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LEAD FOR SOUNDING PURPOSES

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Fig. 1

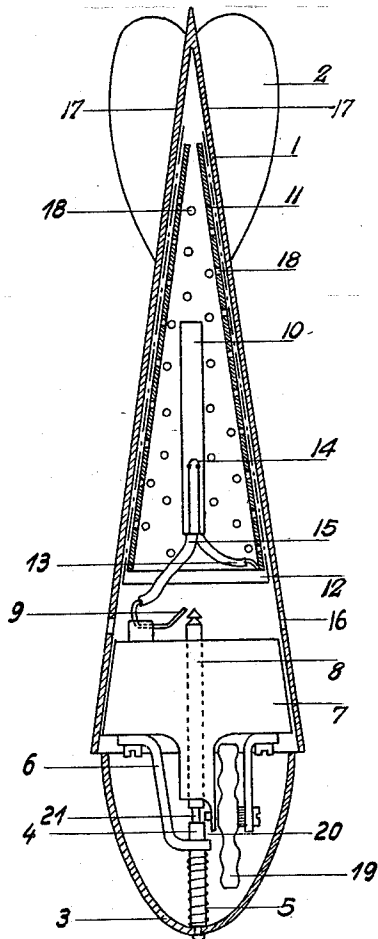
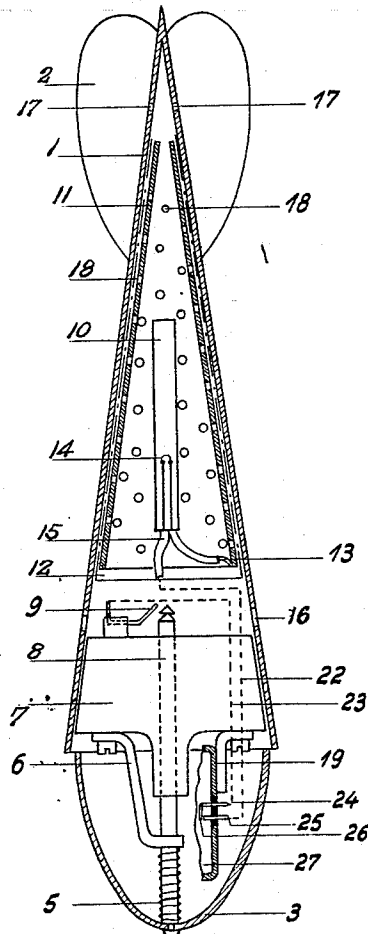


Fig. 2



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LEAD FOR SOUNDING PURPOSES

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The invention relates to a sounding lead for carrying out the well-known method of sounding in which the lead is thrown out from a ship, for example, without a line attached to it and on meeting the surface to be sounded gives a signal, so that from the time of fall the depth to be sounded can be found. The sounding lead according to the invention is mainly intended for soundings in water and is therefore shaped in well-known manner in substantially stream line form. Its function is based on the electric principle, that is to say, on the impact of the lead on the bottom an electric circuit is closed which serves for producing the signal. This is appropriately effected by causing the current to detonate a primer cartridge, so that the actual signal becomes an acoustic one. Of course light signals or signals of another kind can also be produced.

The invention consists further of a series of improvements in different parts of such a sounding lead, the combination of which provide increased certainty, reliability and accuracy of the measurement. Chiefly these improvements relate to the form of the lead body. In order to obtain soundings as exact as possible, it is desirable to obtain a drop of the body within the medium, usually water, as free as possible from disturbances. In order to shorten the sounding, the sinking speed should be made as great as possible, that is to say, the resistance to the travel of the body should be as small as possible. The body is therefore so constructed according to the invention that its greatest cross-section lies between $\frac{1}{5}$ and $\frac{1}{2}$ of its total length and towards the side which is lowermost on falling. Experience has shown that with such a distribution the greatest sinking speed can be obtained.

In order to further perfect its stream line form the part of the body directed downwards, which lies between the greatest cross-section and the leading end, is so constructed that as far as possible it represents exactly a paraboloid.

This part of the body or a portion thereof is appropriately arranged in well-known manner separable from the main body and

relatively movable with respect to it, so that on impact on the surface to be sounded it is displaced with reference to the main body. This displacement is utilised, in a manner also well-known, to produce the signal of impact. In the present example this part is directed downwards and constructed as a cap and it must, in accordance with the invention, amount at least to $\frac{1}{5}$ of the length of the whole lead. Appropriately, in accordance with the invention, the greatest cross-section of the sounding body is located on the boundary line of the cap and the main envelope of the body. In order to avoid eddies and retardations, the upper edge of the cap should be in close connection with the lower edge of the main envelope of the body; but it is better to be somewhat narrower than the edge of the envelope. Otherwise water eddies would arise in the direction of travel behind the edge of the cap, giving rise to retardation and irregularities of fall of the sounding body.

In order to prevent this movable cap from giving the sounding signal on the impact of the lead on the water, it must for this period be prevented from moving by a device which does not give the cap freedom of movement until after it has struck the water surface. According to the invention this is obtained by arranging a detent in the path of movement of the cap itself, or on constructional parts rigidly connected with it, adapted to be operated by the water pressure, which is released from the locking position at a predetermined depth of water by the pressure existing there. Preferably for this purpose a watertight air-filled capsule with flexible diaphragms is employed which is provided with a pin forming the detent and which, on deflection of the diaphragms under the influence of the water pressure, is removed from the path of the cap or the other locked members.

Sounding bodies of this kind may be constructed simplest as electrically operated explosive leads as already previously proposed. For this purpose there are combined an explosive charge with electric ignition, a source of current and a contact adapted to be closed on impact of the cap. An essential feature

of the present invention consists in the construction of the source of current. According to the invention, this is constructed as a cell adapted to be filled up and, in given cases also, the salt necessary for forming the electrolyte is present in the dry condition between the electrodes. The cell so long as the electrolyte has not gone into solution or an existing electrolyte (for example, sea water) is filled in, gives no voltage and an ignition of the explosive charge is therefore impossible in the dry condition of the lead. As soon as the lead is thrown into the water, sea water enters or the salt is dissolved in the water and the cell is ready for use. In order to avoid washing out of the salt, the latter is appropriately suspended in a porous or fibrous body located between the electrodes. In order to secure uniform penetration of the water, one of the electrodes or both are perforated at many places. For the sake of simplicity, the envelope of the lead can be used as one of the two electrodes and a corresponding sheet metal cone within the same as second electrode.

In the electrically operated lead, the above-mentioned pressure safety device can be constructed as electric contact device instead of a mechanically blocking device, in such a way that by the pressure action of the water, for example, on the diaphragm of the capsule, a locking device is not removed, but a contact located in the ignition circuit is operated which prevents premature ignition or a short-circuit for the ignition circuit is opened.

In the drawing two constructional examples of the invention are represented in longitudinal section. 1 indicates the envelope of the main body of the lead, 2 tail steering surfaces, 3 the cap movable relatively to the main body. The cap is held away from the main body in normal condition by means of a spring 5, the spring bearing against the abutment 6. The centre of the cap carries a contact pin 4, whose point makes contact with the contact spring 9 when the cap moves towards the main body. In the lower part of the main body is arranged a ballast and inertia body 7, which closes the main body at the bottom and on which the essential parts of the lead are secured and in which the upper end 8 of the contact pin is guided. The explosive charge is indicated with 10. The electric cell is formed by the envelope 1 of the main body and a coaxial sheet metal cone 11 with holes 18 for penetration of the water. Between 1 and 11 is arranged a porous intermediate layer 12 impregnated with the salt of the electrolyte. Appropriately in well-known manner two different electrolytes are used in order to prevent too powerful and too rapid polarisation of the cell. In the case of a copper-zinc cell, copper sulphate is advantageously employed on the copper

and magnesium sulphate on the zinc. Both salts preferably are separately suspended in two different porous layers lying one on top of the other.

The arrangement of the electric leads is very simple. The pole 11 of the cell is connected at 13 by means of a conductor with the ignition wire 14 of the detonator. From there a conductor 15 leads to the contact spring 9 and on contact between spring 9 and upper end 8 of the contact pin, the circuit is closed through the metallic body 7 to the envelope 1 of the main structure which forms the second pole of the cell. In order that the water may penetrate readily into the interior of the sounding body, holes 16 are provided in the envelope whilst holes 17 permit a rapid escape of the air. The admission of the water to the electrolyte salt is effected through the openings 18 in the inner electrode of the cell. This arrangement gives a very great security against an unintended moistening and activating of the cell by rain, spray and the like.

Regarding the contact it has still to be mentioned that a specially careful insulation between the contact elements 8 and 9 is by no means necessary. The resistance of the water gap between the two elements is very much greater than the total resistance of the closed circuit. In order that the contact between 8 and 9 is securely maintained after the impact of the lead on the surface to be sounded, contact portion pin 8 is recessed behind its point. On pressing in the cap, this point passes the spring 9 and the latter enters the recess, so that even if the pressure on the cap ceases, a separation of the contacts is excluded.

The safety device is represented at 19. It consists of a watertight capsule of thin sheet metal filled with air and provided with a detent 20 which is normally located in a groove 21 on the contact pin portion 4. Only when the lead has been immersed in water as far as the prescribed depth do the diaphragms of the air-filled capsule 19 yield so that the detent 20 is removed from the groove 21, allowing cap and contact pin to move against the force of the spring 5 towards the inside. It is sufficient also to provide the safety capsule with only one diaphragm.

Figure 2 differs from Figure 1 merely in the construction of the safety device. Whereas in Fig. 1 the diaphragm capsule is to be controlled by the water pressure carries a detent pin 20, which is located in the path of movement of the pin 4, in Fig. 2 the detent pin is omitted. In place of it the electric ignition circuit passes by way of conductors 22, 23 into the interior of the safety pressure capsule. It terminates in the interior of the capsule in two pins 24, 25 of which the one carries a contact spring 26 which is located above the end of the other.

The diaphragm 27 is again constructed as manometer diaphragm. On inward movement it presses down the spring 26 and brings it into contact with the counter-contact 25, so that only when the diaphragm 27 has been pressed in, can the ignition circuit be finally completed at contact 9. The inaccessibility of the pressure capsule within the cap 3 practically prevents any unintended pressing in of diaphragm 27.

It is obvious that the particular features of the invention which relate to the safety device and to the form of the body are applicable not only to electrically operated sounding leads but also to those with any desired signal emission. On the other hand, the use of the electric device, that is to say, the cell and the contact device is, of course, not limited to the particular forms of construction which have the given features of form or safety device. In the same way, any desired compositions of metals and electrolytes of well-known kind or kinds still to be discovered can be arranged in the manner here indicated.

What we claim is:—

1. A sounding lead comprising in combination a main body; a movable cap at the bottom end of the main body; an electric element adapted to be activated by water; an explosive charge for electrical ignition; a contact mechanism between the cap and the main body and electric connection lines between the element, the contact mechanism and the explosive charge; and a porous body disposed between the electrodes of said element and carrying an electrolyte in dry form, adapted to be actuated by the water when the device is put into use.

2. A sounding lead comprising in combination a main body; a movable cap at the bottom end of the main body; an electric element adapted to be activated by water; an explosive charge for electrical ignition; a contact mechanism between the cap and the main body and electric connection lines between the element, the contact mechanism and the explosive charge; the electric element containing an electrolyte in dry form between the electrodes and at least one of the electrodes being perforated.

3. A sounding lead comprising in combination a main body built up as a hollow cone of metal; a movable cap at the bottom end of the main body; an electric element one of the electrodes of which is represented by the main body, the other electrode being built up as a concentric cone of other metal within the hollow main body; a layer of fibrous or porous material between the two cones containing electrolytic salt suspended in dry form; an explosive charge for electrical ignition; a contact mechanism between the cap and the main body and electric connection lines be-

tween the element, the contact mechanism and the explosive charge.

4. A sounding lead comprising in combination a main body built up as a hollow cone of metal; a movable cap at the bottom end of the main body; an electric element one of the electrodes of which is represented by the main body; the other electrode being built up as a perforated concentric cone of other metal within the hollow main body; a layer of fibrous or porous material between the two cones containing electrolytic salt suspended in dry form; an explosive charge for electrical ignition; a contact mechanism between the cap and the main body and electric connection lines between the element, the contact mechanism and the explosive charge.

5. A sounding lead comprising in combination a main body; a movable cap at the bottom end of the main body; an electric element; an explosive charge for electrical ignition; a contact mechanism in connection with the movable cap and blocked by a detent releasable by the water pressure at a predetermined depth; and electric connection lines between the element, the contact mechanism and the explosive charge; the releasable detent consisting of a watertight closed hollow capsule provided with a flexible diaphragm carrying a pin which normally is inserted in the path of the contact mechanism and removed on deflection of the diaphragm by the water pressure at a predetermined depth.

6. A sounding lead comprising in combination a main body, a movable cap mechanism at the bottom end of the main body, an explosive charge arranged to be detonated by the movement of the movable cap on striking the surface to be sounded, and a releasable lock for normally blocking the movement of said cap, said lock consisting of a water-tight closed hollow capsule provided with a flexible diaphragm carrying a pin which normally is located in the path of said cap mechanism and is removed on deflection of the diaphragm by the water pressure at a desirable depth.

In testimony whereof we affix our signatures.

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