A control system is disclosed for washers, dryers and the like in which a motor-driven timer automatically operates the appliance through a predetermined cycle. The control system includes a mounting base adapted to be permanently connected to the appliance frame and a motor-driven timer which is removably plugged into the base with electrical connectors which function to provide electrical connection and the mounting of the timer. The connectors are provided in a pattern which prevents improper installation. Separate terminal assemblies are provided to plug into the rearward face of the timer for additional connections. Here again, the terminals provide both the electrical connection and the mounting of the terminal blocks.

12 Claims, 6 Drawing Figures
PLUG-IN TIMER ASSEMBLY

BACKGROUND OF THE INVENTION
This invention relates generally to the installation of controls such as timers or the like on appliances and more particularly to a novel and improved mounting and connecting system for such controls.

PRIOR ART
Various types of appliances, for example washers, dryers and the like, are provided with relatively elaborate systems which function to cause the appliance to operate automatically through a cycle of operation. Such control systems usually include a motor-driven timer which automatically controls the operation of the various sub-systems of the appliance to produce the desired cycle or cycles of operation. Such timers because they control the operation of the various subsystems require relatively large numbers of separate connections to the electrical system of the appliance.

In the past, it has been the general practice to physically mount the control, such as a timer, directly on some portion of the appliance frame and then directly connect terminals on the control to the wiring of the appliance. With this arrangement, any repair or replacement of the control usually requires the removal of individual wires when the control is removed and subsequent reconnection of the individual wires when the control is replaced. Even with color coding or the like, the reconnection of wires is sometimes incorrectly accomplished and difficulties have been encountered not only because of the function of the sub-assemblies may be incorrect, but in some instances damage to some components has resulted.

Further in many instances, because the principal face of the control is mounted against the appliance frame, such face is not available for the placement of terminals.

SUMMARY OF THE INVENTION
A control system mounting and connection in accordance with the present invention greatly simplifies the installation of the control both during initial manufacture and after servicing or repair. Further, the likelihood of improper connection of the control to the wiring system is virtually eliminated, thus eliminating the danger of damage to the subsystems in the appliance caused by improper connection of the control.

In accordance with the illustrated embodiment of this invention, a timer control such as the timer control used on washers, dryers and the like is combined with a mounting base which functions to provide the support for the control as well as at least part of the connection between the control and the wiring system of the appliance. The mounting base is adapted to be mounted on a portion of the appliance frame and is provided with a plurality of connector halves open to a back face of the mounting base in a predetermined pattern. Provision is provided in the mounting base for physically connecting one or more conductors to the connector halves with a connection which need not be removed during normal servicing of the timer control itself.

The timer control illustrated is provided with a forward face adapted to be positioned against the rearward face of the mounting base in which a plurality of mating connector halves are provided. In the illustrated embodiment, the connector halves on the mounting base are female and the connector halves on the timer control are male. The pattern of the connector halves is such that the control can be mounted on the base in only one position which is the correct position. The timer control is installed merely by the movement of the timer toward the installed position so that the male connector halves project into the female connector halves. The engaged connectors function to provide the necessary electrical connections and also to support the control in its properly installed position.

The illustrated embodiment of the timer control is provided with a manually operable shaft projecting from the forward face of the timer through an opening in the mounting base and through the appliance frame to an accessible position on the appliance. During the installation of the control of the movement of this operator shaft into the hole or opening in the mounting base serves to provide initial orientation and alignment of the control with respect to the base. Continued movement toward the installed position can only be accomplished when the male connector halves are properly aligned with the associated female connector halves to allow completion of the installation. Once installation is complete, the manual operator is centrally located within the opening and does not perform either a mounting or a positioning function.

The forward face of the control which is one of the major surfaces thereof is used to provide a location for some or all of the electrical connections to the timer control. In the illustrated embodiment, the timer control is also provided with connectors on its rearward face opposite the forward face so both of the major surfaces of the timer are available for connection purposes. In the illustrated embodiment, two separate terminal assemblies or blocks are provided for mounting on the rearward face of the timer and the connectors are arranged in patterns which prevent the accidental improper installation of such terminal assemblies. Further, bus bar type connections are provided where appropriate in the terminal blocks and mounting block to eliminate the requirement of such connections in the timer itself. This reduces the complexity of the timer and in many instances provides versatility since a given timer can be used in different appliances having different terminal connection requirements.

Preferably, the mounting block and terminal blocks are provided with sufficient numbers of connector half openings to meet the need or the requirements of most types of appliances. Connector halves need not be provided in each opening for a particular installation, but a standardized mounting block because sufficient connector half openings are provided can be used in a large variety of appliances. This reduces tooling and inventory costs.

BRIEF DESCRIPTION OF THE DRAWINGS
FIG. 1 is a perspective view of the various components of a control system incorporating this invention illustrating the components in the disassembled position in which the mounting block is mounted on an appliance frame. A timer control is disconnected from the mounting block and two terminal blocks are illustrated in a disconnected condition;

FIG. 2 is a perspective view of the control system in the assembled condition;
FIG. 3 is a rear view of the timer control taken generally along 3-3 of FIG. 1; FIG. 4 is a view of the forward face of the timer control; FIG. 5 is a rearward view of one of the terminal assemblies illustrating the manner in which bus bar type connections can be provided between selected terminals; and FIG. 6 is an enlarged fragmentary view of the opening of the female connector halves.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates the various sub-combinations of a control system in accordance with the preferred embodiment of this invention. This system includes a mounting block 10 secured to a portion of the frame of an appliance (schematically illustrated at 11) in any suitable manner. A timer control 12 is provided which may be of any suitable type. The illustrated timer control includes a motor 13, a forward or mounting face 14 and a rearward face 16. Projecting from the forward face 14 is a control shaft 17 which when the timer is properly installed projects through an opening 18 in the mounting base and an opening 19 in the frame 11 to a position in which it is accessible to the user for the operation of the appliance. Usually, a knob is mounted on the end of the shaft after installation of the timer. A pair of terminal assemblies 21 and 22 are provided where necessary to provide additional electrical connections to the control system of the appliance. When installed, the terminal assemblies 21 and 22 are positioned against the rearward face 16 of the timer control 12.

The timer control 12 may be of any suitable type and since the internal mechanism of the control itself is not critical to this invention, such mechanism is not illustrated. Usually, however, the control is provided with a rotary switch mechanism driven by a motor 13 to provide programmed switch operation. The U.S. Letters Patents, Nos. 2,703,347; 3,021,399; 3,053,947; and 3,190,418 illustrate the various types of timer control mechanisms which may be utilized in a control system embodying this invention.

The mounting block 10 is provided with a plurality of connector halves 23 which are arranged in a pattern in the rearward face 24 of the mounting block 10. In the illustrated embodiment, the connector halves 23 are female type connector halves, each of which provides an opening projecting forwardly from the rearward face 24 of the mounting block 10, and the connector halves are arranged in four groups 26, 27, 28, and 29. Each group consists of two aligned rows of connector halves with each row in the groups 27 and 28 consisting of three connector halves, and each row in the groups 26 and 29 consisting of four connector halves. Therefore, the mounting block 10 is adapted to provide 28 separate connections. The spacing between the individual connector halves 23 in the groups 27 and 28 from a lateral line 31, which is horizontal in the illustrated embodiment, through the center of the opening 18 is different than the spacing between the individual connector halves in the groups 26 and 29 from the line 31. Therefore, the pattern of the connector halves 23 in the rearward face 24 is not symmetrical with respect to the opening 18. This insures that the installation of the timer control 12 can be accomplished only in a single position which is the correct position for installation.

This is discussed in greater detail below. The connector halves 23 are connected to wires 32 of the electrical wiring harness 33 of the appliance so that when the timer control is installed, the correct electrical connections between the control harness of the appliance and the timer control are provided. Such connections are preferably made on the forward face of the mounting block during the manufacture of the appliance before the mounting block is installed on the frame 11. Such connections are not normally removed during the servicing of the appliance. In a given appliance, connections are not necessarily made to all of the connector halves 23 since the number of connector halves formed in the mounting block is preferably larger than the number normally required. Therefore, a standardized connector block can be used for a number of different types of appliances and a sufficient number of connector halves are provided for even the more sophisticated appliances having complex control cycles.

A plurality of male connector halves 36 project from the forward face 14 of the timer control 12 and are arranged in a pattern around the control shaft 17 so that they mate with associated female connector halves 23 when the forward face 12 of the timer control is properly positioned adjacent to the rearward face 24 of the mounting block. In the illustrated embodiment, the forward face 14 is formed with terminal openings 35 corresponding in number and position to the openings in the base, but male connector halves 36 are not mounted in all of the openings 35. Only three connector halves 36 are required to plug into the group 28 of the connector halves 23. Two male connector halves 36 connect with the group 27, four connector halves 36 connect with the group 26 and two connector halves 36 connect with the group 29. In some instances, a greater number of male connector halves 36 will be required, and in other instances, lesser numbers may be used depending upon the system control requirements of the particular appliance.

During the movement of the timer control 12 toward its installed position, the control shaft 17 is first positioned to enter the opening 18. This provides initial positioning or alignment of the control with respect to the mounting block 10. Continued movement toward the mounting position causes the ends of the male connector halves 36 to either fit within the mating female connector halves 23 or to engage the rearward face 24 of the mounting block to prevent final movement to the assembled position. In the event that proper orientation is not provided, it is merely necessary to move the timer control laterally within the limits of movement established by the projection of the control shaft 17 into the opening 18 until all of the male connector halves 36 are aligned with their mating female connector halves 23. At that time, the completion of the mounting operation is possible and the various male connector halves move into the mating female connector halves to complete the mounting of the timer control.

The mating engagement of the various male and female connector halves automatically serves to provide the electrical connections required between the timer control 12 and the mounting block 10 and also provides for the mounting of the timer control in the appliance. The pattern of the connector halves since it is not symmetrical with respect to the center of the opening 18 allows installation only when the timer control is properly positioned, and it is impossible to install a con-
control in an improper position with respect to the mounting base. When the installation is complete in most instances, the control shaft 17 extends through the openings 18 and 19 with clearance and does not provide any locating function. Such a structure insures that binding or friction will not be present.

To facilitate the alignment of the male and female connector halves, it is preferable to form the openings of the connector halves 23 in the rearward face 24 of the mounting block with flared surfaces as illustrated in FIG. 6 wherein the through opening 37 of each female connector half 23 is flared at both of its ends as illustrated at 38 and 39 and along at least one side at 41. Such a structure assists in establishing the proper positioning of the timer control with respect to the mounting block by providing a degree of lateral camming which moves the timer control to the exact proper position for mounting as it is pressed toward the mounting block.

The rearward face 16 of the timer control 12 is also used in the illustrated embodiment for connecting terminals between the inner control and the appliance wiring system. As best illustrated in FIG. 3, the timer control body is formed with a plurality of openings 42 arranged in a non-symmetrical pattern similar to the pattern of the connector half openings in the rearward face 24 of the mounting block. Here again, four groups of openings 43, 44, 45, and 46 are provided. Mounted in some of the openings are male connectors 47 which project out from the rearward face 16 in a manner similar to the male connector halves 36. These male connector halves project into mating female connector halves 48 in the terminal assemblies 21 and 22 when the terminal assemblies are mounted as illustrated in FIG. 2. Preferably, the pattern of the two groups of terminal halves 43 and 44 which mate with the terminal block 21 is different than the pattern of the groups 45 and 46 which mate with the terminal block 22 so that the two terminal blocks cannot be improperly connected to the timer control. Here again, wires 33 of the appliance wiring harness 33 are connected to the two terminal blocks 21 and 22 during the manufacture of the appliance and are not normally disconnected during servicing or repair.

FIG. 2 illustrates the complete system in the assembled condition in which the timer control 12 is mounted on and supported by the mounting block, and the two terminal blocks 21 and 22 are in turn mounted on the rearward face of the timer control. In many instances, the engagement between the various connectors is sufficient to provide the complete mounting of the timer control and terminal blocks 21 and 22. However, in some instances where substantial amounts of vibration are likely to be encountered such as on a laundry washing machine, U-shaped clips 51 and 52 may be snapped into place to prevent vibration from causing rearward movement of any of the sub-combinations. Such clips need only prevent such rearward movement since lateral movement is positively prevented by the interengaging terminal halves.

It should be recognized that in some installations the additional connections provided by the two terminal blocks 21 and 22 may not be required, and in such instances, the timer control will be used with only the mounting block 10. However, the ability to form connections along both the forward and rearward faces 14 and 16 of the timer permits the use of a control system in accordance with this invention in appliances requiring greater numbers of connections without encountering excessive congestion of the terminal connections. In some instances, it is desirable to connect certain terminals together in accordance with the present invention. Such connections can be made externally of the timer within either the mounting block 10 or the terminal blocks 21 and 22. As illustrated in FIG. 5, the terminal half 48c can be connected to the terminal half 48b by a bus bar type connection 53 so that such terminal halves are electrically connected, when the terminal block 22 is installed. Similarly, a bus bar type connection 54 can be provided to connect the terminal halves 48c and 48d. The use of external connectors in the terminal blocks or the mounting block tends to reduce the complexity of the timer control 12 and, in some instances, permits the use of a given timer control in systems having different circuit requirements.

With the illustrated invention, the removal of the timer control 12 for servicing or replacement is easily accomplished by first removing the clips 51 and 52 if such clips are used, and subsequently unplugging the timer control from the mounting block 10 and the terminal blocks 21 and 22 from the timer control. Since all of the connections for the timer control are provided through either the mounting block or the terminal blocks, the timer control is therefore easily removed, and it is not necessary to break any wire connections. When reinstallation is required, it is merely necessary to replug the timer control into the mounting block, and there is no danger of making improper connections since the timer control can be installed in only one position, which is the proper position. Thereafter, the terminal blocks 21 and 22 are reassembled into the timer control to complete the reconnection of the entire system. Here again, it is preferable to arrange the pattern of connection so that the terminal blocks can be installed only in one position, which is the correct position of installation. The reinstallation of the clips 51 and 52, if required, completes the reassembly.

As an incidental feature of the particular embodiment illustrated, rivet-receiving openings 61 are associated with each of the openings 35 or 43-46, and rivets 62 are received in those of the openings 61 whose associated openings 35 or 43-46 have male connector halves 36 or 47. The rivets secure the male connector halves in the housing by anchoring right angle portions of the male connector halves (only one such right angle portion is shown in dotted lines in FIG. 4 and is labelled 63) to the inner side of the timer control housing wall. Another incidental feature of the particular embodiment illustrated is that because of a step or shoulder 64 formed in the housing wall, some of the openings 35 are partly formed as notches that extend down the "rise" of the step 64 before literally becoming openings through the wall. These incidental features are mentioned merely for the sake of completing the description of the particular actual embodiment from which the drawings were prepared.

Although a particular actual embodiment of this invention is illustrated, it is to be understood that various modifications and rearrangements of parts may be resorted to without departing from the scope of the invention disclosed and claimed herein.

What is claimed is:
1. An electrically controlled appliance comprising a frame, control wiring for said appliance, a base
mounted on said frame and providing an exposed first face, a plurality of separate first connector halves on said base connected to at least part of the control wiring of such appliance and arranged in a predetermined pattern on said face, a separable timer control including a body providing a second face positioned against said first face, a plurality of separate second connector halves on said body arranged in a pattern on said second face and mating with associated first connector halves to provide electrical connection between said base and said timer control, said connector halves including male and female parts which interengage to provide a substantial portion of the releasable mounting of said timer control on said base, said timer control being provided with a manual operator projecting from said second face, means defining openings in said frame and in said base through which said operator extends to provide user access, said openings and manual operator providing initial alignment between said base and the timer control during installation of said timer control, said patterns being arranged so that said connectors cooperate with said openings and operator to prevent improper installation of said timer control on said base and so that said operator is properly aligned in said openings.

2. An electrically controlled appliance as set forth in claim 1 wherein said female parts of said connector halves are flared to assist in aligning said separable control as it is installed on said base.

3. An electrically controlled appliance as set forth in claim 2 wherein said connector halves on said base are female and said connector halves on said separable control are male.

4. An electrically controlled appliance as set forth in claim 3 wherein said separable timer control provides a third face opposite said second face, a plurality of third connector halves are provided on said third face, and a terminal assembly is provided with a fourth face positioned against said third face, said terminal assembly including a plurality of fourth connector halves connected to at least part of the electrical system of such appliance and being arranged in a pattern on said fourth face to mate with the associated third connector halves and provide electrical connection between said terminal assembly and said timer control, said third and fourth connector halves including male and female parts which interengage to provide a substantial portion of the releasable mounting of said terminal assembly on said timer control.

5. An electrically controlled appliance as set forth in claim 4 wherein said female parts of said third and fourth connector halves are flared to assist in aligning said terminal assembly as it is installed on said separable timer control.

6. An electrically controlled appliance as set forth in claim 5 wherein said connector halves on said terminal assembly are female and said connector halves on said separable timer control are male.

7. An electrically controlled appliance as set forth in claim 6 wherein clip means are provided to prevent vibration from causing disassembly of said appliance.

8. An electrically controlled appliance as set forth in claim 1 wherein said separable timer control provides a third face opposite said second face, a plurality of third connector halves are provided on said third face, and a terminal assembly is provided with a fourth face positioned against said third face, said terminal assembly including a plurality of fourth connector halves connected to at least part of the electrical system of such appliance and being arranged in a pattern on said fourth face to mate with the associated third connector halves and provide electrical connection between said terminal assembly and said timer control, said third and fourth connector halves including male and female parts which interengage to provide a substantial portion of the releasable mounting of said terminal assembly on said timer control.

9. An electrically controlled appliance as set forth in claim 1 wherein at least some of the connector halves on said base are permanently connected together.

10. An electrically appliance comprising a frame, control wiring for said appliance, a base having a forward surface mounted against said frame and providing a rearward surface, a timer control providing a forward surface positioned against said rearward surface of said base, a plurality of connector halves on said base connected to said control wiring and being arranged in a pattern on said rearward face of said base, a plurality of connector halves on said timer control mating with the connector halves on said base electrically connecting said timer control to said control wiring and providing a substantial part of the mounting of said timer control on said appliance, and a manual operator on said timer control projecting through said base and said frame to a position providing user access thereto, said connector halves and said manual operator being arranged so said timer control can be installed in only one position.

11. An electrical appliance as set forth in claim 10 wherein said timer control is provided with a rearward face, and a terminal assembly is positioned adjacent said rearward face, and a plurality of connector halves are provided in said terminal assembly connected to said control wiring, and said timer control is provided with a plurality of connector halves on said rearward face in mating engagement with the connector halves on said terminal assembly to provide an electrical connection therebetween, said terminal halves providing a substantial portion of the mounting of said terminal assembly on said timer control, said connector halves providing the entire connection between said timer control and said control wiring and disconnecting of said connector halves permitting removal of said timer control from said appliance.

12. An electrically appliance as set forth in claim 11 wherein clip means are provided to prevent vibration of said appliance from causing disconnection of said connector halves.

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