

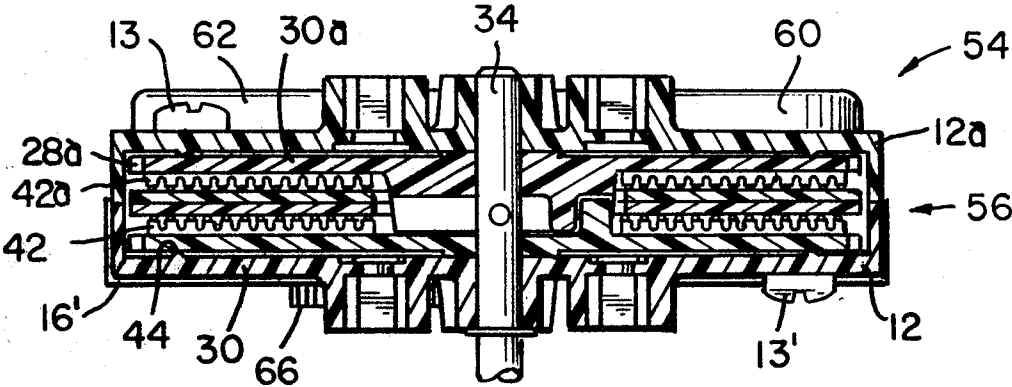
[72] Inventors Peter H. Gerhardt;
Richard E. Pervorse, both of Indianapolis,
Ind.
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[73] Assignee P. R. Mallory & Co., Inc.
Indianapolis, Ind.

[54] **ELECTRIC TIMER MECHANISM WITH
IMPROVED PRINTED CIRCUIT CONTACT AND
ACTUATING STRUCTURE**
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[51] Int. Cl. H01h 7/08,
H01h 43/10
[50] Field of Search 200/11, 14,
33, 34, 36, 61.1, 38, 153.11, 153.12, 153.13,
153.14, 166CPC

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Primary Examiner—J. R. Scott
Attorneys—Richard H. Childress, Robert F. Meyer and Henry
W. Cummings

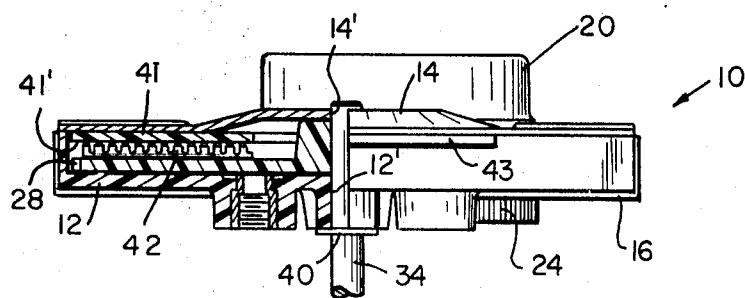
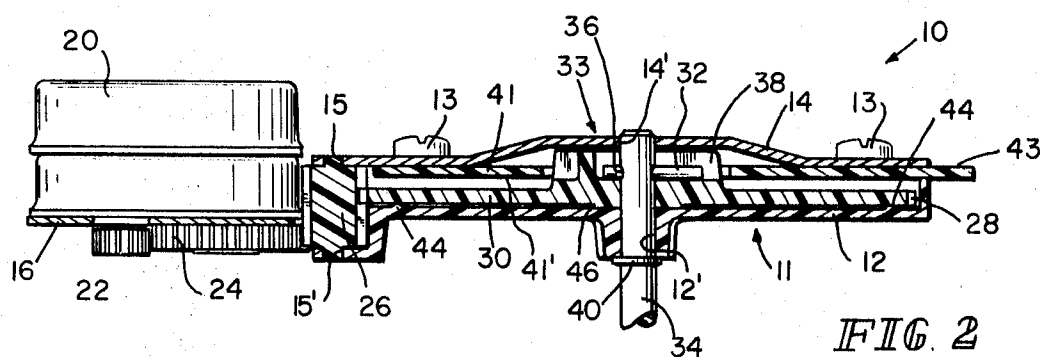
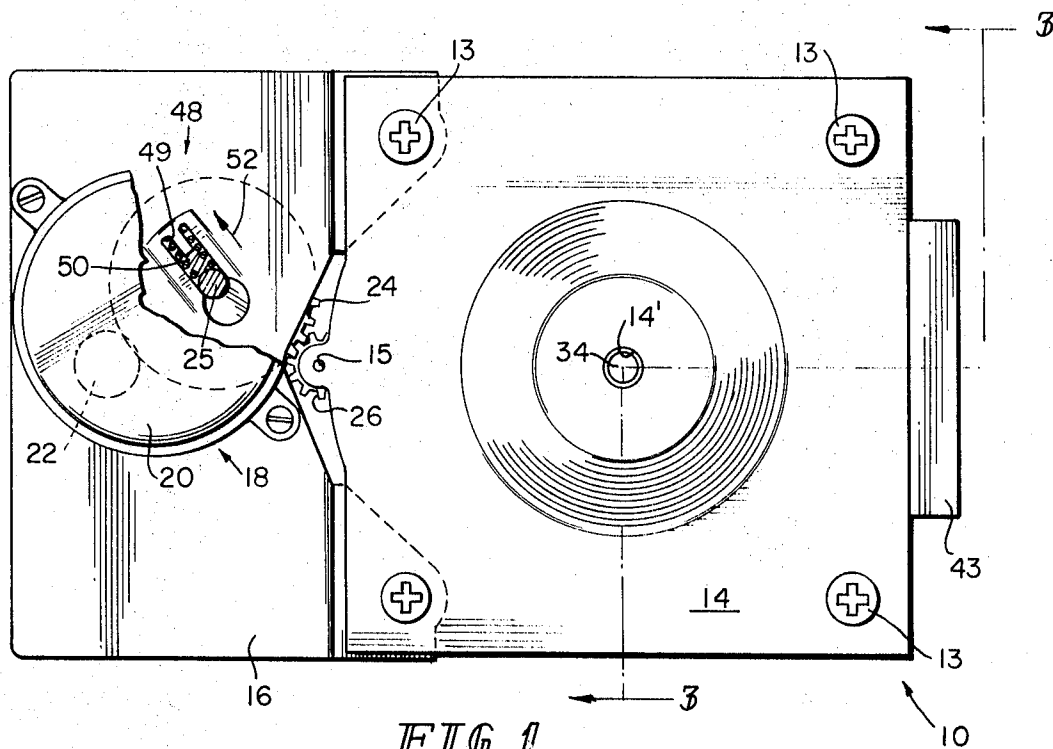
ABSTRACT: A printed circuit timer which includes a hous-
ing, a shaft rotatably carried by and extending through the
housing, at least one printed circuit board carried by the hous-
ing, at least one current selector means carried by the shaft,
and means driving the current selector means. The current
selector means includes wiper means adapted to engage elec-
trical circuit means of the circuit board.



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SHEET 1 OF 3



INVENTORS
 PETER H. GERHARDT
 RICHARD E. PERVERSE
 BY *Robert Meyer*
 ATTORNEY

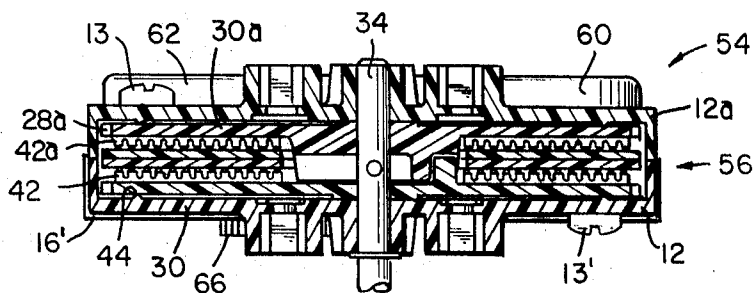
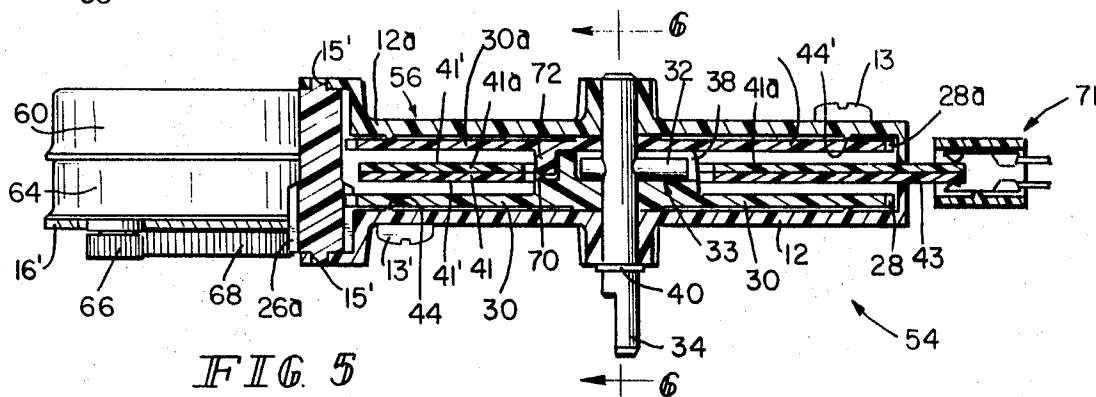
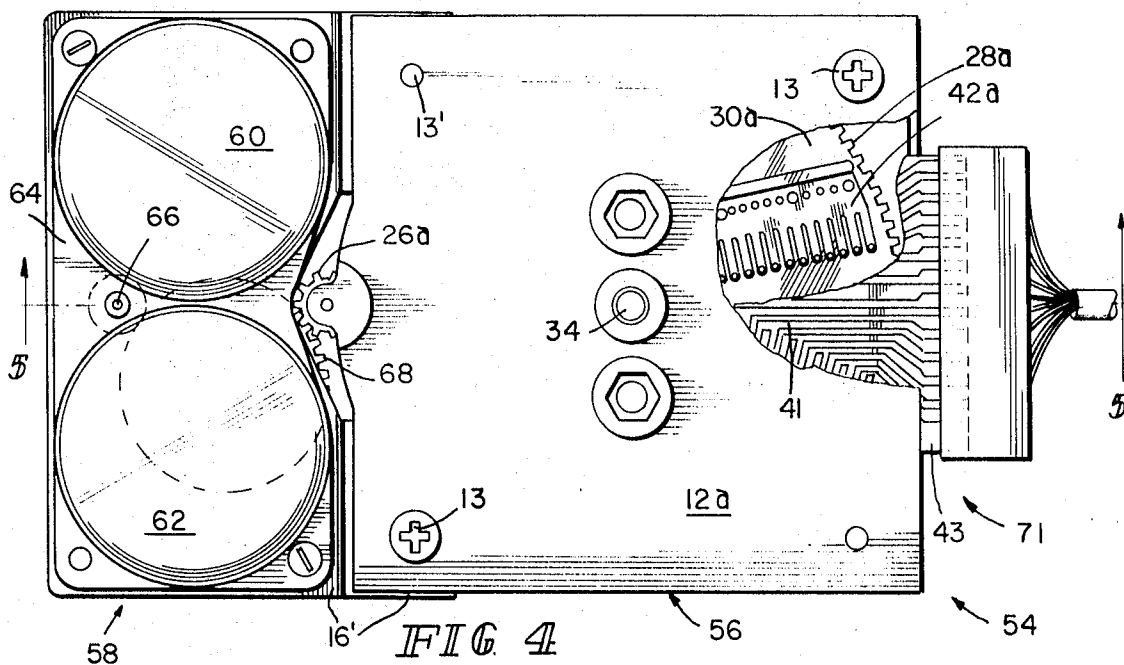


FIG 6

INVENTORS
 PETER H. GERHARDT
 RICHARD E. PERVORSE
 BY *Robert J. Meyer*

ATTORNEY

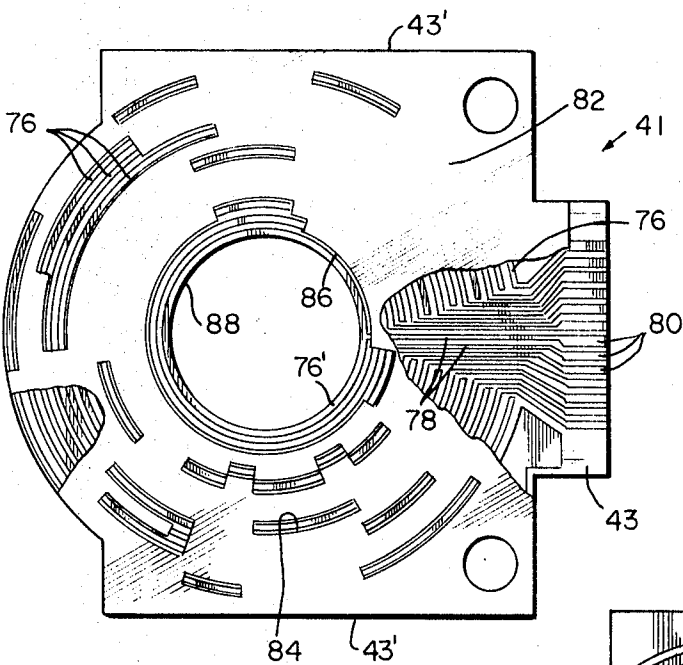


FIG. 7

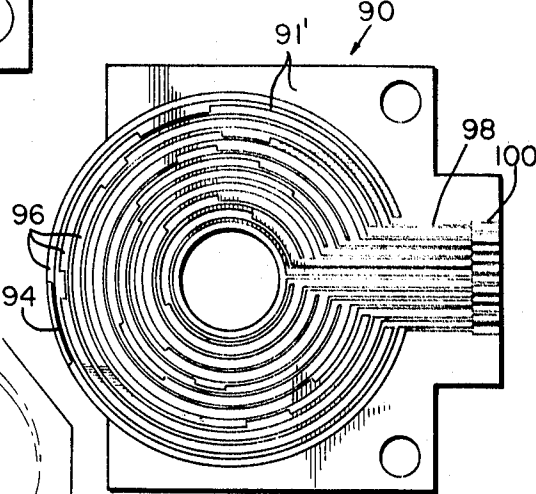


FIG. 8

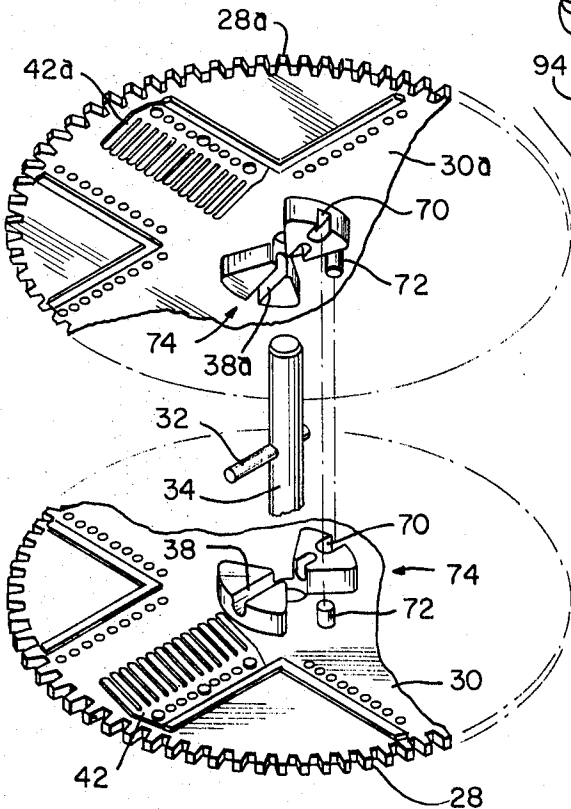


FIG. 9

INVENTORS
PETER H. GERHARDT
RICHARD E. PERVORSE
BY *Robert J. Meyer*
ATTORNEY

ELECTRIC TIMER MECHANISM WITH IMPROVED PRINTED CIRCUIT CONTACT AND ACTUATING STRUCTURE

This invention relates to timing mechanisms, and more particularly to timing mechanisms using a printed circuit board as the programming means of the timing mechanism.

Timing mechanisms such as those which are used to control the operation of appliances such as dryers, dishwashers, and washing machines are increasingly becoming more complex and bulky due to the increased variety of operational sequences needed to be programmed by the timing mechanism. Indeed, present day timing mechanisms have advanced to the point where rapid advance means are included in the timing mechanism to advance the timer over those sequence of operation which may not be desired by the appliance operator. All of this has caused the timing mechanism to become complicated, difficult to fabricate and expensive.

The present invention is concerned with such timing mechanisms and has as one of its objects the provision of such a timing mechanism which is economical, simple and easy to produce.

Another object of the invention is to provide a timing mechanism which as a unit provides a "thin package."

Another object of the invention is to provide a timing mechanism which utilizes a printed circuit board as the programming means of the timer.

Still another object of the invention is the provision of a timing mechanism wherein there are two of such printed circuit boards disposed in back-to-back relationship, each carried by a housing for the timer.

Still another object of the invention is to provide a timing mechanism utilizing a printed circuit board wherein a current selector means driven by suitable drive means cooperates with a printed circuit board to selectively complete predetermined electrical circuits.

Yet another object of the invention is to provide a timing mechanism utilizing a printed circuit board and having a current selector means and means to lock the current selector means to a timer shaft.

Another object of the invention is to provide a timing mechanism utilizing a pair of printed circuit boards disposed in back-to-back relationship carried on a common shaft each having current selector means with the current selector means being coupled together to be driven through a single suitable drive means.

Another object of the invention is to provide a timing mechanism utilizing a printed circuit board having a plurality of spaced, circular electrically conductive strips continuous for substantially a complete circle.

A further object of the invention is to provide a timing mechanism utilizing a printed circuit board having spaced, electrically conductive tabs extending from a plurality of spaced circular electrically conductive strips, the strips being continuous for substantially a complete circle.

Another object of the invention is to provide a timing mechanism utilizing a printed circuit board having a plurality of spaced, circular, electrically conductive strips, continuous for substantially a complete circle with an insulative film disposed over the strip and having apertures exposing portions of the strips in predetermined, spaced relationship.

These and other objects and the nature thereof will become apparent from the following description taken in conjunction with the accompanying drawings wherein like reference numbers described elements of a similar function.

In the drawings:

FIG. 1 is a top view of a single circuit board timer;

FIG. 2 is a cross section of the timer;

FIG. 3 is a partial section of the timer taken along lines 3-3 of FIG. 1;

FIG. 4 is a top view of another embodiment of the timer utilizing more than one circuit board;

FIG. 5 is a view of the timer taken along the line 5-5 of FIG. 4;

FIG. 6 is a cross section taken along lines 6-6 of FIG. 5;

FIG. 7 shows a circuit board in top elevation;

FIG. 8 is a top elevation of another embodiment of a circuit board; and

FIG. 9 is an exploded perspective view illustrating the cooperation and interlocking features of the current selector means for the printed circuit board.

Generally speaking, the objects of the invention are accomplished by providing a timer which includes a housing, a shaft rotatably carried by the housing and having at least one end extending through the housing, at least one printed circuit board carried by the housing, at least one current selector means carried by the shaft, means driving the current selector means, the current selector means including wiper means adapted to engage electrical circuit means of the circuit board.

Referring now to the drawings and more specifically to FIGS. 1, 2 and 3, there is illustrated a single circuit board timer 10 having a housing 11 which includes a housing panel 12. Located above the panel 12 and secured thereto by bolts or screws 13 is a cover 14. Sandwiched between cover 14 and housing panel 12 and rigidly secured thereby by screws or bolts 13 is a cantilevered base 16. A drive means 18 is secured to base 16. The drive means 18 includes a synchronous motor 20 and a motor pinion 22. Motor pinion 22 protrudes through the cantilevered base 16 and meshes with an idler gear 24. The idler gear 24 meshes with pinion 26 which is supported at both ends by way of the aperture 15 in the top plate 14 and by aperture 15' in the panel 12. The pinion 26 is in mesh with gear teeth 28. Gear teeth 28 are included as part of current selector means 30. Included as a part of current selector means 30 is a series of terminal fingers or wipers 42. The current selector means is supported and located inside the housing 11 by way of a timer shaft 34. Timer shaft 34 is journaled in bearing surface 12' of base panel 12. The other end of the timer shaft 34 is supported in aperture 14' in the housing cover 14. The current selector means 30 is angularly rigidly secured to the shaft 34 by way of locking means 33 which includes key 32 which is extended through opening 36 in shaft 34. The key 32 in turn is seated in slot 38 included as part of current selector means 30. Shaft 34 is trapped from any axial movement by way of bearing surface 46 of current selector means 30 and retaining ring 40.

Disposed within housing 11 is a circuit board 41 including a current-carrying surface 41'. Current-carrying surface 41' will be discussed hereinafter with reference to FIGS. 7 and 8. Circuit board 41 is located and aligned in its proper position by way of screws or bolts 13 in the housing 11. One end of the circuit board 41 projects from housing 11 as shown at 43. This end is exposed so that a plug jack can be connected at 43 to thereby provide electrical termination outside of the housing 11. It can therefore be seen that as the current selector means 30 is rotated by way of drive means 18 the terminal fingers or wipers 42 wipe the lower surface 41' of the circuit board 41. As the current selector means rotates, it is supported near its periphery on the side opposite from which the fingers 42 are mounted on a bearing surface ring 44 disposed inside the panel 12. Surface 44 is very small, thereby providing a very small amount of frictional drag during rotation.

The timer shaft 34 may be operated manually by the operator. In this situation, it is necessary for the current selector means 30 to be "free wheeling" from the drive motor pinion 22. This is achieved by way of a clutch means 48 located on base 16. The clutch means 48 includes a slot 49 located in the base 16 and a compression spring 50 which is disposed in the slot 49. The spring 50 is seated in one end of the slot 49 and has its other end in contact with the shaft 25 of idler gear 24. When the motor pinion is driving, it will drive the idler 24 and pinion 26 and thereby rotate the current selector means 30. When the operator rotates the shaft 34 to manually select a specific cycle, the shaft will turn in the same direction in

which it is driven by the motor. As the operator rotates the shaft 34 to select a specific cycle, the pinion 26 rotates in a clockwise direction, for example, as viewed in FIG. 1. When this occurs, the idler gear 24 tends to be lifted away from pinion 26 in the direction of arrow 52 and compresses the spring 50 in the channel 49 of the base 16. If the operator should tend to rotate the shaft in the wrong direction, the timer would tend to be damaged in that the fingers 42 will rotate in the same direction and damage the circuit board 41. This, however, is prevented due to the timer motor 20 including a directional system which prevents the motor from rotating in the wrong direction. Such directional systems are well known in the synchronous motor art. Therefore, the current selector means 30 will not be rotated in the wrong direction.

Referring now to FIGS. 4, 5 and 6, there is shown another embodiment of the invention wherein there is more than one circuit board being used as the timer programming means. A multiple circuit board timer 54 includes a pair of substantially similar housing panels 12 and 12a which cooperate to form a unitary housing 56. Sandwiched between and securely held by the housing panels 12 and 12a is a cantilevered base 16'. Carried on the base 16' is a drive means 58. Drive means 58 includes two synchronous motors 60 and 62, both of which drive at the same speed. However, although not shown, the motors include different gear trains such that they will eventually transmit a different output. The gear trains are disposed in the gear train housing 64. Both gear trains are coupled to the same output pinion 66 and are selectively allowed to rotate pinion 66 by way of a suitable clutch means (not shown). As pinion 66 is rotated by either motor 60 or 62, the pinion 66 drives an idler gear 68. The idler gear 68 rotates pinion 26a which is similar to pinion 26 in the first embodiment except that it has a greater length to accommodate the larger housing. It can be seen from FIG. 5 that the housing panels 12 and 12a are substantially similar and include a bearing surface 44'.

Disposed within housing 56 there is shown a pair of current selector means 30 and 30a. Current selector means 30 and 30a includes gear teeth 28 and 28a. However, only the gear teeth on the periphery of current selector means 30 is in mesh with the pinion 26a. The gear teeth 28a on the periphery of current selector means 30a is not necessary in this embodiment. However, the use of the gear teeth on both the current selector means yields a modular construction and adds versatility to the timer. Pinion 26a is journaled in apertures 15 and 15'.

Both housing panels 12 and 12a carry their own respective circuit boards 41 and 41a, respectively. Circuit boards 41 and 41a includes current-carrying surfaces 41' which are in a cooperating position with the terminal fingers 42 and 42a of current selector means 30 and 30a. Circuit boards 41 and 41a are shown in a back-to-back orientation. Such orientation not only lends itself to a "thin package" design, but also aids in receiving a double terminal plug means 71 at the termination of the boards 43. Current selector means 30 includes a recess 70 which receives a boss 72 included as part of current selector means 30a. As will be more fully described with reference to FIG. 9, when boss 72 and the recess 70 are in nesting relationships to each other, rotational movement between the current selector means 30 and the current selector means 30a is prevented thereby coupling the two selector means together. Since the two current selector means are locked together in nesting relationship and the shaft 34 is keyed to one of the current selector means by way of locking means 33 (which includes key 32 and slots 38, 38a, FIG. 9) in the manner described with reference to FIG. 2, rotation of the shaft 34 either manually or by motor drive means will cause both current selector means to rotate at the same rate.

Referring to FIG. 9, the terminal fingers or wipers 42a and 42 can be placed at four different positions around their respective current selector means. It should be understood however, that the wipers may be disposed in a variety of positions. Included as part of the current selector means are butterfly boss means 74. It can be seen that each side of the but-

terfly bosses 74 are of different size in relationship to the other. These bosses insure proper location of the current selector means with respect to each other. To further prevent improper location of the current selector means 30, there is provided recesses 70 and bosses 72 on the current selector means 30 and 30a. It can be seen that if the current selector means 30a is rotated 180° from the position as shown in FIG. 9 that the boss 72 will try to engage the channel 38 in the current selector means 30. Inasmuch as the channel 38 is not as wide as the recess 70, the current selector means 30 and 30a would not fit together properly. This would be an indication to the assembler that improper registration has been obtained, and the assembler would have to rotate one selector means in relationship to the other 180°.

It can be seen that a double or multiple unit has been achieved by the use of modular housing units and modular current selector means and modular timing circuit boards without increasing the overall size of the timer. It can also be seen that a single unit or a double unit can be built with the same modular components without any change in design or dimensioning.

Referring now to FIG. 7, one embodiment of the circuit boards is shown. Circuit board 41 has located on its surface 41' a plurality of spaced, electrically conductive strips 76. A suitable material for the strips 76 would be copper, for example. These strips are continuous around the board 41 up to the point at which they would cross the connector terminal 78 which connects the conductive strip 76 to an external terminating strip 80. Thus, the rings 76 are continuous for substantially a complete circle. The area in which the connecting strips 78 are located is in the general starting point of the timer. Therefore, this area is not needed as a timing period. To change or alternate the timing cycles required, a thin insulative film 82 is placed over the surface 41' (FIGS. 2, 3 and 5) of the timer board 41. A suitable material for the film 82 would be a polyester, for example. The film has spaced, arcuate apertures 84 to provide a predetermined coded indicia. The coded indicia is arcuately positioned so as to correspond with the cooperating conductive strips 76 which it overlays. Therefore, it can be readily seen that the terminal fingers or wipers 42, when wiping the surface of the film 82, are allowed to make electrical contact with one or more of the conductive rings 76 when the wipers mate with an aperture 84. The center most ring 76' provides the current input to the wiping finger 42. The film 82 may be glued or otherwise securely bonded to the surface 41' of the timer board 41.

After the film 82 is bonded to the circuit board 41, the circuit board 41 is then inserted in the housing 12 and is properly located in relationship to the timer housing by way of bolts 13' in the circuit board 41. Supporting the circuit board 41 in the housing 12 are support means (not shown) on the edge of the housing 12 which supports the outer edges 43' of the circuit board 41. The circuit board and the film 82 have center openings 88 and 86, so as to allow the butterfly boss means 74 of the current selector means 30 and 30a to project through the openings to thereby provide an interconnection between the circuit selector means 30 and 30a in the manner previously described.

Referring to FIG. 8, there is shown another embodiment of the circuit board. In this embodiment, there is shown a circuit board 90 which has located on one surface 91' a coded indicia of electrically conductive spaced strips 94. Strips 94 are continuous for substantially a complete circle and includes at one of its ends a conductive strip 98 which connects it to an external terminating strip 100. Since an overlay is not used on the circuit board 90, the strips 94 includes tabs or projections 96 extending from the strips. It can be seen that the projections 96 are always on the outside, as shown in FIG. 8. Alternately, the projections could be on the inside of the strips 94. The terminal fingers or wipers 42 of the current selector means will not wipe the area 94 and, therefore, the terminal fingers will only see the conductive material where it is intended to be located for a specific timing period.

Having described the invention, it can be seen that with the type of circuit board described, the circuit board itself can be easily changed without changing or altering the remaining elements of the timer. It should also be noted that the timer housing and corresponding parts can be assembled in one assembly. The main assembly will include the lower housing 12 with the shaft and the current means attached to the shaft by way of the key 32 with the retaining ring 40 retaining the shaft and the selector means in proper location in relationship to the housing 12. This assembly then allows the assembler to add or change the circuit board without changing or removing any other portions of the timer 10. It is only necessary to remove the screws or bolts 13 or 13' and remove the cover 14 or the upper housing panel 12a. With this completed, a new or different circuit board or boards can be placed in back-to-back location and the top 14 or the housing panel 12 can then be placed back in its original position and the screws or bolts 13 or 13' can be attached thereto. With this type of construction, shown in the modular component, it is easy for a vendor or possibly a repairman to remove, change or alter the circuit board.

What we claim is:

1. A timer comprising a housing, a shaft rotatably carried by said housing and having at least one end extending through said housing, at least two printed circuit boards carried by said housing in back-to-back relationship, at least two current selector means carried by said shaft and cooperating with said circuit boards, butterfly boss means extending from each of the backs of said current selector means, said butterfly boss means adapted to interfit with each other when said current selector means are disposed in back-to-back relationship, means driving at least one of said current selector means, said current selector means including wiper means engaging electrical circuit means of said circuit board.

2. A timer according to claim 1, wherein said current selector means includes a gear means coupled to said drive means.

3. A timer according to claim 1, wherein said current selector means includes locking means connecting said current selector means to said shaft.

4. A timer according to claim 3, wherein said locking means includes a boss means extending from said current selector means, a slot in said boss means, and a pin means disposed in said slot and extending through said shaft.

5. A timer according to claim 1, wherein said circuit board includes a plurality of spaced circular, electrically conductive strips, continuous for substantially a complete circle.

6. A timer according to claim 5, wherein said circuit board includes spaced electrically conductive tabs extending from said strips.

7. A timer according to claim 5, wherein said circuit board includes an insulative film disposed over said strips and spaced

apertures in said film so as to expose portions of said strips at spaced predetermined intervals.

8. A timer according to claim 7, wherein said insulative film is a polyester.

9. A timer according to claim 1, wherein said current selector means further includes locating means so as to insure that said current selector means are located with respect to each other in a predetermined position.

10. A timer according to claim 9, wherein said locating means includes pin means extending from said current selector means, said pins engaging slots disposed in said butterfly shaped boss means.

11. A timer according to claim 1, wherein said drive means includes a synchronous motor.

12. A timer according to claim 1, wherein said drive means includes two motor means and said means coupling said drive means to said current selector means includes clutch means.

13. A timer according to claim 11, wherein said drive means further includes manual drive means, and said motor drive means includes spring-biased clutch means.

14. In a timer according to claim 11, wherein said circuit board is carried by a housing for said timer, and said wiping means is independently rotatably carried by a shaft extending through said housing.

15. In a timer wherein electrical circuits are opened and closed in accordance with a programmed sequence, a circuit board, spaced electrical conductive paths disposed on a surface of said circuit board, electrical terminal means connected to said paths, a thin electrically insulative film having spaced apertures therein bonded to said surface, said spaced apertures in said film-exposing portions of said electrically conductive paths, drive means and wiping means coupled to said drive means and engaging said thin electrically insulative film and said electrically conductive paths to selectively open and close electrical circuits through said paths and said wiping means to said electrical terminal means.

16. In a timer wherein electrical circuits are opened and closed in accordance with a programmed sequence, a circuit board, spaced electrical conductive paths disposed on a surface of said circuit board, electrical terminal means connected to said paths, a thin electrically insulative film having spaced apertures therein bonded to said surface, said spaced apertures in said film exposing portions of said electrically conductive paths, and wiping means engaging said thin electrically insulative film and said electrically conductive paths in response to relative rotation between said circuit board and said wiping means to selectively open and close electrical circuits through said paths and said wiping means to said electrical terminal means.

17. In a timer according to claim 16 wherein said film is a polyester.

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