

[54] MOTOR DRIVEN TIMER

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Related U.S. Application Data

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[51] Int. Cl. G04b 37/00, G04c 23/00

[58] Field of Search..... 58/21.14, 23, 26 A, 58/53-56; 200/38 R

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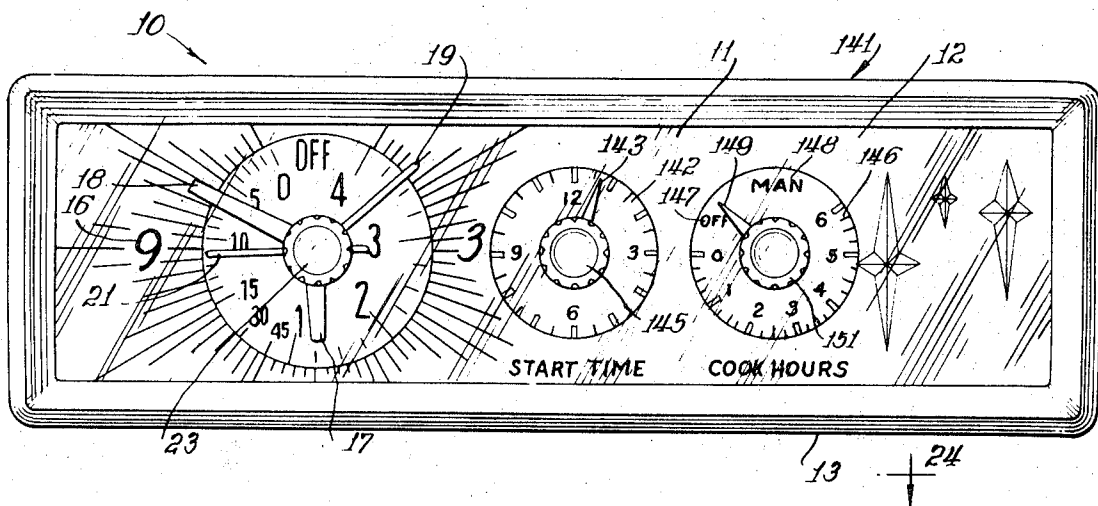
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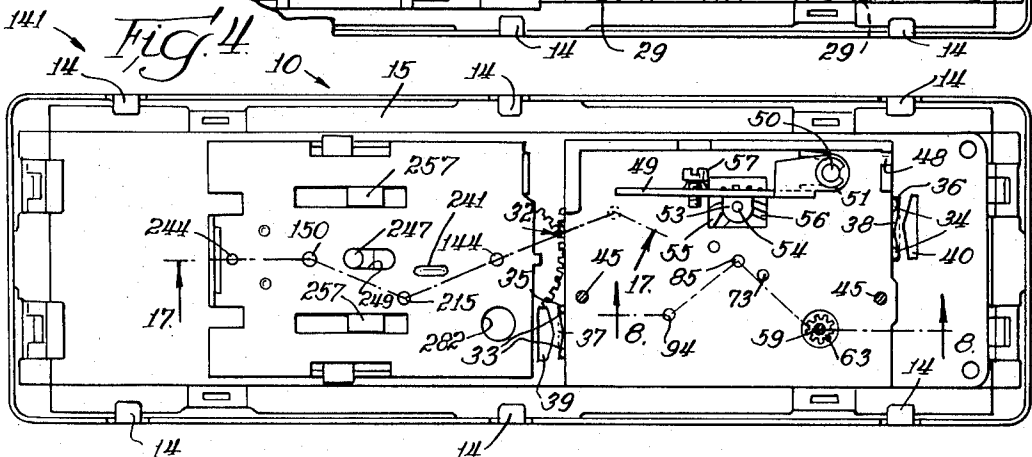
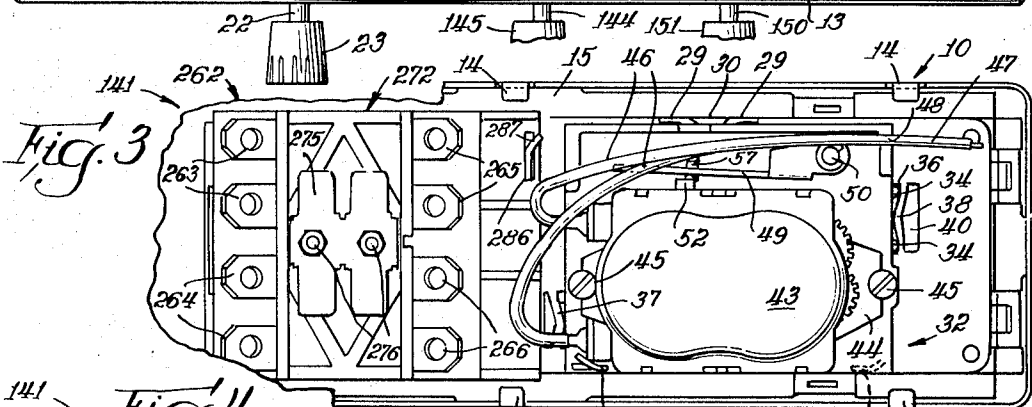
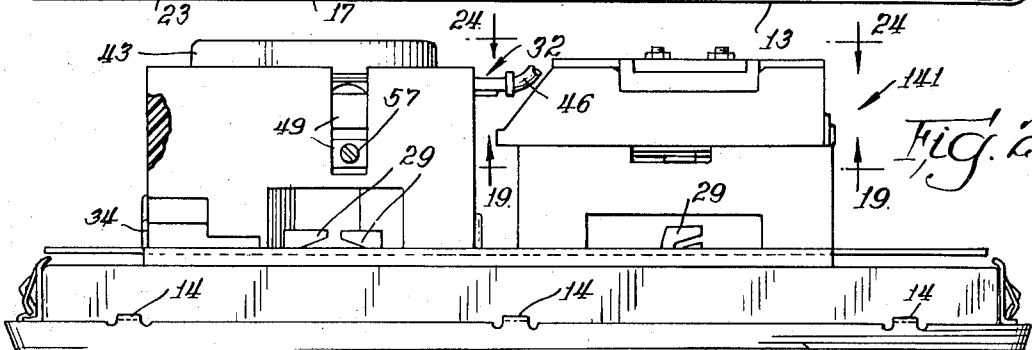
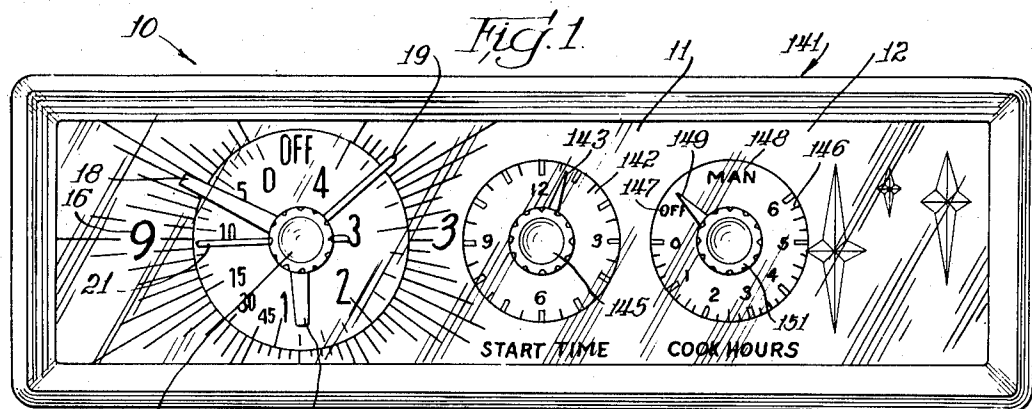
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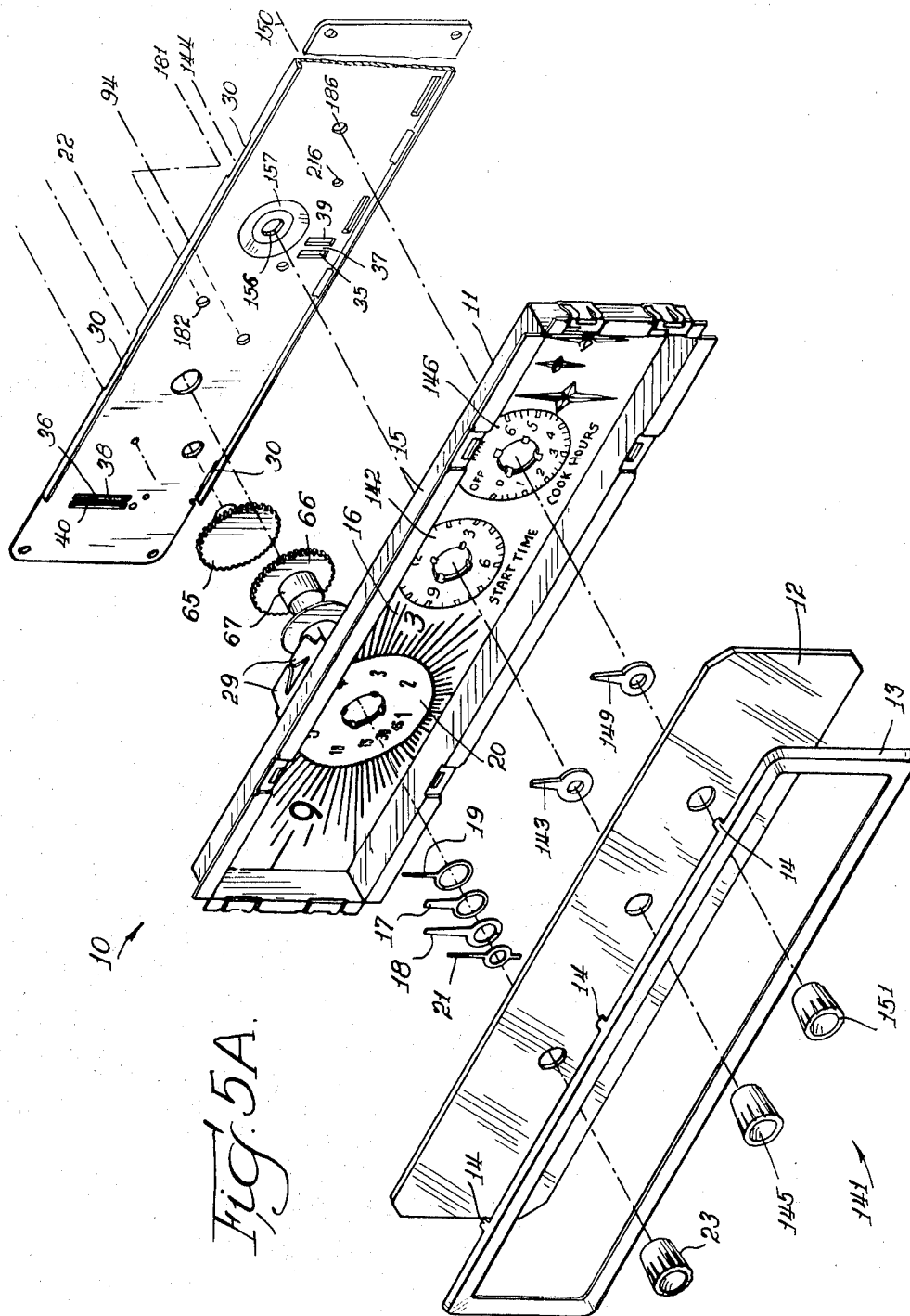
ABSTRACT

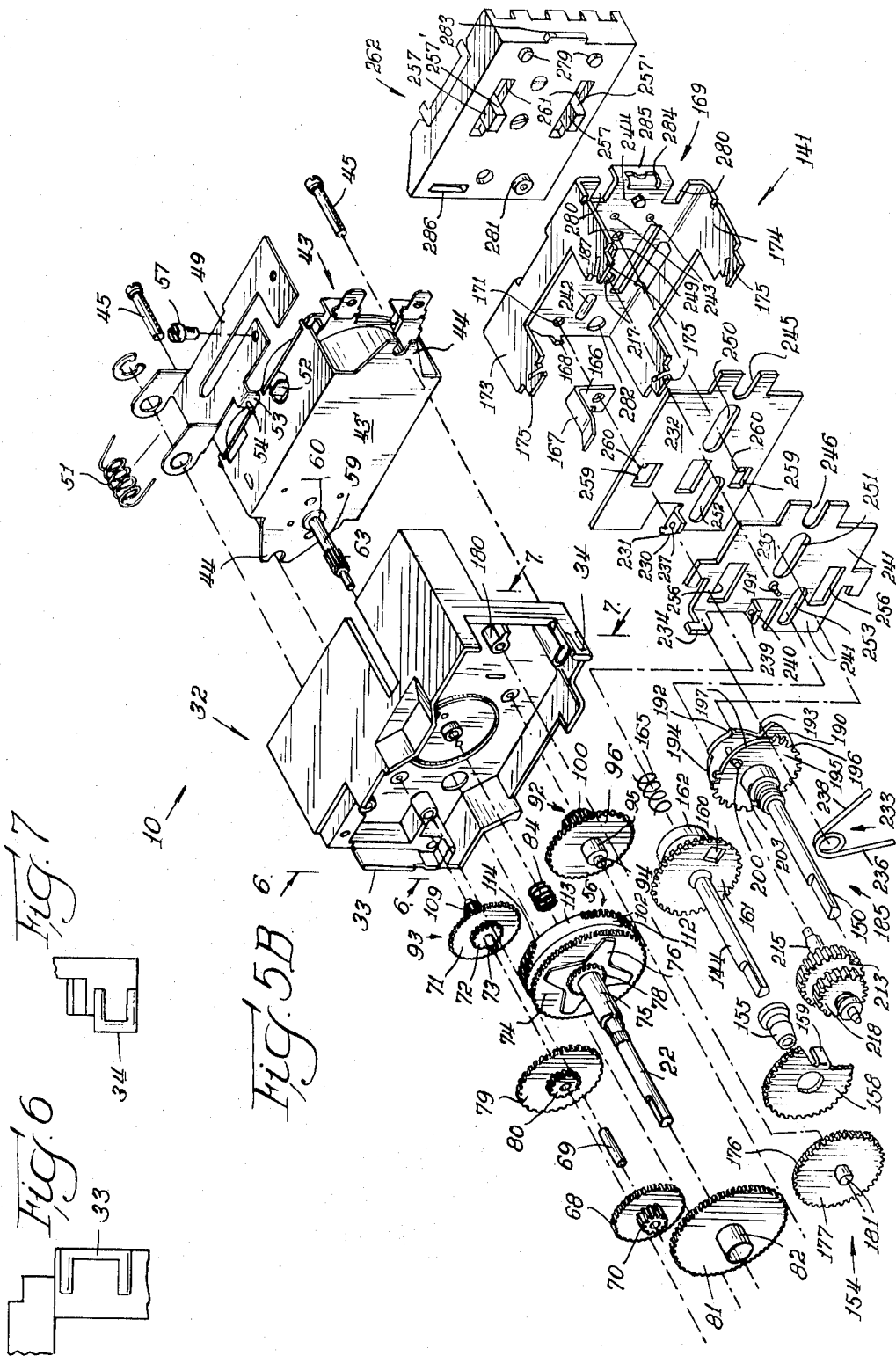
A compact motor driven timer for cooking stoves includes a dial plate carrying time markings with one or more hands rotatable thereto on a shaft rotatably mounted on a mechanism plate on which the dial plate is supported. A plastic mechanism case encloses a gear train interconnecting a synchronous motor mounted on the case and the hand or hands. Shouldered portions of the case extend through the mechanism plate which has deformable ribs to hold the shouldered portions of the case and thereby the case itself in place. Screws extend through the case to secure it and the motor to the mechanism plate. The gear train includes one or more clutches to rotate an interval hand at different speeds. A buzzer arm is released to vibrate in the magnetic field of the motor at the end of the manually preset interval. Time indicating hands are also driven by the motor. The interval hand is concentrically mounted with the time indicating hands or is offset therefrom. A notch is provided in the mechanism case to hold the ends of the leads to the motor temporarily in position. The gear train also operates a range timer which includes contacts that are closed at the beginning of a variable time cycle to start a cooking operation at a preset time of day. The contacts are opened at the end of the preset time cycle. The range timer can be set for manual operation by manual closure of the contacts.

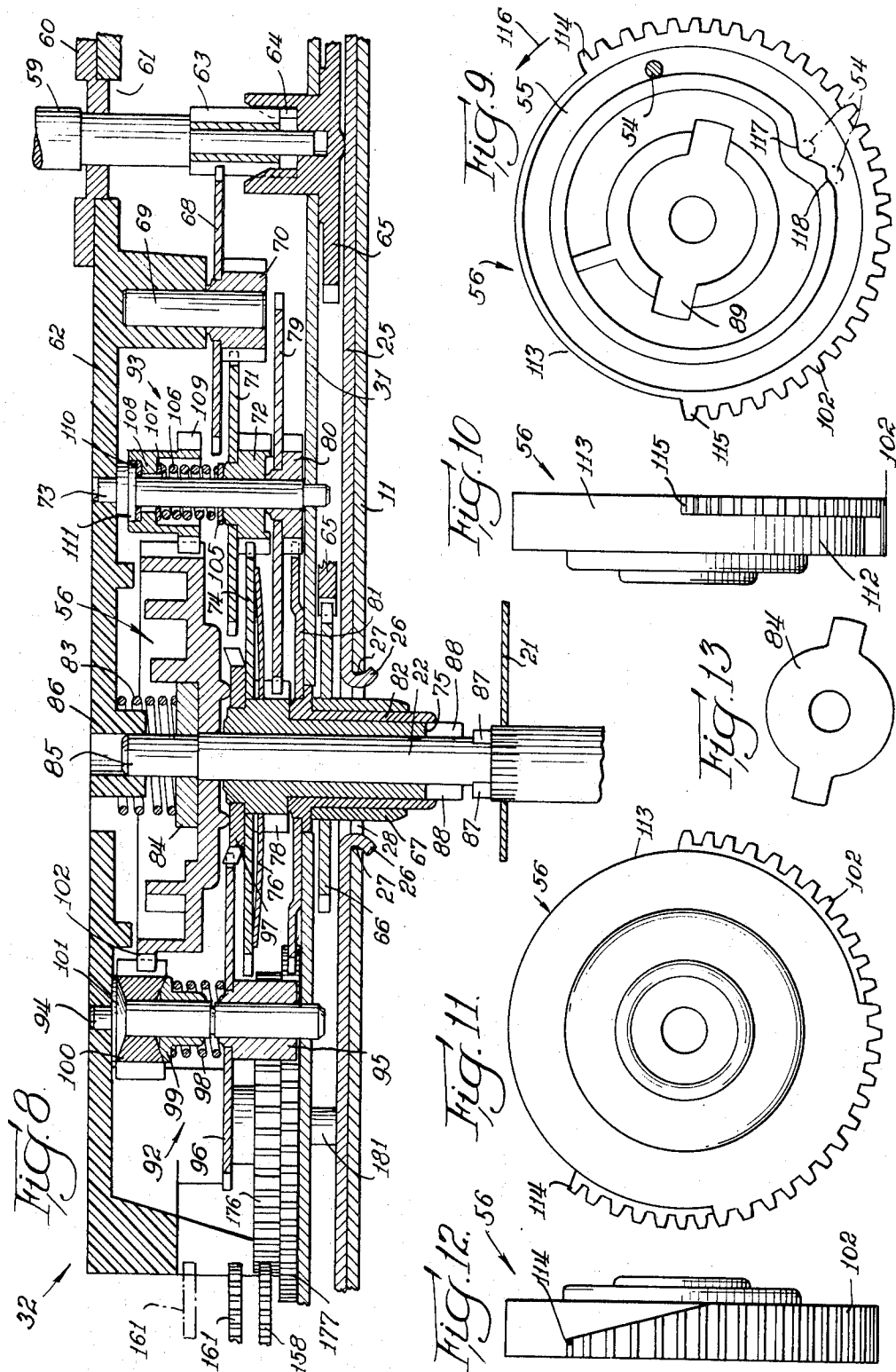
4 Claims, 29 Drawing Figures

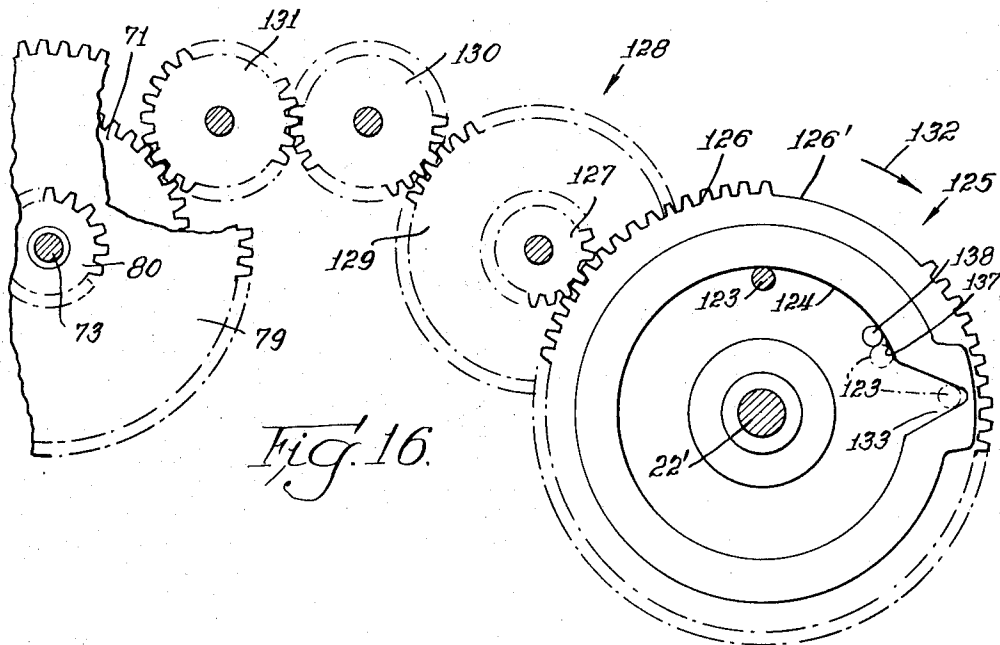
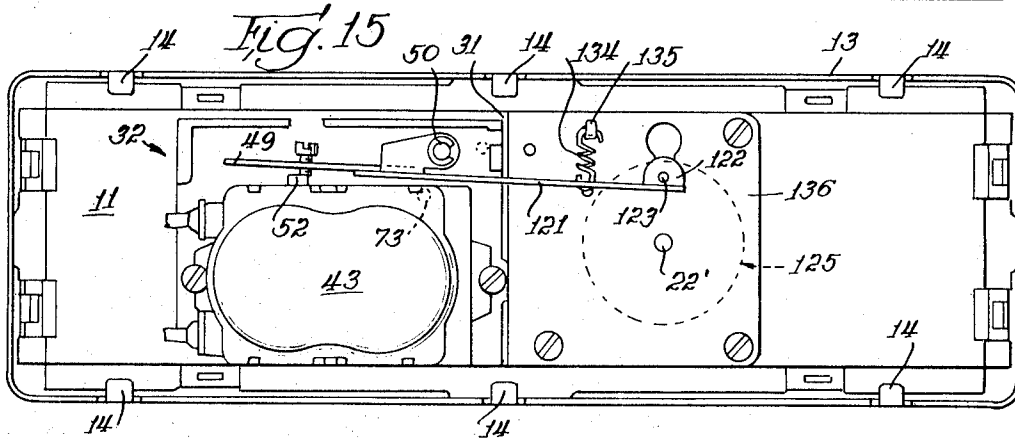
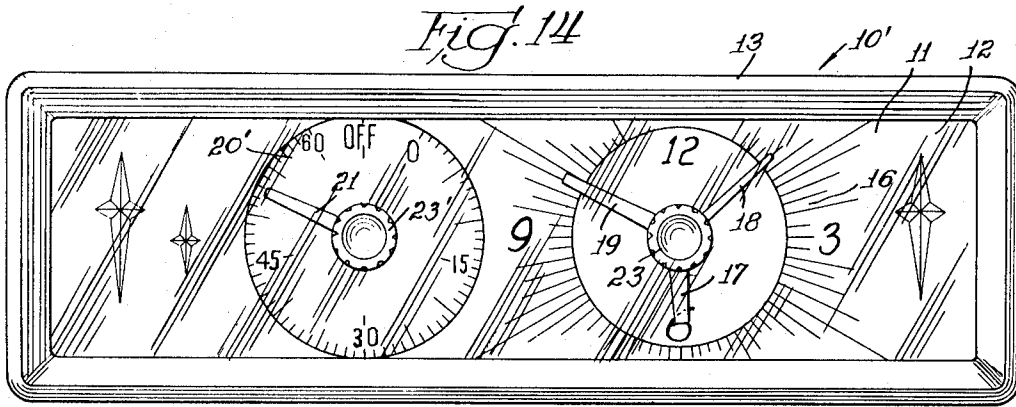


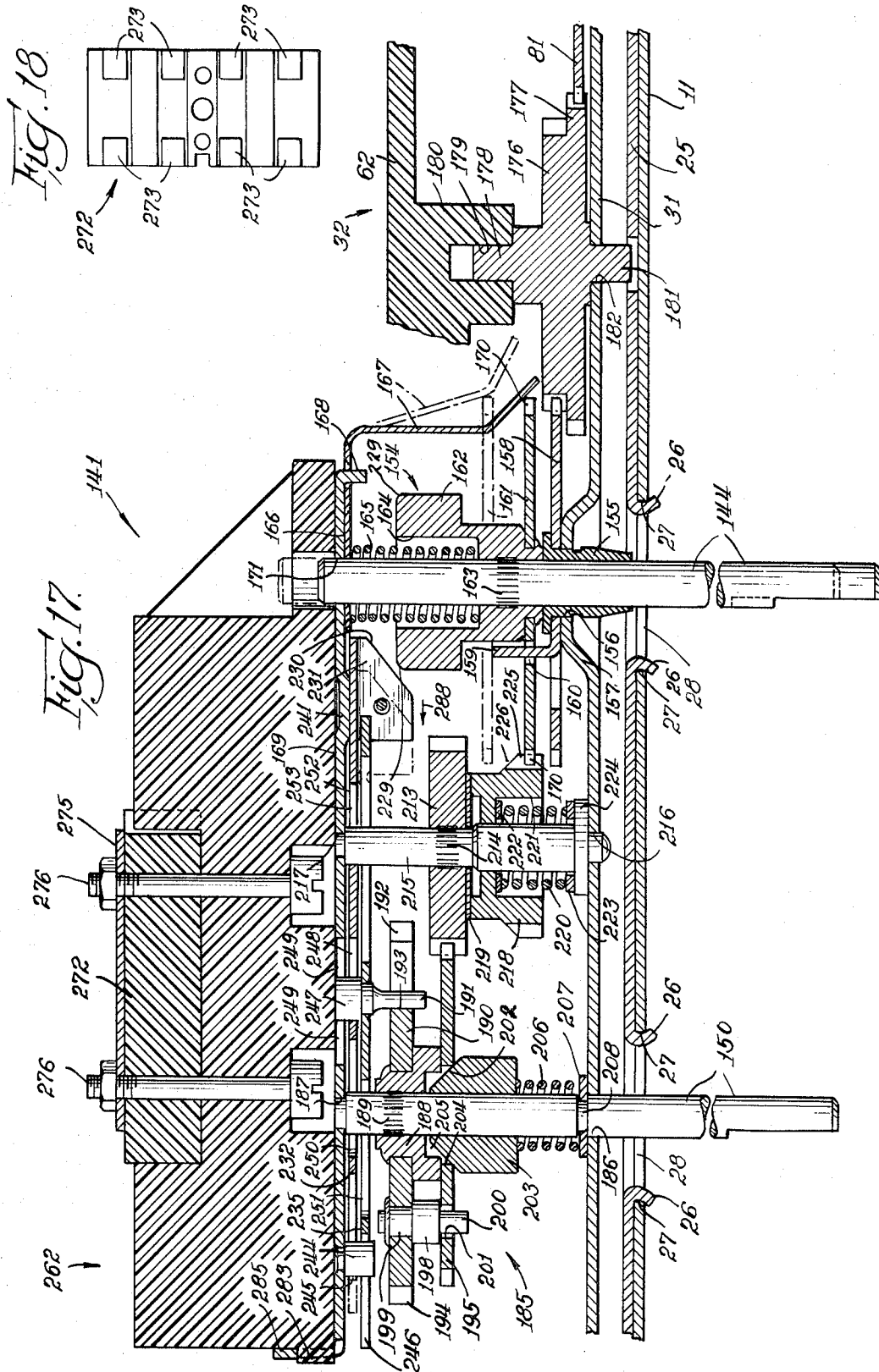


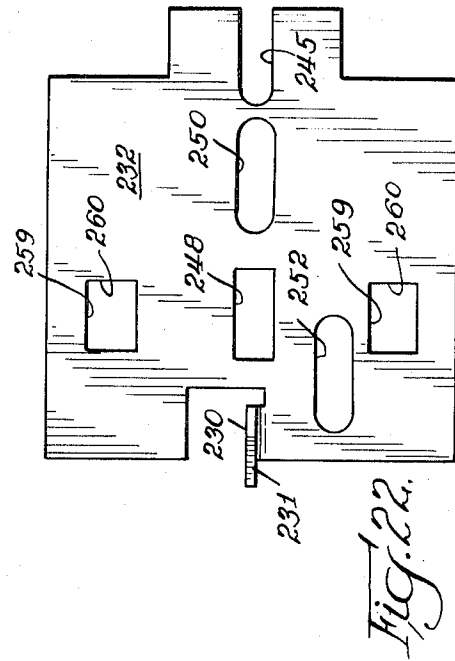
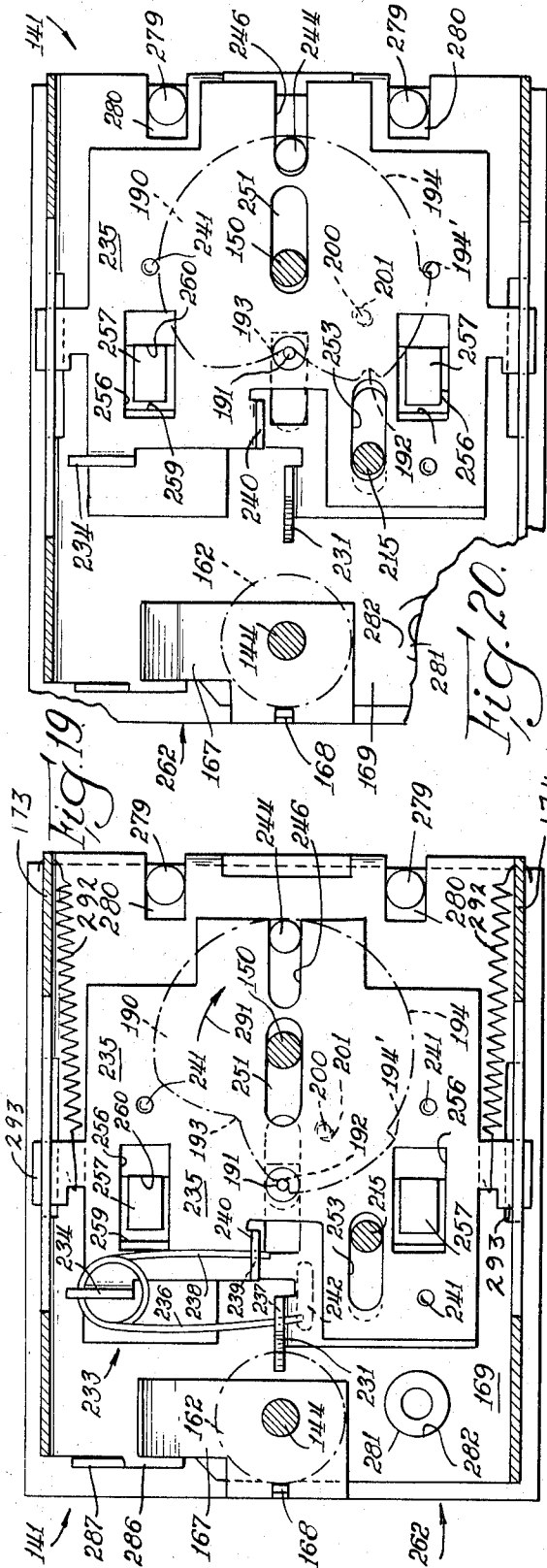


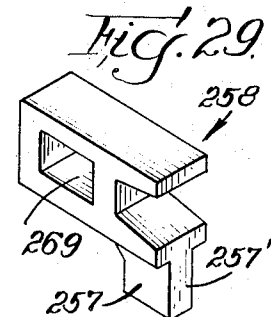
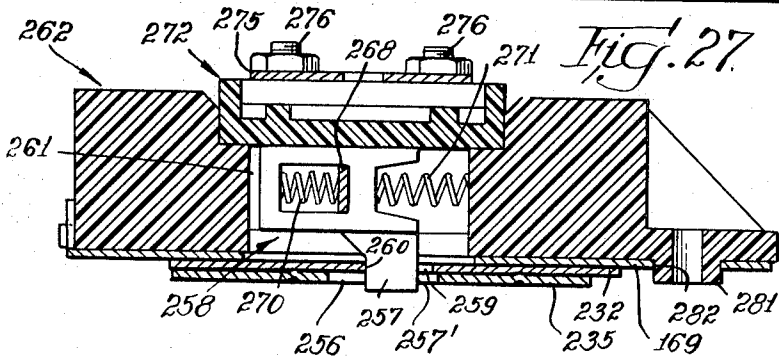
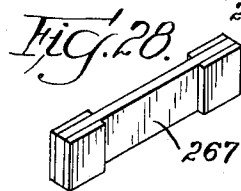
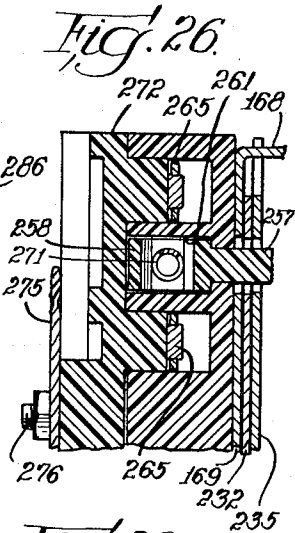
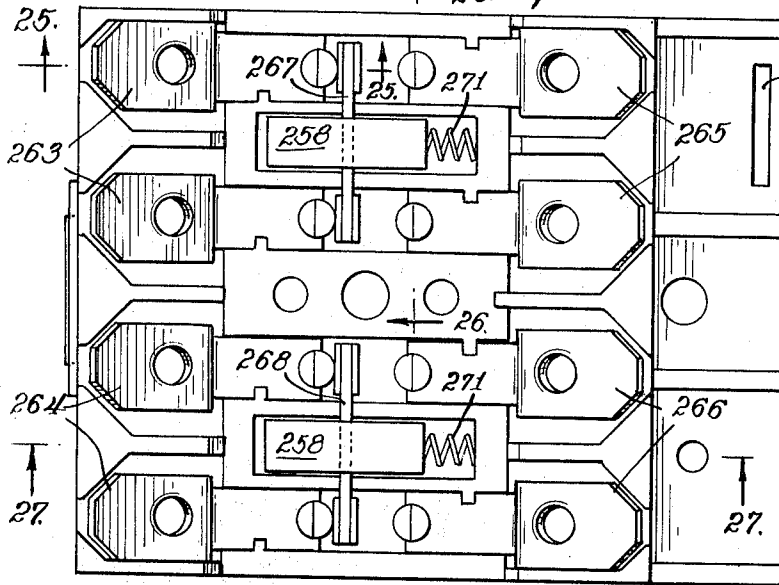
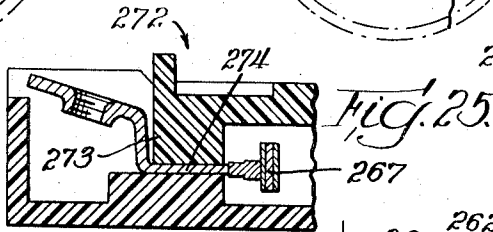
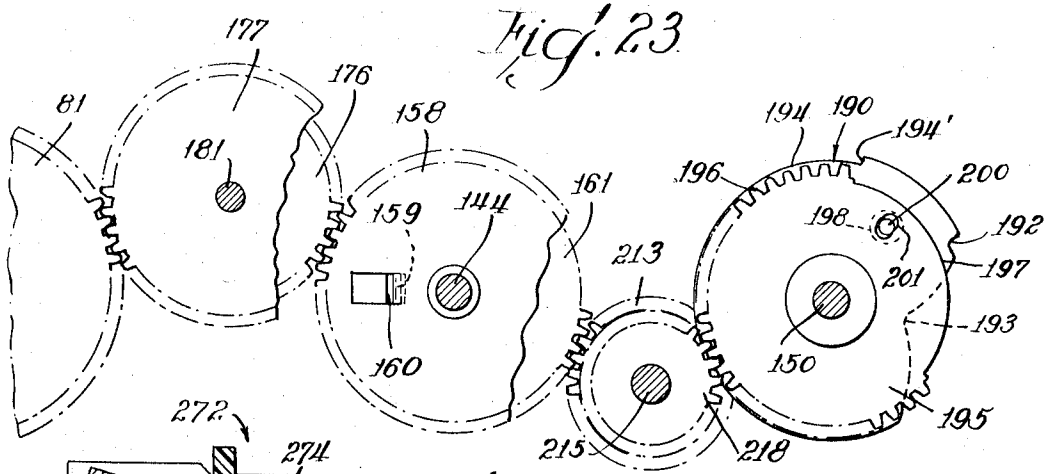












MOTOR DRIVEN TIMER

This is a division of application Ser. No. 878,618, filed Nov. 21, 1969, now U.S. Pat. No. 3,601,973.

This application is a continuation-in-part of application Ser. No. 817,500, filed Apr. 18, 1969, now abandoned.

This invention relates, generally, to motor driven timers for electric and gas ranges and the like. It has particular relation to interval timers capable also of continuously indicating time and to range timers for controlling the cooking time of an oven. It is desirable to reduce the dimensions of such devices and to provide for facilitating their assembly. Also it is desirable to arrange for the interval time hand to be rotated at a relatively low speed during the beginning of the major portion of a relatively long interval, such as a 4-hour interval, and at a relatively high speed during the minor final portion of the interval, such as the last quarter hour.

Accordingly, among the objects of this invention are: To provide a compact motor driven timer which indicates time and can be preset manually to operate a signal at the end of a preset interval and to effect the beginning and duration of the energization of the oven of an electric or gas range; to mount a dial plate on a mechanism plate to which a plastic mechanism case is secured in a novel manner; to secure the mechanism case to the mechanism plate by deformable ribs thereon cooperating with interfitting shoulders on the mechanism case; to subsequently position a synchronous motor on the mechanism case and to secure it and the mechanism case to the mechanism plate by screws; to provide a gear train in the mechanism case for connecting the synchronous motor to a rotatable shaft to which the interval hand is secured for rotation relative to interval time markings on the dial plate and also to time indicating hands rotatable relative to the shaft and to time markings on the dial plate; to include in the gear train a clutch to permit rotation of the interval hand independently of the time indicating hands; for operation of the interval hand at different speeds to employ in the gear train a relatively low speed high torque clutch in combination with a relatively high speed low torque clutch; to arrange for the clutches to drive a cam at the different speeds; at the end of the preset interval to release a buzzer arm to vibrate in the magnetic field of the synchronous motor and provide a signal; to arrange for holding the ends of the leads to the synchronous motor in a notch in the plastic mechanism case; to locate the interval hand in offset relation to the time indicating hands; to provide for operating contacts between closed and open positions to supply heat to an electric or gas oven; to close the contacts at a preset time of day and for a preset number of hours; and to close the contacts manually to permit operation of the oven independently of the timer control.

In the drawings: FIG. 1 is a view, in front elevation, and at full scale of a motor driven timer in which this invention is embodied. FIG. 2 is a top plan view of the motor driven timer shown in FIG. 1. FIG. 3 is a partial view, in rear elevation of the motor driven timer shown in FIG. 1. FIG. 4 is a rear view of the motor driven timer, the synchronous motor having been omitted to show more clearly how the mechanism case is independently secured to the rear side of the mechanism plate and the contact housing also having been omitted to show the rear side of the frame plate on which it is

mounted. FIGS. 5A-5B show an exploded view of the motor driven timer. FIG. 6 is a view, taken generally along line 6-6 of FIG. 5B looking in the direction of the arrows and shows a part of the mechanism case provided with a shouldered portion for interfitting with the mechanism plate to be secured thereto by a deformable rib. FIG. 7 is a view taken generally along line 7-7 of FIG. 5B and looking in the direction of the arrows to show another shouldered portion of the mechanism case for interfitting with the mechanism plate and to be held thereto by a deformable rib. FIG. 8 is a horizontal sectional view at an enlarged scale looking in the direction of the arrows and taken generally along line 8-8 of FIG. 4 and shows the gear train mounted within the mechanism case. FIG. 9 is an elevational view of the cam that is mounted on the interval shaft. FIG. 10 is an elevational view of the cam shown in FIG. 9 looking from left to right. FIG. 11 is a view of the cam shown in FIG. 9 looking from the opposite side. FIG. 12 is an elevational view of the cam shown in FIG. 11 looking from left to right. FIG. 13 is an elevational view of the drive dog that is secured to the interval shaft. FIG. 14 is a view, in front elevation, of a modified form of the motor driven timer, without the range timer section in which the interval hand and interval markings are offset from the time indicating hands and the time indicating markings on the dial plate. FIG. 15 is a view, in rear elevation, of the motor driven timer shown in FIG. 14. FIG. 16 shows a portion of the gear train that is employed in the motor driven timer shown in FIGS. 14 and 15. FIG. 17 is a horizontal sectional view at an enlarged scale looking in the direction of the arrows and taken generally along line 17-17 of FIG. 4 and shows the gearing and related parts for the range timer section. FIG. 18 is an elevational full scale view of the cover for the contact housing. FIG. 19 is a vertical elevational view at an enlarged scale taken generally along line 19-19 of FIG. 2 and shows the cam of the range timer section in the manual position. FIGS. 20 and 21 are views, similar to FIG. 19 in which the cam is shown, respectively, in the "off" position and in the timed cooking position. FIG. 22 is an elevational view of the contact operating plate. FIG. 23 shows the gear train for the range timer section. FIG. 24 is an elevational view at an enlarged scale of the contact housing and contacts taken along line 24-24 of FIG. 2 and looking in the direction of the arrows, the cover having been omitted. FIGS. 25, 26 and 27 are sectional views taken generally along lines 25-25, 26-26 and 27-27 respectively, of FIG. 24. FIG. 28 is a perspective view at an enlarged scale of the contact bar. FIG. 29 is a perspective view at an enlarged scale of the contact slide which carries the contact bar.

In FIGS. 1 and 5A-B the reference character 10 designates, generally, a motor driven timer embodying this invention. It includes an elongated metallic dial plate 11 that is arranged to be viewed through a glass 12 that is held in place by a rectangular escutcheon 13. Tabs 14 extend rearwardly from the escutcheon 13 and overlie a flange 15 on the dial plate 11 to hold the assembly together. Time markings 16 are imprinted on the dial plate 11 and with respect to them an hour hand 17, a minute hand 18 and a second hand 19 are arranged to rotate. Concentrically within the time markings 16 interval markings 20 are imprinted on the dial plate 11 and with respect to them an interval hand 21 rotatable with an interval shaft 22 is arranged to rotate.

It will be observed that the interval markings 20 extend from 0 to 4. The markings between 0 and the 15 minute mark are laid out over an angle of 90° while the markings from 15 minutes to 1 hour are laid out over an angle of 49°. The angular spacing between the hour marks 1, 2, 3 and 4 is 46°. As will appear hereinafter provision is made for rotating the interval hand 21 relatively slowly from the 4 hour marking to the 1 hour marking. During the next 45 minutes the speed of the interval hand 21 is increased slightly and finally during the last 15 minutes it rotates at a relatively high speed. This makes it possible to adjust accurately a setting of the interval hand 21 for a relatively short interval while it is possible to obtain an interval setting of 4 hours within the confines of the interval markings 20.

A knob 23, secured to the end of the interval shaft 22 that projects through the glass 12, permits manual adjustment of the interval hand 21 to the desired interval mark. When the shaft 22 and knob 23 are moved inwardly, as will appear hereinafter, the setting of the hour hand 17 and minute hand 18 to the correct time can be accomplished.

Mounted on the rear side of the dial plate 11 is a metallic adapter plate 25. As shown in FIGS. 8 and 17 tabs 26 extend forwardly from the adapter plate 25 through notches 27 in the dial plate 11 and around openings 28 therein for securing the adapter plate 25 to the dial plate 11. The tabs 26 are turned over to secure the adapter plate 25 in place. Four tabs 26 are employed at each location only two being shown.

Lugs 29, FIG. 3, extend rearwardly from the adapter plate 25 for entering openings 30, FIG. 5A, in a rectangular metallic mechanism plate 31 which is held in spaced relation to the rear side of the adapter plate 25.

A moulded plastic mechanism case 32 is mounted on the rear side of the mechanism plate 31. The manner in which it is held in position to facilitate assembly of the motor driven timer 10 is important. As shown in FIGS. 6 and 7 shouldered portions 33 and 34 are moulded integrally with the opposite ends of the plastic mechanism case 32 and they are arranged to interfit with openings 35 and 36, FIGS. 3 and 5A in the mechanism plate 31. After the plastic mechanism case 32 has been positioned on the mechanism plate 31 with the shouldered portions 33 and 34 extending through the openings 35 and 36, ribs 37 and 38 extending between the openings 35 and 36 and slots 39 and 40 in the mechanism plate 31 are deformed inwardly to overlie the shouldered portions 33 and 34. In this manner the plastic mechanism case 32 is securely held in place on the mechanism plate 31. Thus it is held temporarily in position until additional fastening means are employed for further securing the mechanism case 32 to the mechanism plate 31.

After the mechanism plate 32 has been assembled in the manner described, a synchronous motor, indicated generally at 43, is mounted on the rear side of the plastic mechanism case 32. The motor 43 can be constructed as disclosed in Svarnias U. S. Pat. No. 3,350,589, issued Oct. 31, 1967. Ears 44 extend laterally from the bottom of the rectangular magnetic field structure 43' of the motor 43 and they are notched to receive screws 45 which extend through the plastic mechanism case 32 and are threaded into the mechanism plate 31. In this manner not only is the motor 43 held in position but also the mechanism case 32 is further secured to the mechanism plate 31.

The motor 43 is arranged to be energized from a suitable alternating current source. For this purpose leads 46, FIG. 3, are provided. Some of the insulation is removed from the ends 47 of the leads 46 and the projecting flexible conductors, if allowed to swing freely, might scratch the motor driven timer 10 or adjacent ones on an assembly line. In order to prevent this, a slot 48 is moulded into the rear side of the plastic mechanism case 32 and, as shown in FIG. 3, the ends 47 of the leads 46 are inserted in it. In this manner these ends 47 are held captive until such time as they are required to be removed for connection in an energizing circuit.

After the end of the interval for which the interval hand 21 is set, it is desirable that an audible signal be given. For this purpose a vibrator arm 49 is employed generally as disclosed in the Svarnias patent above referred to. The vibrator arm 49 is pivoted on a shaft 50 that extends rearwardly from the plastic mechanism case 32. A torsion spring 51 acts to bias the vibrator arm 49 in a counter-clockwise direction, FIG. 3, toward an extension 52 of the magnetic field structure 43' of the motor 42. As shown in FIG. 4 a flange 53 depends from the vibrator arm 49 and carries a cam follower pin 54 that extends into a groove 55, FIG. 9, of a cam that is indicated, generally, at 56. The cam 56 is secured to the inner end of the interval shaft 22 and is arranged to be driven in a manner to be described. An adjusting screw 57, which extends through the vibrator arm 49, is employed for adjusting the tension of the spring 51 and thus the frequency of the sound generated by the vibrator arm 59 when it is released.

As shown in FIGS. 5B and 8, a shaft 59 extends forwardly from the motor 43. It is driven through a reduction gear train by the motor 43 at a speed of 1 RPM. The shaft 59 is journaled in a bearing 60 that is secured to the flat bottom portion of the magnetic field structure 43' of the motor 43. The shaft 59 extends through a clearance opening 61 in a rear wall 62 of the plastic mechanism case 32. At its forward end the shaft 59 carries a pinion 63 which has a splined connection 64 with a gear 65 that is journaled in the mechanism plate 31 and between it and the adapter plate 25. The gear 65 meshes with a gear 66 that is secured to a second hand sleeve 67 which extends through the opening 28 in the dial plate 11 and on which the second hand 19 is mounted for rotation therewith.

Also as shown in FIG. 8 the pinion 63 meshes with a gear 68 that is rotatably mounted on a stub shaft 69 that is carried by an embossment formed integrally with the front side of the rear wall 62. Rotatable together with the gear 68 is a pinion 70 which drives a gear 71 that is secured to a pinion 72. The pinion 72 is fast on a shaft 73 one end of which is journaled in the mechanism plate 31 while the other end is journaled in the rear wall 62 of the plastic mechanism case 32. The pinion 72 meshes with a gear 74 that is rotatable with respect to a minute sleeve 75 which is journaled on the interval shaft 22 and to which the minute hand 18 is secured for rotation therewith. In order to permit setting of the time in the manner previously described, a diaphragm time set clutch 76 is secured to the minute sleeve 75 and frictionally engages the juxtaposed surface of the gear 74. Thus, for time setting purposes, the gear 74 remains stationary while the minute sleeve 75 is rotated for setting the correct time.

A pinion 78, integral with the minute sleeve 75, drives a gear 79 which, together with a pinion 80, is ro-

tatably mounted on the shaft 73. The pinion 80 drives a gear 81 that is secured to an hour sleeve 82 which is journaled on the minute sleeve 75 within the mechanism plate 31. The hour hand 17 is mounted on the hour sleeve 82 for rotation therewith. It will be noted that the second hand sleeve 67 is journaled on the hour sleeve 82.

Normally the interval shaft 22 is held in its outermost position by a coil compression spring 83 which reacts between the rear wall 62 of the plastic mechanism case 32 and the rear side of a drive dog 84, FIG. 13, which is secured to the interval shaft 22. The function of the drive dog 84 will be described presently. The inner end 85 of the interval shaft 22 is journaled at 86 in the rear wall 62 of the plastic mechanism case 32. Rearwardly extending teeth 87 are provided on the outer end of the interval shaft 22 for engaging slots 88 in the forward end of the minute sleeve 75. When it is desired to set the time, the knob 23 and the interval shaft 22 are moved inwardly to bring the teeth 87 into engagement with the slots 88. Then, on rotation of the knob 23, the minute sleeve 75 is rotated and, through the gear train including the pinion 78, gear 79, pinion 80 and gear 81, the hour sleeve 82 also is rotated to rotate the minute hand 18 and hour hand 17 to the correct time indication with respect to the time markings 16. The drive dog 84 is slidably located in a correspondingly shaped slot 89, FIG. 9, in the cam 56 and provides a driving connection between the interval shaft 22 and the cam 56 regardless of whether the interval shaft 22 is in the position shown in FIG. 8 or is in the time setting position just described in which the coil spring 83 is compressed.

As pointed out above, provision is made for rotating the interval hand 21 and the interval shaft 22 at a relatively low speed for a major portion of the presettable time interval and then to increase this speed of rotation during the last or minor portion of the interval in order to make it possible to set accurately the position of the interval hand 21 during this remaining interval. For this purpose a relatively low speed high torque clutch, FIG. 8, is employed and it is indicated, generally, at 92. Also there is provided a relatively high speed low torque clutch that is indicated, generally, at 93.

The relatively low speed high torque clutch 92 comprises a shaft 94 that is journaled at one end in the mechanism plate 31 and at the other end in the rear wall 62 of the plastic mechanism case 32. A hub 95 is secured to the shaft 94 for rotation therewith and it carries a gear 96 that is driven by a gear 97 which is secured to and rotates with the minute sleeve 75. A coil compression spring 98 reacts between the gear 96 and a bushing 99 which is slidable on the shaft 94 and has frictional engagement with one side of a pinion 100 the other side of which frictionally engages a flange 101 that is integral with the shaft 94. The pinion 100 is arranged to have driving engagement with gear teeth 102 along the periphery of the cam 56.

The relatively high speed low torque clutch 93, FIG. 8, includes the shaft 73 previously described. Also it includes the gear 71 which is secured to the pinion 72 that, in turn, is secured to the shaft 73 and rotates therewith. A washer 105 bears against the pinion 72 at one side. A coil compression spring 106 reacts between it and a washer 107 which overlies an annular flange 108 that extends inwardly from a pinion 109 which is rotatable on shaft 73. A washer 110 on the other side

of the flange 108 bears against a flange 111 that is integral with the shaft 73. The teeth of the pinion 109 are arranged to engage the gear teeth 102 on the cam 56.

It will be observed in FIG. 10 that the gear teeth 102 are partially omitted at 112. The purpose of this is to bypass the teeth on the pinion 109 of the high speed clutch 93 during a portion of the revolution of the cam 56. The teeth 102 are omitted entirely as indicated at 113 from another portion of the periphery of the cam 56 in order to provide a section of the cam 56 that is not engaged by the teeth of either the pinion 100 of the low speed clutch 92 or the teeth of the pinion 109 of the high speed clutch 93. It is only during the presettable interval that the cam 56 and the interval shaft 22 are rotated. Otherwise they remain stationary in the "off" position of the interval hand 21.

In order to facilitate engagement between the teeth of the high speed pinion 109 and the teeth 102 on the cam 56, as shown in FIG. 12, the teeth 102 increase in length from a minimum length indicated at 114 gradually to the full length. During the interval between the one hour mark and the 15 minute mark, both of the pinions 100 and 109 engage the teeth 102 on the cam 56. However, because the low speed clutch 92, due to the tension of the spring 98, is capable of exerting a higher driving torque than is the high speed clutch 93 with a correspondingly weaker spring 106, the drive is essentially at the relatively low speed until the cam 56 is rotated to disengage the last tooth 115, FIG. 10, from the pinion 100, whereupon the drive is entirely through the high speed clutch 93 for the last 15 minutes of the interval.

During the presettable interval the cam 56 is rotated in a counter-clockwise direction as indicated by arrow 116 in FIG. 9 with the cam follower pin 54 remaining in the groove 55 and holding the vibrator arm 49 in the inoperative position. At the end of the presettable interval, the cam 56 rotates relative to the cam follower pin 54 until it drops into a relatively deep notch 117 as shown by a broken line. This releases the vibrator arm 49 and it is then free to vibrate in the alternating magnetic field of the synchronous motor 43. At this time the teeth 102 are not engaged by the teeth of the pinion 109 and the cam 56 remains motionless while the vibrator arm 49 continues to vibrate. In order to stop vibration of the arm 49, the knob 23 and the interval shaft 22 are rotated to bring the cam follower pin 54, shown by a broken line, into a relatively shallow notch 118. This lifts the vibrator arm 49 to the inoperative position and facilitates stopping the cam 56 in the "off" position which is indicated by the interval hand 21 registering with this indication on the interval markings 21, FIG. 1.

In those instances where it is desired to operate the interval shaft 22 and the interval hand 21 at the same speed throughout the entire interval, for example through an interval of 60 minutes instead of the 4 hour interval indicated by the interval markings 20, then the relatively low speed high torque clutch 92 is omitted and the cam 56 is modified to provide the teeth 102 along its periphery, except for a relatively short span in which the teeth are omitted which corresponds to the end of the interval and to the "off" position. With such a modification the interval markings 20 are appropriately changed, for example to indicate a 60 minute interval over the span of the 4 hour interval markings.

In FIG. 14 there is indicated, generally, at 10' a modified motor driven timer which employs many of the elements of the motor driven timer 10 previously described. Accordingly, where the same elements are used, the same reference characters apply. In FIG. 14 it will be observed that the interval markings 20', instead of being concentric with the time markings 16, are spaced or offset therefrom so as to be displayed separately. Here the interval markings are from 0 to 60 minutes. In this embodiment the interval hand 21 is mounted on an interval shaft 22', FIG. 16, while the time indicating hands 17, 18 and 19 are mounted on a shaft which is the same as the interval shaft 22 previously described. A knob 23' at the outer end of the offset interval shaft 22' permits the setting of the interval hand 21 to the desired position relative to the interval markings 20.

In FIG. 15 it will be noted that an extension 121 is secured to the vibrator arm 49 and that it carries at its distal end an upstanding flange 122 from which a cam follower 123 extends laterally to cooperate with an internal cam surface 124, FIG. 16, on a cam 125 that is secured to the interval shaft 22' and rotates therewith. The cam 125 has teeth 126 along its periphery except for a section 126' where they are omitted to correspond to the end of the interval and permit operation of the motor driven timer 10' for time keeping or other purposes without operating the cam 125.

The cam 125 is driven by the synchronous motor 43. For this purpose a pinion 127 engages the teeth 126 on the cam 125. The pinion 127 forms a part of a clutch that is indicated, generally, at 128. Its construction corresponds to the construction of the high speed clutch 93 previously described. The clutch 128 includes a gear 129 which is driven through idler gears 130 and 131 from the gear 71 which is driven by the motor 43 from the pinion 63 through the gear 68 and the pinion 70 as previously described.

When the interval shaft 22' and interval hand 21 are set to the predetermined mark of the interval markings 20', the cam 125 is rotated in a clockwise direction as indicated by arrow 132 until, at the end of the preset interval, the cam follower pin 123 drops or moves outwardly into a relatively deep notch 133 as shown by a broken line. It is biased to this position by the torsion spring 51, previously described, and by a coil tension spring 134 which is secured at its lower end to the extension 121 and is fastened at its upper end over a tab 135 which is struck from a plate 136 that overlies the cam 125 and is secured to the mechanism plate 31. When the cam follower 123 is positioned in the relatively deep notch 133 in the cam 125, the vibrator arm 49 is released and it vibrates to indicate by a buzzing sound that the end of the preset interval has arrived. Then the knob 23' and the interval shaft 22' are rotated manually in a clockwise direction to remove the cam follower pin 123 from the relatively deep notch 133 and to cause it to interfit with a relatively shallow notch 137 along the internal cam surface 124, as shown by the broken line, and against a stop pin 138 which prevents further rotation of the cam 125 in the clockwise direction as viewed in FIG. 16.

Advantage is taken of the provision of the synchronous motor 43 and associated gear train driven thereby for controlling the operation of the interval timer previously described to extend the utility of this mechanism for operating a range timer that is indicated, generally,

at 141 in FIGS. 1-4, 5A-B. Here it will be observed that the dial plate 11 carries start time markings 142 with respect to which a start time hand 143 rotates. The start time hand 143 is mounted on a start time shaft 144 which can be preset manually by a knob 145 that extends forwardly of the glass 12.

The dial plate 11 also has cook hours markings 146 thereon and associated therewith is an OFF position 147 and a MAN or manual position 148. A cook hours hand 149 is arranged to rotate relative to these markings and is mounted for rotation with a cook hours shaft 150 having a knob 151 at its outer end to permit manual presetting.

In FIG. 17 it will be observed that the start time shaft 144 extends through an opening 28 in the adapter plate 25 and that it comprises a part of a start time assembly that is indicated, generally, at 154. The start time shaft 144 is endwise slidable through a sleeve 155 and is thereby rotatably mounted intermediate its ends. The sleeve 155 is mounted in an opening 156 that is formed at the base of a deformed section 157 of the mechanism plate 31. Rotatably mounted on the sleeve 155 is a gear 158 that is referred to in the claims as a first gear. The gear 158 has a lug 159 struck therefrom for entering an opening 160 in a gear 161 which is referred to in the claims as a second gear. The gear 161 is rotatable with an annular operating member 162 which is secured at a knurled section 163 for rotation with the start time shaft 144. The annular operating member 162 has a counterbore 164 for receiving a coil compression spring 165 that reacts between the bottom of the counterbore 164 and a flat section 166 of a friction spring 167 with which an inturned tang 168 on a metallic frame plate 169 cooperates to prevent turning about the start time shaft 144 which extends through the flat section 166. As will appear hereinafter, the start time shaft 144 is arranged to be moved inwardly against the coil compression spring 165 for the purpose of setting the start time by positioning the start time hand 143 at the desired time with respect to the start time markings 142. When the start time shaft 144 is moved inwardly to position the gear 161, as shown by broken lines, it is desirable that provision be made for preventing rotation of the start time shaft 144 and the gear 161. It is for this purpose that the friction spring 167 is employed and it is arranged to have frictional contact engagement with some of the teeth 170 along the periphery of the gear 161. When the gear 161 is shifted to the broken line position, it is located slightly past the distal end of the lug 159 and then it can be rotated out of registry with the opening 160. Upon release of the manual force moving the start time shaft 144 inwardly against the biasing action of the coil compression spring 165, the latter causes the face of the gear 161 to engage the distal end of the lug 159 to hold the start time shaft 144 in the depressed position until the gear 158 is rotated to again position the lug 159 in registry with opening 160 which occurs at the beginning of the cook hours cycle. At its inner end the start time shaft 144 is rotatably and slidably mounted in a bearing opening 171 in the metallic frame plate 169.

As shown more clearly in FIG. 5B the metallic frame plate 169 includes integral forwardly extending walls 173 and 174 having lugs 175 along their distal edges for entering suitable openings in the metallic mechanism plate 31. The lugs 175 are twisted slightly after passing

through the mechanism plate 31 to hold the metallic frame plate 169 securely in position thereon.

Again referring to FIG. 17 it will be noted that the gear 158 is driven from the gear train that is driven by the motor 43. The gear train includes a gear 176 the teeth of which mesh with the teeth on the periphery of the gear 158. Integral with the gear 176 is a gear 177 the teeth of which mesh with the teeth of the gear 81 previously described which rotates at a speed of one revolution in 12 hours. A stub shaft 178 extends from one side of the gear 176 into a bearing opening 179 that is molded in an embossment 180 which forms a part of the molded plastic mechanism case 32. A stub shaft 181 extends from the other side of the gear 177 through a bearing opening 182 in the metallic mechanism plate 31. In this manner, as long as the synchronous motor 43 is energized, the gear 158 is continuously driven. When the lug 159 registers with the opening 160 in the gear 161, the start time shaft 144 is continuously driven so that the start time hand 143 also indicates the time of day as does the hour hand 17.

In FIG. 17 it will be noted that the cook hours shaft 150 extends through an opening 28 in the metallic adapter plate 25. It forms a part of a cook hours assembly that is indicated, generally, at 185. Intermediate its ends the cook hours shaft 150 is journaled in a bearing opening 186 that is located in the metallic mechanism plate 31. At its inner end the cook hours shaft 150 is journaled in a bearing opening 187 in the metallic frame plate 69. A hub 188 is pressed onto knurling 189 on the cook hours shaft 150 to rotate therewith. A cam 190, FIGS. 5B, 19 and 23, is secured to the hub 188 and thus it rotates conjointly with the cook hours shaft 150. The cam 190 is arranged to move a cam follower pin 191 the mounting of which will be described presently. The cam follower pin 191 is biased toward a periphery of the cam 190 which includes a notch 192. When the pin 191 engages the notch 192, the cook hours hand 149 registers with the MAN position 148 along the cook hours markings 146. The periphery of the cam 190 also includes a recessed section 193, FIG. 20. When the recessed section 193 is engaged by the cam follower pin 191, the cook hours hand 149 registers with the OFF position 147 along the cook hours markings 146. The periphery of the cam 190 also includes as a major portion a circular section 194, FIG. 21, which is engaged by the cam follower pin 191 during the cook hours period. A stop shoulder 194' at one end of the circular section 194 is engaged by the cam follower pin 191 to prevent further rotation of the cook hours shaft 150 past the 6-hour marking.

Adjacent the cam 190 and rotatable therewith and with the cook hours shaft 150 is a cook hours gear 195. As shown more clearly in FIG. 23, gear teeth 196 are provided along a major portion of the periphery of the cook hours gear 195. They are omitted along a minor portion as indicated at 197. A somewhat flexible driving connection is provided between the cam 190 and the cook hours gear 195 in order to facilitate driving engagement with the gear teeth 196. For this purpose a connecting pin 198, FIG. 17, is secured at 199 to the cam 190. The connecting pin 198 has a reduced diameter end portion 200 which projects through a short radial slot 201 in the cook hours gear 195. A tapered end 202 of a hub 203 projects through an opening 204 in the cook hours gear 195 and also projects into an opening 205 in the hub 188. A coil compression spring 206

biases the hub 203 in the position shown in FIG. 17. At one end it reacts against the hub 203 and at the other end against a washer 207 which is located in an annular groove 208 adjacent the bearing opening 186 in the mechanism plate 31.

Driving engagement with the teeth 196 along the major portion of the cook hours gear 195 is had by a gear 213 which is secured by a knurled section 214 to a shaft 215. One end of the shaft 215 is journaled in a bearing opening 216 in the mechanism plate 31. At its other end the shaft 215 is journaled in a bearing opening 217 in the metallic frame plate 169. It is desirable to provide a slip type of drive for the gear 213. For this purpose a gear 218 is rotatably mounted on the shaft 215. Interposed between it and the adjacent surface of the gear 213 is a friction washer 219. A coil compression spring 220 reacts against the other side of the gear 218. The spring 220 is located in a counterbore 221 in the gear 218. At one end the spring 220 bears against a washer 222 at the base of the counterbore 221. The other end of the spring 220 bears against a washer 223 adjacent a flange 224 which is formed integrally with the shaft 215. The gear 218 is arranged to be driven by the gear 161 when it returns from its position shown by broken lines in FIG. 17 to the full line position. The gear 218 has teeth 225 which are engaged by the teeth 170 on the gear 161. To facilitate this engagement the teeth 225 are beveled as indicated at 226.

When the start time shaft 144 is moved inwardly, accompanied by corresponding movement 229 the annular operating member 162, a convex end portion 229 of the operating member 162 engages an inclined surface 230, FIG. 22, that is provided by a shoulder member 231 which is formed integrally with a slidable contact operating plate which is indicated, generally, at 232. This movement of the contact operating plate 232 on inward movement of the annular operating member 162 is against the biasing action of a hairpin spring 233, FIG. 19. The hairpin spring 233 has a central convolution located around a lug 234 that extends from and is formed integrally with a control plate 235 which is slidably mounted on the contact operating plate 232. One arm 236 of the hairpin spring 233 extends through an opening 237 in the shoulder member 231. The other arm 238 extends through an opening 239 in a lug 240 which is struck from and is formed integrally with the control plate 235. In order to reduce frictional engagement between the plates 232 and 235 the latter has dimples 241 formed therein which permit only limited frictional contact engagement therebetween. Limited frictional contact engagement between the contact operating plate 232 and the juxtaposed surface of the metallic frame plate 169 is obtained through the provision in the latter of an elongated shoulder 242, FIG. 5B and dimples 243. In order to guide the plates 232 and 235 for translatory movement relative to the metallic frame plate 169, the latter has a pin 244 extending therefrom through a slot 245 in the contact operating plate 232 and through a slot 246 in the control plate 235.

As shown in FIG. 17 the cam follower pin 191 extends through and is secured for movement to the control plate 235. Thus the position of the control plate 235 depends upon the position of the cam follower pin 191 with respect to the cam 190. A head portion 247 is formed integrally with the cam follower pin 191 and it extends through a slot 248 in the contact operating

plate 232 and through a slot 249 in the metallic frame plate 169.

The cook hours shaft 150 and the shaft 215 extend through both of the plates 232 and 235. As shown in FIGS. 17, 19 and 22, a slot 250 in the contact operating plate 132 has the inner end of the cook hours shaft 150 extending therethrough. Overlying the slot 250 is a slot 251 in the control plate 235. The shaft 215 extends through a slot 252 in the contact operating plate 232 and through an overlying slot 253 in the control plate 235.

As shown in FIGS. 19, 20 and 21 clearance openings 256 are formed in the control plate 235 for receiving therethrough operating arms 257 from plastic contact slides, one of which is indicated at 258 in FIG. 29. The operating arms 257 also extend through openings 259 in the contact operating plate 232 which underlie the clearance openings 256. The ends 260 of the openings 259 engage one side 257' of each of the arms 257 for controlling the positions of the contact slides 258. The operating arms 257 from the contact slides 258 extend through slots 261, FIG. 5B in the base of a plastic contact housing that is indicated, generally, at 262.

FIGS. 24-26 show in more detail the construction of the plastic contact housing 262 and parts associated therewith. Here it will be observed that pairs of stationary contacts 263 and 264 are suitably mounted in the contact housing 262 along one side and additional pairs 265 and 266 of stationary contacts are suitably located on the other side. Bridging contact members 267 and 268 are arranged to interconnect the contacts 263 and 264, respectively, or the contacts 265 and 266, respectively, when they are moved from the positions as shown in FIG. 24. It will be understood that only a single pair of stationary contacts can be employed in conjunction with a single bridging contact member. However, for purposes of illustration several pairs are shown together with a pair of bridging contact members 267 and 268. One of the bridging contact members 267 is illustrated in FIG. 28. It is arranged to be positioned in a slot 269 in the respective contact slide 258.

As shown in FIG. 27 the bridging contact member 268 is arranged to be biased in one direction by a relatively weak spring 270 which reacts between the bridging contact member 268 and one end of the slot 269. It is arranged to be biased in the opposite direction by a relatively strong spring 271 which reacts between one end of the slot 261 and one side of the contact slide 258. It will be understood that the relatively strong springs 271 bias the operating arms 257 against the ends 260 of the openings 259 in the contact operating plate 232 and through the hairpin spring 233 hold the cam follower pin 191 against the cam surface of the cam 190.

The pairs of stationary contacts 263-264 and 265-266 are held in place by a plastic cover 272, FIGS. 18, 25, 26 and 27. The plastic cover 272 has rectangular shoulders 273 on its underside which, as shown in FIG. 25, are arranged to overlie a shank 274 of each of the stationary contacts to hold the same securely in place. A grounding plate 275 overlies the cover 272 and it and the cover 272 are held in place on the plastic contact housing 262 by bolts 276.

In order to locate properly the plastic contact housing 262 on the rear side of the metallic frame plate 169, the former is provided with integrally formed dowel

pins 279, FIG. 19, which extend through slots 280 formed in the frame plate 169. At the other end of the plastic contact housing 262 there is integrally formed a hollow dowel pin 281 which extends through a corresponding opening 282 in the metallic frame plate 169.

For securing the plastic contact housing 262 to the metallic frame plate 169, the former is provided with an elongated lug 283, FIG. 5B, that is arranged to extend laterally through a slot 284 in an upstruck lug 285 from the metallic frame plate 169. At its other end the plastic contact housing 262 has an elongated slot 286 molded therein for receiving a lug 287, FIG. 3, which is struck from the metallic frame plate 169.

In operation, when the range timer section 141 is not preset, the cook hours hand 149 usually is left in registry with the MAN indication. The position of the cam 190 for the manual operation is as shown in FIG. 19 where the cam follower pin 191 engages the notch 192. In this position the bridging contact members 267 and 268 are biased into engagement, respectively, with the pairs of stationary contact 265 and 266 by the springs 270 or in their alternate positions from those shown in FIG. 24 and the springs 271 are further stressed. The bridging contact members 267 are shown in FIG. 24 in their OFF positions biased into contact engagement by the springs 271 with the pairs of stationary contacts 263 and 264 which corresponds to the position of the cam follower pin 191 in the recessed section 193 of the cam 190 as shown in FIG. 20. In this position of the cam 190 the cook hours hand 149 registers with the OFF position 147. To set the number of cook hours, the knob 151, FIG. 1 is rotated in a counter-clockwise direction until the cook hours hand 149 is set to the number of cook hours desired. This is accompanied by rotation of the cam 190 to a position, such as that illustrated in FIG. 21, where the cam follower pin 191 engages the circular section 194 of the periphery of the cam 190. The position of the contact operating plate 232 is the same here as for its position when the cam follower pin 191 engages the notch 192. Accordingly, during the cook hours period, the bridging contact members 267 and 268 are in engagement with the pairs of stationary contacts 265 and 266 respectively, it being understood that only a single bridging contact 267 and single pair of stationary contacts 265 can be employed for controlling the completion of a single circuit.

The start time is set by moving the start time shaft 144 inwardly by manually depressing the knob 145. This action is accompanied by movement of the gear 161, FIG. 17, to the position shown by broken lines and engagement of the convex end portion 229 of the annular operating member 162 with the inclined surface 230 of the shoulder member 231 on the contact operating plate 232. There is a corresponding shifting in the movement, indicated by arrow 288, of the contact operating plate 232 transmitted through the hairpin spring 233 which is accompanied by movement of the bridging contact members 267 and 268 to the positions shown in FIG. 24, this movement of the contact members 267 and 268 being effected by expansion of the coil compression springs 271. There is a corresponding stressing of the hairpin spring 233.

When the start time shaft 144 was moved inwardly to effect a corresponding inward movement of the gear 161 and rotation to the desired start time, the driving connection provided by the lug 159 to the gear 161 is

interrupted and the spring 165 holds the gear 161 against the distal end of the lug 159. When the time driven gear 158 is rotated to such position that the lug 159 registers with the opening 160 in the gear 161, the latter is biased to the position shown by full lines in FIG. 17 by the coil compression spring 165 and the teeth 170 of the gear 161 then slide over the beveled portions 226 to engage the teeth 225 on the gear 218. The convex end portion 229 of the annular operating member 162 is withdrawn from the inclined surface 230 on the shoulder member 231 and the contact operating plate 232 is shifted to the position shown in FIG. 21 under the biasing action of the hairpin spring 233 against the biasing action of the springs 271. The bridging contact members 267 and 268 then engage stationary contacts 265 and 266 to energize the oven and start the cook hours cycle. The gear 213 is rotated to drive the cook hours gear 195 which is accompanied by rotation of the cam 190 in a clockwise direction indicated by arrow 290, FIG. 21, from its position, such, as that shown here until, at the end of the cook hours cycle, the cam 190 will have been rotated to the position shown in FIG. 20 where the cam follower 191 engages the recessed section in 193 of the cam 190. When this occurs the relatively strong springs 271 shift the contact slides 258 and therewith the bridging contact members 267 and 268 to the OFF positions in FIG. 24 thereby opening the circuits through stationary contacts 265 and 266 or at least one pair of these contacts to deenergize the oven or other equipment under the control of the range timer section 141. At this time the cook hours gear 195 has been rotated to such position that none of the gear teeth 196 is engaged by the gear 213 which continues to rotate without driving the gear 195 since that portion 197 of the cook hours gear 195 having no teeth is opposite the gear 213. However, the gear 213 continues to rotate along with gears 218, 161 and 158 with the start time hand 143 then occupying the same position relative to the start time markings 142 that the hour hand 17 occupies with respect to the time marking 16. For manual operation, the knob 151 and cook hours shaft 150 are rotated in a clockwise direction, indicated by arrow 291 in FIG. 19, to rotate

the notch 192 on the cam 190 into engagement with the cam follower pin 191. The cook hours hand 149 then registers with the MAN marking 148.

In order to insure that the cam follower pin 191 is maintained in engagement with the surface of the cam 190 and particularly fully enters the recessed section 193, coil tension springs 292, FIG. 19, interconnect ears 293 on the control plate 235 and one end of each of the walls 173 and 174 that extend forwardly from the frame plate 169.

What is claimed as new is:

1. A timer comprising:

a dial plate carrying time markings,
a mechanism plate carrying said dial plate,
a shaft rotatably mounted on said mechanism plate,
time indicating hands rotatably mounted on said shaft,
a plastic mechanism case mounted on said mechanism plate,
a synchronous timing motor mounted on said mechanism case,
a gear train having at least a part in said mechanism case and interconnecting said motor and said time indicating hands,
deformable means on said mechanism plate securing said mechanism case thereto, and
retaining means extending through said case and securing it and said timing motor to said mechanism plate.

2. The timer according to claim 1 wherein:

shouldered portions of said mechanism case extend through said mechanism plate, and
said deformable means comprises ribs integral with said mechanism plate and overlying said shouldered portions.

3. The timer according to claim 2 wherein screws extend through said mechanism case and secure it and said motor to said mechanism plate.

4. The timer according to claim 1 wherein: flexible leads are connected to said motor, and said mechanism case has a slot for receiving said leads.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,759,032 Dated September 18, 1973

Inventor(s) Ronald M. Bassett and Joseph F. Gluth

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Add the following claim:

5. A timer according to claim 1 further including a vibrator arm mounted on said plastic mechanism case and arranged to be vibrated by a magnetic field generated by said synchronous motor.

On the cover sheet, below the Abstract, "4 Claims" should read -- 5 Claims --.

Signed and sealed this 23rd day of April 1974.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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