May 7, 1968 JEAN-CLAUDE SCHNEIDER 3,381,466

ALARM-BELL MECHANISM FOR AN ALARM TIMEPIECE

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Fig. 1

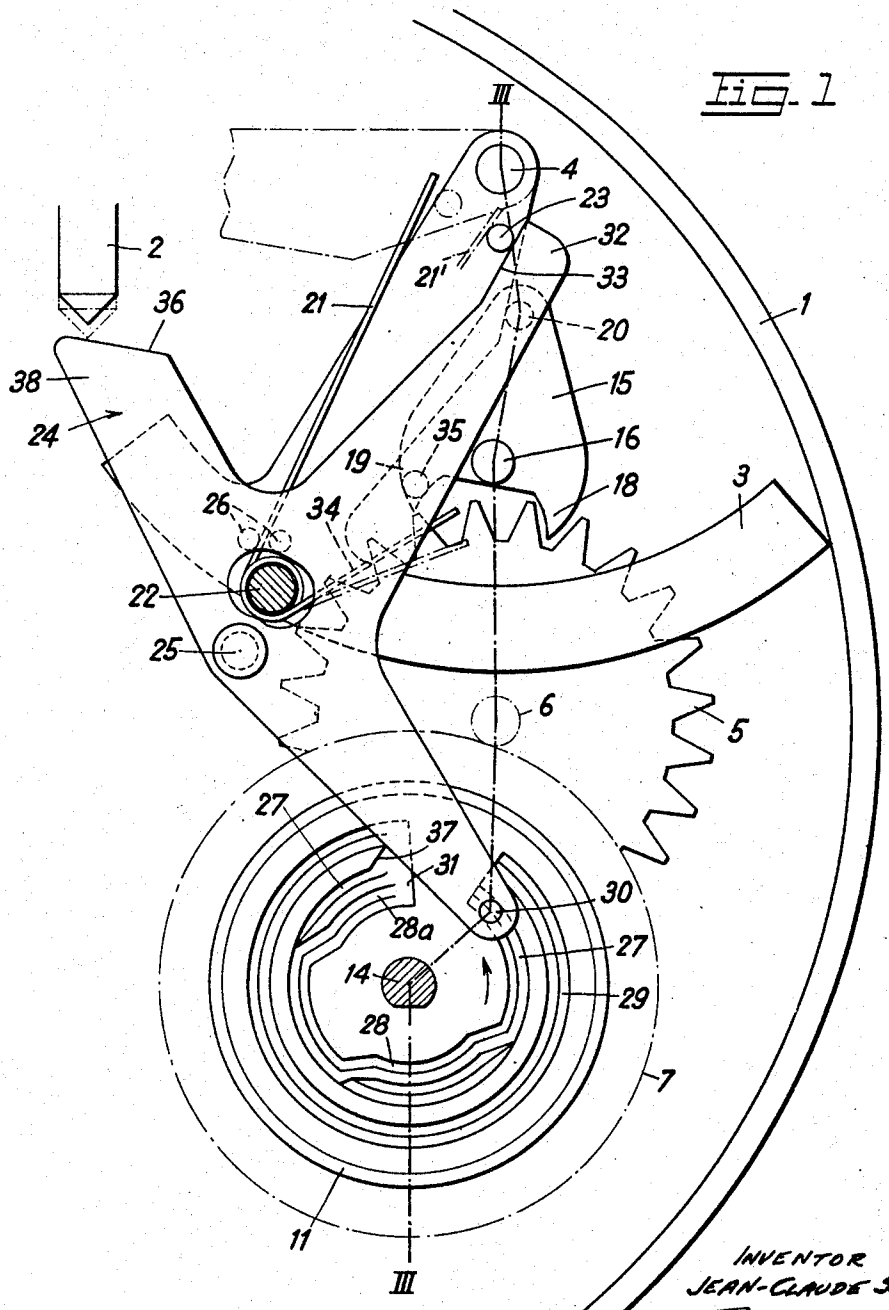

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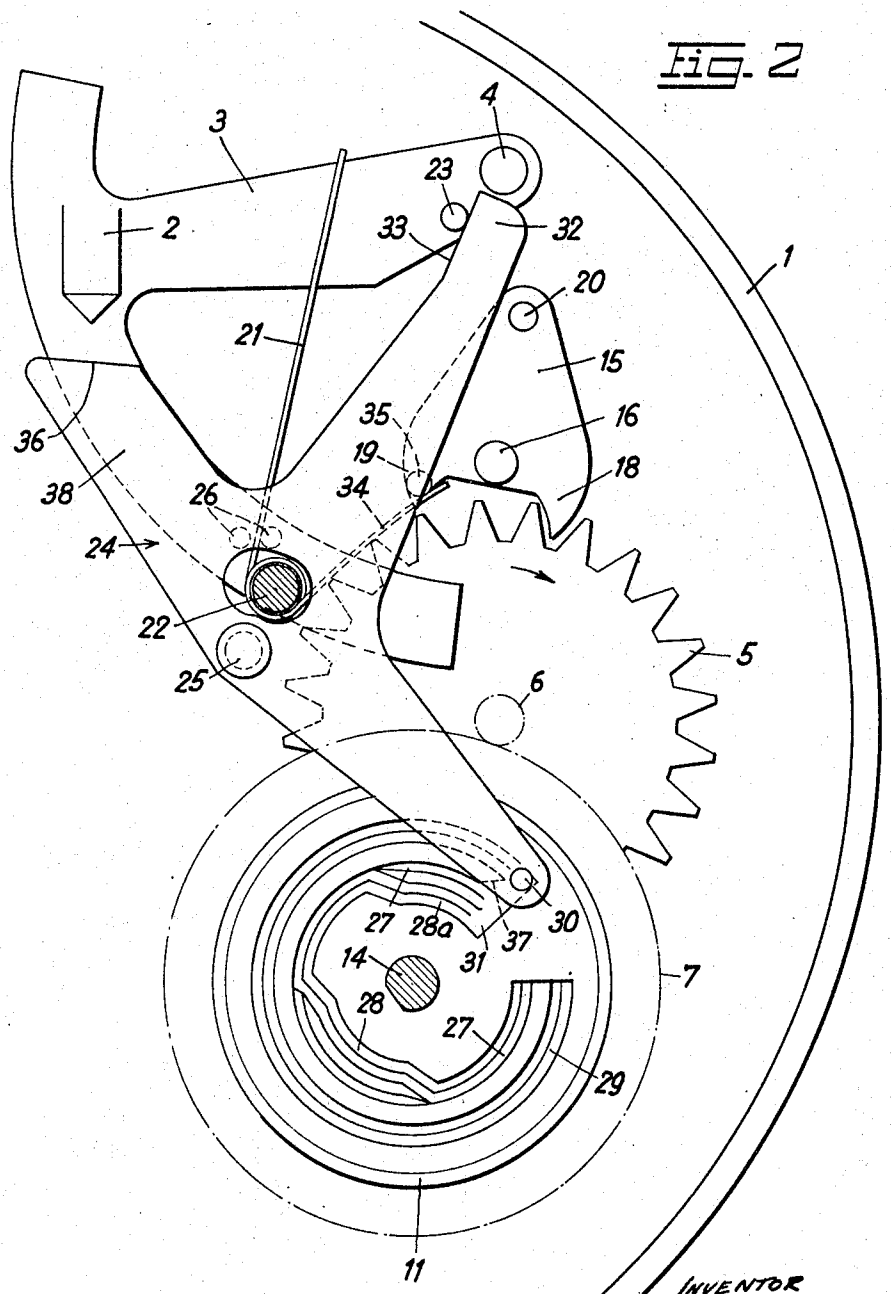
Fig. 2



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ALARM-BELL MECHANISM FOR AN ALARM TIMEPIECE

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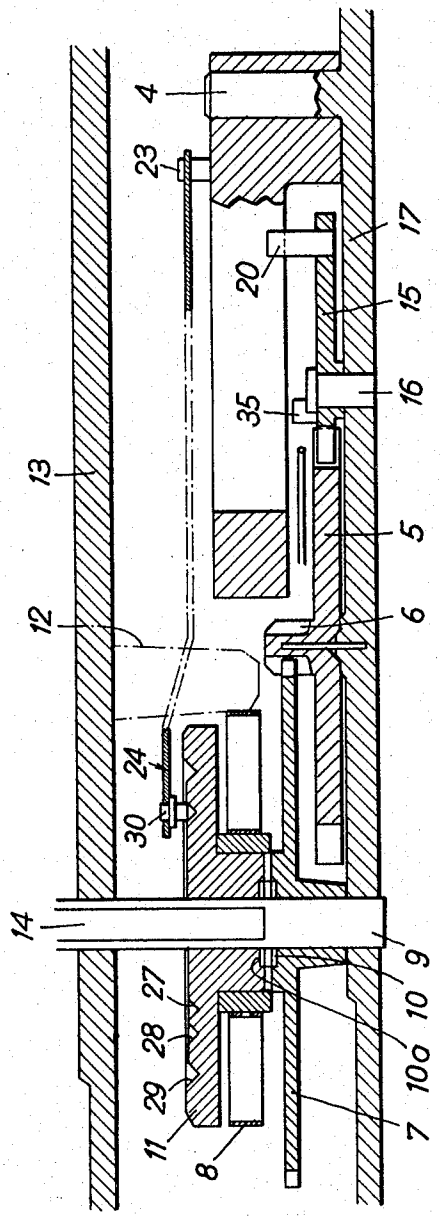
Fig. 3



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ALARM-BELL MECHANISM FOR AN ALARM TIMEPIECE

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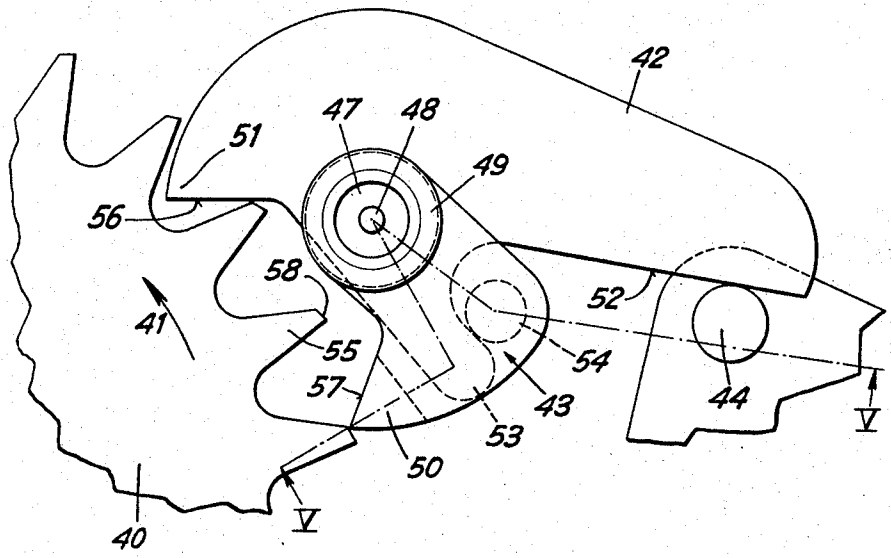

FIG. 4

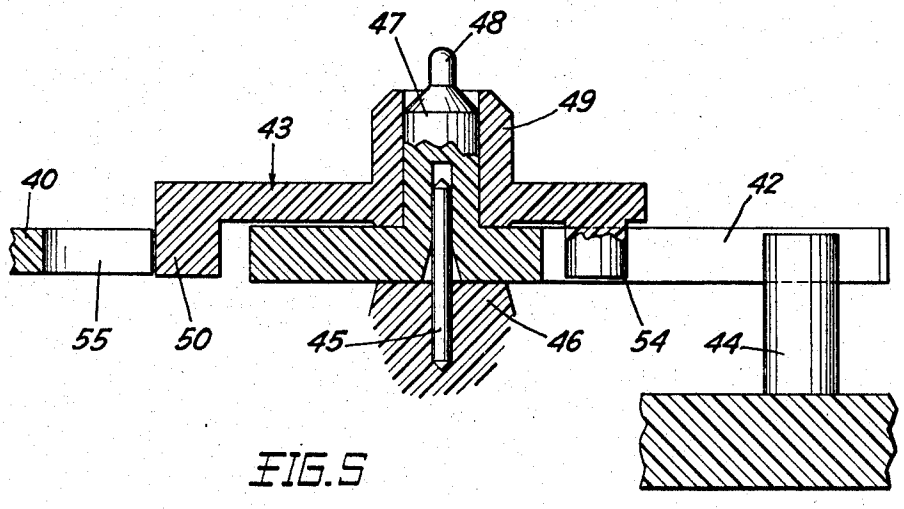

FIG. 5

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ALARM-BELL MECHANISM FOR AN ALARM TIMEPIECE

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15 Claims. (Cl. 58—16)

In alarm timepieces, the alarm-bell mechanism generally comprises an alarm-bell wheel provided with ratchet teeth driving the hammer. The latter is secured to an escapement comprising two projections which slide altenratively on the inclined flanks of the teeth of the alarm-bell wheel when the latter is freed, in such manner that the hammer oscillates and strikes the bell.

According to the present invention we provide an alarm-bell mechanism for an alarm timepiece comprising an alarm-bell provided with teeth, a spring for the entrainment of the alarm-bell wheel and an oscillating escapement provided with an impulsion member for urging an oscillating hammer from an equilibrium position, an input projection and an output projection, the said projections engaging alternately in the teeth of the alarm-bell wheel, the input projection locking the wheel whereas the output projection is urged out by the teeth thereof, the hammer being arranged to return to its equilibrium position, the hammer striking a bell in the course of its oscillation.

The accompanying drawings show, by way of example, two embodiments of the mechanism according to the invention.

FIGURE 1 is a plan view of the first embodiment in a first operating position,

FIGURE 2 is a similar view in a second operating position,

FIGURE 3 is a view in partial section of the mechanism shown in FIGURES 1 and 2,

FIGURE 4 is a partial plan view of the second form of embodiment, and

FIGURE 5 is a view in section along the line V—V of FIGURE 4.

The mechanism shown in the drawings is intended to be lodged in a small alarm clock provided with a circular bell **1** and in its upper portion, with a rod **2** for stopping the ringing action, the rod being vertically movable and adapted to be displaced into different positions, as will be explained later. A hammer **3** having the form of an arc of a circle is suspended within the bell **1** for free pivoting about a horizontal arbor **4**. In the inoperative position, its center of gravity is located in a vertical plane extending through the axis of the arbor **4**. Thus, the hammer occupies a position of equilibrium in which one of its ends contacts the bell **1**.

An alarm-bell wheel **5** secured to a driving pinion **6** is driven in rotation in the clockwise direction seen in FIGURE 1, when the alarm-bell mechanism is tripped. To this end, the pinion **6** engages with a wheel **7** which turns through rather less than a complete rotation during the unloading of an alarm spring **8**. FIGURE 3 shows that the wheel **7** is mounted idly on an arbor **9** and has Breguet form teeth on its upper face. These teeth mesh with corresponding teeth **10***a* formed in the lower face of a cam **11** to which the inner end of the spring **8** is attached. The outer end of the said spring is secured to a post **12** which is attached to a frame element **13**. The cam **11** rotates clockwise during the loading of the alarm spring and anti-clockwise during the unloading thereof, the Breguet coupling **10** being designed in such manner that the wheel **7** is entrained only during the unloading. The cam **11** is keyed to the arbor **9**, by means of a central aperture having a rectilinear edge co-operating with a corresponding flat **14** on the arbor **9**. The latter is driven in rotation during the loading period by means which are not described and is then freed at the instant of tripping of the alarm mechanism. It then rotates in the anti-clockwise direction as seen in FIGURE 1.

In order to drive the hammer **3**, the mechanism comprises an escapement **15** which pivots on a pin **16** secured to a frame element **17**. The escapement has two projections **18** and **19** which co-operate with the teeth of the wheel **5** in the manner of the pins on a conventional escapement. The projeceion **19** constitutes an input projection which, when it is engaged in the teeth of the wheel **5** locks it, whereas the projection **18** constitutes an output projection which, when it is engaged in the teeth of the wheel **5**, is expelled therefrom whilst rocking the escapement **15**. A stud **20**, constituting an impulsion member and fixed in the escapement opposite the projections **18** and **19** then communicates a pulse to the hammer **3**.

FIGURE 1 shows, in broken lines the position into which the hammer **3** rises under the effect of the impulses of the escapement. When removed from its position of equilibrium, it drops back under the effect of its own weight and the front edge of the arm of the hammer brings about, at the end of travel, the disengagement of the escapement which recovers the position shown in FIGURE 1, at the same time, the hammer **3** strikes the bell **1**.

Instead of the hammer oscillating freely when it receives the impulse from the escapement, it may also be braked, and then recalled by a resilient element **21** which consists of a rectilinear arm of a wire spring wound about a cylindrical post **22** on the frame element **13**. The said wire spring is normally in the position shown in full lines of FIGURE 1. However, it can be displaced into the position **21'** shown in broken lines, in which case it bears constantly against a stud **23** fixed in the arm of the hammer. It is clear that the wire spring, in its position **21'**, is loaded as soon as the impulse is imparted to the hammer, in such manner that the latter ascends to a lower level than when it is free and the disengagement of the escapement **15** is brought about more rapidly. The striking rate is thus accelerated. This variation in the striking rate may be obtained automatically during the alarm-bell action due to a rocker **24** consisting of a thin blade pivoting on a stud **25**. Fixed in the said rocker are two parallel pins **26** which embrace the limb **21** of the wire spring at a point very near the post **22**.

A rotation of the rocker **24** in the clockwise direction suffices to displace the wire spring from the position **21** to the position **21'**. This rotation is brought about by the cam **11**. The latter has in its upper face a series of grooves **27**, **28** and **29**. Furthermore, the rocker **24** has, at its lower part, an arm at the end of which is secured a pin **30** which, in the position shown in FIGURE 1, is engaged in the groove **27**. The rocker **24** is resilient, in such manner that the pin **30** bears slightly against the bottom of

the groove **27**. The resilience of the rocker **24** permits furthermore displacements of the cam **11** in the axial direction when it is entrained clockwise during winding-up, the Breguet coupling **10**, **10***a* being freed.

As will be seen in FIGURE 1, the grooves **27**, **28** and **29** have a V-shaped profile. They extend in concentric arcs of a circle centred on the axis of the arbor **9**. The grooves **27** and **29** extend in an arc of substantially 330°. The groove **28** comprises two segments **28** and **28***a* and begins in the groove **27** at approximately 80° from its commencement. It extends along a chord of a circle having its centre on the axis of the arbor **9** then has a portion comprising an arc of a circle centred on the axis of the arbor **9**, and then a second portion on the chord by means of which it reaches the groove **27**. The segment **28***a* also commences in the groove **27**. It has a rectilinear chordal portion and a portion forming an arc of a circle centred on the axis of the arbor **9**. The ends of the grooves **27**. **28***a* and **29** are joined by a radial groove **31**. At the commencement of the alarm action, the cam **11** is in the position shown in FIGURE 1. If the pin **30** is in the inlet of the groove **27**, the rocker being in a position illustrated in FIGURE 1, it will be seen that the cam **11** maintains the said rocker immobile for as long as the pin is in the groove **27**. At the inlet of the groove **28**, the pin is drawn towards the axis of the arbor **9**, thus pivoting the rocker **24** clockwise and displacing the resilient wire **21** into the position **21'**. From this instant on, the hammer rate is accelerated.

When the pin follows the portion of the groove **28** approaching the groove **27**, the rocker pivots anti-clockwise and the pins **26** return the resilient wire **21** into its normal position. The rate of the hammer is slowed down once more. The same phenomenon of acceleration of the rate is reproduced when the pin **30** reaches the groove **28***a*.

It will be noted that the device described also comprises a mechanism (not shown) which brings about the momentary stopping of the rotation of the cam **11** and of the wheel **7** at the instant at which the pin leaves the groove **28** to return into the groove **27**, in such manner that the actuation of the alarm mechanism, when it takes place as described hereinabove, is effected in two stages which may follow each other with an interval of greater or lesser length and each of which comprises as low-rate period and a rapid rate period.

The rocker **24** further comprises an arm **32** extending in the direction of the axis of the hammer and having an abutment face **33** at its free end. In the position illustrated in FIGURE 1, the said abutment face **33** is disposed in such manner that the stud **23** of the hammer reaches a point very near this face at the instant at which the hammer impinges against the bell. In this position, the face of the abutment **33** is thus inactive. It is also inactive when the rocker has pivoted towards the right so as to accelerate the hammer movement. On the contrary, it becomes active if the rocker pivots anti-clockwise out of the position shown in FIGURE 1 and passes into the position shown in FIGURE 8. The abutment **33** then locks the hammer **3** in a raised position, spaced-apart from the bell **1**. On the other hand, the studs **26** remove the wire spring **21** from the stud **23** but bring up a further resilient element consisting of a shorter arm **34** of the wire spring **21** contacting a stud **35** projecting from the projection **19** of the escapement **15**. The resilient arm **34**, under these conditions, causes disengagement of the escapement. The wheel **5** is able to rotate clockwise and the escapement **15** oscillates regularly without the hammer being actuated. If reference is again made to FIGURE 1, it will be seen that it suffices to pivot the rocker in such manner that the pin **30** passes from the groove **27** or from the groove **28** to the groove **29**, so as to put the mechanism in the position illustrated in FIGURE 2. The alarm-bell movement then develops idly until the pin **30** reaches the height of the groove **31** (FIGURE 2).

In this position, the alarm-bell mechanism is stopped.

Furthermore, the weight of the hammer **3** exerted through intermediary of the stud **23** on the rocker **24** pivots the latter clockwise, the pin **30** sliding in the groove **31**, and the rocker returns into the rapid-operation position. A winding-up mechanism then entrains the cam **11** in the clockwise direction and restores it finally to the starting position shown in FIGURE 1.

The passage of the pin from the groove **27** to the groove **29** may be manually controlled, at will. For this purpose, the rocker **24** has a third arm **38** terminating in an abutment face **36** extending under the control rod **2**. The lower end of the said rod extends normally to a height such that the abutment **36** just contacts it when the rocker is in the rapid-operation position. In the slow-operation position, a small space therefore extends between the rod **2** and the abutment **36** (position shown in full lines in FIGURE 1). However, a pressure may be exerted on the rod **2** at any desired instant and it causes the rocker to pass from one of the two operating positions into the idle-travel position. The rod **2** is carried on an annular member provided with an abutment which can be screwed into a support on the time-piece. By screwing this support, it is possible to displace the lower end of the rod **2** into the position shown in broken lines in FIGURE 1. It will be seen that the rocking of the rocker **24** in the clockwise direction at the instant of passage of the pin **30** at the inlet of the groove **28** is then prevented by this rod.

The inclined flank of the groove **28** passing through the groove **27** at this point tends to entrain the pin **30** toward the axis of the arbor **9**, but since the rocker is prevented from pivoting, the pin **30** ascends the said oblique flank and drops back into the groove **27**. The same phenomenon takes place when the groove **28** reaches the groove **27** and at the commencement of the groove **28***a*. In other words, by screwing the support of the knob **2**, the rocker is compelled to remain constantly in the slow-operation position. No acceleration of the rate of the hammer during the ringing action is produced.

The screwed or unscrewed position of the support of the knob **2** does not of course have any influence on the pivoting of the rocker which displaces the pin in the groove **29**. In other words, the knob for stopping the ringing action, on the rod **2** may be actuated whatever the position of the support. On the contrary, if the latter is in the screwed position, the pin **30**, instead of sliding in the groove **31** as far as the inlet of the groove **28***a*, at the end of the ringing action, will only slide as far as a point opposite the end of the groove **27**. For this purpose, an inclined ramp **37** is formed at the outlet of the said groove, so as to permit the pin to enter it readily at the instant of winding-up of the alarm-bell mechanism. The cam **11** could also have only two grooves instead of three, if no variation in the operational rate is desired. It could also have only a single groove **28** instead of two grooves **28** and **28***a*, so as to produce only one variation in the striking rate during the complete ringing action.

Furthermore, the mechanism described could also be utilised with a device for winding up the alarm-bell action which differs from that shown in the drawings.

The projections on the escapement could be inverted, in such manner that the inlet projection provides the impulse and the outlet projection serves as an abutment.

The alarm-bell mechanism shown in FIGURES 4 and 5 is similar, in broad outline, to that of FIGURES 1 to 3. It comprises an alarm-bell wheel **40** which is capable of rotating in the direction of the arrow **41** under the action of an alarm-bell spring (not shown), an escapement consisting of the two members **42** and **43** and a hammer **44** actuated by the escapement.

The main element **42** of the escapement is mounted on a pivot rod **45** (FIGURE 5) which is secured at its lower end in a boss **46** forming a part of a frame element of the alarm mechanism. The element **42** has a stud **47** projecting from its upper face coaxially with the rod **45** and

terminating in a pivot 48 of reduced diameter, which is freely engaged in a seating formed in a frame element located immediately above the escapement. The element 43 is mounted on the stud 47. It comprises a sleeve portion 49 which guides it relatively to the stud 47. As can be seen from FIGURE 4, the element 43 forms the input projection 50 of the escapement whereas the element 42 forms, at one of its ends, the output projection 51. This latter member is prolonged beyond the pivoting point of the escapement in the form of an arm one of the sides 52 of which cooperates with the stud projecting from the hammer 44. The member 42 has furthermore a lateral finger 53 forming, with the side 52, a notch in which a projection portion 54 of the member 43 is engaged. The portion 54 limits the possible angular movement between the two elements of the escapement.

In order to improve the cooperation between the teeth 55 of the alarm mechanism wheel 40 and the projections 50 and 51 on the escapement, the latter each have a rectilinear side 56, 57 and the teeth 55 each have a plane, oblique face 58 extending from their apex in the direction of the arrow 41.

The improvement in the functioning obtained due to the special construction of the escapement as just described results, on the one hand, from the fact that the members 42 and 43 which carry the entry and outlet projections are articulated relatively to each other and, on the other hand, from the fact that the teeth of the alarm mechanism wheel are able to act by communicating an impulse to the outlet projection 51 during the time that the sides 58 of the said teeth slide on the tip of the projection.

During the impulse, i.e. during the time that a tooth 55 bears on the side 56 of the projection 51 and the side 52 of the escapement urges the hammer 44, the member 43 only begins to engage in the teeth of the wheel 40 when its stud 54 contacts the side 52 of the member 42. The depth of penetration of the said projection is thus diminished. Furthermore, the action of the face 58 on the teeth 55 on the tip of the projection 51 prolongs the impulse to the maximum extent.

On the contrary, during the return movement of the hammer, when the latter rocks the member 42, by bearing on the side 52, the member 43 which contacts a tooth 55 and retains the alarm mechanism wheel remains immobile until the finger 53 entrains it by contacting the stud 54. The angular travel of the two parts of the escapement therefore retards the disengagement to the maximum extent. The penetration of the outlet projection in the teeth may be increased in such manner that the impulse commences as soon as the disengagement has terminated, i.e. as soon as the tip of the projection 50 has reached the front end of the face 58 of the tooth which it retains.

The mechanism of FIGURES 4 and 5 permits an improvement in the efficiency of the escapement by approximately 30% relative to the arrangement of FIGURES 1 to 3.

It will be noted furthermore that the rocker provided for modifying the functioning conditions of the escapement and the spring adapted to be put into contact with one of the projections on the escapement so as to permit the rotation of the alarm mechanism wheel when the hammer is immobilised, have not been shown.

I claim:

1. An alarm bell actuating mechanism comprising:
an alarm bell wheel provided with teeth;
an alarm spring for entraining the alarm bell wheel;
an oscillating hammer adapted to strike the bell in the course of its oscillation, said hammer having an equilibrium position and being arranged to return to its equilibrium position;
an oscillating escapememnt having an input projection and an output projection, said input and output projection alternately engaging the teeth of the alarm bell wheel, said output projection being located at the trailing side of the escapement with respect to the direction of rotation of the alarm bell wheel and being shaped so as to lock said wheel when it engages the teeth thereof, said input projection being located at the leading side of said escapement with respect to the direction of rotation of the alarm bell wheel, said input projection being urged out of said wheel when it engages the teeth thereof whereby said escapement will rotate in a first direction;
a driving member mounted on said escapement, said driving member contacting said hammer and urging the hammer from its equilibrium position when said escapement oscillates in said first direction, said oscillation in said first direction causing said output projection to lock in engagement with the teeth on said alarm bell wheel, return of said hammer to its equilibrium position urging said output projection out of engagement with the teeth of said alarm bell wheel and permitting said hammer to strike the bell.

2. A mechanism according to claim 1, wherein the hammer is caused to return to its equilibrium position by a horizontal pivot.

3. A mechanism according to claim 1 wherein the hammer is caused to return to its equilibrium postiion by resilient element loaded by the hammer when the latter moves away from the equilibrium position, in one direction.

4. A mechanism according to claim 3, wherein the said resilient element is adjustable between two positions in one of which it remains constantly out of contact with the hammer whereas in the other it is loaded with each oscillation of the hammer.

5. A mechanism according to claim 4, wherein the resilient element is controlled by a rocker.

6. A mechanism according to claim 5, wherein the said rocker comprises a sensing means co-operating with a guide element driven in rotation simultaneously with the alarm-bell wheel, the said guide element being disposed in such manner as to bring about a rotation of the rocker and the displacement of the resilient element from one of the said positions to the other during the ringing action.

7. A mechanism according to claim 3, wherein a second adjustable resilient element is provided, which is adapted to be displaced to a position wherein it co-operates with the escapement so as to bring about the disengagement thereof without the intervention of the hammer.

8. A mechanism according to claim 7, wherein the second resilient element is also controlled by the rocker and the latter has an abutment which, in the position wherein the second resilient element co-operates with the escapement, locks the hammer.

9. A mechanism according to claim 8, wherein the rocker further comprises an arm for manual control permitting the rocker and the second resilient element to be selectively disposed in the position for rocking the hammer.

10. A mechanism according to claim 1 wherein the escapement comprises two members which are articulated to each other and which are capable of moving through a limited angle relatively to each other, each of them having one of the projections.

11. A mechanism according to claim 10, wherein the output projection has a rectilinear side along which the teeth of the alarm-bell wheel are able to slide so as to impart to the escapement an impulse to actuate the hammer.

12. A mechanism according to claim 10 wherein the teeth of the alarm-bell wheel have an oblique face co-operating with the output projection in such manner as to prolong the duration of the impulse until the rear end of the said oblique face leaves the tip of the projection.

13. A mechanism according to claim 10, wherein the articulation pivot between the two said members coincides with the pivoting axis of the escapement.

14. A mechanism according to claim 10, wherein the member which carries the output projection is secured to

an arm extending beyond the escapement pivoting point and carrying the said impulse member.

15. A mechanism according to claim 10, wherein one of the said members constituting the escapement has a projecting portion and the other a recess the dimensions of which are larger than those of the said projecting portion, the latter being engaged in the recess in such manner as to limit the angular displacements of the two members relatively to each other.

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