Aug. 27, 1963 S. POLONSKY ETAL 3,101,586

TIMER MECHANISM WITH IMPROVED GEAR MESHING MEANS

Filed Jan. 26, 1962 2 Sheets-Sheet 1

Fig. 1.

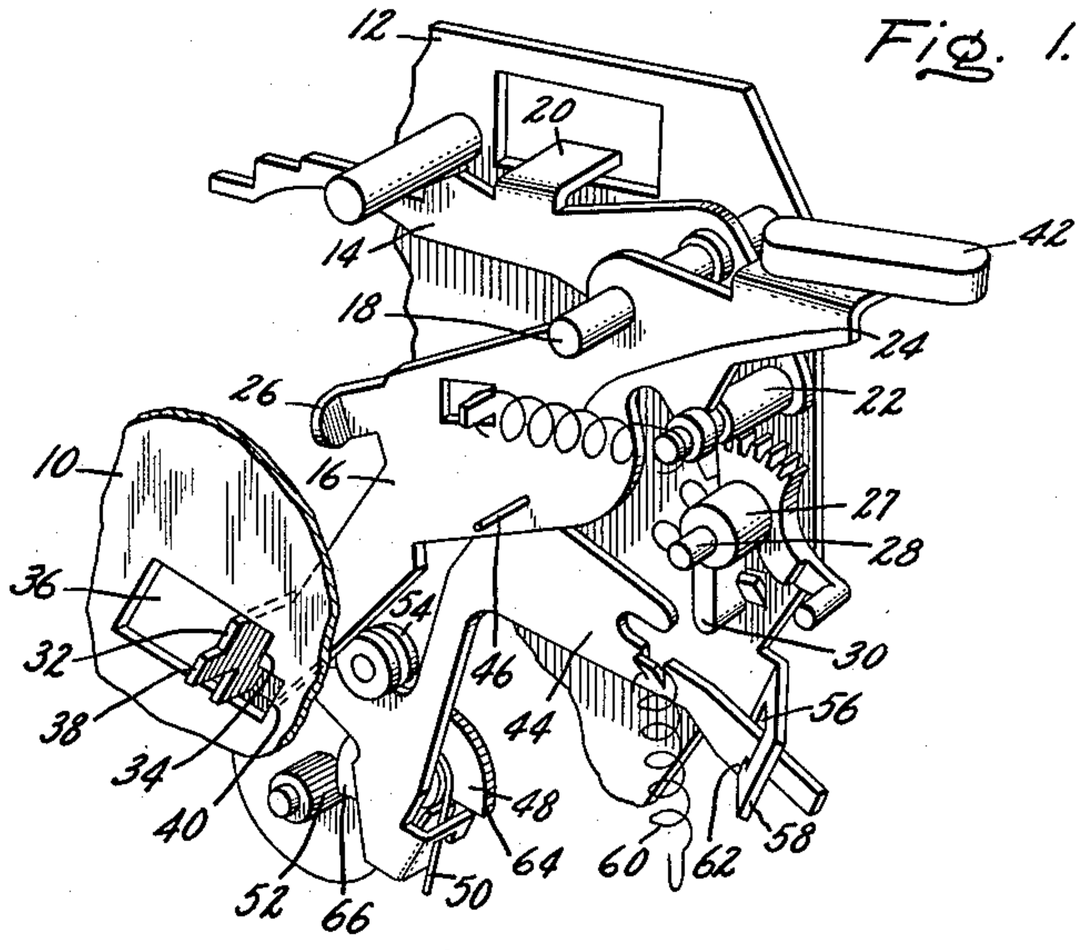
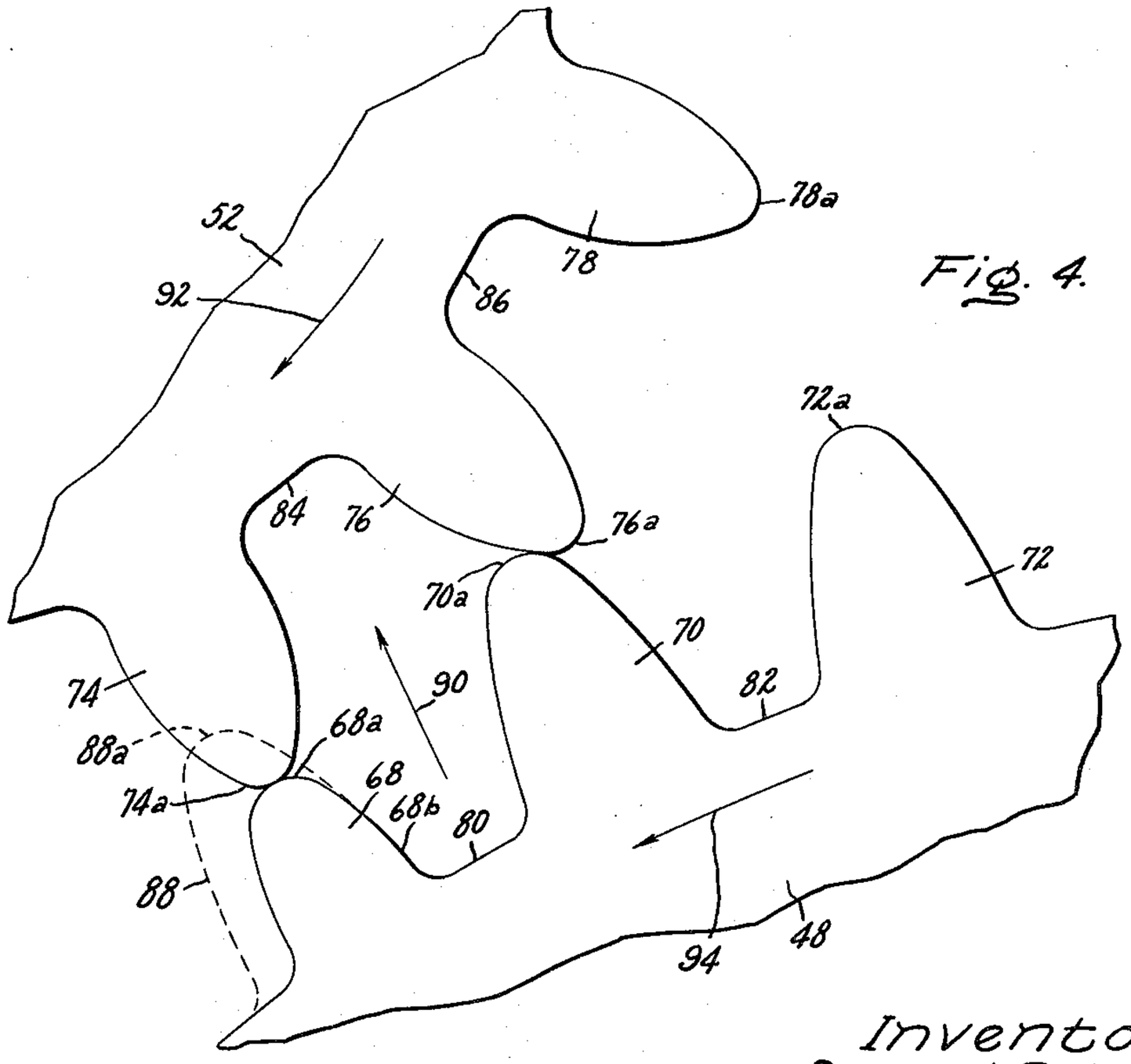


Fig. 4.



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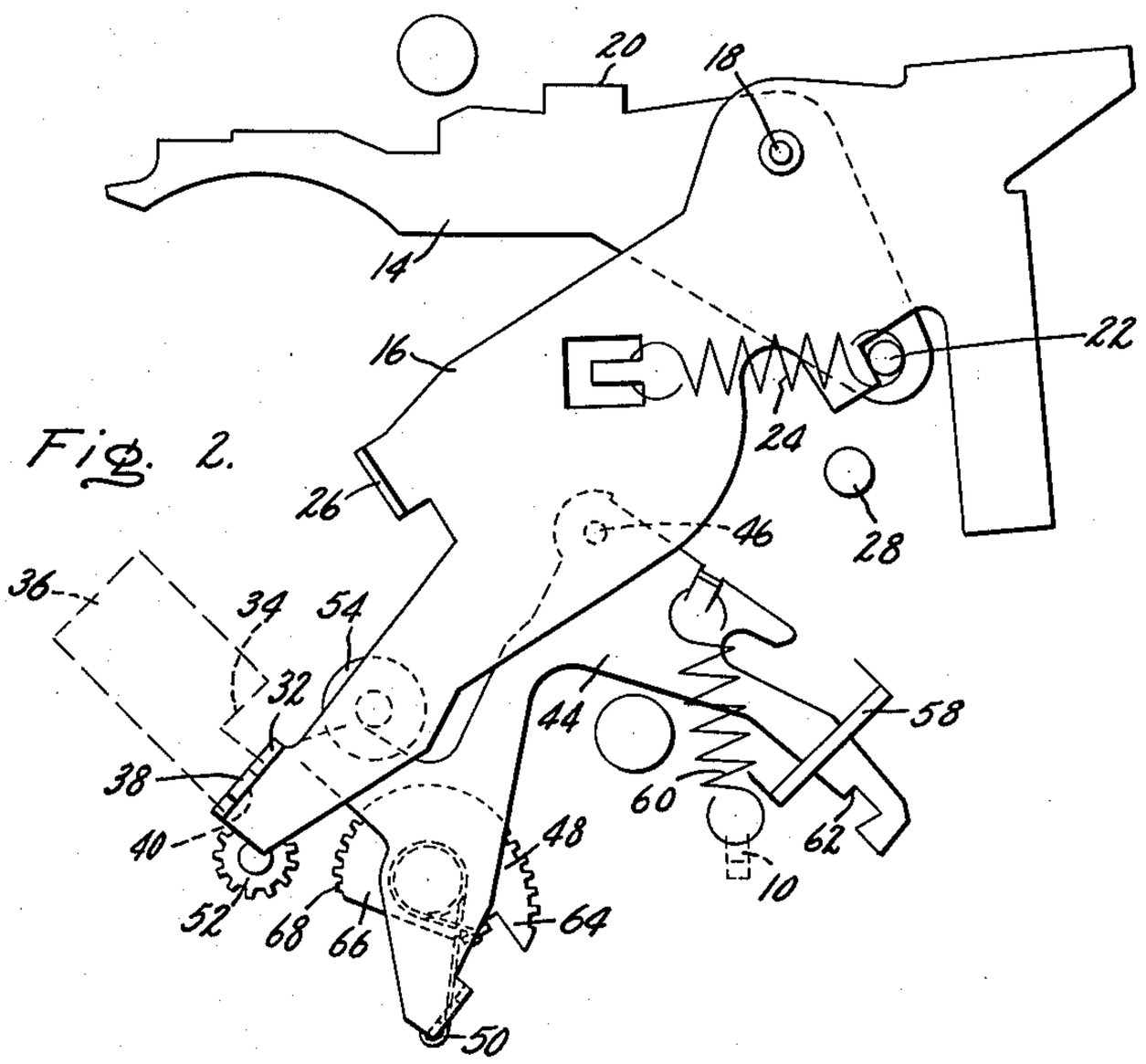

Fig. 2.

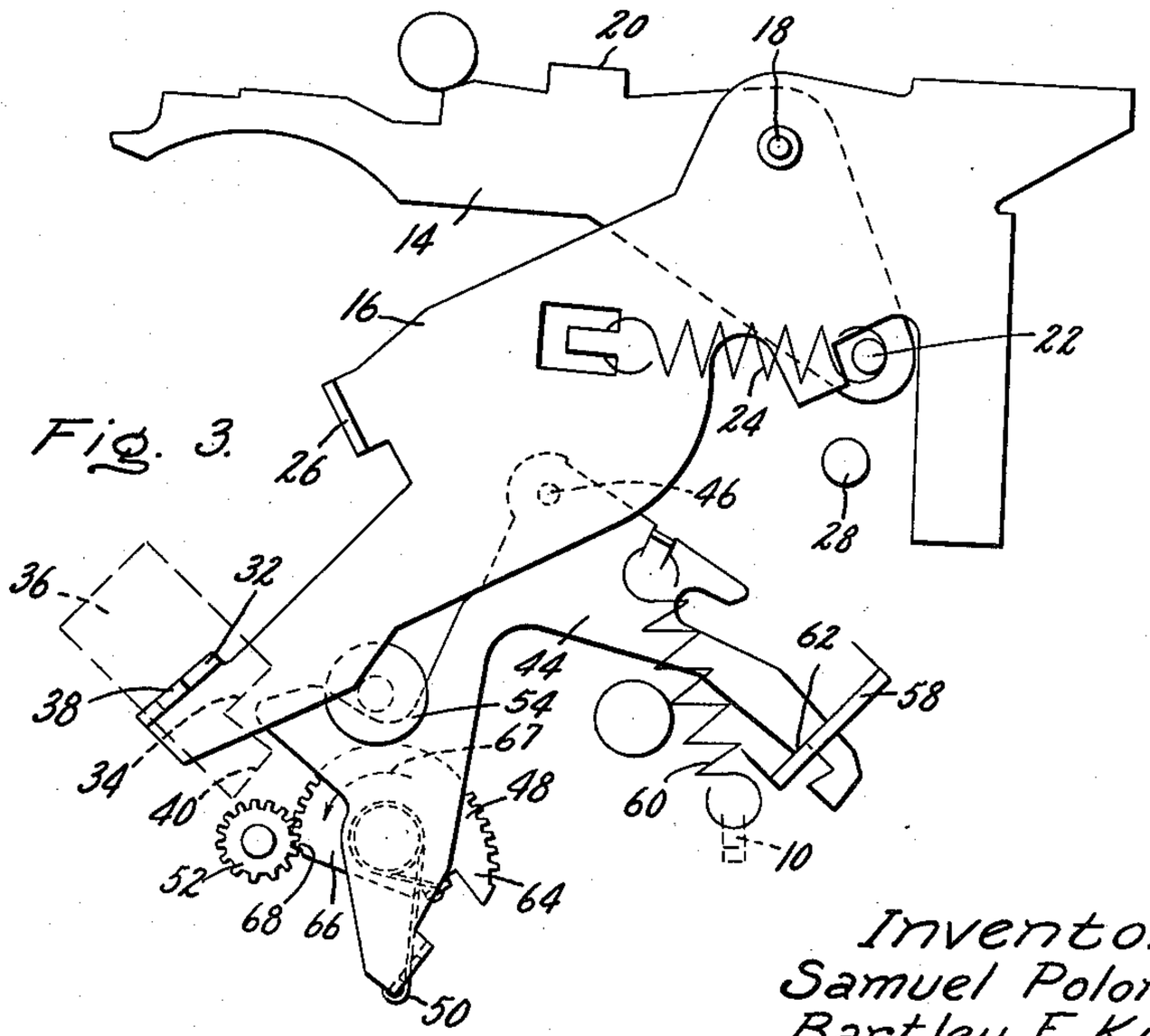

Fig. 3.

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TIMER MECHANISM WITH IMPROVED GEAR MESHING MEANS

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8 Claims. (Cl. 58—16)

This invention relates to a timer gear mechanism, and more particularly to an arrangement for insuring the proper meshing of gear teeth as a first gear is moved into engagement with a second gear.

The invention will be explained as incorporated in a timer mechanism and as thus used may be considered to represent an improvement on an arrangement described in a copending application entitled "Timer Blocking Mechanism," Serial No. 146,792, filed October 23, 1961, now abandoned, by Robert L. Boyles, assigned to the same assignee as the present invention. The application mentioned describes a gear and lever mechanism employed to block the operation of a switch or an alarm for a predetermined period of time. One use for such a mechanism is in conjunction with a so-called twenty-four hour clock wherein the blocking mechanism blocks the operation of the alarm mechanism for a period of time greater than twelve hours but less than twenty-four hours thereby eliminating an alarm setting operation every twenty-four hours. The blocking mechanism included in the aforementioned application includes a gear mounted for rotation and a second gear mounted on one end of a pivotally mounted lever which is situated such that as the lever is pivoted the second gear is moved into engagement with the first gear.

It is a primary object of the present invention to provide an improved gear arrangement whereby one gear may be readily moved into mesh with another gear.

It is another object of the invention to provide a timer mechanism with a unique gear arrangement for obtaining an accurate and reliable timed interval.

Briefly stated, the invention relates to a timer mechanism including a first toothed gear mounted for rotation and a second toothed gear mounted for movement into and out of mesh with the first gear. One of the teeth of the second gear is made shorter than the tooth adjacent thereto, and the shorter tooth is spaced with respect to its adjacent tooth so that the distance from the tip of the shorter tooth to the tip of its adjacent tooth is less than the distance between the tips of two adjacent gear teeth of the first gear. With this arrangement, as the second gear is moved into contact with the first gear, the teeth of the second gear are readily moved into meshing engagement with the teeth of the first gear.

Further features, objects and advantages will be apparent with reference to the following drawings in which:

FIG. 1 is a perspective view of a portion of an alarm clock having a blocking mechanism shown in the operative position and incorporating the gear meshing means of the invention;

FIG. 2 is a partial front elevation of the clock of FIG. 1 showing the blocking lever positioned to be moved to the operative position;

FIG. 3 is a partial front elevation of the mechanism of FIG. 1; and

FIG. 4 is an exploded front elevation of a pair of clock gears employed in the blocking mechanism of FIG. 1 and incorporating the improved gear meshing means of the invention.

For purposes of illustration, the gear meshing means of the invention will be described as incorporated in a gear and lever mechanism employed in a twenty-four hour clock. Since a complete description of the operation of

the clock is not essential to gain an understanding of the invention, only a portion of the mechanism has been shown and generally only such portion will be described. A more complete understanding of the operation of the overall clock may be obtained by reference to the aforementioned patent application, assigned to the same assignee as the present invention.

Referring to FIG. 1, the clock may be seen as including a front plate partially shown at **10**, a rear plate **12**, and operating lever **14**, and a control lever **16**, both of said levers being pivotally mounted on a shaft **18** extending between the front and rear plates. The operating lever **14** is provided with a rearwardly extending tab **20**, which is adapted to engage a resilient alarm vibrator (not shown). The clock may also be provided with a switch (not shown) to operate a radio or other appliance, and the control lever **14** may be adapted to control the operation of such a switch. Control lever **16** is loosely positioned on a reduced portion of shaft **18** so that the lever may be pivoted forwardly and rearwardly as well as transversely to shaft **18** as will hereinafter be described. The levers **14** and **16** are also connected by means of a pin **22** and a spring **24** so that the levers may be moved as a unit or individually.

To operate the alarm and the switch in response to the operation of a timing mechanism or motor, the clock may be provided with a manually set conventional cam gear arrangement (not shown) whereby at the set time, one of the cam gears is axially moved into engagement with a forwardly extending tab **26** on the control lever **16**, which in turn controls the alarm and switching operations through lever **14**.

The control lever **16** may be selectively positioned by a cam member **27** mounted on a selector shaft **28**, which may be manually placed in an "off" position wherein a radially extending lug **30** on the cam member **27** engages the control lever and restricts its movement. Additionally, the selector shaft **28** may be placed in two automatic positions, one wherein the electrical switch is allowed to close after the desired time has been reached, and the other wherein the alarm vibrator is permitted to sound a few minutes after the switch has been closed. As shown in FIG. 1, the radially extending lug **30** has been placed in the latter automatic position. When the pre-set time has been reached, the timing cam will engage the tab **26** moving one end of the lever **16** rearwardly so that the step **32** on the lever no longer engages the edge **34** of the opening **36** within the front plate **10**. This action permits the control lever **16** and the operating lever **14** to pivot in response to the urging of the resilient vibrator (not shown) against projection **20** on operating lever **14**. This movement is interrupted as step **38** engages edge **40** of front plate **10** adjacent opening **36**, as shown in FIG. 2. Such limited movement of operating lever **14** is sufficient to close the electrical switch but insufficient to permit the alarm vibrator to begin vibrating. After a short interval, further axial movement of the timing cam gear against tab **26** completely withdraws step **38** from the opening **36** so that control lever **16** and operating lever **14** are now free to be further moved in a counterclockwise direction to permit the alarm to operate.

At this point, if the user desires to open the electrical switch and shut off the alarm and set the clock so that the alarm mechanism will repeat 24 hours later but will not function after 12 hours, he need merely depress an external control button **42** moving control lever **16** in a clockwise direction. This action also moves a blocking lever **44** which is connected by means of a pin **46** to control lever **16** so that pivotal movement of control lever **16** will move pin **46** in an arc causing lever **44** to move, and conversely, movement of lever **44** will cause lever **16** to pivot about shaft **18**. One end of the blocking lever **44** has pivotally

mounted thereon a sector gear 48 continuously urged in a clockwise direction by a spring 50. The sector gear 48 is provided with teeth adapted to engage pinion 52, which is continuously driven in a clockwise direction by the timing mechanism. A stud 54 staked to the back plate 12 may be provided to guide movement of the blocking lever 44.

The opposite end of blocking lever 44 may be positioned within an opening 56 in projection 58 extending forwardly from back plate 12. The edges bordering opening 56 serve to guide the movement of the blocking lever 44, in conjunction with stud 54, as the lever is moved in response to the urging of spring 60 attached to the lever and a fixed support such as front plate 10. The lever end may be notched to form a step 62 which is adapted to engage the edge bordering the opening 56. When the control button 42 is depressed, sector gear 48 engages pinion 52 and step 62 on lever 44 engages the edge bordering opening 56 within the projection 58 to latch the lever 44 in this operative position. While so latched, the control lever 16 and the operating lever 14 are fixed in the position shown in FIGS. 1 and 3 wherein the alarm and switch are unable to function.

The blocking lever 44 will remain in this operative position until step 62 is unlatched from the projection 58. The means for unlatching the lever may be provided by forming sector gear in the shape of a spiral or snail gear. As best seen in FIGS. 2 and 3, the radial dimension of snail gear 48 is greater at its tail 64 than at this leading edge 66. It will be appreciated that rotating snail gear 64 in a counterclockwise direction, as shown by arrow 67 in FIG. 3, will move delay lever 44 as the tail 64 of the gear begins to engage pinion 52. This movement will overcome the force of spring 60 to release blocking lever 44 from engagement with projection 58 allowing the lever to be moved in response to forces from spring 24, the resilient vibrator (not shown) a switch load (not shown) and spring 60 so that the snail gear 48 is moved out of engagement with pinion 52. The blocking lever 44 is thus returned to its inoperative position; and the control lever 16 is again placed under the operation of the timing cam gears to permit operation of the alarm at the pre-set time. When using the blocking mechanism, in conjunction with a conventional alarm clock, it has been found that 14 hours is an appropriate run-out time for the snail gear 48. This restrains the alarm mechanism safely beyond the usual 12 hour repeat cycle, but yet allows considerable tolerance in the various components.

A unique gear arrangement is provided for insuring accurate and reliable meshing of gear 48 with pinion 52 in order to provide an accurate timed interval. As shown in FIG. 4, there is shown therein an exploded view of a portion of snail gear 48 and a portion of pinion 52 including the first three teeth, 60, 70 and 72 of the snail gear and three teeth, 74, 76 and 78 of the pinion. Each of the teeth are shown as having a relatively curved tip, and the teeth of both gears are equally spaced at their root portions, that is, the spaces 80 and 82 between sector gear teeth 68 and 70 and 70 and 72, respectively are equal to each other and also equal to the distances 84 and 86 between teeth 74 and 76 and 76 and 78, respectively, on the pinion 52. Further, the teeth 70, 72, 74, 76 and 78 have been given substantially identical shapes and consequently, the distance between the tips of adjacent teeth of this group are substantially equal. That is, the distance beween tooth tip 70*a* and tooth tip 72*a* is substantially equal to the distance between the tooth tip 74*a* and the tooth tip 76*a* as well as the distance between the tooth tip 76*a* and tooth tip 78*a*. In order to insure the proper meshing of the snail gear teeth with the pinion gear teeth, the first tooth 68 of the snail gear 48 has, in accordance with the invention, been given a special configuration and specially positioned. In order to illustrate the shape and position of tooth 68, a tooth the size and shape of tooth 70 or 72 has been superimposed over tooth 68, as indicated

in dotted lines at 88, and positioned such that the tip 88*a* of tooth 88 is approximately the same distance from tooth tip 70*a* as tip 70*a* is from 72*a*. By this illustration it can be seen that the tooth 68 has a shape similar to tooth 88, and that of the remaining teeth, but that it is reduced in size or is shorter. It can also be seen that the trailing surface 68*b* of tooth 68 near the root of the tooth is coincident with the corresponding surface of the superimposed tooth 88. Thus, it can be seen why the distance 80 between teeth 68 and 70 is equal to distance 82, as previously explained. By so shaping tooth 68, it will be appreciated that its tip 68*a* is closer to the adjacent tooth tip 70*a* than tip 70*a* is to tooth tip 72*a*. Further, the distance between tips 68*a* and 70*a* is less than the distance between pinion gear tooth tip 74*a* and the adjacent tip 76*a*.

At this point it should be noted that the final movement of the blocking lever 44 into its operative blocking position is a clockwise pivotal motion around pin 46 as the latching step 62 on the end of lever 44 slips into engagement with the projection 58, as seen in FIGS. 1 and 3. This pivotal movement causes the snail gear 48 to move in a large arc, as shown by arrow 90, about the pin 46. Such arcuate movement is substantially radial with respect to the pinion 52, i.e., the snail gear 48 is moved on a line more or less directed toward the axis of pinion 52. This substantially radial movement may be distinguished from tangential gear engagement wherein the axis of neither gear is mounted to be moved transversely.

If the tooth tip 68*a* should engage the tooth tip 74*a* as the snail gear is moved radially toward the pinion, tooth tip 70*a* will be offset from tooth tip 76*a* due to the shorter distance between tips 68*a* and 70*a*, as seen in FIG. 4. Clockwise rotation of the pinion 52, as indicated by arrow 92, will cause the pinion tooth 76 to react against snail gear tooth 70 and rotate the gear in a counterclockwise direction, as indicated by arrow 94, to begin moving tooth tip 68*a* out of contact with tooth tip 74*a*. Simultaneously, the pivotal force on lever 44 caused by spring 60 will tend to move snail gear 48 radially toward the pinion, the combined action causing the right side of tooth 70 to slide on the left side of tooth 76 as viewed in FIG. 4. In this manner the two gears will thus be quickly and properly meshed.

With the arrangement shown and described herein, an accurate timed interval will be achieved by the positive meshing of gear 52 with snail gear 48 and reliable operation of the blocking mechanism will be realized. After the run-out period of the snail gear 48 has elapsed, the gears will be uncoupled due to the movement of lever 44 previously described, and spring 50 will snap the snail gear in a clockwise direction to its original position wherein first tooth 68 will once more be in position to make the initial contact with pinion 52 the next time the blocking mechanism is placed in the operative position.

It will, of course, be realized that the particular embodiment described is merely an example of the invention; therefore, it is intended by the appended claims to cover all such changes and modifications that fall within the true spirit and scope of the invention.

Having thus described the invention, what is claimed is:

1. A timer mechanism comprising a first gear mounted for rotation, said gear having a plurality of teeth, a second gear having a plurality of teeth, said second gear being mounted for movement into or out of mesh with said first gear, one of the teeth of said second gear being shorter than the tooth adjacent thereto, said shorter tooth being spaced with respect to its adjacent tooth on said second gear so that the distance from the tip of said shorter tooth to the tip of its adjacent tooth is less than the distance between the tips of two adjacent gear teeth of said first gear so that when said second gear is moved into contact with said first gear the teeth of said second gear are readily moved into meshing engagement with the teeth of said first gear.

2. A timer mechanism comprising a first gear mounted

for rotation, said gear having a plurality of teeth, a second gear having one tooth and a plurality of adjacent teeth, said second gear being mounted for movement into or out of mesh with said first gear, said one tooth of said second gear being shorter than the tooth adjacent thereto, said shorter tooth being spaced with respect to is adjacent tooth on said second gear so that the distance from the tip of said shorter tooth to the tip of its adjacent tooth is less than the distance between the tips of two other adjacent gear teeth of said second gear so that when said second gear is moved into contact with said first gear the teeth of said second gear are readily moved into meshing with the teeth of said first gear.

3. A timer mechanism comprising a first gear mounted for rotation, said gear having a plurality of teeth, a sector gear having a first and a second gear tooth, said sector gear being mounted for movement into or out of mesh with said first gear, said first tooth being shorter than said second tooth, said first tooth being spaced closer to said second tooth than the distance between the tips of two adjacent gear teeth of said first gear, so that when said sector gear is moved into contact with said first gear, the teeth of said sector gear are readily moved into meshing engagement with the teeth of said first gear.

4. A timer gear and lever mechanism comprising, a first gear mounted for rotation, said gear having a plurality of teeth, a pivotally mounted lever, a sector gear positioned on said lever and having first and second gear teeth, said first tooth being shorter than said second tooth, said first tooth being spaced with respect to said second tooth such that the distance from the tip of said first tooth to the tip of said second tooth is less than the distance between the tips of two adjacent gear teeth of said first gear, said lever being arranged to move said second gear into contact with said first gear, whereby the teeth of said gears will readily mesh with each other.

5. The mechanism of claim 4 wherein said sector gear is moved into contact with said first gear substantially directly toward the axis of said first gear.

6. In a clock including a timing mechanism, a first gear mounted to be rotated by said timing mechanism, a control lever movable to perform a function at a preset time, means for restraining said control lever for a predetermined period comprising a blocking lever connected to said control lever in a manner such that the blocking lever may be moved to an operative position from an inoperative position in response to manual movement of the control lever, a second gear mounted on said blocking lever and adapted to be moved into contact with said first gear when the blocking lever is placed in the operative position, said second gear having a plurality of teeth one of the teeth of said second gear being shorter than the tooth adjacent thereto, said shorter tooth being spaced with respect to its adjacent tooth on said second gear so that the distance from the tip of said shorter tooth to the tip of its adjacent tooth is less than the distance between the tips of two adjacent gear teeth of said first gear so that when said second gear is moved into contact with said first gear the teeth of said second gear are readily moved into meshing engagement with the teeth of said first gear, latch means positioned on the opposite end of said blocking lever and adapted to retain the blocking lever in the operative position, and means responsive to the rotation of said second gear to cause movement of the blocking lever after a predetermined period to release said latch means and move the blocking lever to the inoperative position, wherein said control lever may be moved to perform the function at a preset time.

7. An alarm clock including a timing mechanism, a first gear mounted to be rotated by said timing mechanism, 12 hour cam means operated by the timing mechanism, a control lever adapted to be moved by said cam means to release an alarm at a preset time, means for restraining said control lever for a period of time greater than 12 hours but less than 24 hours comprising a blocking lever connected to said control lever in a manner such that the blocking lever may be moved to an operative from an inoperative position in response to manual movement of the control lever, a second gear adapted to connect said blocking lever to said first gear when the blocking lever is moved to the operative position, said second gear having a first tooth which is shorter than an adjacent second tooth, said first tooth being positioned such that the distance between the tips of said first and second teeth is less than the distance between the tips of adjacent teeth of said first gear, latch means adapted to retain the blocking lever in the operative position, said second gear being adapted to release the blocking lever after a period of time greater than 12 hours but less than 24 hours in response to the rotation of the first gear wherein the control lever is free to be moved by said cam means to release the alarm at the preset time.

8. A timer gear and lever mechanism comprising a rotatably mounted pinion, a pivotally mounted lever, a snail gear rotatably mounted on one end of said lever, said snail gear having first and second gear teeth, said first tooth being shorter than said second tooth, said first tooth being spaced from said second tooth such that the distance from the tip of the first tooth to the tip of the second tooth is less than the distance between the tips of two adjacent teeth of said pinion, said lever being arranged to move said snail gear into contact with said pinion whereby the pinion and snail gear teeth will readily mesh, and spring means connected to continuously urge said snail gear in one direction such that when said pinion and said snail gear are uncoupled the snail gear will snap back to its original position.

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