United States Patent [19]

Short

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[54] **CONTROLLER FOR AUTOMATIC PINSETTER**

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[52] **U.S. Cl.** ..... **273/43 A**

[51] **Int. Cl.** **A63d 5/09**

[58] **Field of Search** ..... 273/43 R, 43 A, 54 R

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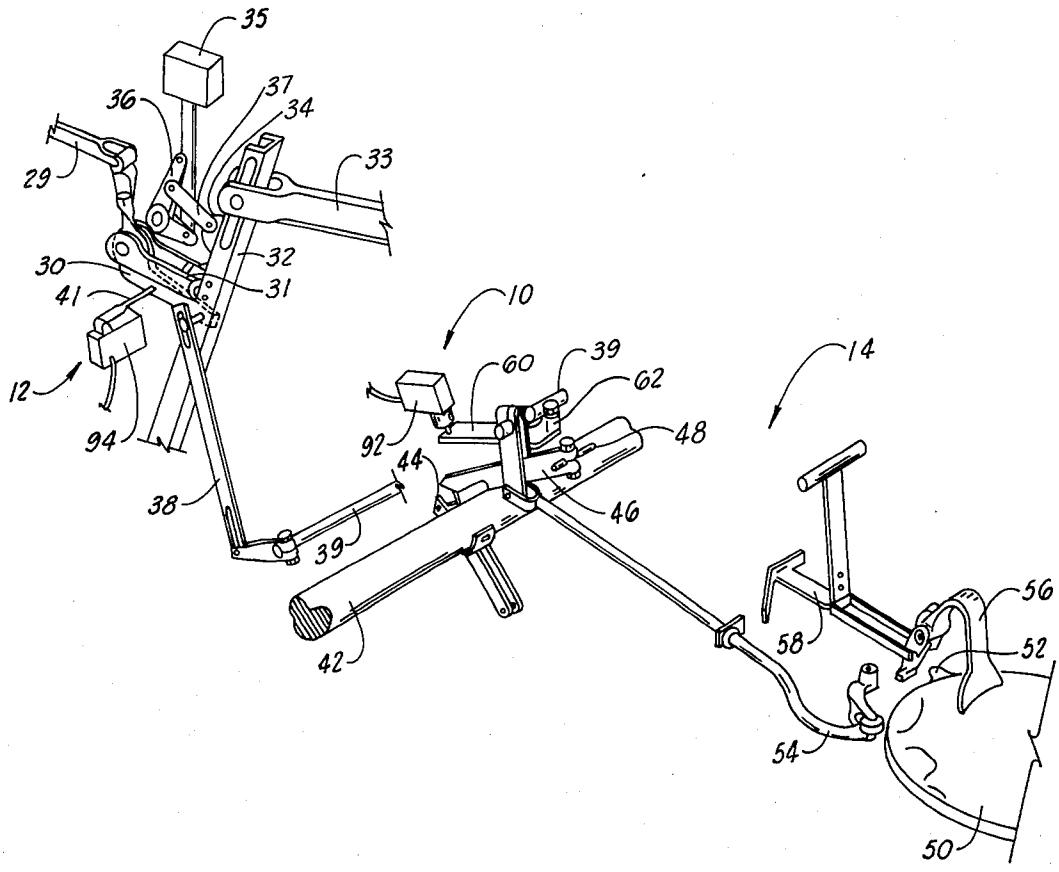
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[57] **ABSTRACT**

A controller for a bowling pinsetter has an electric motor with a clutch and a raisable and lowerable deck to receive pins and place them on a lane. A first switch is operable by the deck. A second switch is operable by a clutch linkage on the electric motor. The switches are connected in parallel to control on and off operation of the motor so it will operate when either switch is closed and it will not operate when both switches are open. In a second embodiment, a delay relay is associated with the second switch in such manner as to maintain the motor in operation for a predetermined time after the second switch is closed. In both embodiments the motor is maintained in operation for a period of time sufficient to enable the pin distribution apparatus driven by the motor to perform the pin handling operations required of it.

12 Claims, 7 Drawing Figures



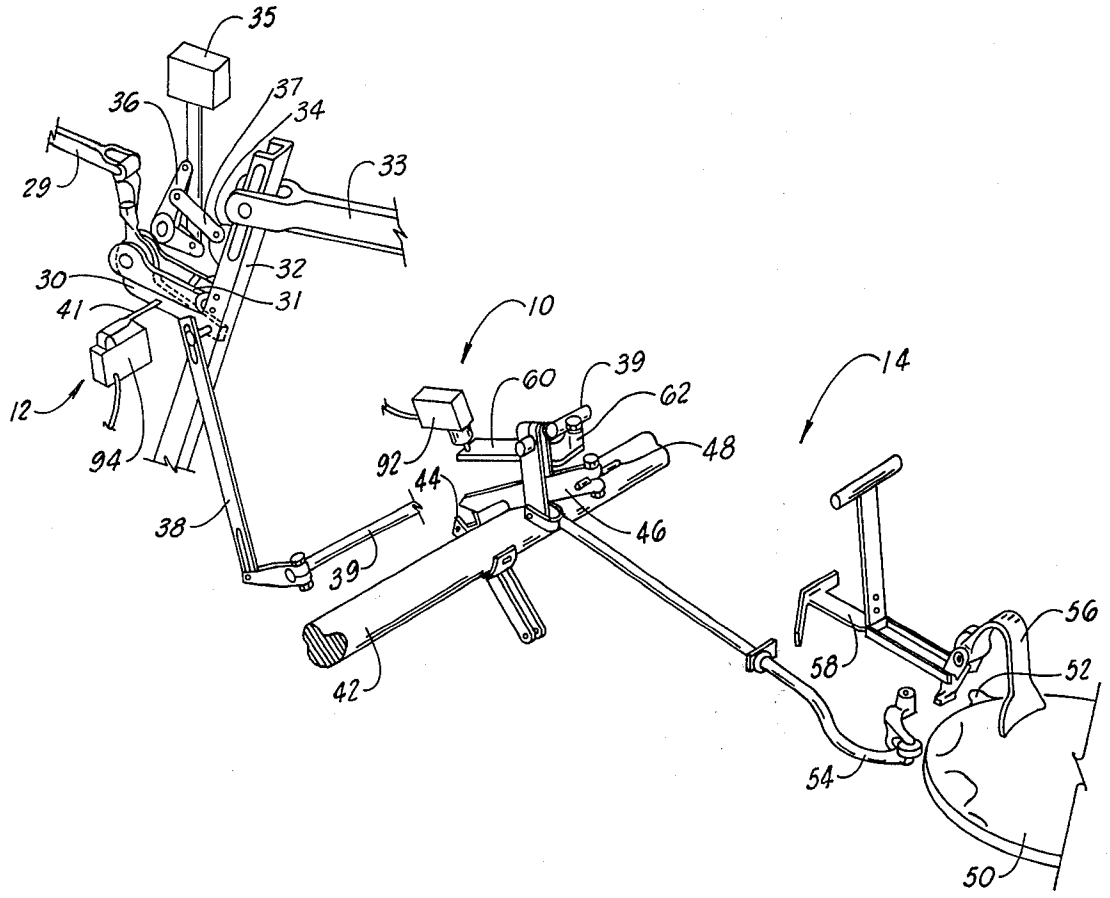

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FIG-1

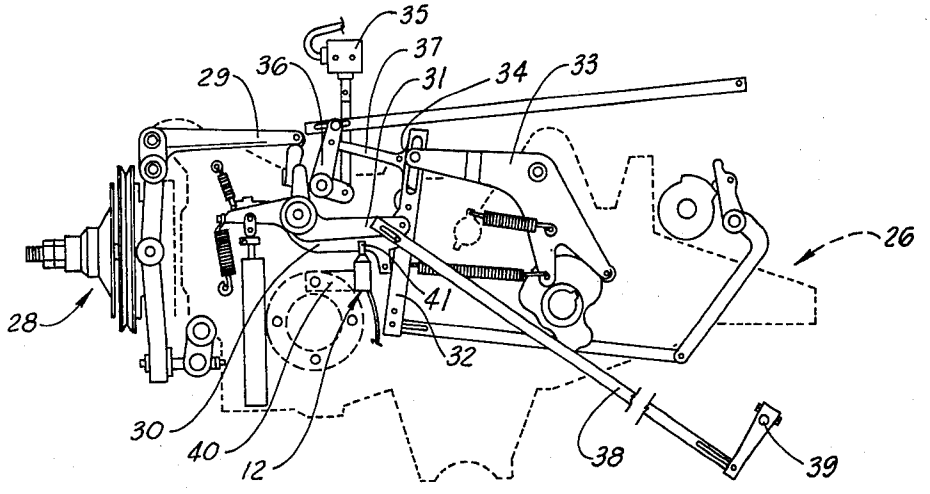

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FIG-2

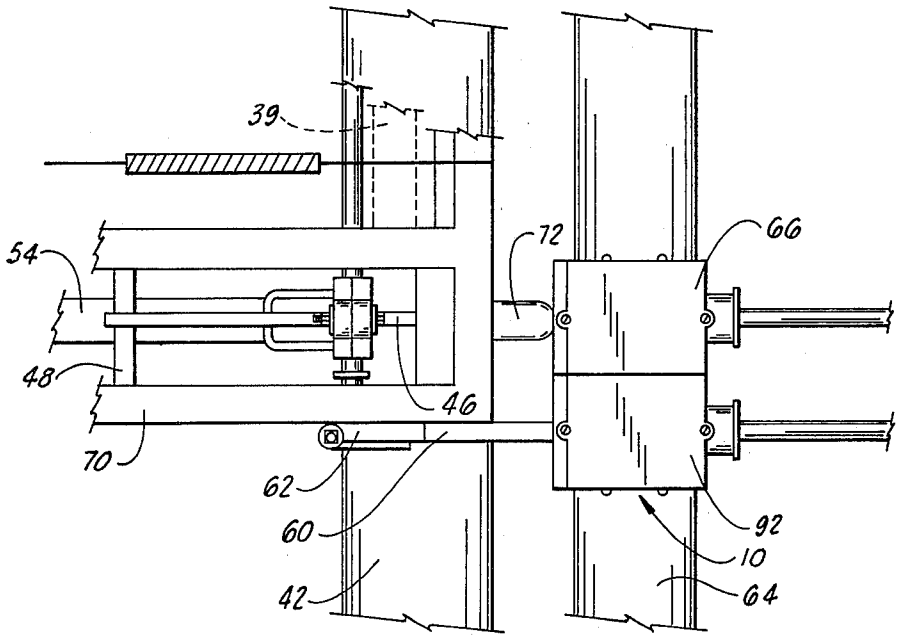

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FIG-4

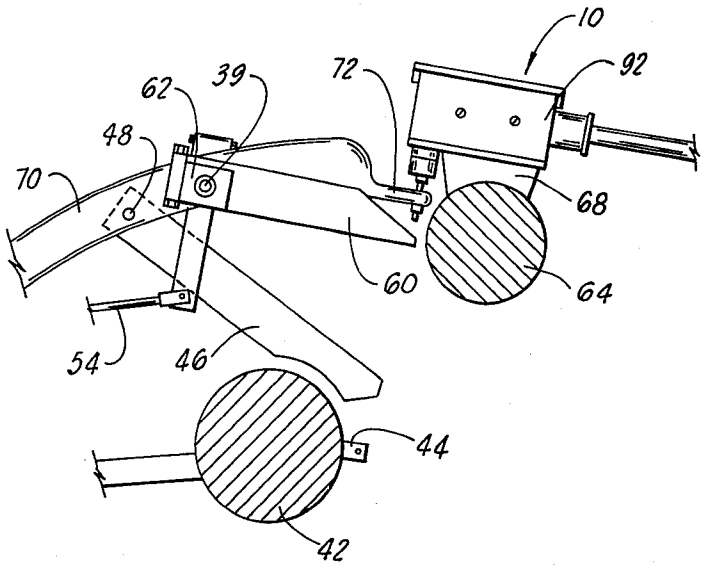

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FIG-3

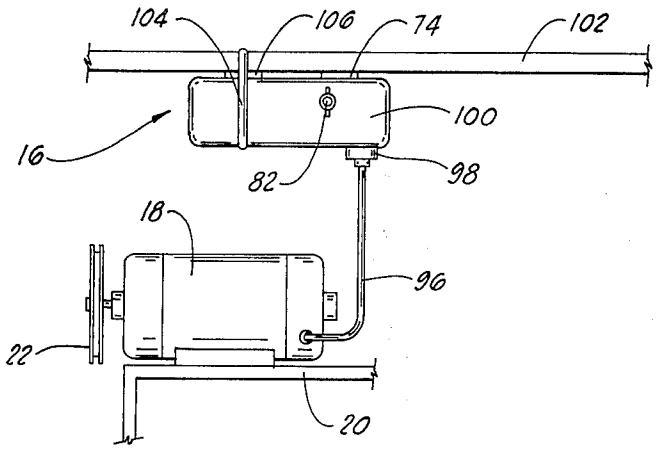


FIG. 5

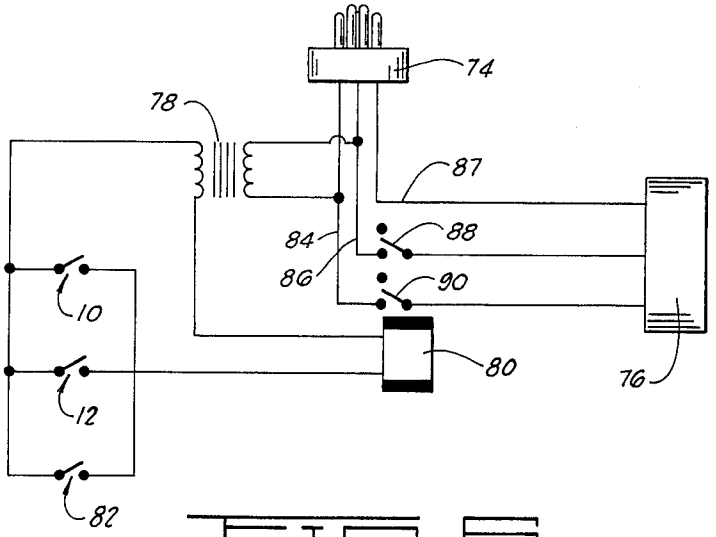


FIG. 6

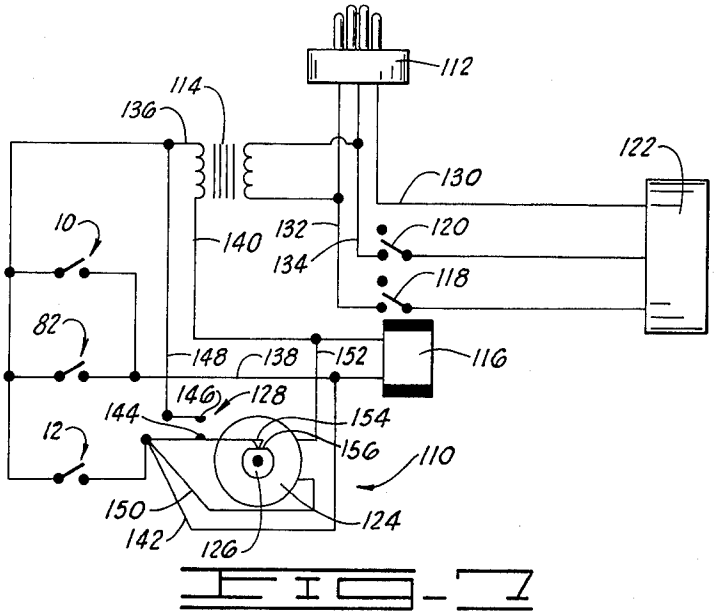


FIG. 7

CONTROLLER FOR AUTOMATIC PINSETTER

BACKGROUND OF THE INVENTION

The invention is related to automatic bowling pinsetters and particularly controllers therefor which terminate operation of an electric motor in the pin distribution system thereof during periods when it is not necessary for the motor to operate. In the prior art automatic bowling pinsetters of the type for which this invention is designed have a pin distribution system with an electric motor and a clutch. This portion of the mechanism is operable to pass the bowling pins from a pin gathering portion of the apparatus into a deck assembly that is raisable and lowerable to receive bowling pins and place them on the end of the bowling lane. In such pinsetters the motor normally runs continuously when the machine is turned on for operation and due to the complicated nature of the machines, many of the movable parts thereof are kept in motion. The electric motor is connected to the clutch of a transmission assembly which functions to cycle a portion of the machine through the steps of removing pins from the end of the bowling alley and placing them in the deck for resetting. The motor powers a pin elevator which picks up the bowling pins and raises them to a position where they are taken by a conveyor, also powered from the electric motor, to a turret assembly, also powered by the electric motor, where they pass into the deck, which is powered by the motor through the transmission assembly. Prior art controllers are known which govern the operating time of the electric motor so that it operates for a predetermined certain time period which allows a more than substantial time for the machine to complete its operation then turns the motor off. This particular type of prior art controller causes the electric motor to operate longer than actually necessary because it lets the motor operate or idle once the deck has been loaded with bowling pins to be placed on the bowling lane in the next cycle. An additional disadvantage to this particular prior art controller is that during league play the bowlers take turns quite rapidly, thus the electric motor may not necessarily reach the end of its operating time period or would do so very shortly before the next operating cycle so the motor runs substantially continuously and there is little or no improvement in reducing unnecessary operating time for the motor or wear on the mechanism of the machine.

SUMMARY OF THE INVENTION

In a specific embodiment, (1), a controller for automatic pinsetters includes a first switch assembly electrically connected to the pin distribution system drive motor and operable by motion of the deck assembly, and a second switch assembly electrically connected in parallel with the first switch assembly and operable by the clutch mechanism of the pin distribution systems drive motor. The switch assemblies are connected with the electric motor so that the electric motor will be operated when either of the switches are closed and will be stopped when both of the switch assemblies are open. Before the first ball is thrown, the switches are open, ten pins are on the end of the bowling lane, and the machine is stopped waiting for the bowler to deliver the ball. When the first ball is delivered, the clutch is engaged when the ball impacts at the pinsetter and the second switch assembly is actuated by engagement of the clutch, thus starting the motor. The first switch closes when the deck assembly is lowered and opens when the deck assembly is full of pins. Either the first switch assembly or the second switch assembly stops operation of the motor depending upon the particular cycle in which the machine is operating. The switch assemblies are connected with a relay that is electrically connected to intermittently interrupt power normally continuously supplied to the electric motor when the pinsetter machine is turned on.

In a second specific embodiment, (2), of the controller of this invention, such is designed for use on pinsetter machines which have a shortened cycle time and therefore cannot be operated by the first described embodiment of the controller of this invention. The controller of this embodiment, (2), is designed to function generally similar to the first described embodiment, (1), and it includes a delay relay apparatus to extend operating time of the motor beyond the time when the clutch is disengaged in a first ball standing pin cycle of operation so that the machine will function properly in filling the deck and returning the deck to the proper position.

One object of this invention is to provide a controller for automatic pinsetters overcoming the aforementioned disadvantages of the prior art devices.

Still, one other object of this invention is to provide a controller for automatic pinsetters having switch assemblies which are connected with an operating motor of the pinsetter to control operation of the motor so it operates only during the time necessary for functioning of the machine and not during times when the pin distribution system is idle and the motor would otherwise idle and also idly operate a portion of the mechanism.

Still, one other object of this invention is to provide a controller for automatic pinsetters which is operable to minimize the operation of an electric motor used for powering several portions of the pinsetter mechanism to have the overall result of reducing unnecessary wear on the mechanism and substantially reduce the amount of electrical power necessary to operate the pinsetter machine.

Yet, another object of this invention is to provide a controller for automatic pinsetters which has a pair of switches and additionally including a timer in one embodiment of the invention, the switches being connected in a parallel relation and connected to a relay to intermittently interrupt electrical power to an electric motor of the pinsetter which operates a major portion of the pinsetter mechanism with one switch actuated when a deck assembly is needing additional bowling pins and the other switch actuated from a clutch which is engaged when the first ball is thrown and is released as the pin distribution system finishes an operation cycle.

Yet, another object of this invention is to provide a controller for automatic pinsetters which is attachable with a conventional and popular make of automatic bowling pinsetters in a kit-like form.

Various other objects, advantages and features of the invention will become apparent to those skilled in the art from the following discussion, taken in conjunction with the accompanying drawings, in which:

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a portion of the portion of interlock system and gear box stop and start

mechanism for the automatic pinsetter with the switches for the controller shown therewith;

FIG. 2 is a side elevation view of the clutch, gearbox and related stop and start mechanism of the automatic pinsetter having a switch of the controller mounted on the gearbox, with the gearbox shown in outline for clarity;

FIG. 3 is an enlarged side elevation view of a portion of the automatic pinsetter at the rear of the turret frame and the deck showing the deck lift shaft, the rear of the turret frame, the rear interlock cross shaft and a switch of the controller mounted on a brace portion of the pinsetter;

FIG. 4 is a top plan view of the portion of the automatic pinsetter shown in FIG. 3, and further including the turret jam microswitch which is positioned alongside the controller switch;

FIG. 5 is a side elevation view of the portion of the automatic pinsetter supporting the drive motor, and including the drive motor and an electrical conduit portion of the pinsetter with the control box portion of the controller mounted on the conduit;

FIG. 6 is a schematic diagram of the electrical circuit of an embodiment of the controller; and

FIG. 7 is a schematic diagram of the electrical circuit of an embodiment of the controller including a delay relay apparatus.

The following is a discussion and description of preferred specific embodiments of the controller for automatic pinsetters of this invention, such being made with reference to the drawings, whereupon the same reference numerals are used to indicate the same or similar parts and/or structures. It is to be understood that such discussion and description is not to unduly limit the scope of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

The pinsetter controller of this invention is disclosed herein in two embodiments. One embodiment, (1), includes a pair of switches mounted with the pinsetter mechanism and a relay electrically connected with the motor to intermittently interrupt electrical power supplied to the motor. Another embodiment, (2), includes a pair of switches mounted on the pinsetter mechanism, a delay relay apparatus connected with one of the switches and a relay electrically connected with the other switch and the delay relay apparatus, and the motor to intermittently interrupt electrical power normally supplied to the motor.

Referring to the drawings in detail and in particular to FIGS. **1** and **5**, such illustrates portions of a bowling pinsetter apparatus and portions of an embodiment, (1), of the automatic pinsetter controller of this invention. The automatic pinsetter controller, (1), includes a pair of switches generally indicated at **10** and **12** mounted with the interlock system of the pinsetter, (generally indicated at **14** and shown partially in FIG. **1**), and further including a control box **16** (shown in FIG. **5**) and electrically connected with electric motor **18** which powers the pinsetters pin distribution system. FIG. **1** shows a portion of the interlock system and gearbox stop and start mechanism of a bowling pinsetter; this portion of the pinsetter apparatus which controls some of the stopping, starting and sequencing of the pinsetter so that during the cycle of operation of the machine the turret portion thereof and the deck portion thereof are moved at appropriate times during the operating cycle. FIG. **5** shows the electric motor **18** mounted on a support member **20** of the pinsetters frame, a pulley **22** is on the output drive shaft of the motor **18.** The motor **18** furnishes power for the pinsetters pin distribution system, including driving a gearbox which in turn operates the turret and deck portions of the pinsetter, operating an elevator assembly and a conveyor assembly for moving the bowling pins from the place where they are removed from the end of the bowling lane to the turret which places the pins in the deck for resetting on the end of the bowling lane. The bowling pinsetter apparatus depicted in part in the drawings is a bowling pinsetter manufactured by the Brunswick Corporation of Chicago, Illinois. The Brunswick Corporation has manufactured several models of the pinsetter, the A-1, A-2 and A-2 with jet back modification which in the identified pinsetter apparatus the motor **18** is connected in the electrical circuit of the machine to operate continuously when the machine is turned on for operation, thus the pin elevator and the bowling pin conveyors operate continuously whether or not bowling pins are being carried by them. The clutch assembly on the gearbox is used to engage and disengage the gearbox when it is needed in the operating cycles of the machine.

FIG. **2** shows the bowling pinsetter gearbox assembly, indicated generally at **26,** with the second switch **12** of the controller mounted thereon. The gearbox **26** functions in the pinsetter to operate a rake that pulls bowling pins from the end of the bowling lane, to raise and lower the deck, and to index the turret for placing pins in the deck, and additionally it includes many components not necessary for the understanding of the operation of the controller of this invention and which will not be described. The gearbox **26** has a clutch **28** mounted on one end thereof. The clutch **28** has a clutch lever **29** movable for engaging and disengaging. A clutch release lever **30** and plunger lever **31** are supported on the gearbox at the same pivotal mount with the plunger lever **31** being hollow on its interior and having the clutch release lever **30** positionable therein but not connected. The clutch release lever **30** is connected with the end of the clutch lever **29** by a stop arm and it is connected with and moved by the 180° interlock link **38** that is moved by the rear interlock cross shaft **39** of the interlock system **14** shown in FIG. **1.** A clutch actuator link **32** is pivotally attached to the end of the plunger lever **31.** The clutch actuator link **32** is slidably connected with the reset lever **33** by a pin. The clutch actuator link is hollow and encloses the clutch latch **34** with the pin of the reset lever **33** resiliently urged contacting an upper portion of the clutch latch **34.** The clutch latch **34** is moved to release the clutch **28** at the start of a cycle. FIG. **2** shows the gearbox and associated apparatus of a model A-2 Brunswick Corporation pinsetter. A cycle solenoid **35** is mounted above the gearbox **26** is connected by a start bell crank **36** and short connection link **37** to the clutch latch **34.** Retraction of the cycle solenoid's slug is done at the start of a cycle when a ball impacts at the rear of the pinsetter, thus instantly causing the starter bell crank **36** to be rotated which pulls the clutch **34** from its resting position in the clutch actuator linnk **32** so that the clutch actuator link **32** moves upward, thus rotating the plunger lever **31** in a counterclockwise direction. At the proper time in the cycle, the cycle solenoid **35** is de-energized so that the bell crank **36** rotates clockwise letting the

clutch latch **34** fall back into place in the clutch actuator link **32.** In A-1 models of the Brunswick pinsetter, the cycle solenoid **35** shown in FIG. **2** is not present and a mechanical linkage is provided to move the start bell crank **36** and release the clutch latch **34** upon ball impact. The switch **12** is mounted on a bracket **40** and it has an actuator arm **41** extending under a lower portion of the plunger lever **31.** When the clutch **28** is released and the plunger lever **31** rotates counterclockwise, it permits the switch actuator arm **41** to raise and thereby close the contacts of the switch **12.**

FIG. **1** shows portions of the interlock system **14** of the automatic bowling pinsetter with the switches **10** and **12** positioned in their appropriate locations. The first switch **10** is mounted on a stationary portion of the pinsetter structure, and it is actuated by a lever as will be described hereinafter. The interlock system **14** includes portions not shown in FIG. **1** as such has been omitted as it is not necessary for the understanding of how the controller of this invention functions. The interlock system has a deck lift shaft **42** mounted transversely through the pinsetter machine and structurally connected with the deck for raising and lowering same. Structural connection between the deck lift shaft **42** and the deck is not shown, however, the deck moves up and down to detect the presence of pins on the bowling lane and to place new pins. The deck lift shaft **42** has a protrusion **44** thereon which is engaged by a hook latch **46** mounted on a shaft **48.** The hook latch **46** is released from the protrusion **44** only when the deck is lowered to the floor setting new pins. The turret portion of the pinsetter includes a turret indexing cam **50** with a projection **52** extending therefrom at one point. A follower moving on the turret indexing cam is connected with a long link **54** which is connected to the rear interlock cross shaft **39** for movement thereof when the follower contacts the turret cam projection **52.** A pin release lever **56** is mounted above the turret indexing cam **50.** The turret interlock probe **58** is shown in position against the pin release lever **56.** The interlock system **14** has what is called a 180° stop interlock which is a control on the gearbox apparatus which will enable the clutch **28** to be released thereby stopping indexing of the turret in the event that pins are not available for placing in the deck. As the pinsetterr approaches the 180° position, the clutch release lever is brought under the control of the turret interlock to enable the clutch to be disengaged if necessary at the 180° position in the event that the deck has to wait for pins. When the deck is full and the last or tenth pin is placed therein, the turret cam projection **52** contacts the long link follower and such moves the long link to rotate the rear interlock cross shaft **39** and re-engage the clutch **28.**

The first switch **10** is mounted on a structurally stationary portion of the pinsetter structure and is actuated by an auxiliary lever **60** attached by a clamp **62** to the rear interlock cross shaft **39.** FIGS. **3** and **4** show in detail mounting of the first switch **10.** A structural brace member **64** extends transversely through the pinsetter machine, and such is used for a support of a turret jam microswitch **66** and for mounting the first switch **10.** The structural brace member **64** has a bracket **68** extending upward therefrom on which the turret jam microswitch **66** and the first switch **10** are attached in a side by side relation. The turret frame **70** has a rear portion with a protrusion **72** extending rearwardly therefrom. The turret jam microswitch **68** contacts the protrusion **72** on the rear of the turret frame **70.** The turret jam microswitch functions in the circuit of the pinsetter to stop its operation thereof in the event a pin or a foreign object becomes lodged between the deck and the turret. The rear interlock cross shaft **39** extends through the turret frame rear portion **70** as shown with the switch actuator lever **60** attached to the end portion of the shaft that extends beyond the frame **70.** Normally, the rear interlock cross shaft **39** extends beyond the frame **70** and it is fitted with a lock to hold the shaft in a fixed longitudinal position relative to the frame; this lock is removed and replaced by the lever **60.** The lever **60** has a clamp portion **62** for clamping it to the end portion of the rear interlock cross shaft **39.** The clamp portion **62** of the lever enables the lever to be properly adjusted in position on the rear interlock cross shaft **39** to contact switch **10.** The rear interlock cross shaft **39** rotates between two positions; a first position when the deck is raised and a second position when the deck is lowered. With the rear interlock cross shaft **39** in the first position (deck raised), lever **60** contacts switch **10** and holds the contacts of the switch open. With the rear interlock cross shaft **39** in the second position (deck lowered), lever **60** does not contact the switch **10** and the contacts of the switch are closed.

FIG. **6** shows a schematic diagram of the electrical circuit of this embodiment, (1), of the controller of this invention. The electrical circuit includes an input connector **74,** an output connector **76,** a transformer **78** and a solenoid operated relay **80,** having two sets of contacts, the switches **10** and **12** and a bypass switch **82.** The input connector is preferably a plug-like connector and is connectable in the circuit which normally provides power for the electric motor **18.** Electrical power supplied to the motor **18** is **220** volts single phase alternating current. The transformer **78** is connected to the wires **84** and **86** from the input connector **74** and it has an output of **24** volts alternating current which is used to operate the switches and the solenoid of the relay **80.** A ground wire **87** is provided between the connectors **74** and **76** for safety. The relay **80** is provided with two sets of contacts **88** and **90** which are normally open and are closed when the solenoid is energized. Switches **10** and **12** are preferably microswitch type switch structures enclosed in housings **92** and **94,** respectively. The bypass switch **82** is closable to complete the circuit and operate the motor **18.** The bypass switch **82** is provided to operate the machine for servicing purposes and it is not required for normal operation of the machine. In normal operation switch **82** is open as shown in FIG. **6** and has no effect on the machine. Switches **10** and **12** are normally open switches, open when the machine is idle and closed in operating sequence when the machine is in use. FIG. **6** shows switches **10, 12** and **82** in their normal open positions.

FIG. **5** shows the structure of the control box **16** which mounts the transformer **78,** relay **80,** input connector **74,** output connector **76,** and bypass switch **82.** The control box **16** includes a housing **100** which is mountable on an electrical conduit **102** existent on the pinsetter machines. The control box **16** has the male type input connector **74** rigidly mounted in the housing **100** so it can be engaged in an existing socket in the conduit **102.** The output connector **76** is preferably a female socket rigidly mounted in the housing and con-

nectable with the power line to the motor **18** by the plug **98.** The motor **18** has a power wire **96** with a male plug **98** on the end which is normally connected with a female socket mounted in the conduit **102** of the machine structure. Preferably, the housing structure **100** is attached to the conduit **102** by a holding strap **104** with a spacer member **106** placed between the conduit and the housing on the end opposite to the input connector **74** so the housing can be rigidly mounted on the conduit **102.** In practice, the controller of this embodiment, (1), of this invention is provided with the relay **80** preferably rated at 20 amps and 24 volts continuous duty. Practice has shown that power required for the 1 horsepower electric motor **18** is approximately 30 to 35 amps at starting time and operation of the motor requires 5 to 6 amps.

In the use and operation of the controller of this embodiment, (1), of this invention, the basic operation of the bowling pinsetter is no different than it is without the controller except that the motor **18** is stopped during the times when the pin distribution system of the pinsetter is idle or is not required for operation. Following is a description of operating characteristics of the pinsetter with and without the controller of this invention. The pinsetter controller of this embodiment, (1), is constructed and adapted for use on the identified pinsetters in the A-1 model and the A-1 model having the jet back modification. All pinsetters necessarily have three basic cycles which are dictated by the bowling game itself, such being the strike cycle, the first ball standing pin cycle, and the second ball standing pin cycle. In the strike cycle the bowler knocks all the pins from the end of the bowling lane; the pinsetter detects this and sets new pins on the end of the bowling lane. In the strike cycle for the model A-1 pinsetter the pin distribution system is required to operate approximately 12 seconds, and in the A-1 model with the jet back modification the pin distribution system is required to operate 10 seconds. During the strike cycle the motor is required to operate an additional time so that the pin distribution system can fill the deck with pins; this time is normally approximately 15 seconds, making a total of approximately 27 seconds, however, these times can be longer if a pin is delayed in the pin gathering apparatus portion of the pinsetter. In the second ball standing pin cycle the bowler has thrown two balls and a pin or pins are still standing on the end of the bowling lane; the pinsetter detects this; it removes the standing pins and sets new pins for the next player. The operating time for the pin distribution system of both A-1 model pinsetters in the second ball standing pin cycle is the same as the time for the strike cycle. In the first ball standing pin cycle the bowler has thrown one ball and pins remain standing on the end of the bowling lane; the pinsetter detects this and waits for the bowler to throw the second ball. The time required for the pin distribution system of the pinsetter to operate in the first ball standing pin cycle is 15 seconds for the A-1 model pinsetter and 12½ seconds for the A-1 model pinsetter with the jet back modification. In operation of the A-1 model pinsetter the operating time is comprised of 12 seconds for operation plus an additional 3 seconds for overtravel making the total of 15 seconds. In the A-1 model pinsetter with the jet back modification the operating time in the first ball standing pin cycle is comprised of 10 seconds for operation plus an additional 2½ seconds for overtravel making the total of 12½ seconds. During operation of the pinsetter without the controller of this invention, the motor will operate the pin distribution system as long as the machine is turned on; therefore, it will operate the pin distribution system during the times mentioned in the various cycles after the pins have been set on the bowling lane or left standing on the bowling lane until the bowler delivers the next ball to again start sequencing of the machine. In practice it has been observed that approximately 30 seconds lapse during the time when the pin distribution system is no longer needed and the bowler delivers the next ball where players are taking turns in succession. Obviously, this time may vary up to a few minutes or longer where players are not taking turns in rapid succession. With the automatic pinsetter controller of this invention, the motor of the pinsetter will run normally approximately 30 seconds as that is generally approximately the time required considering sufficient time for the deck to be filled in the strike cycle or second ball standing pin cycle. Obviously, in view of the observation as to player return times, without the controller of this invention the pinsetter will operate approximately 60 seconds per frame per bowler whereas with the controller of this invention, it will operate approximately 30 seconds per frame per bowler or in other words approximately 50 percent of the time when the machine is turned on for operation. The time which the pinsetter controller turns off the motor is the idling time of the machine that is unnecessary operation. Stopping the motor during this idling time stops the motion of 11 belts and numerous pulleys, bearings, etc., in the pinsetter machine which would otherwise be moving because of operation of the motor.

In the use and operation of the controller for automatic pinsetters of this invention, the operation of the controller of this embodiment, (1), is as follows during the several operating cycles of the pinsetter. Operation of the pinsetter controller in the strike cycle and the second ball standing pin cycle is the same regardless of the operating differences in the function of the pinsetter mechanism. When the ball is thrown and the ball impacts at a trigger mechanism of the pinsetter which rotates the starter bell crank **36** pulling the clutch latch **34** from the clutch actuator link **32** which lets the plunger lever **31** rotate counterclockwise to raise the arm **41** of the switch **12** thereby closing the contacts of the switch **12** and starting the motor **18** which operates the pin distribution system. Switch **10** closes as the rear interlock cross shaft **39** is rotated when the deck is full and descends to the floor for setting new pins. Switch **12** opens when the starter bell crank **36** is rotated clockwise replacing the clutch latch **34** in the clutch actuator link **32** when the clutch **28** is disengaged. Opening the contacts of the switch **12** at this time has no effect on operation of the motor **18** due to switch **10** being closed, thus completing the circuit as can be seen in examining FIG. **6.** As the motor continues to operate the deck is raised; when it is in the proper position, the rear interlock cross shaft **39** rotates so that the lever **60** contacts switch **10** opening the contacts thereof. Opening the contacts of switch **10** at this time stops operation of the motor **18.** When the motor stopped at this time, it will remain stopped until the next bowler throws his ball at the new set of pins just placed on the end of the bowling lane. Without the controller of this invention, the motor **18** would continue to operate and

idle the complex mechanism of the pinsetter. In the first ball standing pin cycle the sequence of operation of the controller is slightly different from the strike cycle and the second ball standing pin cycle. When the ball is delivered and impacts at the pinsetter with the appropriate trigger mechanism, the starter bell crank **36** is rotated counterclockwise pulling the clutch latch **34** from the clutch actuator link **32,** thus moving the arm **41** of switch **12** to close the contacts of the switch and start the motor. In this cycle the deck moves in a detecting motion to check for the presence of standing pins on the end of the bowling lane and the rear interlock cross shaft **39** is not rotated to close the contacts of switch **10,** thus switch **10** has no effect on the operation of the pinsetter in this cycle. When the function of the cycle is completed and the starter bell crank **36** is rotated clockwise replacing the clutch latch **34** in the clutch actuator link **32,** the arm **41** of switch **12** is moved to open the contacts of the switch thereby stopping the motor **18.** In this first ball standing pin cycle the operation of the motor in the A-1 model pinsetter is completed in 15 seconds, and in the A-1 model pinsetters with the jet back modification such is completed in 12½ seconds. At the end of the first ball standing pin cycle the bowler will deliver one additional ball in an attempt to knock the remaining pins from the end of the bowling lane. From the time when the motor **18** is stopped at this point by the controller until the time the bowler delivers the second ball the motor **18** will not operate so that the described portions of the mechanism will not idle.

In practice it has been found through operation of the identified pinsetters for a considerable length of time with the controller that use of the controller, (1), of this embodiment of this invention to stop and start the motor **18** as described does not adversely affect the functioning of the pinsetter or the motor. Additionally, it has been found that a considerable savings of electrical power can be made by using the controller for automatic pinsetters of this invention as it operates the motor only approximately one-half the time which it would be operated without the controller of this invention.

An additional embodiment, (2), of the controller for automatic pinsetters of this invention is provided for using the controller with the A-2 model of the identified pinsetter. The controller effects the general operation of the A-2 model pinsetter the same as that for the first described embodiment, (1), of the controller of this invention in that it stops operation of the motor for the pin distribution system during idle periods. Normal operation of the A-2 model pinsetter is such that it requires approximately 8 seconds to operate in either the strike cycle or the first ball standing pin cycle. However, in the first ball standing pin cycle approximately 14 seconds is required for proper operation of the pinsetter to load the deck with pins in order to complete the cycle. In the second ball standing pin cycle or the strike cycle, the pinsetter may run from 14 to 25 seconds depending upon the time it takes the pins to move through the distribution system to fill the deck.

The structure of the controller for automatic pinsetters of this embodiment, (2), of this invention, is substantially the same as the first described embodiment, (1), of the invention with the exception that a delay relay apparatus is included to insure operation of the motor for a predetermined certain period of time so the controller will allow enough time for proper operation of the A-2 model pinsetter. The controller of this embodiment, (2), uses the same pair of switches mounted with the clutch actuator mechanism in the pinsetter interlock system as described in detail above. For clarity in description the switches of this embodiment, (2), of the controller are referred to by the same numerals **10,** 12 and **82** for the switches mounted in the structure described above. The electrical circuit for the controller of this embodiment, (2), is shown in FIG. **7,** the switches and their mountings are the same as shown in FIGS. **1–5.** The pinsetter structure shown in FIGS. **1** and **2,** particularly the clutch actuator mechanism, is the mechanism for the A-2 model of the pinsetter. The structure of the pinsetter mechanism shown in FIGS. **1** and **2** is essentially the same for all models of the pinsetter except that the A-2 model uses the cycle solenoid **35** to rotate the starter bell crank **36** whereas the other models use a mechanical linkage to accomplish the same result as noted, supra. Operation of the A-2 model pinsetter is substantially described above in conjunction with the description of the operation of the pinsetter and the description of the first embodiment, (1), of this invention. The operation of the pinsetter in the A-2 model pinsetter is no different with the exception that the cycle solenoid **35** rotates the starter bell crank **36** at the appropriate times in the operating cycle. Operation of the A-2 model pinsetter is more rapid than the A-1 model pinsetter and the A-1 model pinsetter with the jet back modification. This increase in speed is accomplished by changing the size of certain pulleys in the drive portion of the apparatus and refining other portions of the model A-1 machines in order to increase the operating speed. The cycle solenoid **35** rotates the starter bell crank **36** for pulling the clutch latch **34** from the clutch actuator link **32** in a substantially instantaneous motion. Increased speed of the pinsetter allows the mechanical apparatus of the pinsetter to accomplish the same functions in a shorter time than possible with the A-1 model machines. Approximately 8 seconds is required for the mechanism of the A-2 model pinsetter to complete an operating cycle. Speeding up the operation of the mechanical portions of the apparatus does not necessarily speed the pin movement from the pin gathering apparatus into the deck as pin movement depends upon agitation of the pins in the pit and their movement into the pin elevator, conveyor, etc. In the strike cycle or the second ball standing pin cycle the pinsetter must run from 14 to 25 seconds depending upon the time it takes the pins to move through the pin gathering apparatus, the conveyors, etc., and fill the deck. Since switch **10** which controls turning off the motor when the machine is operating in the strike cycle or the second ball standing pin cycle the controller will function to turn off the motor when the deck is raised at the end of either of these cycles without regard to the 8 second operating time of the other portion of the machine. In the first ball standing pin cycle approximately 14 seconds is required for proper operation of the A-2 model pinsetter which is approximately 6 seconds longer than the approximate 8 seconds operating time of the gearbox portion of the machine. Inasmuch as the clutch actuation mechanism is used by the controller for stopping and starting the motor in the first ball standing pin cycle, the delay relay portion of the apparatus is required to prevent the motor from being turned off prematurely. The delay

relay apparatus is provided in the controller of this embodiment, (2), to extend operation of the motor for approximately a 6 second period after the time when the clutch **28** is disengaged so the motor will operate for the normal time (approximately 14 seconds) required for the first ball standing pin cycle.

FIG. **7** shows in detail the electrical circuit for the controller of this embodiment, (2). The electrical circuit for the controller of this embodiment, (2), generally similar to that described above and is provided with the operating switches **10** and **12** and the bypass switch **82** and it additionally includes the delay relay apparatus which is indicated generally at **110.** The controller includes an input connector **112,** a transformer **114,** a solenoid operated relay **116** having a pair of contact sets **118** and **120,** an output connector **122,** the switches **10, 12** and **82** and the delay relay portion of the apparatus **110.** The delay relay apparatus **110** includes an electric motor **124** having a cam **126** mounted on its output shaft to operate a switch that is indicated generally at **128.** Leads or wires **132** and **134** from the input connector **112** are connected to the output connector **122** via the contact sets **118** and **120** of the solenoid operated relay **116.** A ground wire **130** is provided connected between the input connector **112** and output connector **122** for safety. The transformer **114** is connected with the leads **132** and **134** from the input connector **112.** One wire **136** from the transformer **114** is connected to one side of switches **10, 12** and **82** with the switches being connected in a parallel relation. Switches **10** and **82** are connected by a wire **138** with the coil of the solenoid operated relay **116.** Switch **12** is connected by a wire **142** to wire **138.** Switch **128** has one contact **144** connected with switch **12** and the other contact **146** connected with a wire **148** joining it with the transformer output wire **136.** The motor **124** has one power input wire **150** connected with the output side of switch **12** and the other power input wire **152** connected with the transformer output wire **140.** Switch **128** has an extended actuator arm with a cam follower **154** mounted on the outer end portion thereof. The cam **126** has an offset portion **156** which is indented relative the perimeter portion of the cam for detection by the cam follower **154.** Preferably, the cam **126** has a circular perimeter with the cam offset **156** being a substantially flat portion as shown in FIG. **7** so that the cam follower **154** will move the actuator arm of the switch **128** to open and close its contacts **144** and **146.** Preferably, the motor **124** is an electrical motor connected with a gear drive to rotate the cam **126** through one complete rotation in approximately 14 seconds so that the contacts of the switch **128** can be closed for approximately 14 seconds then opened.

In operation of the controller of this embodiment, (2), the delay relay apparatus provides for a connection between the transformer **114** and the solenoid actuated relay **116** which will be maintained for approximately 14 seconds from the time cyclic operation of the machine is begun. At the start of a cycle of the machine, switch **12** is moved to the closed position as the clutch plunger lever **31** is rotated counterclockwise. This starts the motor **124** which rotates the cam **126** and closes the contacts of switch **128.** As the motor **124** rotates the cam **126,** switch **128** maintains electrical connection between the transformer output wire **136** and the solenoid coil wire **138** through wires **148** and **142.** Approximately 8 seconds after switch **12** is moved to the closed position it is moved to the open position as the clutch **28** is disengaged and the clutch plunger lever **31** rotates clockwise as described above, however, electrical connection is maintained through switch **128** as described so that relay **116** remains in the closed position and the motor **18** continues to operate. Electrical power for the delay relay apparatus motor **124** is supplied to wires **150** and **152** through switch **128** and wire **140.** Fourteen seconds after the start of a cycle and approximately 6 seconds after the end of the cycle when switch **12** is moved to the open position the cam's flat or offset portion **156** moves under the cam follower **154** and switch **128** is opened, thereby opening the electrical connection between the transformer **114** and the solenoid coil of the relay **116** which in turn stops operation of the motor **124** and at the same time opens the contact sets **118** and **120** of the relay to stop the motor **18.**

In regard to the structure of the controller for automatic pinsetters of this embodiment, (2), the switches **10** and **12** are preferably microswitch type switches enclosed in housings as illustrated in the drawings with the delay relay apparatus **110,** the solenoid actuated relay **116,** the transformer **114,** and the input and output connectors **112** and **122** mounted in a control box similar to that shown in FIG. **5.** The motor **18** driving the pinsetter apparatus is a 220 volt alternating current electric motor of approximately one horsepower. The transformer **114** is preferably provided with windings to convert 220 volt power normally supplied to the motor to 24 volts alternating current for operation of the relay **116** and the motor **124** of the delay relay apparatus **110.** The input connector **112** is preferably a male type connector rigidly mounted in the control box housing so that it can be engaged in an existing socket in the pinsetter structure which is provided for connecting the motor **18** in the pinsetter's electrical circuit. The output connector **122** is preferably a female socket rigidly mounted in the control box housing so as to be connectable with the plug of the power line for the motor **18.** Preferably, the relay **116** is rated at 20 amps and 24 volts continuous duty, which in practice has shown to be sufficient to operate the one horse power motor as it requires only 5 to 6 amps for operation.

In the use and operation of the controller for automatic pinsetters of this invention, the operation of the controller in this embodiment, (1), is as follows during the several operating cycles of the A-2 model pinsetter. Operation of the controller in the strike cycle and in the second ball standing pin cycle is the same regardless of the operating differences in the pinsetter mechanism. When the ball is thrown and impacts at the trigger mechanism of the pinsetter, the cycle solenoid **35** rotates the starter bell crank **36** pulling the clutch latch **34** from the clutch actuator link **32;** this lets the plunger lever **31** rotate counterclockwise to raise arm **41** of the switch **12** thereby closing the contacts of switch **12** and starting the motor **18** which operates the pin distribution system and the motor **124** of the delay relay apparatus **110.** Switch **10** closes as the rear interlock cross shaft **39** is rotated when the deck is full and descends to the floor for the setting of new pins. Switch **12** opens approximately 8 seconds after it is closed, specifically when the starter bell crank **36** is rotated clockwise replacing the clutch latch **34** in the clutch ac-

tuator link **32.** Opening of switch **12** at this time has no affect on operation of the motor **18** since switch **10** is closed, thus completing the circuit as can be seen in examining FIG. **7.** As the motor **18** continues to operate the deck is raised; when it is in the proper position the rear interlock cross shaft **39** rotates and lever **60** contacts switch **10** opening same. Normally, switch **10** is opened later than **14** seconds after the start of this strike cycle or second ball standing pin cycle, which would be after switch **128** is opened, therefore, opening the contacts of switch **10** at this time stops operation of motor **18.** In other words, approximately 14 seconds after switch **12** is closed switch **128** is opened which will stop operation of the motor **124** in the delay relay apparatus, however, this will have no affect on the operation of motor **18** since switch **10** is closed as it usually is when the deck is being filled with pins. Operating time of the pinsetter in the strike cycle or the second ball standing pin cycle may vary from 14 seconds to 25 seconds depending upon the time required to fill the deck and move it to the proper position so switch **10** will be opened. At the end of the strike cycle or second ball standing pin cycle, motor **18** is stopped and will remain stopped until the next bowler throws his ball at the new set of pins just placed on the end of the bowling lane.

The first ball standing pin cycle for the A-2 model pinsetter begins when the ball is delivered and impacts at the trigger mechanism with the cycle solenoid **35** being actuated to rotate the starter bell crank **36** in a counterclockwise manner pulling the clutch latch **34** from the clutch actuator link **32,** thus moving arm **41** of switch **12** to close the contacts of the switch which in turn closes the contacts of relay **116** starting motor **18.** In this cycle the deck moves in a descending motion to check for the presence of standing pins on the bowling lane and returns to the raised position, the rear interlock cross shaft **39** is not rotated to close the contacts of switch **10.** Switch **10** remains open and has no affect on operation of the pinsetter in the first ball standing pin cycle. At the time switch **12** is closed the motor **124** in the delay relay apparatus **110** is started and switch **128** is closed. Approximately 8 seconds after the start of the cycle switch **12** is opened as the cycle solenoid **35** is released and the starter bell crank **36** rotates clockwise replacing the clutch latch **34** in the clutch actuator link **32** and arm **41** of switch **12** is depressed opening the contacts of the switch. Electrical connection in the controller is maintained to hold the solenoid **116** in the closed position by the delay relay apparatus **110** so that the motor **18** will continue to operate. Approximately 14 seconds after the start of the cycle or approximately 6 seconds after the opening of switch **12,** the delay relay apparatus **110** causes the relay **116** to be opened thereby stopping the motor **18.** As the end of 14 second time period approaches the cam **126** of the motor **124** is rotated so that the cam follower moves onto the cam's flat portion **156** thereby opening the switch **128** at the end of the time period to disconnect the coil of the relay **116** so that the contact sets **118** and **120** of the relay **116** open thus stopping the motor **18.** At the end of the first ball standing pin cycle the bowler will deliver one additional ball in an attempt to knock the remaining standing pins from the end of the bowling lane. From the time the motor **18** is stopped at the end of the first ball standing pin cycle (approximately 14 seconds from the start of the cycle), the motor **18** will remain stopped until the bowler delivers his second ball. When the next ball is delivered, the machine will begin the second ball standing pin cycle.

In practice, it has been found that the operation of a pinsetter of the identified model of pinsetters having the controller of this embodiment, (2), to stop and start the motor **18** does not adversely affect the structure of the pinsetter or the motor. Additionally, it has been found that a considerable saving of electrical power can be made by using the controller of this embodiment of this invention with the A-2 model pinsetters because such controls the motor to operate approximately one-half of the time it would normally operate without the controller of this invention. The time of operation for this pinsetter in the first ball standing pin cycle is approximately 14 seconds. It has been observed that approximately 30 seconds lapse during the time when the pin distribution system is no longer needed for operation and when the bowler or the next bowler delivers the next ball when players are taking turns in succession. Obviously, the time between ball deliveries may vary from a few seconds to a few minutes depending upon the manner of play of the bowler or bowlers. In view of these observations as to players times and machine operating times, it is obvious that the pinsetter would operate at least 55 to 60 seconds per frame per bowler whereas with the controller of this invention, it will operate from approximately 28 seconds per frame per bowler or in other words approximately 50 percent of the time when the pinsetter is turned on for operation. It is to be emphasized that the pinsetter controller of this embodiment, (2), turns off the motor when it is needlessly idling portions of the machine after a time sufficient for the machine to function or after the machine has completed necessary operations. Stopping of the motor during this idling time stops the motion of 11 belts and numerous pulleys, bearings, etc., in the pinsetter machine which would otherwise be kept in motion because of the continued operation of the motor.

In the manufacture of the controller for automatic pinsetters of this invention, it is obvious that same can be easily constructed to achieve the end product. The controller structure including the electrical circuit thereof is generally uncomplicated and, therefore, easy to manufacture. Preferably, the controller is constructed with portions thereof mounted in a removably connectable control box so the controller can be added to existing machines as a modification. It is to be understood that the controller can be incorporated in the structure and electrical circuit of pinsetters in a permanent construction or in an original construction when the machine is built initially.

In the use and operation of the controller for automatic pinsetters of this invention, it is seen that same provides a substantial reduction of the operating time for the motor powering the pin distribution system of an automatic bowling pinsetter. The controller is specifically constructed and adapted for use on the above-identified models of the pinsetter and it is constructed such that it can be adapted for use on other pinsetters of the same general type or nature if desired. Practice has shown that the controllers of this invention substantially reduce wear on the pinsetter structure particularly in the pin distribution system thereof which considerably lengthens the life of the elements of the pinsetter thereby reducing necessity for periodic mainte-

nance and part replacement which in turn reduces the operating cost of the machine. Practice has shown that operating the pin distribution system for a shorter period of time by using the controller of this invention it results in a considerable reduction in electrical power required to operate the pinsetter therefore a direct reduction in operating cost and a reduction in use of electrical power.

As will become apparent from the foregoing description of the applicant's controller for automatic pinsetters, relatively inexpensive and simple means have been provided to reduce the normal operating time of the pin distribution system of an automatic bowling pinsetter machine. The controller structure is economical to manufacture, simple to install on the pinsetter structure and functions in conjunction with the control system for the pinsetter without modifying the operation of the pinsetter other than to start and stop operation of the motor powering the pin distribution system of the pinsetter during periods when it is not necessary for the motor to operate. The controller of this invention is usable to reduce the cost of operating a bowling pinsetter by reducing the power requirements therefor and reducing the wear on portions of the mechanical system.

While the invention has been described in conjunction with preferred specific embodiments thereof, it will be understood that this description is intended to illustrate and not limit the scope of the invention which is defined by the following claims.

I claim:

1. In an automatic bowling pinsetter having a pin distribution system powered by an electric motor, a clutch means connected to said motor, a raisable and lowerable means of said pin distribution system to receive bowling pins and set same on a bowling lane, a controller therein and therewith, comprising:

a. a first switch means mounted with said pinsetter operable by motion of said raisable and lowerable means and electrically connected to said motor, and

b. second switch means mounted with said pinsetter operable by motion of said clutch means and electrically connected in parallel relation to said first switch means,

said motor being controlled by said first switch means and said second switch means, said motor being operable when either said first switch means or said second switch means are in a closed relation, said motor being not operable when both said first switch means and said second switch means are in open relation, said raisable and lowerable means and said clutch means having operating cycles such as to maintain one or the other of said switch means closed only for a sufficient period of time during the cycling of the pin distribution system to enable the pin distribution system to perform the pin handling operations required of it.

2. The controller of claim **1,** wherein:

a. said clutch means has an actuator means therefor, and

b. said second switch means has an actuator means contactable by said clutch means being closable when said clutch actuator means engages said clutch means.

3. The controller of claim **2,** wherein:

a. said pin distribution system has an interlock means operably coupled with said raisable and lowerable means, and

b. said first switch means has an actuator means contactable by said interlock means, said second switch means being closable when said raisable and lowerable means lowers to set new pins.

4. The controller of claim **3,** wherein, said controller has a relay means connected to said first switch means, said second switch means, and said motor, said relay means being closable to electrically connect said motor to a source of electrical power when either said first switch means or said second switch means are closed and said relay means being openable to electrically disconnect said motor from said power source when said first switch means and said second switch means are open.

5. The controller of claim **4,** wherein:

a. said clutch actuator means has a clutch plunger lever movably mounted and movable between a first position when said clutch means is disengaged and a second position when said clutch means is engaged,

b. said second switch means actuator means has an arm member contactable with said plunger lever member when said plunger lever member is in said first position to open said second switch means,

c. said interlock system has a shaft movably mounted with a deck frame means of said raisable and lowerable portion, movable between a first position when said raisable and lowerable means is in a raised position and a second position when said raisable and lowerable means is in a lowered position,

d. said first switch means has a lever member rigidly mounted on said shaft, and

e. said first switch means actuator means is contactable with said lever member when said shaft is in said first position to open said first switch means.

6. The controller of claim **5,** wherein:

a. said controller has a bypass switch means electrically connected in a parallel relation to said first switch means and said second switch means, said bypass switch means being normally open and being manually closable to actuate said relay means for electrically connecting said motor with said source of electrical power independently of said first switch means and said second switch means, and

b. said controller is removably connectable with said motor and said electrical power source.

7. In an automatic bowling pinsetter having a pin distribution system powered by an electric motor, a clutch means connected to said motor, a raisable and lowerable means of said pin distribution system to receive bowling pins and set same on a bowling lane, a controller therein and therewith, comprising:

a. a first switch means mounted with said pinsetter operable by motion of said raisable and lowerable means and electrically connected to said motor,

b. second switch means mounted with said pinsetter operable by motion of said clutch means and elctrically connected in parallel relation to said first switch means, and

c. a delay relay means electrically connected to said second switch means and said motor,

said motor being controlled by said first switch means and said second switch means, said motor being operable when either said first switch means or said second switch means are in a closed relation, said delay relay

means being operable to electrically connect said motor with a source of electrical power for a predetermined and certain time after said second switch means is closed, said raisable and lowerable means and said clutch means having operating cycles such as to maintain one or the other of said switch means closed only for a sufficient period of time, including said predetermined and certain time, during the cycling of the pin distribution system to enable the pin distribution system to perform the pin handling operations required of it.

8. The controller of claim **7,** wherein:

a. said clutch means has an actuator means therefor, and

b. said second switch means has an actuator means contactable by said clutch means being closable when said clutch actuator means engages said clutch means.

9. The controller of claim **8,** wherein:

a. said pin distribution system has an interlock means operably coupled with said raisable and lowerable means, and

b. said first switch means has an actuator means contactable by said interlock means, said second switch means being closable when said raisable and lowerable means lowers to set pins.

10. The controller of claim **9,** wherein:

a. said controller has a relay means connected to said first switch means, said second switch means, and said motor, said relay means being closable to electrically connect said motor to a power source when either said first switch means or said second switch means are closed and said relay means being openable to electrically disconnect said motor from said power source when said first switch means and said second switch means are open, and

b. said delay relay means has a timer means with a timer switch means, said timer means is electrically connected with said second switch means and startable when said second switch means is in use closed, said timer switch means is electrically connected with said source of electrical power and said relay means, said timer switch means being closable upon starting of said timer means and openable at the end of said predetermined certain time.

11. The controller of claim **10,** wherein:

a. said clutch actuator means has a clutch plunger lever movably mounted with said pinsetter and movable between a first position when said clutch means is disengaged and a second position when said clutch means is engaged,

b. said second switch means actuator means has an arm member contactable with said plunger lever member when said plunger lever member is in said first position to open said second switch means,

c. said interlock system has a shaft movably mounted with a deck frame portion of said raisable and lowerable means, movable between a first position when said raisable and lowerable means is in a raised position and a second position when said raisable and lowerable means is in a lowered position,

d. said first switch means has a lever member rigidly mounted on said shaft,

e. said first switch means actuator means is contactable with said lever member when said shaft is in said first position to open said first switch means,

f. said timer has a motor with a cam mounted on its output shaft, said cam having an offset portion, and

g. said timer switch means has a cam follower contacting said cam, said timer switch means being openable in use when said cam follower contacts said offset portion of said cam.

12. The controller of claim **11,** wherein:

a. said controller has a bypass switch means electrically connected in a parallel relation to said first switch means and said second switch means, said bypass switch means being normally open and being manually closable to actuate said relay means for electrically connecting said motor with said source of electrical power independently of said first switch means and said second switch means, and

b. said controller is removably connectable with said motor and said electrical power source.

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