May 31, 1960 E. C. PRATT 2,938,493

FIRE ALARMS

Filed Feb. 21, 1956

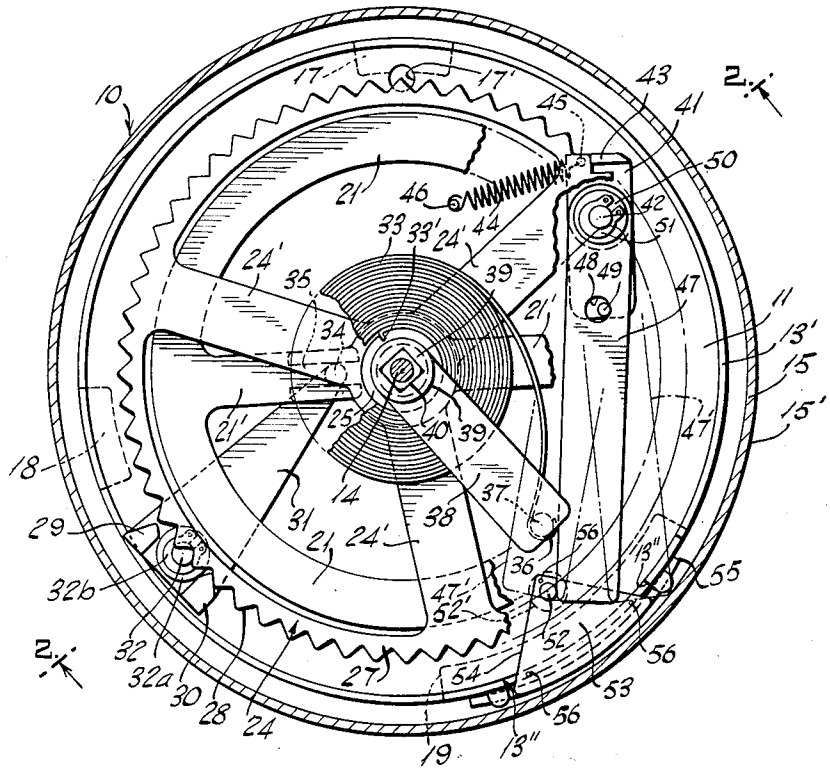


FIG. 4

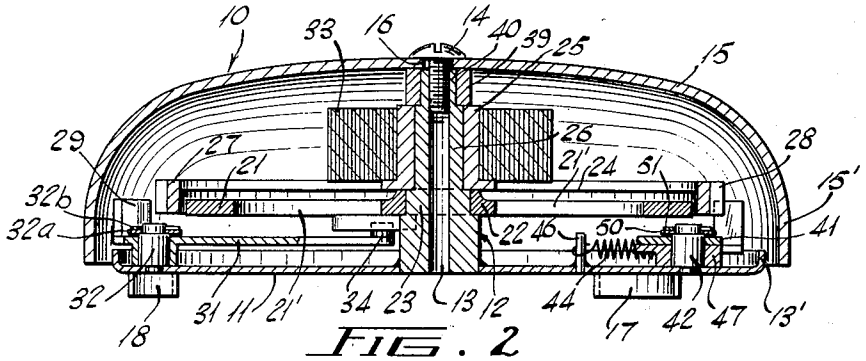


FIG. 2

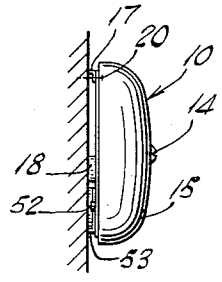


FIG. 1

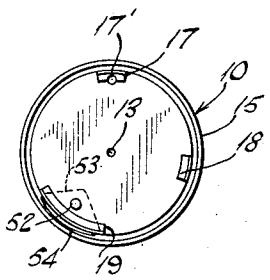


FIG. 3

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FIRE ALARMS

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4 Claims. (Cl. 116—106)

The present invention relates to fire alarms and more specifically to an improved compact alarm embodying a self-contained power source and responsive to a predetermined ambient temperature to sound a high level warning signal for extended periods of time.

Many types of fire alarms and fire detection devices embodying self-contained power sources have been proposed, but these devices have not been entirely satisfactory and dependable. For instance, one type of prior alarm embodied a container filled with a gas under pressure and sealed with a drop or link of fusible, low-melt material. Upon melting of the fusible material, the released gas would function to operate a whistle or horn as the alarm. With this type of alarm, a substantial delay is encountered in sounding the alarm because the relatively large mass in contact with the fusible material retards the melting of said material after the critical ambient temperature has been reached. Moreover, if the fusible material melts rapidly, the gas is released too quickly so that the duration of the audible alarm is shortened. On the other hand, incomplete melting will retard the escape of gas and fail to generate a sufficiently high sound level.

Still other alarm systems have utilized self-contained batteries that must be checked frequently, or they are connected with the housewiring system. This power supply may, however, have been rendered inoperative by the fire to be detected. Furthermore, inasmuch as such systems usually employ a heat-sensitive detecting element connected by wires to an electric bell or gong and to the power source, the cost of the installation together with the individual components is relatively high, and, unless care is exercised in wiring, the resultant installation may be unsightly. Mechanical alarms have also been suggested, but these, too, have been found to be unsatisfactory because of the relatively high cost, the lack of complete dependability and failure to generate distinctive signals of a sufficiently high level to serve effectively as an alarm.

Another disadvantage with the prior systems such as those discussed above is that a visual indication is not provided in order to quickly determine the operative condition of the equipment. In the case of the gas alarm, it is not possible to determine at a glance and in the absence of expensive pressure gauges or accurate scales whether sufficient pressure has been retained within the chamber. Known mechanical and electrical devices have the same difficulties. A further defect in many prior known systems—and particularly systems embodying a self-contained power source—is that they fail to produce a sufficiently high sound level that is distinctive in character and not easily mistaken for sound normally heard in homes, offices and factories; also one which would continue for a long enough time to provide adequate warning.

Accordingly, one object of the invention is the provision of a new and improved alarm system that not only overcomes the disadvantages of prior systems and

devices but also avoids the need for frequent and time-consuming tests in order to determine its operative condition.

Another object of the invention resides in the provision of an improved alarm embodying a self-contained power source that is characterized by its simplicity, dependability and ease of manufacture. Moreover, after the alarm has been actuated to sound the warning signal, it may be quickly and easily returned to an operative condition.

Still another object of the invention resides in the provision of an improved warning alarm that is wholly self-contained, affords a visual means for determining its operative condition and may be readily and easily mounted on the wall or other vertical partition. Inasmuch as a visual check is provided for determining the operative condition of the alarm, the device may be positioned near the ceiling of the room to be protected, which provides a more rapid response of the device to the heat generated by a fire and, at the same time, keeps it out of reach of persons normally using the room so that it will not be accidentally damaged or tampered with.

A further object of the invention resides in the provision of a new and improved fire warning device embodying a self-contained power source and one that presents a neat and attractive appearance.

The above and other objects of the invention will become more apparent from the following description and accompanying drawings forming part of this application.

In the drawings:

Figure 1 is a side elevation of an alarm in accordance with the invention;

Figure 2 is a diametral cross section of the alarm shown in Figures 1 and 4 and taken along the line 2—2 of Figure 4;

Figure 3 is a rear view of the alarm shown in Figure 1; and

Figure 4 is a front view of the alarm of Figure 1 with the covering bell indicated in section and with certain of the elements broken away to show certain constructional features thereof.

Referring now to the drawings, the alarm, in accordance with the invention, is generally denoted by the numeral **10** and includes a generally circular base **11** having a central shaft **12** that may either be secured to the base as illustrated or formed integral therewith. The shaft **12** includes an opening **13**, the upper end of which is threaded to receive a bell mounting screw **14**. The bell or gong **15** has an inside diameter slightly greater than the outside diameter of the base and includes a central opening **16** to receive the mounting screw **14** and secure the bell firmly to the outer end of the shaft **12**. The skirt portion **15'** of the bell **15** is arranged to slightly overlap an upwardly formed flange **13'** disposed about the outer edge of the base **11** and formed integral therewith. The base further includes three supporting feet **17**, **18** and **19**, which space the base **11** from a wall when mounted thereon, as shown in Figure 1. The foot **17** is further provided with an opening **17'** to receive the head of a nail **20** or other wall-carried hook. The alarm may, however, be supported in a horizontal position, as on a table.

The operative mechanism of the alarm includes a balance wheel **21**, having a central hub **22**, rotatably mounted on a section **23** of the shaft **12** which is of slightly reduced diameter in order to form a shoulder to limit the downward movement of the balance wheel **21**. The axial length of the hub **22** is preferably made slightly less than the length of the shaft part **23** so that the balance wheel can move independently about the shaft part **23** when the other elements of the mechanism are in place.

The balance wheel 21 is held in position in the mechanism by the escapement gear 24 having an elongated central hub 25 rotatably mounted on section 26 of the shaft 12. The shaft section 26 is of lesser diameter than the section 23 to provide a shoulder to receive the escapement gear 24 and prevent its interference with the balance wheel 21. In addition, the length of the hub 25 is somewhat less than the shaft section 23 so that independent rotation can be imparted at all times to the escapement gear. While the escapement gear, as well as the balance wheel, may be made in any desirable form, the balance wheel 21 is provided with radial members 21', 21' that carry the hub 22 while the escapement gear is provided with three equally spaced radial spokes 24'. The outer periphery 27 of the escapement gear 24 is provided with a plurality of equally spaced V-shaped teeth 28 that cooperate with a pair of teeth 29 and 30 on an escapement arm 31.

The escapement arm 31 is mounted on and rotatably supported by a stud 32 secured to the base 11, and it is held in place by suitable fastening means such as the washer 32*a* and a spring clip 32*b*. The position of the mounting means on the escapement arm 31 is coordinated with the teeth 29 and 30 so that, as the arm is rocked about the stud 32, the teeth 29 and 30 will alternately engage the teeth 28 on the escapement gear and thus permit the gear to rotate slowly step by step in the clockwise direction as shown in Figure 4.

The energy imparted to the escapement gear 24 by means of a central spring 33 to be described produces the rocking action of the escapement arm. In order to control the periodicity of this rocking action and thus the rotation of gear 24, the inner end of the escapement arm 31 is provided with an upwardly extending stud 34 which engages a slot 35 disposed on the underside of the diametral member 21' supporting the balance wheel 21. With this arrangement, as energy is imparted to rotate the escapement gear in a clockwise direction, it will cause the escapement arm 31 to oscillate. At the same time, the escapement arm will cause the balance wheel 21 to rotate alternately clockwise and counterclockwise about the central shaft section 23. Since the balance wheels adds mass to the oscillatory system, the inertia of the balance wheel and escapement arm will determine the periodicity of the operation.

In order to impart power to the escapement gear 24, the coil spring 33 is wound about the hub 25 of the escapement gear 24, and the inner end 33' of the spring is provided with an inwardly bent portion for engagement with a corresponding slot in the hub 25. If desired, the inner end of the spring may be secured to the hub by screws or any other suitable fastening means to insure positive coupling between the spring and the hub and prevent relative motion therebetween.

In order to hold the spring 33 in a tightly coiled position as illustrated in Figure 4, the outer end 36 of the spring is provided with a small reversely curved portion for engaging a stud 37 on the outer end of the spring retaining bar 38. The inner end of the bar 38 is provided with a hub 39 that is fixedly keyed to the upper section 40 of the central shaft 12. In the present embodiment of the invention, keying of this spring retaining bar 38 is accomplished by forming the shaft part 40 with a square section and providing the hub 39 with a square opening for cooperation therewith. The shaft section 40 is preferably made slightly smaller than the shaft section 26 so that the hub will rest against the shoulder formed therebetween and hold the escapement gear 24 and the balance wheel 21 in position on their respective shaft parts.

In order to utilize the intermittent rotary motion of the escapement gear 24 for ringing the bell or gong 15, a hammer bar actuator 41 is pivotally mounted on a stud 42 secured to the base 11 and disposed generally diametrically opposite the escapement arm mounting stud 32. This actuator bar is provided with a tooth 43 on the outer end thereof that is adapted to engage gear teeth 28 of the escapement gear one at a time. A spring 44 balance wheel adds mass to the oscillatory system, the ator 41 and, at the other end, to a fixed stud 46 secured to the base 11. This spring, which may be termed an actuating spring, holds the tooth 43 in engagement with one of the teeth 28 of the escapement gear. As the escapement gear revolves, the actuator is rotated in a clockwise direction as shown in Figure 4 until the tooth 43 clears the outer edge of a tooth 28, whereupon the spring 44 will cause the actuator to snap rapidly in a counterclockwise direction until the tooth 43 engages the base of the next successive tooth 28. Thus, the escapement gear imparts a rocking or oscillatory motion to the actuator with relatively slow clockwise motion and rapid counter-clockwise motion.

The hammer bar 47 is operated by the actuator 41, is considerably longer in length, and has an opening 48 engaging a stud 49 secured to and extending outwardly from the actuator 41. The diameter of the opening 48 is substantially greater than that of the stud 49 and permits the hammer 47 to rebound after striking the gong 15 to prevent damping of the resonant vibration imparted to the bell. Thus, as the actuator moves in a clockwise direction under the action of the escapement gear 24, the hammer bar 47 is moved inwardly to a point denoted by the broken outline 47'. At the moment the tooth 43 of the actuator 41 clears an escapement gear tooth, it is snapped rapidly in a counter-clockwise direction, driving the outer end of the hammer 47 to a position wherein the leading edge of the hammer 47 is spaced slightly from the inner periphery of the gong 15. At this point, the momentum imparted to the hammer 47 is sufficient to carry it outwardly to strike the gong, whereupon it immediately retracts because of the elasticity of the materials. In so doing, the kinetic energy of the hammer 47 is generally absorbed when the edge of the opening 48 contacts the pin 49. In addition, the pin 49 by this time has moved to the left, as shown in Figure 4, so that the actuator 41 not only absorbs the remaining energy in the hammer 47 but starts to retract the hammer for the next operation.

It will be observed that, when the warning alarm 10 is hung on a wall with the opening 17' at the top, the hammer bar 47 will occupy a generally vertical position and pivot back and forth about the stud 42. In this way, minimum energy is required on the part of the escapement gear 24 to actuate the hammer, and the oscillatory motion of the hammer in the vertical plane tends to reduce frictional losses in the system. In order to retain the actuator 41 together with the hammer bar 47 on the stud 42, a suitable washer 50 and spring clip 51 are provided for this purpose.

Operation of the alarm is controlled by a fusible stud 52 disposed in the path of movement of the inner edge of the hammer 47. This stud may be observed more clearly in Figure 4. The stud is inserted through an opening in the base 11 and is provided with an anchorage or head 52' which may be observed on the back view of the alarm as shown in Figure 3. This stud, as will be observed from the drawing, blocks the clockwise motion of the hammer bar and holds the tooth 43 of the actuator 41 in fixed engagement with a tooth of the escapement gear 24. When a predetermined temperature is reached, the stud 52 will soften and release the hammer bar 47 and the actuator 41 for operation, as previously described.

In order to increase the sensitivity of the alarm in response to ambient temperature and to provide a visual indication of the operative condition of the alarm, a triangular tab member or trigger 53 is held in position on the alarm by means of the fusible stud 52. The trigger 53 is in the form of a flat triangularly shaped plate 54.

It is received in a notch 13'' in the flange 13' of the base 11 and has an integral flanged edges 55 of a radius slightly smaller than the radius of the base 11 so that it will touch the periphery of base 11 only at its end portions, as shown in Figure 4. The trigger is held in position by engagement with the fusible stud 52, and the part 54 is held out of contact with the base by three small bumps 56 that engage the rim 13' of the base as well as the inner face of the base near the position of the fusible stud 52. With this arrangement, should the stud be damaged or fused, the trigger 53 will be released from an alarm mounted on the wall and fall to the floor. By painting the trigger 53 a bright color to make it easily visible, its absence from the bell will indicate that the alarm had been operated or damaged in some way and that inspection is required. Usually, the trigger 53 will be observed on the floor directly beneath the gong and will indicate that the gong or alarm is not in operable condition. The trigger 53 also serves another function, namely, to provide a relatively large surface that will become quickly heated by a rapid increase in the ambient temperature and impart such heat directly to the fusible stud 52. Since the trigger contacts the base of the alarm at a relatively few points of small area, absorption by the massive base 11 is minimized. In this way, the temperature of the pin 52 will follow closely the temperature of the trigger 53 and thus insure a rapid response of the alarm to a change in the ambient temperature.

Fusible materials of any desired type may be used with this invention to cause the alarm to function at a wide variety of temperatures. Conventional low-melting alloys or plastics may be used that will fuse at temperatures as low at 136 degrees Fahrenheit while others will fuse at temperatures of about 156 degrees Fahrenheit and even higher.

Actual tests with the alarm in accordance with this invention have indicated that sound levels exceeding 85 to 95 decibels may be readily obtained. By limiting the periodicity of operation, a distinctive alarm signal can be obtained that will be readily distinguished from such common noises as door bells, telephone bells, call systems and the like and, at the same time, provide a continuous warning signal for periods of three minutes and even greater, depending on the repetition rate that may be employed. Thus, this invention provides a highly dependable, simplified, and relatively fool-proof device that is highly sensitive to rapid changes in ambient temperature and will provide a high level warning signal that is sufficiently loud to attract attention.

Hanging weights may be utilized as energy-storing means to drive arbor 25 instead of the spring.

While only one embodiment of the invention has been illustrated and described, it is apparent that modifications, alterations and changes may be made without departing from the true scope and spirit thereof.

What is claimed is:

1. An alarm comprising a base, means to mount the base in spaced-apart relation to a surface, a hub secured to the base and arranged to extend outwardly from the surface, a gong supported on the hub and having its perimeter overhanging the perimeter of the base to form a closure with the base, an escapement gear disposed within the closure and rotatably mounted on the hub, speed control means pivotally secured to said base and engaging said escapement gear to limit the rate of rotation of the latter, an oscillatory hammer mounted on the base within the closure and arranged to strike the gong, means within the closure coupled between the teeth of the escapement gear and the hammer for periodically moving the hammer relative to the base to cause the hammer to repeatedly strike the gong in response to rotation of the escapement gear relative to the hub, means for releasably locking the hammer against movement relative to the base, a spring secured at one end to the escapement gear and at the other end to the hub for rotating the escapement gear relative to the hub when the hammer is released, the means for releasably locking the hammer including a triangular plate positioned on the base outside of the closure and a heat-responsive element extending through a hole formed into the plate and thence into the interior of the closure to engage the hammer, the fusible element being replaceable from outside the closure and adapted to be positioned to extend into the path of the hammer and thereby prevent movement of the hammer and escapement gear when resetting the alarm.

2. An alarm comprising a base, means to mount the base in spaced-apart relation to a surface, a hub secured to the base and arranged to extend outwardly from the surface, a gong supported on the hub and having its perimeter overhanging the perimeter of the base to form a closure with the base, an escapement gear disposed within the closure and rotatably mounted on the hub, a hammer movably mounted on the base within the closure and arranged to strike the gong, means within the closure coupled between the teeth of the escapement gear and the hammer for periodically moving the hammer relative to the base to cause the hammer to repeatedly strike the gong in response to rotation of the escapement gear relative to the hub, means for releasably locking the hammer against movement relative to the base, a spring secured at one end to the escapement gear and at the other end to the hub for rotating the escapement gear relative to the hub when the hammer is released, the means for releasably locking the hammer including a triangular plate positioned on the base outside of the closure and a heat responsive element extending through a hole formed into the plate and thence into the interior of the closure to engage the hammer, the triangular plate including a plurality of feet which contact the base to minimize the heat transfer between the plate and the base whereby the plate functions as an accumulator to gather heat in case of a fire and thereby expedite the fusing of the fusible element, the fusible element being replaceable from outside the closure and adapted to be positioned to extend into the path of the hammer and thereby prevent movement of the hammer and escapement gear when resetting the alarm.

3. An alarm comprising a base mounting a hub, means for mounting the base on a surface, a gong supported on the hub of said base and overhanging the perimeter of the base to form a closure therewith, a hammer disposed within the thus defined closure and pivotally connected to the base, the hammer being arranged to strike the gong, heat responsive means coupled between the base and the hammer for securing the hammer relative to the base and operable at a predetermined temperature to release the hammer for movement about its pivotal connection, and means including an escapement gear rotatably mounted on the hub and a first spring disposed within the closure for rotating the hammer about its pivotal connection alternately toward and away from the gong to cause the hammer to strike the gong, a second spring coupled between the hub and the escapement gear for rotating the gear relative to the hub, an actuator connected to the hammer and having a tooth in cooperative relation with the gear teeth of the escapement gear, and a third spring connected between the actuator and the base for holding the tooth of the actuator in engagement with one of the teeth of the escapement gear as the escapement gear rotates whereby the extremity of the hammer periodically snaps rapidly and strikes the gong when the hammer is released by the heat responsive means, the heat responsive means including a plate element external to the closure and adapted to fall to the floor when released and a fusible stud replaceable from outside the closure and extending through the plate into the path of the hammer for releasing the hammer and the plate at a predetermined temperature.

4. An alarm as defined in claim 3 wherein the hammer

has a hole formed therein and including a stud substantially smaller in diameter than the hole and extending through the hole to permit the hammer to rebound after striking the gong and thereby prevent damping of the resonant vibration imparted to the gong.

References Cited in the file of this patent

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2,609,786	Turner	Sept. 9, 1952

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,938,493 May 31, 1960

Edmund C. Pratt

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, lines 4 and 5, for "balance wheel adds mass to the oscillatory system, the ator 41" read -- is attached at one end to an opening 45 in the actuator 41 --; column 5, line 2, for "edges" read -- edge --.

Signed and sealed this 29th day of November 1960.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents