March 26, 1957 H. JUNGHANS ET AL 2,786,326

ALARM TIMEPIECE SOUNDING DEVICE

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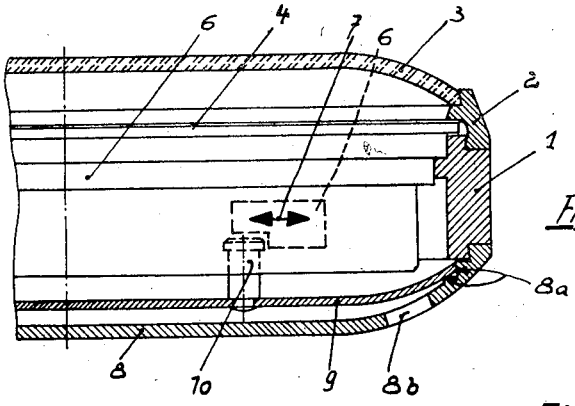


Fig. 1

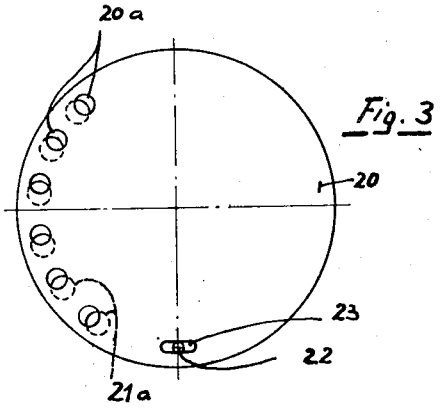
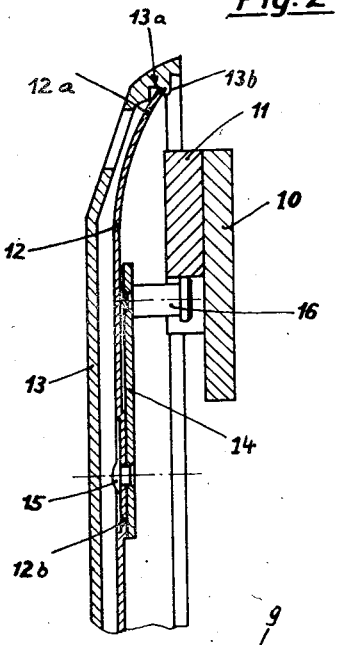


Fig. 3

Fig. 2



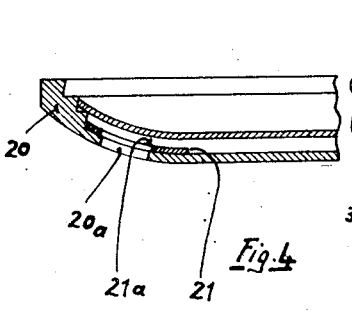


Fig. 4

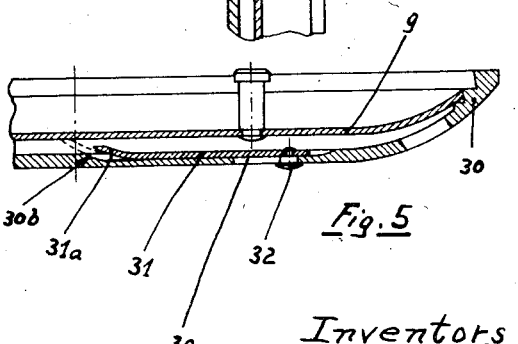


Fig. 5

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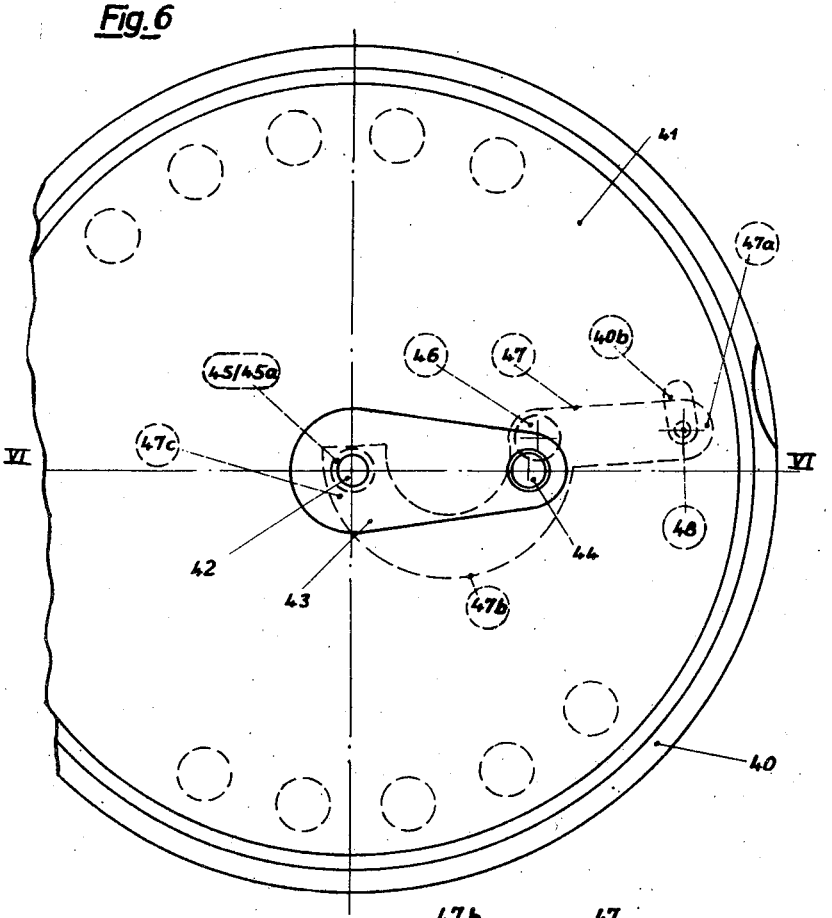
Fig. 6



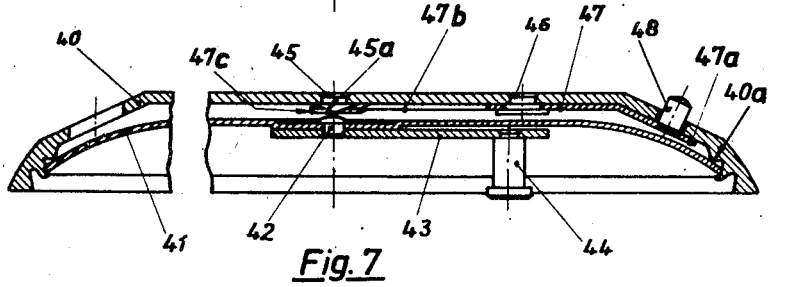


Fig. 7

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ALARM TIMEPIECE SOUNDING DEVICE

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2 Claims. (Cl. 58—57.5)

The invention relates to alarm time-pieces of the type which can be worn or carried. By this expression is understood, within the scope of the invention, more particularly wrist alarm watches, but also pocket alarm watches, alarm watches in the form of fob watches and the like. The object of the invention is to improve the means for the production of sound in watches of this type so that the greatest possible sound intensity is attained with restricted agitation energy. The condition that the assembly and manufacture should be simple is met at the same time.

A further object of the invention, is to make it possible to regulate the sound intensity within predetermined limits.

The invention consists in that a diaphragm is stretched in the base of the casing and the latter is constructed so as to be capable of being secured directly to the middle element of the casing. The rim of the diaphragm is advantageously sprung with pre-tension into a step arranged in the rim of the casing base and is thereby curved to correspond to the casing base.

In connection with wrist alarm watches, it is known to construct the casing base of three parts, namely, a so-called lunette ring, a flat diaphragm which is fitted into the lunette ring from without or within and a protective cap which is sprung on to the lunette ring. The arrangement according to the invention differs in an advantageous respect from this construction by the fact that it consists of only two parts.

In another known construction, the diaphragm is formed as the base of the casing and has a reinforced rim by which it is sprung on to the middle element of the casing. A protective cap is again secured to the diaphragm in the same way. In this construction, since the diaphragm constitutes the casing base proper, it must be lifted out of its sprung seating on the middle element of the casing when the latter is opened. In addition, because of the double duty which it has to perform, the diaphragm is a component which is complicated to manufacture and the requirements as to acoustic and mechanical properties of this part may be in opposition.

Finally, a wrist alarm watch is also known in which the diaphragm is sprung into the middle element of the casing more or less as an inside cover, and the protective cover is sprung independently thereof on to the said middle element; thus, both parts have an independent seating on the middle element. Here again the diaphragm is provided with a reinforced rim and must be lifted out of its sprung seating on the middle element when the casing is opened.

The arrangement according to the invention differs to its advantage from these known constructions by the fact that the diaphragm and the casing base constitute a constructional unit which only has to be dismantled if the diaphragm should have become damaged, this being a case for repair that is scarcely conceivable in practice. Therefore the diaphragm is not touched when the casing is opened and above all its pre-tension is not altered. This

is very essential for the acoustic quality of the arrangement; in the known arrangements, it is possible for the diaphragm to become unfavourably distorted by awkward application of the opening device for the casing or when forcing the diaphragm back again. The springing of the diaphragm into the casing cover in accordance with the invention offers the further advantage that the diaphragm can be made of a plate of the same thickness, that is to say, not only is it extremely simple to manufacture, but it is also possible to employ the most suitable material from the sound point of view. According to a further feature of the invention, the diaphragm is made as a flat plate and is given its curvature and pretension only when it is sprung into the casing base.

The arrangement of the diaphragm in the casing cover, in accordance with the invention, gives a surprisingly high sound intensity with comparatively moderate agitation energy.

However, it has been found that the strength and purity of tone can be still further considerably improved if the following conditions are met, these being effective when used separately, but being more so when used in combination: The alarm hammer, or at least the striker thereof, should be made of hardened steel. It is advantageous to rivet a hardened striker on a non hardened hammer body. Protracted tests have shown that the maximum sound intensity is obtained when the number of hammer blows is between 25 and 37 per second, and preferably an average of 31.

On the other hand, the anvil is preferably made as an angle member with unequal limbs, the free end of the long limb being secured approximately at the centre of the diaphragm and advantageously on a raised portion of the latter; the long limb may be a strong flat strip and the short limb a headed stud riveted in the latter.

The diaphragm may be more firmly secured in the recess of the casing cover into which it is sprung by the edge of the recess being rolled over the rim of the diaphragm.

The wearer of a wrist alarm watch frequently does not wish people nearby to be aware of the fact that it is an alarm watch. One the other hand, in order that the wrist alarm watch may be used for awakening the owner from a deep sleep, it is necessary that it operates with the greatest possible sound intensity when required. In order to satisfy both these requirements, it is possible, according to a further feature of the invention, for an externally operable device for regulating the sound intensity to be arranged on the base of the casing, such device advantageously being in the from of a damping device, which can at will be brought into contact with or removed from the diaphragm.

Several embodiments of the invention, as used on a wrist watch with an alarm device, are shown in the drawings, wherein:

Fig. 1 is a part section, seen from the side, of a wrist alarm watch in acordance with a first embodiment, the constructional parts which are not necessary for the purpose of understanding the invention being omitted so that the invention may be better seen;

Fig. 2 is also a part section, seen from the side, of a wrist alarm watch in accordance with a second embodiment;

Figs. 3 and 4 are a plan view and section, respectively, of a first embodiment of a device for regulating the sound intensity, Fig. 4 being shown to a large sale than Fig. 3;

Fig. 5 is a section of a second embodiment of a device for regulating the sound intensity;

Fig. 6 is a greatly enlarged view of a third embodiment of a device for regulating the sound intensity, such figure being a view on the inside of the sound element;

Fig. 7 is a section on the line VI—VI of Fig. 6.

The arrangement and construction of the sound element in the embodiment represented in Fig. 1 is as follows: The middle element in the casing of a wrist watch is indicated at **1**, the general construction thereof being assumed to be known. **2** is the glass rim, **3** is the glass, **4** is the dial and **5** is the clockwork mechanism. **6** is the alarm hammer which can execute oscillatory movements in the direction of the double-headed arrow **7**.

The base **8** of the casing is sprung onto the middle element **1** of the casing. The base acts as support for the diaphragm **9** and for this purpose a step **8***a* is turned in the rim of the base, the diaphragm being sprung into the step with suitable pre-tension. The assembly consisting of the diaphragm and its support, viz: the base of the casing, is here referred to as the sound element. It has proved to be desirable for the pre-tension to be imparted to the diaphragm as it is sprung into position in such manner that when it is in position, it assumes a curvature corresponding approximately to the curvature of the cover. A similar method is employed when inserting so-called unbreakable watch glasses. The springing and deforming of the diaphragm is effected under control of the tension for the purpose of obtaining the predetermined acoustic values. A striker pin **10** is riveted in the diaphragm. Sound openings **8***b* are formed in the base **8** of the casing.

Although the securing of the diaphragm by springing into the base of the casing is given as the preferred arrangement it is also possible to provide other methods of fixing within the scope of the invention, for example, by beading or rolling in the diaphragm. In this case, the curvature corresponding to the casing base can be imparted to the diaphragm before fitting, for example, by drawing.

In the embodiment shown in Fig. 2, special provisions are made for increasing the sound intensity and purity of tone:

Secured to the body **10** of the alarm hammer is a striker **11** consisting of hardened steel and secured, for example, by riveting. The hammer **10**, **11** swings parallel to the main plane of the diaphragm **12**, that is to say, perpendicular to the plane of the drawing.

The diaphragm **12** is sprung by its rim **12***a* into a turned recess **13***a* in the casing base **13** and is additionally secured by beading the edge **13***b*. At its centre, the diaphragm is formed with a raised portion **12***b* and secured to the latter by the rivet **15** is the strip **14**. The strip **14** again sets as support for the headed pin **16** against which the hammer **10**, **11** strikes with its hardened striker **11**.

In a wrist alarm watch according to the invention, the maximum sound intensity has been attained by complying with the following data:

Mean number of strokes of the alarm hammer=31 per sec.
Mean turning moment of the spring core=105 cm./gr.
Transmission from spring core shaft to alarm escapement wheel=1/26.2
Number of teeth on alarm escapement wheel=12
Weight of hammer=0.7 gr.
Distance from axis to centre of gravity=5.4 mm.
Diameter of diaphragm=31.0 mm.
Thickness of diaphragm=0.2 mm.
Resonance frequency of the diaphragm (within the maximum range of audibility)

The following means are provided for varying the second intensity:

In the arrangement according to Figs. 3 and 4, 20 sound apertures **20***a* are provided on the casing cover **20** and a ring **21** (Fig. 4) provided with corresponding holes **21***a* is placed in position in the casing base underneath the diaphragm. By means of a pin **22**, which extends through an aperture **23** in the casing cover, the ring **21** can be rotated into the open or closed position or into any desired intermediate position.

The means for damping the sound according to Fig. 5 makes use of a resilient damping slide member **31** mounted in the base **30** of the casing. A push button **32** secured to the slide projects through a slot **30***a* in the casing base. The resilient free end **31***a* of the slide runs on a deflecting surface **30***b* on the casing base when the slide is displaced and is thereby curved upwardly until it is in contact with the diaphragm **9**. The oscillation of the diaphragm is strongly damped thereby.

In the sound element represented in Figures 6 and 7, the casing base is indicated by **40**; a rib **40***a* is formed in its rim by turning and the diaphragm **41** is sprung thereinto. The bar **43** with the hammer striking post **44** is fixed at the centre of the diaphragm **41** by means of a rivet **42**.

The rivet **45** formed with a conical bead **45***a* is riveted in the casing base **40** in axial alignment with the rivet **42**. The double-armed lever **47** can be oscillated about the rivet **46** which is also secured in the casing base. A pin **48** is secured to the arm **47***a* and projects outwardly through a slot **40***b* in the base. The free end of the lever arm **47***b* is bent slightly upwards at **47***c* towards the diaphragm and the lever **47** is so shaped and arranged that, by swinging its bent end **47***c*, it can be made to travel on the inclined rivet head **45***a*. In this way, the lever arm **47***b*, made of thin flexible material, is raised from the base **40** of the casing and is moved so that its end **47***c* is moved onto the head of the rivet **42** in the diaphragm **41**. The contact thus obtained between the diaphragm and the lever arm **47***b* effects an appreciable damping of the noise of the alarm, the degree of damping depending upon the angle through which the damping lever **47** is turned.

The lever **47** is a stamping and the rivets **45**, **46** and the pin **48** are turnings, so that the entire arrangement can be easily and inexpensively made.

We claim:

1. In an alarm wrist watch an annular central casing member, a base casing member in dished form provided on one side of the central casing member, said base casing member having an abutment formed on and projecting internally from the base member on the internal surface side of the base member, a vibratory diaphragm consisting of a flat plate of uniform thickness sprung into said abutment in the base casing and thereby assuming a dished form approximately corresponding to the shape of the base member, an anvil secured to said diaphragm, and an alarm hammer arranged to oscillate in a plane parallel to a dial plane of the watch in a path to strike said anvil, and said base member having at least one aperture provided therein for facilitating the emission of sound from the diaphragm to the outside of the watch.

2. In an alarm wrist watch an annular central casing member, a base casing member in dished form provided on one side of the central casing member, said base casing member having an abutment formed on the internal suface side of the base member concentric therewith, a vibratory diaphragm consisting of a flat plate of uniform thickness sprung into said abutment in the base casing and thereby assuming a dished form approximately corresponding to the shape of the base member, the diaphragm having a central portion projecting therefrom, an angle member with arms of unequal length of which the longer arm is rigidly fixed to the projecting portion of the diaphragm and the shorter arm acts as an anvil, and an alarm hammer arranged to oscillate in a plane parallel to a dial plane of the watch and in a path to strike said anvil, the striker portion of said hammer being of steel, and the base member having apertures provided therein for facilitating emission of sound from the diaphragm to the outside of the watch.

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