Oct. 20, 1970 C. OSTER ET AL 3,534,545

CLOCK AND INTERNAL TIMER APPARATUS

Filed Jan. 24, 1969 2 Sheets-Sheet 1

FIG. 1

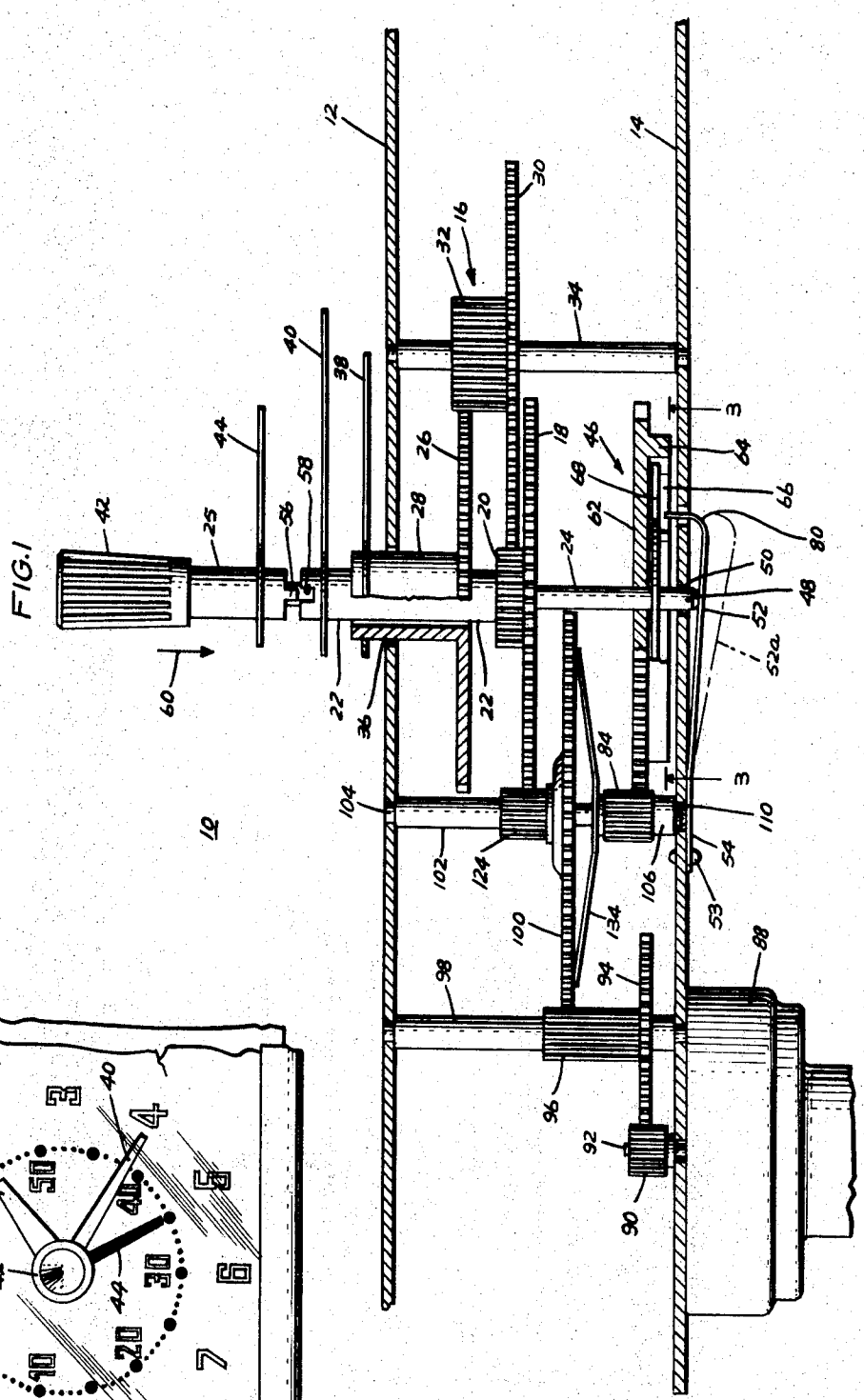
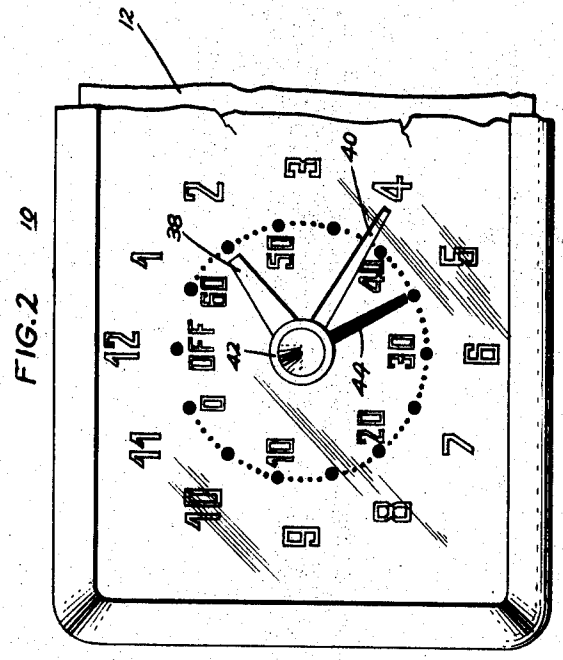


FIG. 2



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FIG. 3

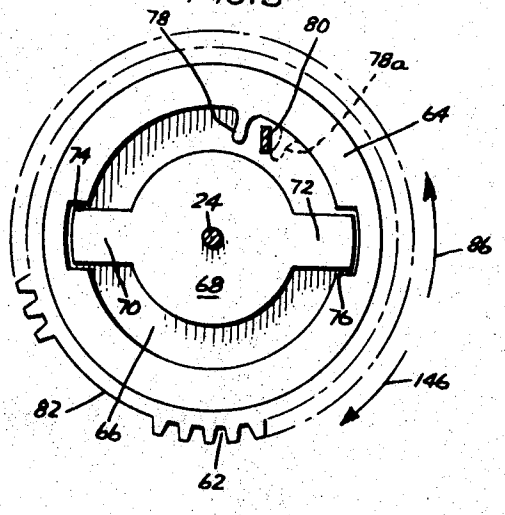


FIG. 5

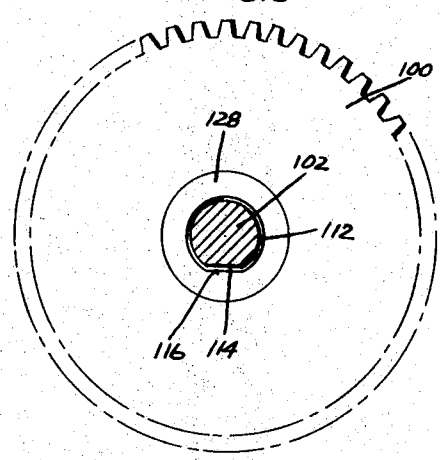


FIG. 6

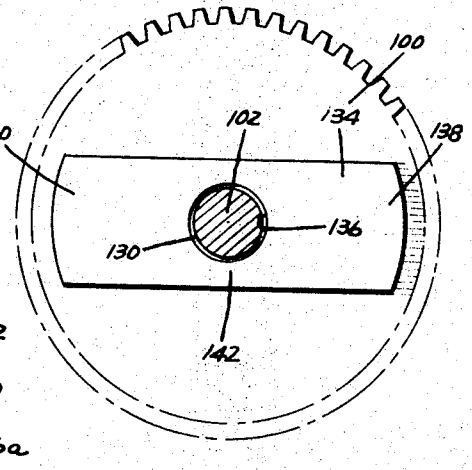


FIG. 7

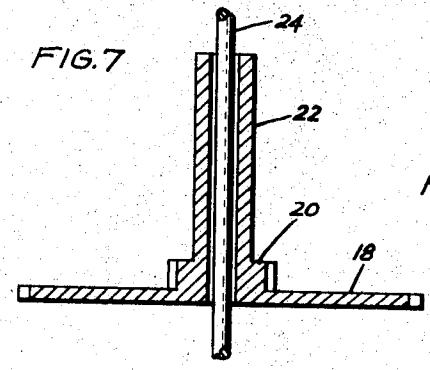


FIG. 4

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3,534,545

CLOCK AND INTERVAL TIMER APPARATUS

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U.S. Cl. 58—21.14 10 Claims

ABSTRACT OF THE DISCLOSURE

A combined clock and intarval timer includes a clock mechanism with an input gear, an interval timer mechanism with an input gear and a setting shaft for setting the clock mechanism and the interval timer mechanism. A motor for driving the apparatus is connected to a main gear, which is positioned on a second shaft between a first pinion, engaged with the clock input gear, and a second pinion, engaged with the timer input gear. A leaf spring clutch is mounted between the main gear and one of the pinions to provide a frictional coupling force connecting the main gear and each of the pinions. This frictional coupling force is sufficient to transfer driving motion from the main gear to each of the clock and interval timer mechanisms and is insufficient to transfer manual setting motion of either the clock or the timer mechanism to the main gear. With this apparatus the minute input gear and minute shaft may be constructed integrally and the clutch, normally interconnecting them, omitted.

BACKGROUND OF THE INVENTION

This invention relates generally to combined clock and interval timer apparatus of the type employed in range timers.

Combined clock and interval timers are well-known, commonly being employed in range timers. In such an apparatus, a clock mechanism is provided which tells the time of day and an interval timer is provided, and driven by the same driving motor as the clock mechanism, to provide an audible alarm upon expiration of a predetermined interval, such as for instance sixty (60) minutes. Also the clock mechanism may be connected to another control selectively for turning on the oven at a desired time of day and then turning it off at a subsequent desired time of day so as to provide an automatic cycle of operation.

In one such prior art clock and interval timer apparatus, described and illustrated in United States Patent No. 2,993,099, issued to Malcolm G. Doyle, and assigned to the Assignee of the present application; the interval timer indicating shaft extends concentrically through the minute indicating shaft of the clock mechanism, the minute shaft and interval timer shaft respectively having input driving gears thereon. The minute and interval timer input gears are respectively driven by pinions coaxially mounted on a shaft with a gear driven by the clock motor. The minute pinion is secured to rotate with the driving gear while an interval timer setting clutch spring normally couples the interval timer pionion to the main drive gear for rotation therewith. A time-of-day setting clutch spring normally couples the minute input gear to the minute shaft for rotation therewith. Thus, the main drive gear is normally driven by the clock motor to rotate both the minute and interval timer drive pinions. The drive pinions in turn simultaneously drive the minute and interval timer input gears respectively. However, setting of the interval timer causes the interval timer setting clutch spring to slip so that rotation of the interval timer drive pinion is not transmitted to the main drive gear and minute drive pinion and thus, setting motion of the interval timer is not transmitted to the clock motor and to the minute shaft. Similarly, setting of the clock mechanism causes the time-of-day setting clutch spring to slip so that the setting rotation of the minute shaft is not transmitted to the minute input gear and, in turn, to the clock motor.

In the construction disclosed in the aforesaid Doyle Patent, two separate clutches are required, i.e. the time-of-day setting clutch and the interval timer setting clutch. Further, the minute input gear and the minute shaft (actually a sleeve which coaxially surrounds the interval timer shaft) are separate elements which are normally coupled by the time-of-day setting clutch spring. Not only does the necessity for providing two separate clutches add appreciably to the overall cost of the device, but problems have been encountered with failure of the time-of-day setting clutch spring.

SUMMARY OF THE INVENTION

It is accordingly an object of the present invention to provide clock and interval timer apparatus.

Another object of the invention is to provide improved clock and interval timer appartus utilizing a single clutch mechanism for both time-of-day and interval timer setting functions.

In accordance with one form of the inventon, the separate time-of-day setting clutch and interval timer setting clutch are replaced with a single, simplified clutch assembly which employs only one spring. This construction further permits simplification of the minute sleeve and minute input gear assembly, thus simplifying and reducing the cost of the device.

The invention, in one embodiment thereof, provides clock and interval timer apparatus of the type having a clock mechanism which includes a first input gear for driving the clock mechanism to indicate the passage of time, and means for manually driving the first input gear to set the clock mechanism. An interval timer mechanism also is provided and includes a second input gear for driving the timer mechanism from a preset timed interval position to a disengaged position, and means are provided for manually driving the second gear to set the timed interval. A driving motor is provided with a gear train which couples the driving motor and the first and second input gears for driving the same. The gear train includes first and second pinions, which respectively mesh with the first and second input gears, and a third gear coaxial with the pinions and operatively coupled to the motor and driven thereby. Means are provided for mounting each of the pinions for independent rotation with respect to the other pinion and the third gear. Single clutch means are provided for normally coupling both of the pinions to the third gear for rotation therewith so that the motor normally drives the first and second gears to cause the clock mechanism to indicate the passage of time and to drive the interval timer mechanism from a preset timed interval position to its disengaged position. The clutch means effectively decouples the first pinion from the third gear in response to manual driving of the first gear, and decouples the second pinion from the third gear in response to manual driving of the second gear.

The above mentioned and other features and objects of this invention and the manner of attaining them will become more apparent, and the invention itself will be better understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial side elevational view, partly in cross-section and partly broken away, of a range timer

illustrating the improved clock and interval timer apparatus of the invention;

FIG. 2 is a partial plan view of the range timer of FIG. 1;

FIG. 3 is a fragmentary cross-sectional view taken generally along the line 3—3 of FIG. 1;

FIG. 4 is an enlarged, fragmentary view in cross-section illustrating in greater detail the embodiment of the improved time-of-day and interval timer setting clutch mechanism of the invention used in the apparatus of FIG. 1;

FIG. 5 is a fragmentary cross-sectional view taken generally along the line 5—5 of FIG. 4;

FIG. 6 is a fragmentary cross-sectional view taken generally along the line 6—6 of FIG. 4; and

FIG. 7 is a fragmentary cross-sectional view further illustrating the construction of the minute sleeve and minute input gear of the apparatus of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the figures of the drawings, the improved clock and interval timer of the invention, generally indicated at **10**, includes outer or top and base plates **12**, **14** maintained in spaced-apart relationship by suitable posts (not shown). A conventional clock face and concentric interval timer dial is arranged on the upper surface of top plate **12**.

The clock mechanism, generally indicated at **16**, includes a minute input gear **18** having a pinion **20** and a minute sleeve or shaft **22** concentrically secured thereto for rotation therewith. As best seen in FIG. 7, minute input gear **18**, pinion **20** and minute sleeve **22** may be integrally formed. Alternatively, minute input gear **18**, pinion **20** and minute sleeve **22** may be formed as separate elements, but rigidly secured together for rotation as a unit. Minute input gear **18**, pinion **20** and minute sleeve **22** are mounted for rotation on, but independently of, an interval timer setting shaft **24**.

The minute assembly comprising minute input gear **18**, pinion **20** and minute sleeve **22** drives an hour assembly comprising hour input gear **26** and hour sleeve **28**, coaxially secured together for rotation as a unit, through a gear reduction comprising pinion **20**, gear **30**, and pinion **32**, coaxially secured to gear **30** for rotation therewith. Gear **30** and pinion **32** are mounted on a shaft **34** having its ends journaled in top and base plates **12**, **14** respectively. The hour assembly, comprising input hour gear **26** and hour sleeve **28**, is coaxially mounted on minute sleeve **22** for rotation thereon.

Hour sleeve **28** projects outwardly through an opening **36** in top plate **12** and has hour hand **38** secured thereto. Minute sleeve **22** projects upwardly beyond hour sleeve **28** and has minute hand **40** secured thereto. Interval timer setting shaft **24** projects upwardly beyond minute sleeve **22**, where it is formed as an enlarged diameter section **25**. A setting knob **42** and an interval timer indicating hand **44** are secured to enlarged diameter section **25**.

As will be hereinafter described, manual rotation of setting knob **42**, without depressing it so as to depress setting shaft **24**, results in setting rotation of the interval timer mechanism **46**. The lower extremity **48** of interval timer setting shaft **24** projects downwardly through opening **50** in base plate **14** and engages leaf spring element **52** having one end **54** secured to base plate **14**, as by a rivet **53**. Spring **52** normally biases interval timer setting shaft **24** upwardly to the position shown in FIG. 1.

The enlarged section **25** of setting shaft **24** has a pair of diametrically oppositely disposed dogs **56** formed in its lower extremity. The dogs cooperate with a corresponding pair of diametrically oppositely disposed notches **58** formed in the upper end of minute sleeve **22**. Manual depression of setting knob **42** in the direction shown by arrow **60**, against the force exerted by spring **52**, causes dogs **56** to engage notches **58** so that manual rotation of setting knob **42** is accompanied by manual rotation of the minute assembly comprising minute input gear **18**, pinion **20** and minute sleeve **22**. Pinion **20** drives hour sleeve **28** through gear **30**, pinion **32** and gear **26**. Thus depressed rotation of setting knob **42** manually sets clock mechanism **16**.

Referring now to FIG. 3 in conjunction with FIG. 1, interval timer mechanism **46** comprises interval timer input gear **62** mounted for rotation on interval timer setting shaft **24**. Input gear **62** has an annular flange **64** depending therefrom and defining a cavity **66**. A driving member **68** is disposed in cavity **66** and is secured to interval timer setting shaft **24** for rotation therewith. Member **68** has a pair of diametrically oppositely disposed ears **70**, **72** respectively cooperatively engaging notches **74**, **76** formed in flange **64**. Thus, manual rotation of setting knob **42**, either in the interval timer setting position shown in FIG. 1 or in its depressed clock setting position, will rotate member **68** and thus interval timer input gear **62**.

Flange **64** has an inwardly extending projection **78** formed thereon which is normally engaged by a projection **80** formed on the end of spring **52** and projecting upwardly through an opening in base plate **14** into the cavity **66**. Interval timer input gear **62** also has a mutilated portion **82**, i.e. a portion from which a number of teeth have been removed. As will hereinafter be more fully described, the position of projection **78** with reference to projection **80** shown in solid lines in FIG. 3 is the ZERO setting of the interval timer and in that setting, interval timer driving pinion **84** is aligned with the mutilated portion **82** of gear **62**, i.e. out of driving mesh therewith. Gear **62** may be manually rotated by means of settng knob **42** in the direction shown by the arrow **86** to the desired timed interval setting, the maximum setting of one hour being determined by abutment of projection **78** with the opposite side of projection **80** as shown in dashed lines at **78*a*** in FIG. 3. However, when setting knob **42** and interval timer setting shaft **24** are manually depressed, thereby depressing spring **52** to the position shown in dashed lines at **52*a*** in FIG. 1, projection **80** is moved downwardly out of abutting relationship with projection **78** on gear **62** thereby to permit unrestricted rotation of interval timer input gear **62** during the clock setting operation.

With the exception of the rigid attachment of minute input gear **18**, pinion **20** and minute sleeve **22**, the clock mechanism **16** and interval timer mechanism **46**, as thus far described, may be the same as that disclosed and described in the aforesaid Doyle patent and reference may be had to that patent for other details of construction not forming a part of the present invention.

In order to drive the clock and interval timer mechanisms, a conventional clock motor **88** is mounted on base plate **14** and has driving pinion **90** secured to its output shaft **92**. Pinion **90** drives gear **94**, having pinion **96** coaxially secured thereto for rotation therewith. Gear **94** and pinion **96** are mounted on shaft **98**, having its ends respectively journaled for rotation in the top and base plates **12**, **14**. Pinion **96** meshes with and drives main drive gear **100**. Referring additionally particularly to FIGS. 4, 5 and 6, gear **100** is mounted on shaft **102** having its upper end **104** journaled in top plate **12**. A cap member **106** is secured to the bottom end **108** of shaft **102** and has a portion **110** journaled in base plate **14**. More particularly, gear **100** is mounted on portion **112** of shaft **102**, which has a flat **114** formed thereon. Gear **100** has a central D-shaped opening **116** formed therein which slidably receives portion **112** of shaft **102**. Thus, gear **100** is mounted for rotation with shaft **102** and for limited axial sliding movement with respect thereto.

Portion **118** of shaft **102**, above portion **112**, is joined to a portion **120**, of larger diameter, thus forming a shoulder **122**. A minute drive pinion **124** is rotatably mounted on portion **118** between shoulder **122** and gear **100**.

A first washer **126** is disposed about shaft **102** between minute drive pinion **124** and the central portion **128** of gear **100**, and another washer **126***a* is mounted about shaft **102** between minute drive pinion **124** and shoulder **122**. This mounting arrangement positions minute drive pinion **124** in driving mesh with minute input gear **18**.

An interval timer drive pinion **84** is rotatably mounted on portion **130** of shaft **102**, which is below portion **112** and above cap member **106**. A washer **132** is disposed about shaft **102** between pinion **84** and cap member **106**. A leaf spring clutch member **134** is provided having a central opening **136** through which portion **130** of shaft **102** extends. The diametrically opposite ends **138**, **140** of clutch member **134** engage the bottom surface of gear **100**. Central portion **142** of spring clutch member **134**, surrounding opening **136**, resiliently engages a washer **144** which, in turn, engages interval timer drive pinion **84**. This mounting arrangement positions interval timer drive pinion **84** in driving mesh with interval timer input gear **62**.

It will now be seen that the resilient force exerted by clutch spring **134** biases main drive gear **100** into driving engagement with minute drive pinion **124** through washer **126**. Pinion **124**, in turn, is biased into engagement with shoulder **122**. Similarly, clutch spring **134** biases interval timer drive pinion **84** into driving engagement with end cap **106** through washer **132**. In other words leaf spring clutch **134** establishes a frictional coupling force connecting main gear **100** to the pinions **84** and **124**. Thus, normally, the driving of main drive gear **100** by motor **88** through pinion **90**, gear **94** and pinion **96**, causes simultaneous rotation of minute drive pinion **124** and interval timer drive pinion **84**. They, in turn, simultaneously drive minute input gear **18** and interval timer input gear **62** in the same direction, as shown by the arrow **146** in FIG. 3; unless, of course, interval timer drive pinion **84** has run out of mesh with interval timer input gear **62** by being in alignment with mutilated portion **82**.

Assuming now that it is desired to set the interval timer, setting knob **42** is manually rotated thereby to rotate interval timer input gear **62** in the direction shown by the arrow **86** from the disengaged position as shown in FIG. 3 to the desired timed interval setting. This may be any rotational position betwen that shown in solid lines in FIG. 3 and the maximum position shown in dashed lines at **78***a* in FIG. 3. With the exemplification timer this maximum period would be sixty (60) minutes, as indicated by the indicia in FIG. 2. However the interval timer may be designed to have other maximum timed interval settings. This manual rotation of interval timer input gear **62** is in a direction opposite to the direction of the torque exerted on interval timer drive pinion **84** by main drive gear **100** through clutch spring **134** and washer **144**. This causes slippage between the clutch spring **134** and interval timer drive pinion **84** so that drive pinion **87** will rotate with respect to shaft **102** and gear **100**. Meanwhile, clutch spring **134** continues to exert an axial force sufficient to couple minute drive pinion **124** to main drive gear **100** and thereby drive minute input gear **18** and clock mechanism **16**. Thus, the movement incident to manual setting of the interval timer is not transmitted either to the clock mechanism **16** or to the clock motor **88**.

Assume further that it is desired to set the clock mechanism and that the manual setting knob **42** is thus depressed so as to engage dogs **56** with notches **58** and then rotated resulting in simultaneous manual rotation of the minute input gear **18** and interval timer input gear **62**. This manual rotation, which may be in either direction, will cause both of the pinions **84** and **124** to slip or rotate relative to shaft **102** and main drive gear **100**, which continue to be driven by motor **88**. As soon as the manual setting of the clock mechanism is terminated, clutch spring **134** again couples minute drive pinion **124** and interval timer drive pinion **84** for rotation with gear **100** and the normal operation then continues.

It will be understood that, at least when energized, motor **88** exerts a relatively large resistance against a force tending to rotate in its reverse direction or tending to rotate it in its forward direction at other than its normal speed. The manual force for setting the interval timer mechanism **46** or for setting the clock mechanism **16** can be transferred from pinions **84** and **124** to the main drive gear **100** only through the frictional coupling force between the main gear **100** and the pinions **84**, **124**. Since gear **100** is firmly connected to drive motor **88**, this frictional coupling force is insufficient to alter the speed of main gear **100**, as determined by motor **88**. Also, during manual setting of the interval timer mechanism, the only connection between interval timer drive pinion **84** and minute drive pinion **124** is through the main gear **100** and shaft **102**. As stated above, the frictional coupling force between pinion **84** and the assembly comprising shaft **102** and gear **100** is insufficient to change the rotation of the shaft and gear by motor **88**. Therefore, none of the interval timer setting motion is transferred to the clock drive pinion **124**.

On the other hand the clock mechanism **16** and interval timer mechanism **46** offer relatively little resistance to advancement by motor **88** through main gear **100**. Therefore the frictional coupling force between main gear **100** and interval timer drive pinion and between the main gear **100** and the minute drive pinion **124** is sufficient to transfer the driving or operational movement from the motor **88** to the interval timer mechanism **46** and clock mechanism **16**, respectively. Spring clutch member **134** serves to maintain proper frictional coupling force between the various members mounted on shaft **102** despite variations due to manufacturing tolerances and wear during operation.

It will now be seen that the main drive gear **100**, clutch spring **134**, minute and interval timer drive pinions **124** and **84**, cap member **106** and shaft **102** comprise a single clutch mechanism which functions as both a time-of-day setting clutch and an interval timer setting clutch, thus replacing the two separate clutches, each having a clutch spring, required in the construction of the aforesaid Doyle patent. It will further be seen that the provision of the single clutch assembly permits rigid attachment or integral formation of the minute gear, pinion and minute sleeve assembly thus simplifying the construction of the aforesaid Doyle patent in which the minute input gear was rotatably mounted on the minute sleeve and coupled thereto by the time-of-day clutch spring. It will also be seen that the mounting of the main drive gear **100** on shaft **102** by means of the D-shaped opening **116** and flat **114** on shaft portion **112** permits limited axial movement of gear **100** relative to shaft **102** so that the single clutch spring **134** may be employed to allow slippage of both the minute drive pinion **124** and the interval timer drive pinion **84**.

It will be readily understood that an audible alarm may be actuated by the interval timer mechanism at the conclusion of the predetermined timed interval in the manner described and illustrated in the aforesaid Doyle patent, and likewise that a range time switch mechanism may be operated by the clock mechanism, as also described and illustrated in the aforesaid Doyle patent. Such audible alarm and range time switch mechanisms are well-known in the art and have been omitted from the present disclosure for the sake of simplicity and ease of understanding.

While in accordance with the patent statutes, we have described what, at present, is considered to be the preferred embodiments of our invention, it will be obvious to those skilled in the art that numerous changes and modifications may be made therein without departing from the invention, and it is therefore aimed in the appended claims to cover all equivalent variations as fall within the true spirit and scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. In clock and interval timer apparatus; a clock mechanism including a first input gear for driving said clock mechanism to indicate the passage of time and means for manually driving said first input gear thereby to set said clock mechanism; an interval timer mechanism including a second input gear for driving said timer mechanism from a preset timed interval position to a disengaged position and means for manually driving said second input gear from its disengaged position to a timed interval position thereby to set said timed interval; a driving motor and a gear train coupling said motor to said first and second input gears for normally driving the same; said gear train including first and second pinions, respectively meshing with said first and second input gears, and a third gear operatively coupled to said motor and driven thereby; means for mounting each of said pinions for independent rotation with respect to the other of said pinions and said third gear; and single clutch means for normally coupling both of said pinions to said third gear for rotation therewith so that said motor normally drives said first and second input gears to cause said clock mechanism to indicate the passage of time and to drive said interval timer mechanism from a preset timed interval position to its disengaged position; said clutch means effectively decoupling said first pinion from said third gear in response to said manual driving of said first gear, and effectively decoupling said second pinion from said third gear in response to said manual driving of said second gear.

2. The apparatus of claim 1 wherein said clutch means comprises resilient means for providing a frictional force between said pinions and third gear to couple the same.

3. The apparatus of claim 1 wherein said mounting means includes a shaft having said pinions and third gear coaxially mounted thereon, each of said pinions being mounted for rotation with respect to said shaft.

4. The apparatus of claim 3 wherein said third gear is mounted between said pinions with freedom for axial movement with respect to said pinions and further comprising means on said shaft for respectively restraining axial movement of said pinions in directions away from said third gear.

5. The apparatus of claim 4 where said clutch means comprises a leaf spring clutch acting between one of said pinions and said third gear to provide an axial force between said third gear and each of said pinions.

6. The apparatus of claim 1 wherein said clock mechanism further includes a third pinion and a shaft driven by said first input gear, a sleeve coaxially surrounding said shaft, and speed reducing gearing drivingly connecting said third pinion and said sleeve, said shaft and third pinion being rigidly connected to said first input gear for rotation therewith at all times.

7. The apparatus of claim 6 wherein said mounting means includes a second shaft having said first and second pinions and said third gear coaxially mounted thereon with said third gear disposed between said first and second pinions, and with each of said first and second pinions being mounted for rotation with respect to said second shaft; said second shaft having first and second means thereon for respectively restraining axial movement

of said first and second pinions in directions away from said third gear; said third gear being mounted for rotation with said second shaft and for axial movement thereon with respect to said first and second pinions; said clutch means comprising a leaf spring clutch acting between one of said first and second pinions and said third gear to provide an axial force between said third gear and each of said first and second pinions.

8. In a clock and interval timer apparatus; a clock mechanism including a first input gear for driving said clock mechanism to indicate the passage of time and means for manually driving said first input gear to set said clock mechanism; an interval timer mechanism including a second input gear for driving said timer mechanism from a preset timed interval position to a disengaged position and means for manually driving said second input gear from its disengaged position to a timed interval position; a driving motor and a gear train coupling said motor to said first and second input gears for normally driving the same; said gear train including first and second pinions, respectively meshing with said first and second input gears, and a third gear operatively coupled to said motor and driven thereby; means for mounting each of said pinions for independent rotation with respect to the other of said pinions and to said third gear, said motor offering greater resistive force to movement of said third gear by said pinions than either of said clock mechanism and interval timer mechanism offer to driving by said motor through said third gear and said pinions; and single clutch means causing a frictional coupling force between each of said pinions and said third gear; the frictional coupling force being greater than the resistive force offered by either of said clock mechanism and said interval timer to driving by said motor through said third gear and said pinions and less than the resistive force offered by said motor to movement of said third gear by said pinions.

9. The apparatus of claim 8 wherein said mounting means includes a shaft having said pinions and said coaxially mounted thereon, each of said pinions being mounted for rotation with respect to said shaft.

10. The apparatus of claim 9 wherein said third gear is mounted between said pinions with freedom for axial movement with respect to said pinions; there are means on said shaft respectively restraining axial movement of said pinions in directions away from said third gear; and said clutch means comprises a leaf spring clutch acting between one of said pinions and said third gear to provide an axial frictional coupling force between said third gear and each of said pinions.

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L. R. FRANKLIN, Assistant Examiner

U.S. Cl. X.R.

58—7, 22.9