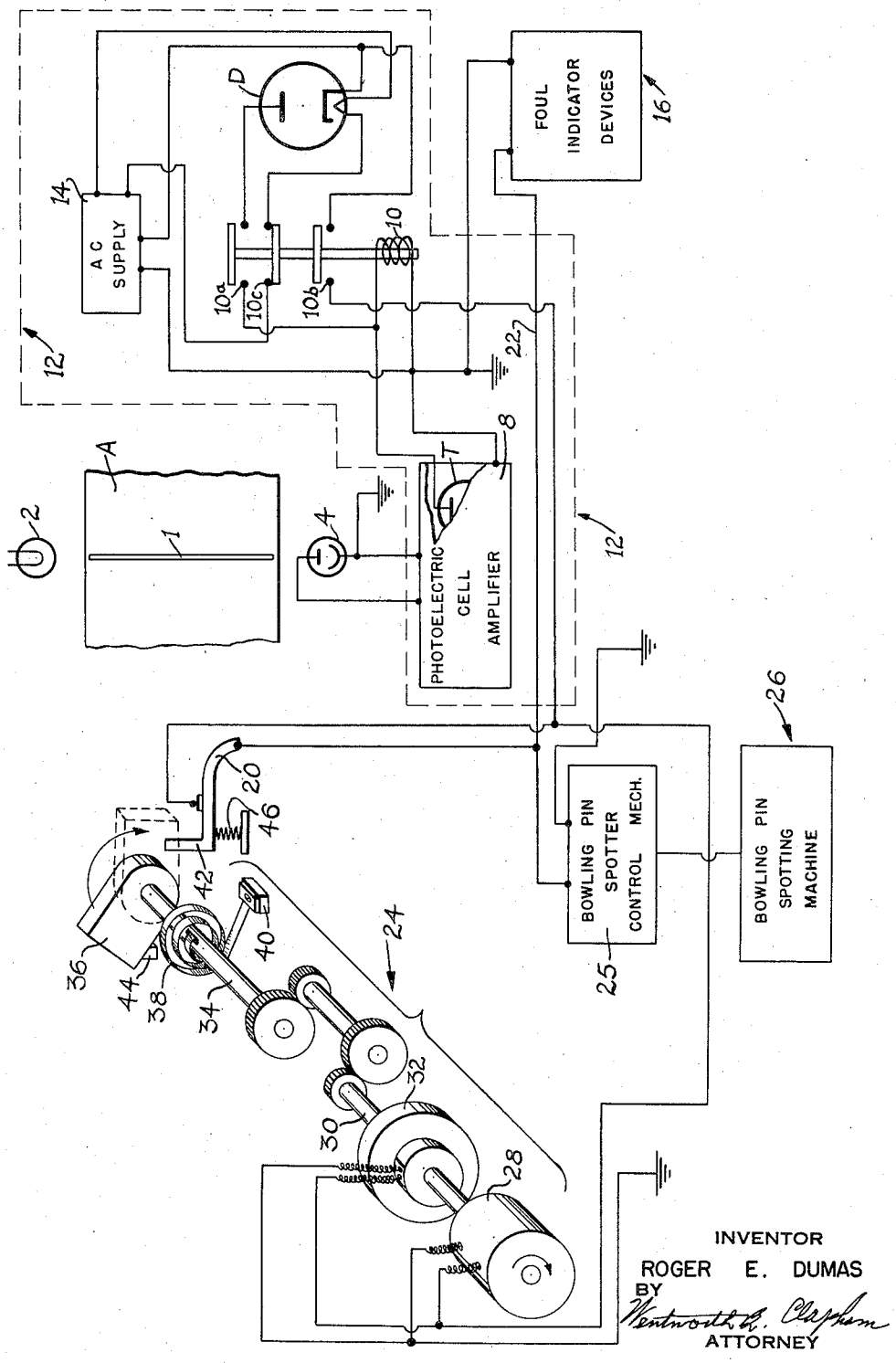
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FOUL DETECTING AND CONTROL MECHANISM

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FOUL DETECTING AND CONTROL MECHANISM

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This invention relates to bowling pin spotting machines, and more particularly to mechanism for adapting a foul detecting device of the thermal type for use with an automatic bowling pin spotting machine such that the foul detecting device will not remain in operation longer than a predetermined uniform length of time. The invention therefore insures that a bowling pin spotting machine, operated in conjunction with a thermal type of foul detecting device, will be properly controlled when a foul is made, and when the next ball is rolled subsequent to the commission of a foul.

In accordance with certain prescribed recognized rules of play, a foul should not be signalled for more than twelve seconds after it occurs. When certain types of automatic foul detecting devices, such for example as a thermal type, are used with a bowling pin spotting machine of the type disclosed in Broekhuysen Patent 2,559,274, or in a machine embodying the control mechanism disclosed in my copending application, Serial Number 412,187, filed February 2, 1954, for Bowling Pin Spotting Machine Control Mechanism, the thermal elements in the detector and signaling device age, their characteristics change, and the period of operation increases such that the required time limit cannot be maintained. A more practical disadvantage arises because of this situation since it is known that the time delay in the cooling of a thermal type detector may extend up to twenty-four seconds. Thus it can be seen if this length of time must elapse before a bowling pin spotting machine provided with this type of foul detector goes into operation for the next ball rolled subsequent to the declaration of a foul, a great deal of time, which otherwise could be used in the continuing play of the game, is lost. Thus the invention prevents the machine from making two foul cycles when only one is required.

The present invention solves the problems discussed above because it provides means for automatically limiting the operative connection of a thermal type foul detecting device with an automatic bowling pin spotting machine to a pre-set time well within the requirement of the rules of bowling, such for example as the rules of play prescribed by the American Bowling Congress. In the embodiment selected for purposes of illustration, the invention comprises timing mechanism provided with a motor which is automatically set into operation when a foul is declared to drive a shaft having an operating arm which actuates a control switch. When this switch is actuated, at a predetermined time after a foul is declared, the control mechanism of the bowling pin spotting machine which is normally connected to the foul detecting device, is disconnected from the foul detecting device so that the failure of the foul detecting device to reset within the prescribed time will not cause incorrect operation of the automatic bowling pin spotting machine on the next ball rolled. The motor stalls after the switch is operated and stays in operation until the thermal element of the foul detecting device cools and the foul detecting device is reset. When the motor is de-energized, a magnetic clutch coupling the motor to the shaft which supports the switch actuating arm, is also de-energized, and the arm is returned to its initial inoperative position. In this manner, any foul signal duration greater than that desired, say twelve seconds, is prevented from causing the incorrect operation of the bowling pin spotting machine on the next ball rolled subsequent to the declaration of a foul.

It is an object of the invention to provide a foul detector control mechanism which is operative to prevent the operation of a foul detector beyond a predetermined period of operation.

It is a further object of the invention to provide a control device operative to adapt a foul detector of the thermal type for coaction with an automatic pin spotting machine such that the aging of the thermal element or elements of the detector has no effect upon the proper operation of the machine, and the latter operates at all times within prescribed time limits.

With these and other objects not specifically mentioned in view, the invention consists in certain combinations and constructions which will be fully described hereinafter, and then set forth in the claims hereunto appended.

The drawing shows a preferred embodiment of the invention including a suitable wiring diagram for effecting the purposes thereof.

Referring to the drawing, A indicates a portion of a conventional bowling alley provided with the usual foul line 1. At one end of the foul line is located a conventional focused light source 2 which projects a beam of light across the foul line 1 to a photoelectric cell 4 connected to a conventional type of photoelectric cell amplifying mechanism 8. This mechanism is so designed and constructed that short interruptions, such as caused by the mere passage of a bowling ball through the beam of light, will not operate the photoelectric cell amplifying mechanism. However, longer interruptions, such as caused by the foot of a bowler moving across foul line 1 in fouling, will cause output tube T of the amplifying mechanism to conduct and operate a direct current type relay 10. In the drawing, tube T is only partially shown since it is considered unnecessary to show all details of the photoelectric cell amplifying mechanism 8 in order to understand the invention. Tube T may be a type 6J5.

The foul detecting device indicated generally 12 may be a thermal type such as type T–44, manufactured by Brunswick-Balke-Collender Co., Muskegon, Michigan. Obviously any other thermal type detecting device could be adapted for use in accordance with the invention. In the drawing, only as much of the foul detecting device is shown as is considered necessary to a full understanding of the invention.

Foul detecting device 12 is provided with a suitable A. C. current supply 14 to which the heater of an electronic valve D is connected. Normally, the heater or filament of electronic valve D is heated because of the fact that contacts 10*c* of relay 10 are normally closed. Electronic valve D may be of any suitable type such as a 6V6, diode connected. When relay 10 is energized, as noted above, contacts 10*a* and 10*b* are closed and pulsating direct current immediately flows through tube D, contacts 10*b*, and the coil of direct current relay 10, thereby locking in relay 10. Relay 10 remains locked in until the heater or filament of diode D cools to a point where the stream of electrons through diode D substantially ceases, whereupon relay 10 is de-energized. As the result of the closing of contacts 10*a*, current flows from the A. C. supply 14 through contacts 10*a*, switch 20 and line 22 to the foul indicating devices designated 16, thereby making known to the player that he has

fouled. The foul indicating devices may be a conventional bell signal (not shown) and/or a signal light (not shown).

Since it is essential, in order to comply with the rules of bowling, that the operation of an automatic pin spotting machine be correct both during the ball cycle when a foul was made, and during the next subsequent ball cycle, and since it is known that as diode D ages, its heater cools more slowly, it follows that the operation of the thermal type foul detecting device will continue beyond the desired and prescribed period. Therefore when a foul detecting device of this type is connected to an automatic bowling pin spotting machine, the machine will not operate properly insofar as elapsed time and insofar as the next subsequent ball cycle is concerned if the resetting of the foul detector, after the declaration of a foul, is delayed in excess of the prescribed time, for example, twelve seconds. In accordance with the present invention, mechanism is provided for insuring that the operative connection between the foul detecting device and the automatic pin spotting machine is interrupted after a prescribed period of time so that inaccuracies in the resetting time of the foul detector **12** will not cause incorrect operation of an automatic bowling pin spotting machine and will not delay the rolling of the next ball.

In the embodiment of the invention selected for purposes of illustration, there is provided a timing mechanism designated generally **24** which operates automatically on each declaration of a foul to control properly the operation of the machine control mechanism designated **25** of the bowling pin spotting machine designated generally **26**. Timing mechanism **24** consists of a suitable timing motor **28**, such as a Hayden motor, having an output shaft **30**. Motor **28** is provided with a magnetic clutch **32** which will mechanically disconnect motor **28** from the output shaft **30** when power to the motor is cut off. Output shaft **30** through intermediate gears and shafting, drives a shaft **34** on the end of which is mounted an arm **36** adapted to turn with shaft **34** and at the proper time open normally closed switch **20**. Arm **36** is spring loaded by means of a torsion spring **38** having one end connected to shaft **34** and its other end connected to a block **40** suitably mounted on the frame of the mechanism (not shown). Arm **36** is so positioned on shaft **34** that when the latter is rotated approximately one-half of a revolution, arm **36** engages switch actuating arm **42**, moves it downwardly, as viewed in the drawing, and thereby opens the normally closed contacts of switch **20**. This movement of arm **36** from its rest position shown in full lines in the drawing, to its switch operating position, shown in broken lines in the drawing, requires twelve seconds. Obviously the period of time required to move arm **36** from its rest position to switch operating position can be varied by providing suitable adjusting means to increase or decrease its movement from stop **44** to switch operating position. One way of accomplishing this adjustment is to provide means (not shown) for raising or lowering stop **44** relative to arm **36**.

As a result of the engagement of arm **36** with switch actuating arm **42** of switch **20**, the torque on shaft **34** is increased due to the action of spring **46** on arm **42**, and timer motor **28** stalls after the opening of the normally closed contacts of switch **20**. These normally closed contacts of switch **20** remain open until power is interrupted by the resetting of foul detecting device **12**, occurring as a result of the cooling of diode D heater to such a point that relay **10** is de-energized and contacts **10***a* are opened. Stalling of this type of motor does not injure it because of its limited power of from two to four watts.

When the foul detecting device resets, contacts **10***a* are opened, thereby interrupting the flow of current to motor **28** and clutch **32**, whereupon clutch **32** disengages and shaft **34** is rotated by a spring **38** in a counter-

clockwise direction as viewed in the drawing, thereby returning arm **36** to its inactive position against stop **44** suitably mounted on the frame (not shown) of the mechanism. When this occurs, spring **46** moves operating arm **42** of switch **20** to again close its contacts.

It will be seen that as the result of the opening of contacts of switch **20**, the operation of foul detecting mechanism **12** is stopped. This is particularly important with respect to the use of thermal type foul detecting device with bowling pin spotting machine **26**, which may be of the type referred to above as disclosed in the Broekhuysen patent and in the Dumas application. If a thermal type foul detecting device such as **12**, were used with either of the machines shown in the patent and/or application, and the period of operation of the detecting mechanism extended beyond the desired period of twelve seconds, it could affect the proper operation of the bowling pin spotting machine. For example, if the period of operation of foul detecting device orginally was twelve seconds when the tube D was operating properly, or was new, there would be no serious disadvantage in its use with bowling pin spotting machine **26**. However, if the period of operation of foul detecting mechanism **12** becomes twenty or more seconds, it can be seen that when a foul is declared, after the fouling of a first ball of a frame, it would prevent the machine from being ready for the rolling of the second ball of a frame until twenty or more seconds have elapsed. Since the period of time required for the machine to return the ball is approximately sixteen seconds, unless the foul detecting mechanism resets in a shorter period of time, bowling pin spotting machine **26** would not be ready for the second ball until after the completion of the time duration of the thermal type foul detecting mechanism. Thus time would be lost, and a bowler would be uncertain as to whether or not he should roll a ball because the signalling means of the foul indicating device **16** are still in operation. If a second ball were rolled while the foul detecting device is still operated as the result of a first ball foul, it would be apparent that the foul detecting mechanism still was in control of the bowling pin spotting machine control mechanism **25**, and that if a second ball were rolled, it would be counted as a foul and the machine would operate accordingly. In accordance with the present invention, however, the arrival of a ball in the pit (not shown) operates the pit switch mechanism (not shown) of bowling pin spotting machine control mechanism **25**, and as a result, the machine goes through its foul cycle operations and all standing pins are swept into the pit and a new set of pins is placed on the alley bed awaiting the rolling of the second ball. In the meantime, the period of twelve seconds has passed and the foul detecting mechanism has been incapacitated by the mechanism described above which forms the invention. Thus when the ball is returned to the player, the player is ready to roll his second ball and the machine also has set pins awaiting the rolling thereof.

A similar sequence of actions occurs when a foul is committed during the rolling of a second ball and the foul detecting device **12** does not reset in time for the next succeeding first ball being rolled, thereby preventing false operation of machine **26** on the next succeeding first ball operation as a result of the foul signal from the previous ball still being present when the next ball is rolled.

The invention above described may be varied in construction within the scope of the claims, for the particular embodiments selected to illustrate the invention are but a few of the possible concrete forms which my invention may assume. The invention, therefore, is not to be restricted to the precise details of the structures shown and described.

What I claim is:

1. A foul detecting timing control apparatus for use with a control mechanism operatively connected with a

bowling pin spotting machine comprising a timing element provided with a heater, a normally closed heater circuit, said heater being operative in response to the declaration of a foul and the breaking of said circuit to maintain said foul detecting device in operation for a predetermined time interval, foul indicating devices actuated by said element during the cooling of said heater, an electric circuit for said foul indicating devices, electrical means in said circuit for actuating said bowling pin spotting machine control mechanism to operate said machine in response to the occurrence of a foul, and control timing means connected in said circuit for interrupting the operation of said foul detecting devices prior to the completion of said predetermined time interval of said heater, the time in which said heater reaches its predetermined degree of cooling increasing with its age whereby the aging of said heater is nullified and said machine operates on a predetermined time interval determined by said control timing means.

2. The invention defined in claim 1 wherein said control timing means comprises a switch in said circuit, a switch operating arm, and a motor operative in response to the occurrence of a foul for driving said arm for a period of time less than the time interval of said heater to operate said switch and incapacitate said foul indicating devices.

3. The invention defined in claim 2 wherein said switch operating arm is mounted on a shaft, said shaft being driven through an electric clutch connected in said circuit, a relay in said circuit, said relay being locked in response to the occurrence of a foul, said relay having normally closed contacts which are opened in response to the energization of said relay whereby said heater cools, and means operative in response to the cooling of said heater for moving said arm out of engagement with said switch actuating arm whereby said other timing means is reset.

4. In an apparatus for detecting and signalling bowling fouls, the combination comprising a heater circuit, a heater in said circuit, means normally maintaining said circuit through said heater closed whereby said heater normally is energized, a foul detector, an operating circuit for said detector, foul signalling means in said circuit, mechanism operative in response to the making of a foul for closing said operating circuit and breaking said heating circuit whereby said heater cools and said foul signalling means remains in operation until said heater cools to a predetermined temperature, said heater being

adapted normally to maintain said foul signalling means in operation for a predetermined time interval after the breaking of said heater circuit, and said heater being operative after a period of time due to aging to increase said time interval abnormally, and control timing means operative in response to the operation of said mechanism for breaking said operating circuit and terminating the operation of said signalling means after a lapse of time less than said abnormal period.

5. In an apparatus for detecting and signalling bowling fouls, a thermal timing device, foul signalling mechanism, means normally energizing said thermal timing device to ready it for operating said foul signalling mechanism when a bowler fouls, means operative in response to a bowler fouling for de-energizing said thermal device, whereby said thermal device cools, said thermal device being operative during its cooling period to maintain said signalling mechanism in operation, means for incapacitating said signalling mechanism when said thermal device reaches a predetermined degree of cooling, the time in which said thermal device reaches said predetermined degree of cooling increasing with the age of said thermal device, and control operating means operative in response to the making of a foul for operating said incapacitating means after a predetermined cooling period less than that of said thermal device has elapsed.

6. The apparatus defined in claim 4 wherein said control timing means includes a normally closed switch in said operating circuit, and selectively operated positively actuated means for opening said switch to break said circuit after a predetermined cooling period less than the abnormal cooling period of said heater has elapsed.

7. The apparatus defined in claim 5 wherein said control operating means includes a timing motor, an operating circuit for said motor, said thermal device and said signalling mechanism, a normally closed switch in said circuit, a shaft driven by said motor, and a switch operating arm on said shaft for opening said switch to break said circuit.

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