

Nov. 9, 1971

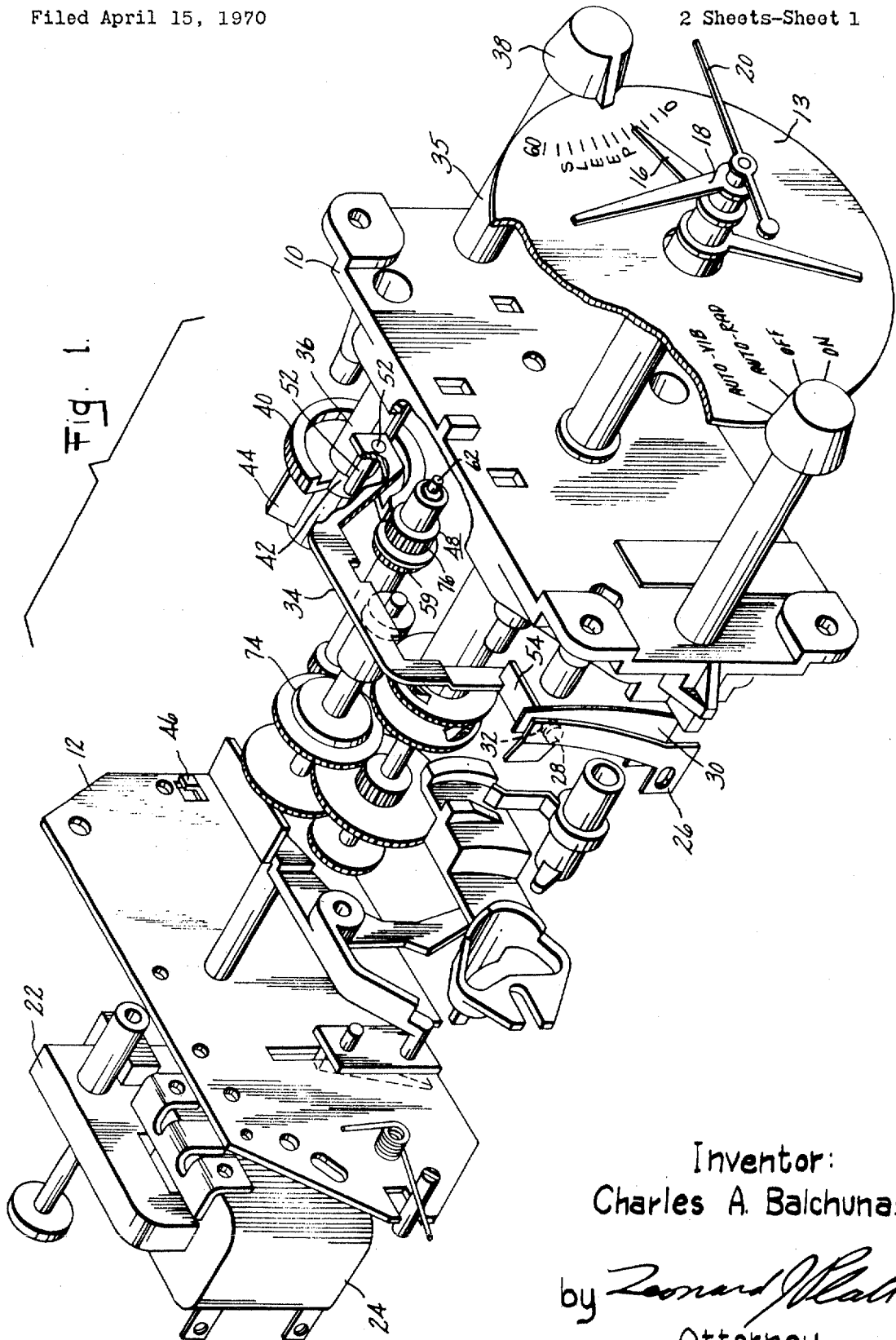
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3,618,310

CLOCK TIMER WITH SLEEP SWITCH

Filed April 15, 1970

2 Sheets-Sheet 1



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Fig. 2.

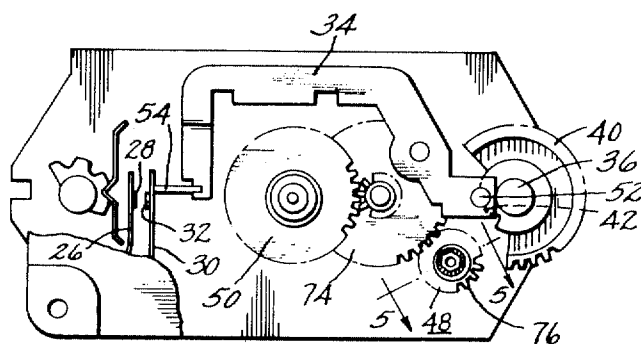


Fig. 6.

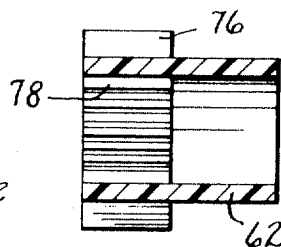


Fig. 3.

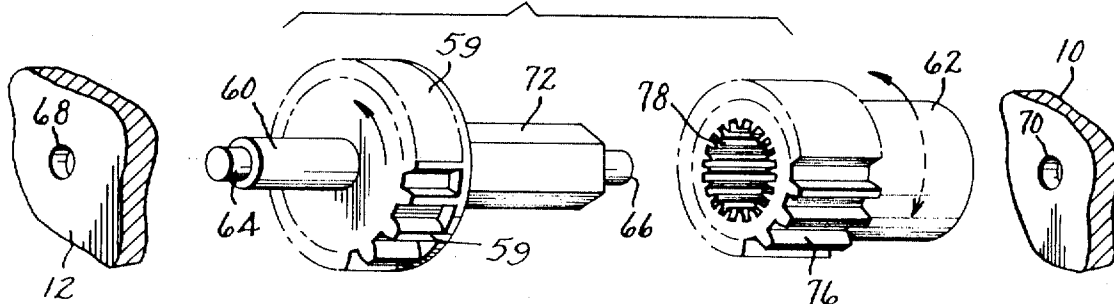


Fig. 4.

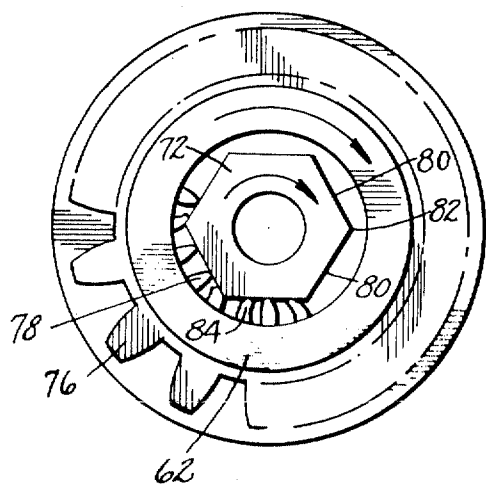
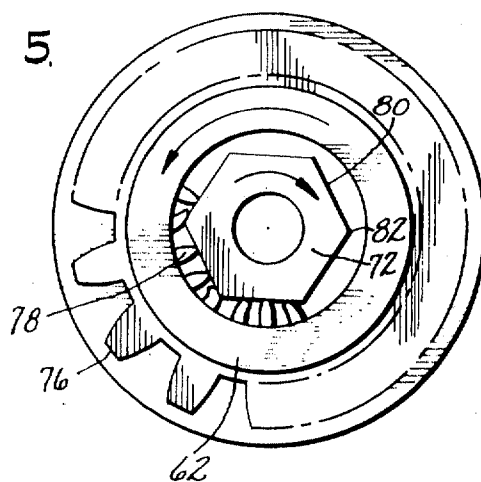


Fig. 5.



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3,618,310

CLOCK TIMER WITH SLEEP SWITCH

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6 Claims

ABSTRACT OF THE DISCLOSURE

A "sleep switch" mechanism for a clock timer wherein a unique friction clutch mechanism is positioned between a continuously rotated gear of the clock timer and a manually movable sector gear of the clock timer. The sleep friction clutch mechanism comprises two parts, a hollow pinion having internally molded flexible teeth, and a continuously rotated hexagonal shaft upon which the hollow pinion rides so that a sliding friction clutch results from the interaction between the internal teeth of the pinion and the hexagonal shaft when the sector gear is manually moved into engagement with the pinion gear.

BACKGROUND OF THE INVENTION

This invention relates to a clock timer and more particularly to an improved "sleep switch" mechanism for a clock timer having a minimum number of parts.

It is found highly desirable in the manufacture of clock timers to incorporate a "sleep switch" mechanism for manually turning on a radio at bed time and then automatically turning off the radio a short time thereafter while the user goes to sleep. A known "sleep switch" timer of this type is shown in a prior U.S. Pat. No. 3,475,899 to Boyles dated Nov. 4, 1969, assigned to the same assignee as the present invention. As shown in the patent, a rotatable sector gear 150 is moved into engagement with a constantly rotating clock gear 160 through the use of a friction clutch assembly 162, 158, 164 and 166 which is positioned between the continuously rotatable gear 160 and the sector gear 150. The sector gear 150 rotates with the clock gears 160 and 158 until the sector gear is driven out of mesh with a pinion gear 158 to thereby shut off the radio by opening a switch 57-59 which is actuated by the sector gear. As shown in the patent the friction clutch mechanism includes seven parts, a pinion gear 160, a pinion gear 158, a slip clutch disc washer 162, a shaft, a stop disc, a spring 164 and a stop disc 166.

My invention is concerned with such a friction clutch mechanism, and more particularly to a friction clutch requiring only two plastic parts in place of the mechanism shown in Pat. No. 3,475,899 which requires seven parts.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of this invention to provide an improved friction clutch arrangement for a clock timer "sleep switch" mechanism having a minimum number of parts which may be readily manufactured and assembled to each other.

In accordance with one of the aspects of this invention, a continuously rotated gear of the clock timer is formed of plastic and is provided with an integral shaft which is formed to include a plurality of outwardly extending surfaces. A unique hollow pinion gear is also formed of plastic material and is rotatably mounted on the shaft of the continuously rotatable gear. The pinion gear is arranged to be co-axial with the continuously rotated gear and is provided with a plurality of inwardly extending teeth for resiliently engaging the outwardly extending surfaces of the continuously rotated gear shaft. A sector gear is laterally spaced from the continuously rotated gear and the pinion gear, and the sector gear is provided with a plu-

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ality of teeth which may be selectively rotated into mesh with the gear teeth on the periphery of the pinion gear.

With this arrangement, when the sector gear is moved into mesh with the pinion gear, the pinion gear is caused to rotate with respect to the continuously rotated gear as the internal teeth of the pinion gear resiliently engage the outwardly extending portions of the continuously rotated gear shaft. The fact that both the outwardly extending portions of the continuously rotated gear shaft and the internal teeth of the pinion gear are made of plastic allows the sector gear to be moved easily into mesh with the pinion. No problems with tooth topping are encountered because the internal teeth of the pinion gear have a flexibility which provides tooth topping relief.

With this construction, a unique "sleep switch" friction mechanism having only two parts is provided. Thus, a very simple yet effective construction for a clock timer has been achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and attendant advantages of the invention will be apparent from the following description taken in connection with the accompanying drawing in which:

FIG. 1 is an exploded front perspective view of a clock timer mechanism incorporating my unique sleep switch mechanism showing the switch in the "ON" position with the sector gear in mesh with the pinion gear;

FIG. 2 is a front elevational view of the clock timer mechanism shown in FIG. 1 with the sleep switch in the "OFF" position wherein the sector gear has been driven out of mesh with the pinion gear;

FIG. 3 is an exploded perspective view of my unique friction clutch mechanism;

FIG. 4 is a front end view of the friction clutch mechanism showing the continuously rotated gear shaft in driving engagement with the pinion gear;

FIG. 5 is a front end view of the friction clutch mechanism similar to FIG. 4 showing the internal flexible teeth on the pinion gear sliding on a cooperating portion of the continuously rotated gear shaft when the sector gear is being moved into mesh with the pinion gear; and

FIG. 6 is a cross sectional view of my unique pinion gear taken along the lines 5-5 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and particularly to FIG. 1, the sleep switch mechanism of my invention is shown in combination with an electric alarm clock having a supporting structure including a front plate 10 molded of plastic or other suitable material, a rear plate 12 and a dial plate 14 mounted on the front plate and having the usual clock indicia painted or otherwise generally centrally placed thereon. The clock is provided with hour, minute and second hands 16, 18 and 20, respectively, mounted for movement over the dial and driven by a conventional timing device gear train.

The timing device may include any suitable form of timer motor here shown as a self-starting synchronous motor 22, a field coil 24 of which is connected to a source of regulated frequency alternating current.

A switch contained in the clock is of the single pole, single throw type and is connected in a control circuit across the clock motor supply in which there may be a radio receiver to be controlled. The switch comprises a resilient blade 26 with a contact 28 at its end and a resilient blade 30 with a contact 32 at its end.

The sleep switch mechanism includes a lever 34 for moving switch blade 30 to open or close the switch contacts 32 and 28 at the desired times. The "sleep switch" mechanism does not interfere with any of the other timer

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mechanism parts for manually operating the switch except to the extent that operation of the sleep switch mechanism takes over control of the switch.

The sleep switch mechanism is controlled by a shaft 36 which extends between the front plate 10 and rear plate 12 and terminates in a control knob 38. A sector gear 40 is formed on the shaft 36, intermediate the front and rear plates, and includes a cam surface 42 which is preferably integrally formed thereon. A radial flag 44 extends outwardly from the shaft 36 and axially between the sector gear 40 and the rear plate 12 for cooperating with a stop lug 46 lanced from the rear plate 12 for limiting the rotation of the shaft 36 to a time setting of 60 minutes as indicated by the indicia on the dial plate 13. The sector gear 40 is adapted to be driven by my unique friction clutch mechanism 48 in a manner to be more particularly described hereinafter.

A U-shaped lever 34 is provided for transmitting motion of the sleep switch sector gear 40 to blade 30 of the switch mechanism. As illustrated more particularly in FIG. 2, the lever 34 passes around a timing gear train 50 and includes a cam follower pin 52 for cooperating with cam surface 42 on the sector gear 40 for permitting rotational movement of the sector gear 40 to result in generally horizontal movement of the lever 34. The left end of lever 34 contacts a short insulator pusher member 54 which abuts switch blade 30 for moving it toward switch blade 26 in order to close the switch contacts 28 and 32 in response to horizontal leftward movement of the lever 34. The resilient switch blade 30 normally biases the lever 34 to the right and at the end of a preselected "sleep switch" time interval, the pin 52 of the lever 34 moves rightwardly on the sector gear 40 for opening the switch contacts 28 and 32.

The principal parts of the structure so far described are described and illustrated in greater detail in the aforementioned patent of Robert L. Boyles. The patent of Robert L. Boyles also describes and illustrates a friction clutch mechanism which is positioned between the continuously rotated timing mechanism of the clock and the sector gear 40 for permitting the sector gear to be moved into mesh with the continuously rotated gear train without damaging the gears. As shown in the patent to Boyles, the friction clutch mechanism includes a pinion gear 160, a washer 162, a pinion gear 158, a shaft, and a spring 164 positioned between a stop 166 formed at the end of the shaft and a stop disc at the side surface of pinion gear 158.

SLEEP SWITCH FRICTION CLUTCH MECHANISM

My unique two-part friction clutch mechanism which performs all of the functions of the seven-part friction mechanism shown in the aforementioned patent to Robert L. Boyles will now be more particularly described.

As shown more particularly in FIG. 3, the principal parts of my unique friction clutch mechanism include an integrally molded gear 59 and shaft 60, and an integrally molded hollow pinion gear 62. The gear 59 and shaft 60 is preferably provided with integrally formed reduced end portions 64 and 66 for reception in complementary apertures 68 and 70, respectively, which are formed in the rear plate 12 and the front plate 10 of the clock timer supporting mechanism. The unique hollow pinion gear 62 is rotatably supported on a shaft portion 72 of the integrally formed gear and shaft 59-60, and with this construction the pinion gear 62 is guided and mounted for rotation on shaft portion 72 between a forwardly facing wall of gear 59 and the rearwardly facing wall of the front plate 10.

The integral gear and shaft 59-60 preferably molded of relatively hard Delrin plastic and is arranged to be continuously rotated by the timing mechanism of the clock. As shown more particularly in FIG. 1, the teeth of gear 59 are arranged to be always in mesh with a gear

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74 of the timing mechanism gear train. Thus, when the synchronous motor 22 of the clock timer is connected to a source of regulated frequency alternating current, the timing mechanism including gear 74 and the integral gear and shaft 59-60 is also continuously rotated.

My unique pinion gear 62 is designed so that it will normally be rotated by shaft portion 72 of the continuously rotated gear 59 to drive sector gear 40 out of mesh with the pinion gear 62 to thereby open switch contacts 28 and 30 at the end of the sleep switch time interval. The pinion gear 62 is preferably formed of a relatively soft plastic material such as polyurethane, and as shown more particularly in FIGS. 5 and 6, it has a plurality of external gear teeth 76 formed on its outer periphery for meshing with the teeth of sector gear 40, and a plurality of inwardly extending flexible teeth 78 for uniquely cooperating with the outwardly extending surfaces 82 which are formed on shaft portion 72.

As shown more particularly in FIG. 4, the shaft portion 72 which cooperates with the inwardly extending teeth 78 of the pinion gear is preferably hexagonal in shape, and the inwardly extending flexible teeth 78 of the pinion gear extend radially inwardly further than the corners 82 of the hexagonal shaft portion 72. Thus with this construction, when the hexagonal shaft portion 72 is rotated in the direction of the arrows shown in FIG. 4, end portions 84 of the gear teeth 78 engage the outwardly extending surfaces which form the corners 82 of the hexagonal shaft portion 72 to cause the pinion gear 62 to be rotated along with shaft 72. The inwardly extending teeth 78 extend far enough inwardly and are sufficiently rigid so that rotation of the shaft 60-72 will carry with the shaft not only the pinion gear 62, but also the sector gear 40 which may have been placed in mesh with the pinion gear.

The inwardly extending teeth 78 of the pinion gear 62 are also designed to be sufficiently flexible so that they will bend and slide over the corners 82 of the hexagonal shaft portion 72 whenever the sector gear 40 is moved into mesh with the teeth 76 on the outer periphery of the pinion gear to close the switch 28-32 and set a "sleep" time interval. As shown by the arrows in FIG. 5, during such movement the sector gear 40 causes the pinion gear 62 to be rotated in a direction opposite to the direction of rotation of the continuously rotated shaft 60 to cause the ends of teeth 78 to slide on and over the corners of the hexagonal shaft portion 72. Thus, the sector gear may be moved into mesh with the pinion gear without damaging the teeth on the pinion gear or the continuously rotated gear.

As shown more particularly in FIG. 3, twenty internal pinion gear teeth 78 are provided for cooperating with the six corners 82 of the hexagonal shaft portion 72. With this construction, a detent type action is felt by a user who moves the sector gear 40 into mesh with the pinion gear 62. This action can be described as the kind of action that might be felt by a boy rubbing a stick along a picket fence. It can be appreciated that the number of internal teeth 78 on the pinion gear and the number of corners 82 of shaft 72 could be varied to obtain various friction effects. For example, the shape of the continuously rotated shaft portion 72 could be square with four teeth or corners, or pentagonal with five teeth or corners, and a fewer or greater number of flexible internal teeth 78 could be provided. Thus, the shape of the shaft portion 72 and the number of internal teeth 78 could be selected so that a user could feel each five minute or ten minute incremental adjustment of the sleep setting interval as he moved the sector gear into mesh with the pinion gear.

OPERATION

When the user of the clock timer mechanism desires to turn on the radio at bed time and utilize my unique "sleep switch" mechanism for turning off the radio after he has fallen asleep, it is merely necessary that the user

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rotate knob 38 to the desired period of time that he wishes to have the radio to play. With the construction illustrated, it is simply necessary to rotate the knob 38 and the sleep shaft 36 in a clockwise direction an angular amount corresponding to the length of time the user wishes the radio to be operative, as indicated by the indicia on the dial plate 13. Rotation of the sleep shaft 36 causes the cam follower pin 52 to follow the cam 42 to urge the U shaped lever 34 leftwardly, causing the insulated pusher member 54 to move the switch blade 30 toward the left to close the contacts 28 and 32 and the circuit through the radio. Rotation of the shaft 36 also causes engagement of the sector gear 40 with the teeth 76 on the outer periphery of the pinion gear 62 and causes the pinion gear 62 to rotate in a counterclockwise direction, as shown by the arrows in FIG. 5. During this movement the internal teeth 78 on the pinion gear slide on the corners of the hexagonal shaft 72 without damaging the shaft and permitting the shaft 72 to continuously rotate in a clockwise direction. Thus, the internal teeth 78 on the pinion gear are sufficiently flexible to allow the pinion 62 to be rotated by the sector gear in order to set the sleep interval; however, after the time interval has been set, the inwardly extending teeth 78 are sufficiently rigid to allow the external corners of hexagonal shaft 72 to engage the ends of the teeth 78 of the pinion gear to drive the pinion gear 62 and the sector gear back to its original position as the continuously rotated gear 60 is driven by the gear train of the clock timer. At the end of the predetermined sleep time interval, the cam follower pin 52 allows the lever 34 to be biased to the right under the influence of resilient switch blade 30 to open switch 28-32 to turn off the radio.

From the foregoing description, it will be appreciated that my unique sleep switch friction mechanism is achieved with the use of a minimum number of parts which are uniquely connected to each other and to an existing clock timer structure. In order to connect the friction mechanism to the clock timer, it is merely necessary to slide pinion gear 62 over the hexagonal shaft portion 72 and insert the reduced shaft portions 64 and 66 of shaft 60 into the appropriate apertures 68 and 70 which are formed in the rear plate and the front plate of the clock timer.

It can also be appreciated that my unique friction clutch arrangement is achieved with the use of only two parts, an integral gear and shaft 59-60, and a pinion gear 62. This is a decided improvement over the prior art structure shown in the aforementioned Boyles patent which required approximately seven parts to form a friction clutch assembly. Moreover, with this unique construction a detent feel action for enabling a user to feel each five or ten minute setting interval can be achieved. Thus, an exceedingly simple, yet reliable sleep switch mechanism has been provided.

What I claim is:

1. In a clock timer sleep switch mechanism the improvement comprising:

- (a) a continuously rotated gear having a shaft provided with a plurality of outwardly extending surfaces;
- (b) a hollow pinion gear formed of plastic material, said pinion gear being co-axial with and rotatably mounted on the shaft of said continuously rotatable gear, said pinion gear including a plurality of integrally formed inwardly extending flexible teeth for slidable movement on the outwardly extending surfaces of said continuously rotatable gear shaft, said pinion gear also including a plurality of external teeth formed on its periphery;
- (c) a sleep gear spaced from said continuously rotatable gear and said pinion gear having a plurality of teeth which may be moved into mesh with the external teeth of said pinion gear for causing said pinion

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gear to rotate with respect to the continuously rotatable gear; and

- (d) the inwardly extending teeth on said pinion gear being sufficiently flexible and extending further inwardly than portions of the outwardly extending surfaces of said shaft so that when said sleep gear is moved into mesh with the teeth on the outer periphery on the pinion gear, the inwardly extending flexible teeth slide on portions of said outwardly extending surfaces to permit the pinion gear to be moved with respect to the continuously rotated gear and shaft, and the inwardly extending teeth on said pinion gear being sufficiently rigid so that when said sleep gear is in mesh with the teeth on the outer periphery on the pinion gear the outwardly extending surfaces on said shaft will frictionally abut said inwardly extending teeth so that said continuously rotated shaft and said pinion gear will rotate in unison to drive said pinion gear out of mesh with the sleep gear.

2. A sleep switch mechanism as defined in claim 1 wherein said pinion gear and its inwardly extending flexible teeth are integrally molded of a polyurethane plastic material.

3. A sleep switch mechanism as defined in claim 2 wherein the continuously rotated gear and its shaft including the outwardly extending surfaces are integrally formed of Delrin plastic.

4. A sleep switch mechanism as defined in claim 1 wherein the shaft is shaped in the form of a hexagon, and the inwardly extending teeth of the pinion gear are arranged to slide on the outwardly extending surfaces which form the corners of the hexagon.

5. A sleep switch mechanism as defined in claim 1 wherein twenty inwardly extending teeth are formed on said pinion gear so that a smooth detent action may be observed as the sleep gear is moved into mesh with the pinion gear and the twenty inwardly extending flexible fingers slide on the outwardly extending surfaces of said shaft.

6. In a clock timer mechanism the improvement comprising:

- (a) a supporting structure including a base plate and a front plate having a plurality of apertures integrally formed therein;
- (b) a continuously rotated shaft and gear integrally formed of a single piece of plastic material, said shaft having reduced end portions for rotatably mounting said gear and shaft in two axially aligned apertures which are formed in the front plate and the rear plate, said shaft including a shaft portion having a plurality of corner surfaces formed thereon;
- (c) a hollow pinion gear integrally formed of a single piece of plastic material, said pinion gear being co-axial with and rotatably mounted on the shaft of the continuously rotatable gear between the continuously rotatable gear and the front plate of the timer, said pinion gear including a plurality of integrally formed inwardly extending teeth for resilient engagement with the corner surfaces of said continuously rotatable gear shaft, said pinion gear also including a plurality of external gear teeth formed on its periphery;
- (d) a sector gear laterally spaced from said continuously rotatable gear and said pinion gear and mounted in axially aligned apertures formed in said base plate and said front plate, said sector gear including a plurality of teeth which may be rotated into mesh with the external teeth of said pinion gear to thereby cause said pinion gear to rotate with respect to said continuously rotatable gear without causing corresponding movement of said continuously rotatable gear; and
- (e) the inwardly extending teeth on said pinion gear being flexible and extending further radially inwardly than the corner portions of said shaft so that when

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said sector gear is moved into mesh with said pinion gear the flexible teeth slide on the corner surfaces to permit the pinion gear to be moved with respect to the continuously rotated gear and shaft.

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L. R. FRANKLIN, Assistant Examiner

U.S. Cl. X.R.

58—22.5; 64—30 D