe 17 of the club points. The indicator 13 is secured to the shaft 12 so that, with the club 11, in the position shown, the movable member part of the indicator can move in the 1.30 time direction (arrow 18). This orientation is suited to the detection of forcing at the top of the swing as per FIG. 1. The orientation can, however, be varied to suit the character of the golfer's swing or to detect adverse accelerations transverse to the shaft at other points of the swing, such as at take-away.

In FIGS. 3 and 4 the indicator 13 is shown as comprising a body part or housing 20 which has, integral with it, means, in the form of a arcuate-sectioned strip 21, for secure and demountable attachment of the indicator 13 on the golf club shaft 12. Typically, a wound rubber band or adhesive tape 22 could be used for the attachment.

Within the housing 20 there is a movable member part or sensorhammer 23. This hammer has drillings 24 which accommodate stub spindles 25 to allow the hammer to pivot in holes 32 in the housing 20. Pinned into the upper part of the housing 20 there is a bridge 26 into which is screwed an adjuster screw 27 which defines the "starting point" of the hammer 23. The screw and bridge can be a metal/plastics combination so that the screw is vibration and shock resistant to unscrewing but at the same time can be adjusted by hand.

A stop pin 28 is located in the housing 20 for arresting the movement of hammer 23 and thereby generating mechanically an audible signal. A tension spring 29 is provided between a spring anchor pin 30 in the housing 20 and a spring anchor pin 31 in the hammer 23 so that the spring acts to hold the hammer against the adjuster screw 27 in the bridge 26. This is the first rest position of the hammer.

In operation, any acceleration in the direction of the arrow 100 (which direction is transverse to the axis 99 of the shaft 12) will tend to cause the hammer 23 to pivot in the housing 20. When the acceleration reaches or exceeds a threshold level the initial pivoting of hammer 23 will be adequate to overcome the restraint of the spring 29 and the hammer will move through a neutral equilibrium position beyond which the tension of the spring acts to accelerate the hammer 23 to a second rest position so that the hammer impacts on the stop and thereby produces mechanically an audible signal.

A fine range of adjustment is provided by the screw 27. If it is screwed out of the bridge until the hammer is very close to its neutral equilibrium position then the threshold of operation will be very low. If, on the other hand, the screw 27 is screwed into the bridge a high threshold can be set. The hammer 23 is restored manually to its first rest position.

In FIG. 3a a body part 20a is shown made from extruded plastics section. The body part has a clip 21a for gripping a golf club shaft 12a. The body part has a threaded hole 27a for an adjuster screw and holes 25b for the pivoting of a sensor-hammer. A stop pin 28a is located in the housing 20a. The pin 28a can be snapped into position. The thread 27a can accommodate a tight fitting metal vibration resistant screw. This design exploits the various characteristics of plastics material to the full to produce a very low cost article of good quality and performance. A plastic injection moulding may be used in lieu of an extruded plastic section. In either case the assembly of the hammer 23 into the body part 20a requires that the stub spindles 25a be fitted to the unit through the bush holes 25b of the body part 20a with the hammer in place. The stub spindles 25a can be a force or push fit in the hammer, the connection being augmented by a suitable adhesive. Ample clearance between spindles 25a, and bush holes 25b permits rotational freedom for the hammer. Alternatively, the spindles 25a can be fixed rigidly in the body part with ample clearance between spindles and bush holes in the hammer to permit rotational freedom.

In FIG. 5 the same basic operation is provided but additionally other ways of setting the threshold level of operation are shown. The indicator comprises a framework 40 having a back plate 41 and two side plates 42. The plate 41 is slotted so that a bracket 43 can pass through the slots for securing the framework 40 to a golf club shaft 12. A rubber pad 44 is provided as a filler between shaft 12 and framework 40. A hollow tube 45 spans between side plates 42 which acts both as an audible signal generating component and as a strut giving rigidity to the framework.

A mass 46 is pivoted in the side plates 42 at bearings 47 and carried on arms 48. The mass 46 has a fulcrum screw 49 at which the top of a spring 50 is attached. The spring is attached at its lower end to a fulcrum 51 defined by a nut 52 which has a projection 53 movable in a slot 54 defined by a base number 55 of the frame-

work 40. The nut 52 is movable by rotation of an adjuster screw 56 which is supported in back plate 41 and bracket 57 to vary the line of action of the spring. The dotted nut 52 shows an alternative position achieved by adjustment and hence a new line of action of the spring.

The mass 46 can be provided with an adjusting screw 58 which screws into a cavity 59 in the mass 46 and is gripped by a compressed rubber ring 60.

In operation, accelerations in the direction of the arrow 100, that is transverse to the axis 99 of the golf club shaft 12, tend to lift the mass 46 away from the plate 41 against the restoring action of the spring 50. Up to a threshold acceleration the spring will act to keep the mass against the plate. At or beyond a threshold of acceleration the mass 46 will move away from plate 41, through a neutral equilibrium position, in which the fulcrum 51 axis of bearings 47 and fulcrum 49 will all be in line. Beyond the neutral equilibrium position the spring will act to accelerate the mass 44 so that it strikes the tube 45 to generate an audible signal.

Adjustment of threshold can be effected either at screw 58 or at screw 56. It is not essential that both adjusters are provided. The mass 46 is restored manually.

In FIGS. 6 and 7 the indicator comprises a casing 70 with a clamp 71 for attachment of the indicator to the shaft 12 of a golf club. The casing exposes clamping screws 72, a threshold adjusting screw 73 and a restoring lever 74 which emerges from a slot 75 in the casing 70.

Inside the casing 70 two runners 76 are provided to provide a track for a steel ball 77 which functions as an inertial mass and also generates noise when it strikes the casing 70 at the end of the track provided by the runners 76. The ball normally abuts the adjusting screw 73 and is held in this position by the action of a miniature ball race 78 on an axle 79. The axle is loaded by leaf springs 80 so that the ball race 78 presses on the ball 77. The lever 74 is connected to the axle 79.

In operation, acceleration in the direction 100 tends to cause the ball 77 to move along the runners 76 but this is resisted by the restoring force of the springs 80 acting through the ball race 78. When a threshold of acceleration is exceeded the ball 77 displaces the ball race 78 to that it is freed from the restraint of the springs 80 and thereafter the springs act to assist acceleration of the ball 77 towards the end of the runners 76 when the ball strikes the casing to generate an audible signal. To restore the ball the lever 74 is raised and the ball allowed to run back along the runners 76. To prevent the ball lifting from the runners 76, guard runners, like runners 76, can be provided above the ball but with slight clearance with the ball.

Another embodiment can be made to respond to transverse accelerations in any direction. This embodiment is illustrated in FIG. 8. A rigid rod 110 in a first equilibrium position is connected at one end to flexible diaphragm 119 which fits into a casing 111. A flexible strut 112 is in compression between the flexible diaphragms 119 and another flexible diaphragm 113, but whereas it is encastre in diaphragm 119 it is in a free hinge (or "simply connected") at diaphragm 113. A threshold transverse force on rod 110, such as could be induced by transverse acceleration, can cause the rod 110 to move out into a second equilibrium position and strike the casing 111. In this position the flexible strut

112 is in a curved configuration, the distance between the ends of the rod thereby being reduced, and flexible diaphragm 119 is distorted to hold the rod 110 in its second position. An adjusting nut 114 and a clip 115 are also provided, the clip providing means for attaching the indicator to a golf club shaft.

A further embodiment is illustrated in FIG. 9. Within a casing 121 a rigid crack-shaped lever 122 is located on a bearing 123. The lever carries at its heel a ball race 124 which bears against a spring loaded detent 125. The spring load on the detent is adjustable by screw 126. A transverse acceleration in the appropriate direction causes the lever 122 to rotate about the bearing 123 and the ballrace 124 to roll over the spring loaded detent 125 so that the spring force is acting to force the mass against the casing 121 and provide an audible signal. The threshold acceleration required to achieve this is adjustable by varying the spring load by means of adjustment screw 126. A clip 127 is provided and a sounding plate 128.

A yet further embodiment (FIG. 10) a casing 141 has two pivot bearings 142, 143 and a coil spring 144 is held in compression between these bearings. The upper end of the spring acts on the bearing 142 through a rod 145 pivoted at the bearing 142, secured to the upper end of the spring 144, and provided with a hammer head 146. The axis of the spring is, as shown, curved towards the right hand. When the rod 145 experiences a threshold of acceleration it moves with a snap, to generate an audible signal as it strikes the casing 141, and the spring is then curved to the left hand. Adjustment can be provided by moving the lower bearing to alter the compression in the spring 144 by adjustment of a screw 146. A clip 147 is provided.

It is desirable that the indicators described above should be small in size and light in weight. To ensure that the indicators repeatedly and reproducibly operate very close to their set thresholds it is desirable that any bearings used should have a low friction. Minature ball bearings can assist in this respect.

An audible signal may be produced by deflection of a member without impact, as in a steel leaf clicker.

The springs used in above described indicators have a low spring rate. Typically the spring 29 has a rate of 1.5 lb/inch.

Indicators as described above weigh less than 1 oz. and typically about 0.4 oz.

I claim:

1. In combination with the shaft of an article of sports equipment which is swung in use, a lightweight indicator for indicating predetermined acceleration of the shaft, said indicator comprising a body part, a movable member part movable in the body part in response to accelerations of the shaft in directions transverse to the axis of the shaft during the swinging of the shaft, a stop member for arresting the movable member part, means on the body part for secure and demountable attachment of the indicator on said shaft and means for controlling the movement of said movable member part so that it moves, at a threshold level of the transverse acceleration, from a first rest position, through a neutral equilibrium position to a second rest position at said stop member and thereby produces mechanically an audible signal on impact with said stop member.

2. The combination claimed in claim 1 in which said movable member part comprises a pivoted mass pivotable against the force of a spring whereby the spring holds the movable member part in said first rest position and, with pivoting of the mass, the spring force increases until said neutral equilibrium position is reached whereupon the spring accelerates the mass towards said second rest position where the mass strikes the stop member to produce said audible signal.

3. The combination as claimed in claim 2 having means to adjust said threshold level, that means comprising an adjuster for adjusting the line of action of the spring on the mass.

4. The combination as claimed in claim 2 having means to adjust said threshold level, that means comprising an adjuster for adjusting the location of said first rest position.

5. The combination as claimed in claim 1 having means to adjust said threshold level.

6. The combination of claim 1 in which said movable member part is exposed for manual resetting from said second to said first rest position.

7. The combination of claim 1 in which there is provided reset means to reset the movable member part from said second to said first rest position.

8. The combination of claim 1 in which the body part and said means on said body part are formed integrally of plastics material.

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