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INEXPENSIVE SYSTEM FOR REMOTE TRIGGERING OF WATER SAMPLERS

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INTRODUCTION

When sampling from a helicopter, bridge or high wharf it is difficult to judge when a sampling bottle has reached the desired collecting depth, and therefore when it should be triggered. This is partly because the sampling operation is being viewed "end on", and partly because such a small portion of the total cable length above the sampler is under the water.

This system has been devised as a precise means of triggering a water sampler, from a distance, at any pre-determined depth. Such precision is especially important for sampling at shallow depths.

OPERATION

The device is clamped to the hydrographic cable such that the clamp is at a distance above the sampler equal to the required sampling depth. A standard mechanical messenger is attached. The cable is paid out carefully until the float reaches the water surface. As the float becomes buoyant, the release pin supporting the loop of the messenger wire withdraws from the staples, and the messenger drops down to close the sampler.

CONSTRUCTION

The system is made entirely of chrome plated brass except for a stainless steel spring and polypropylene ball float. A standard wedge clamp, a pair of staples and the spring housing are silver brazed to a 50 mm x 100 mm x 5 mm base plate. The clamp and staples are on opposite sides of the plate to minimize interference. The float arm is 400 mm long and made of 10 mm diameter rod. It is pivoted from the top corner of the plate and rests along the edge of the plate which is set at 30° to the hydrology wire. The ball float is a standard plumber's item with axial dimensions of approximately 120 mm x 80 mm; it displaces a volume of 580 ml. The spring has a compression strength of 30 g mm^{-1}. Its free length equals the distance between the plate and the back of the spring socket. The spring acts on the float arm at a point 80 mm from the fulcrum. This force is sufficient to prevent displacement of the float arm by wind resistance or jolting alone.

DISCUSSION

A more precise value of the actual depth sampled, d_A, may be obtained from the relationship:

$$d_A = d + \frac{d \cdot v_C}{v_M - v_C} - d_H$$

where

d_A = actual depth at which sampler functions (m)

d = required sampling depth (m)

= distance between clamp and sampling bottle

v_C = cable speed ($m.min^{-1}$)

v_M = messenger speed ($m.min^{-1}$)

d_H = height of clamp above surface when float becomes buoyant (approx. 0.35 m).

The second term represents the increase in sampling depth if the cable continues to be lowered after the float becomes buoyant. v_M may be taken as 190 $m.min^{-1}$ for $d < 20$ m and as 200 $m.min^{-1}$ for $d > 20$ m. For example, if $d = 5$ m, $v_C = 10$ $m.min^{-1}$, and $d_H = 0.35$ m the actual depth of sampling is 5.07 m.

For much work these depth corrections are insignificant particularly when it is realized that errors of larger magnitude are introduced by waves and the fact that most samplers collect water over a depth interval rather than at one point.

The apparatus shown in Figures 1 has been built and tested. Figure 2 is a proposed modification. This design would not only be simpler to construct but would also be easier to orientate and hold while being clamped to the hydrology wire.

Because reversing thermometers need 5 minutes to equilibrate they cannot be used in conjunction with water samplers which are being triggered in this manner.

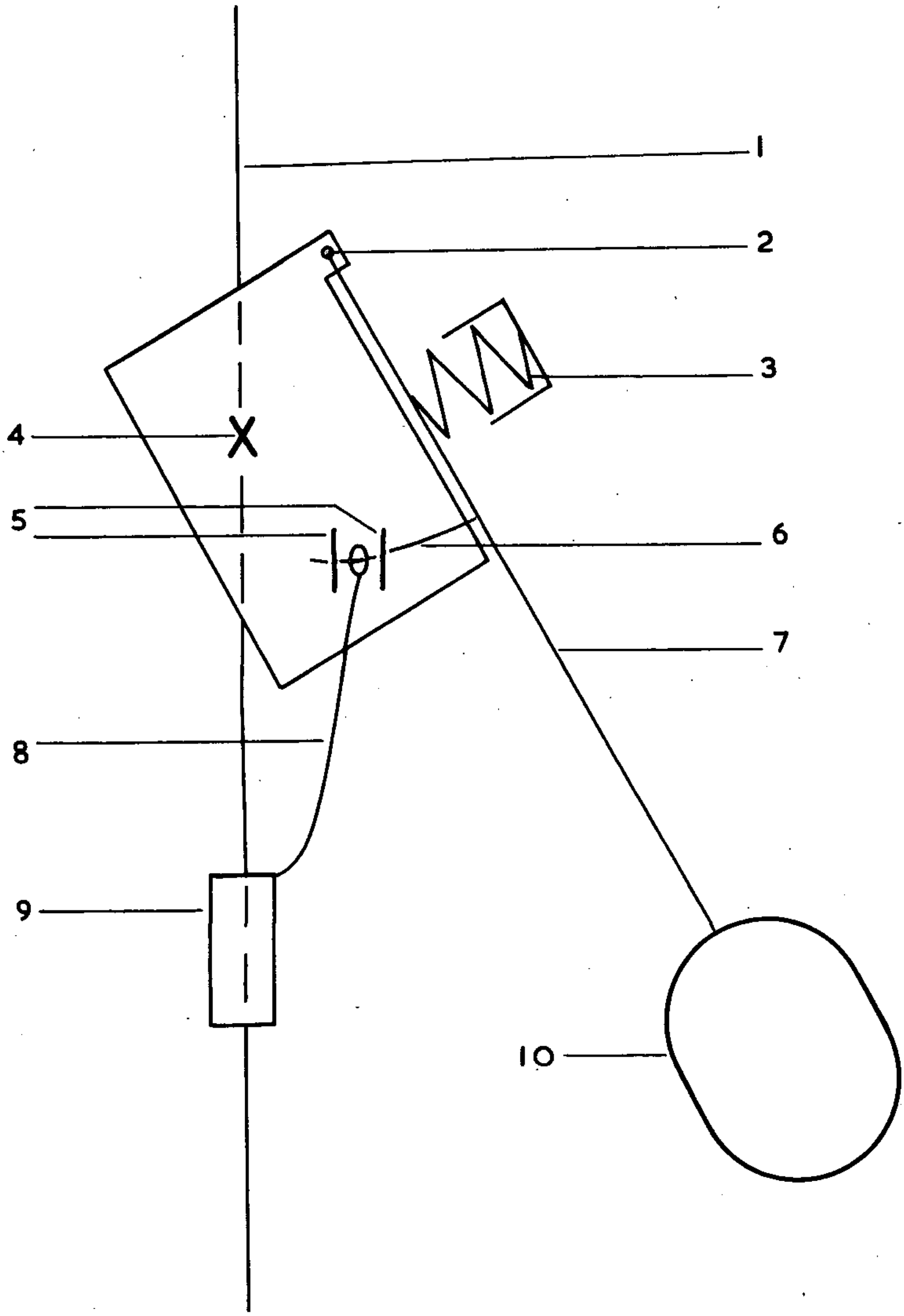

Figure 1(a). Messenger Release System (schematic diagrams) - Before release.

1. Hydrographic wire
2. Pivot
3. Spring
4. Clamp
5. Staples
6. Release pin
7. Float arm
8. Messenger wire
9. Messenger
10. Float

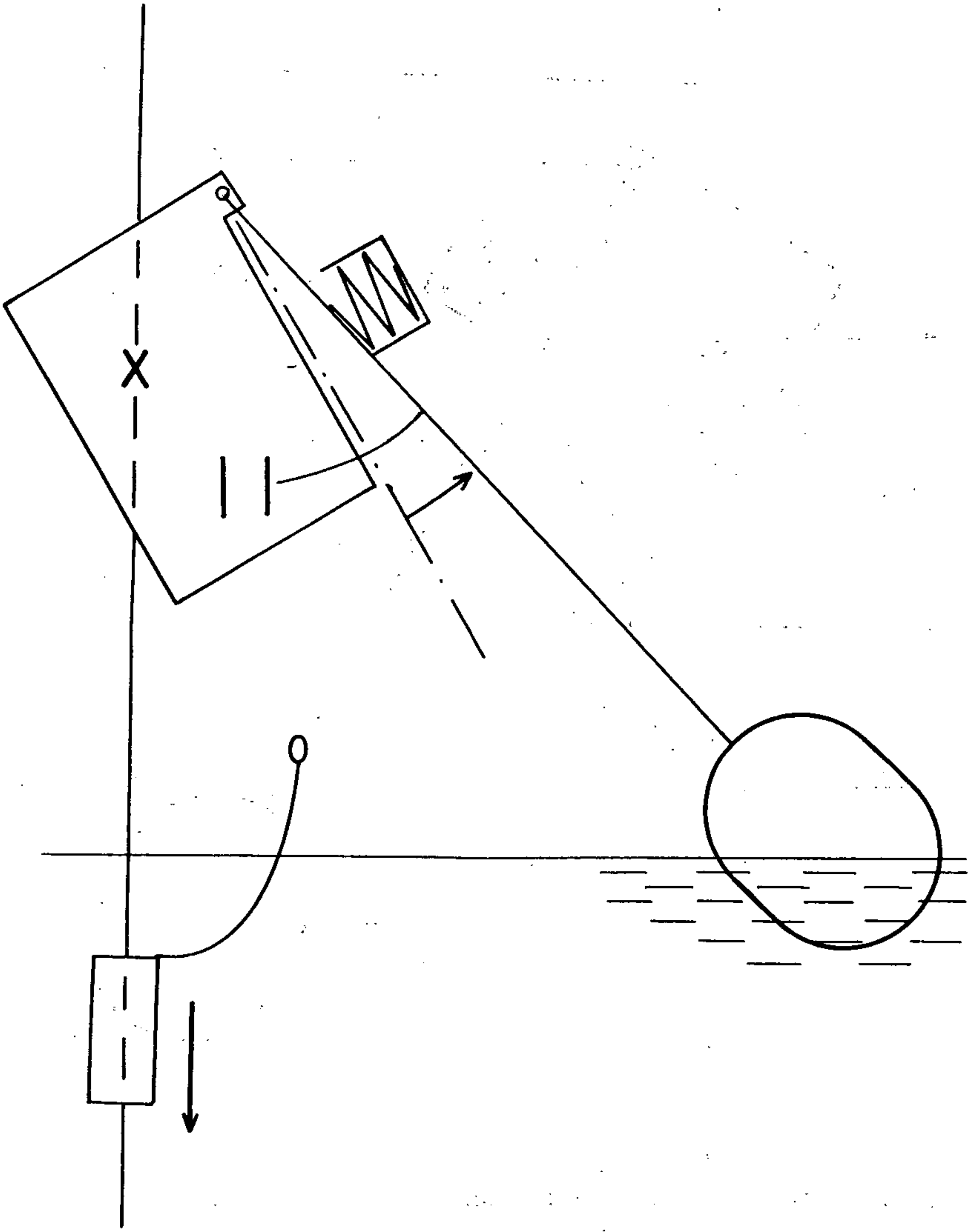

Figure 1(b). Messenger Release System (schematic diagram).
After release.

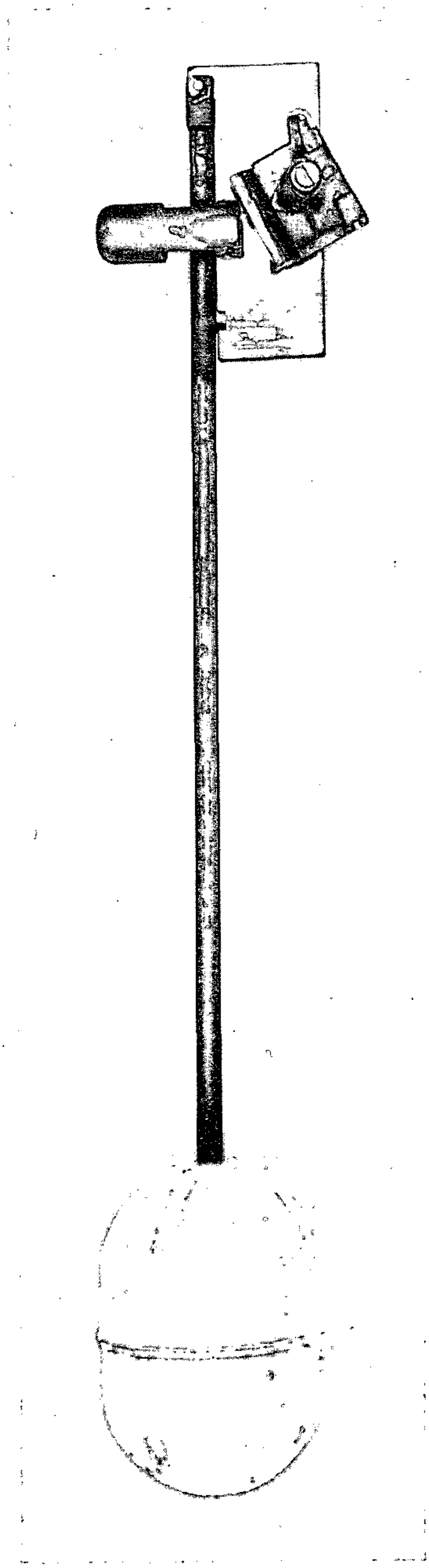

Figure 1(c). Messenger Release System (schematic diagram).
Clamp side view.

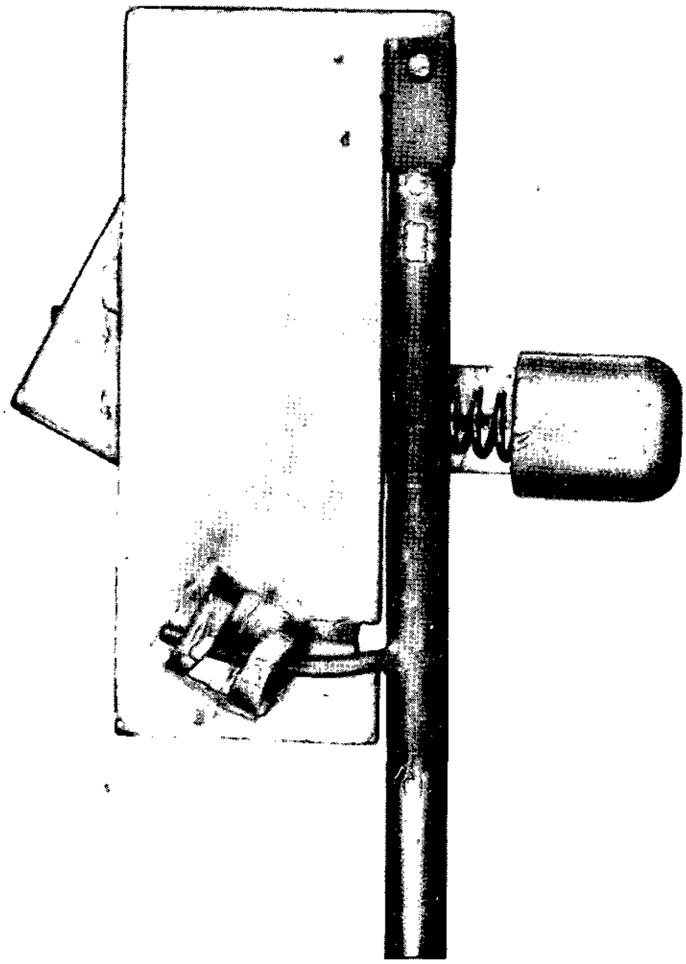

Figure 1(d). Messenger Release System (schematic diagram).
Release mechanism.

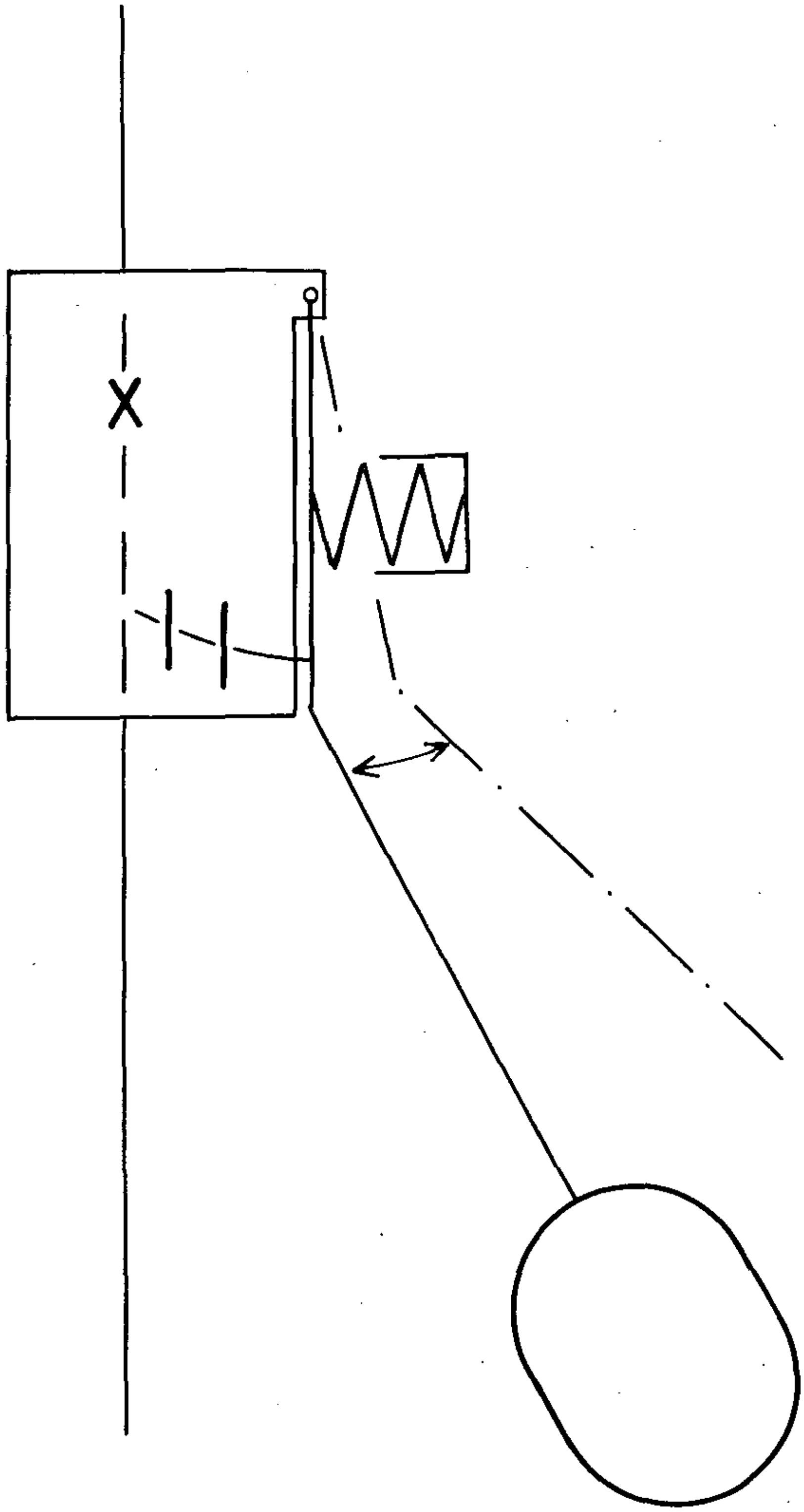

Figure 2. Alternative design of apparatus.