

July 28, 1953

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2,646,984

PINFALL SIGNALING MECHANISM

Filed Nov. 12, 1948

3 Sheets-Sheet 1

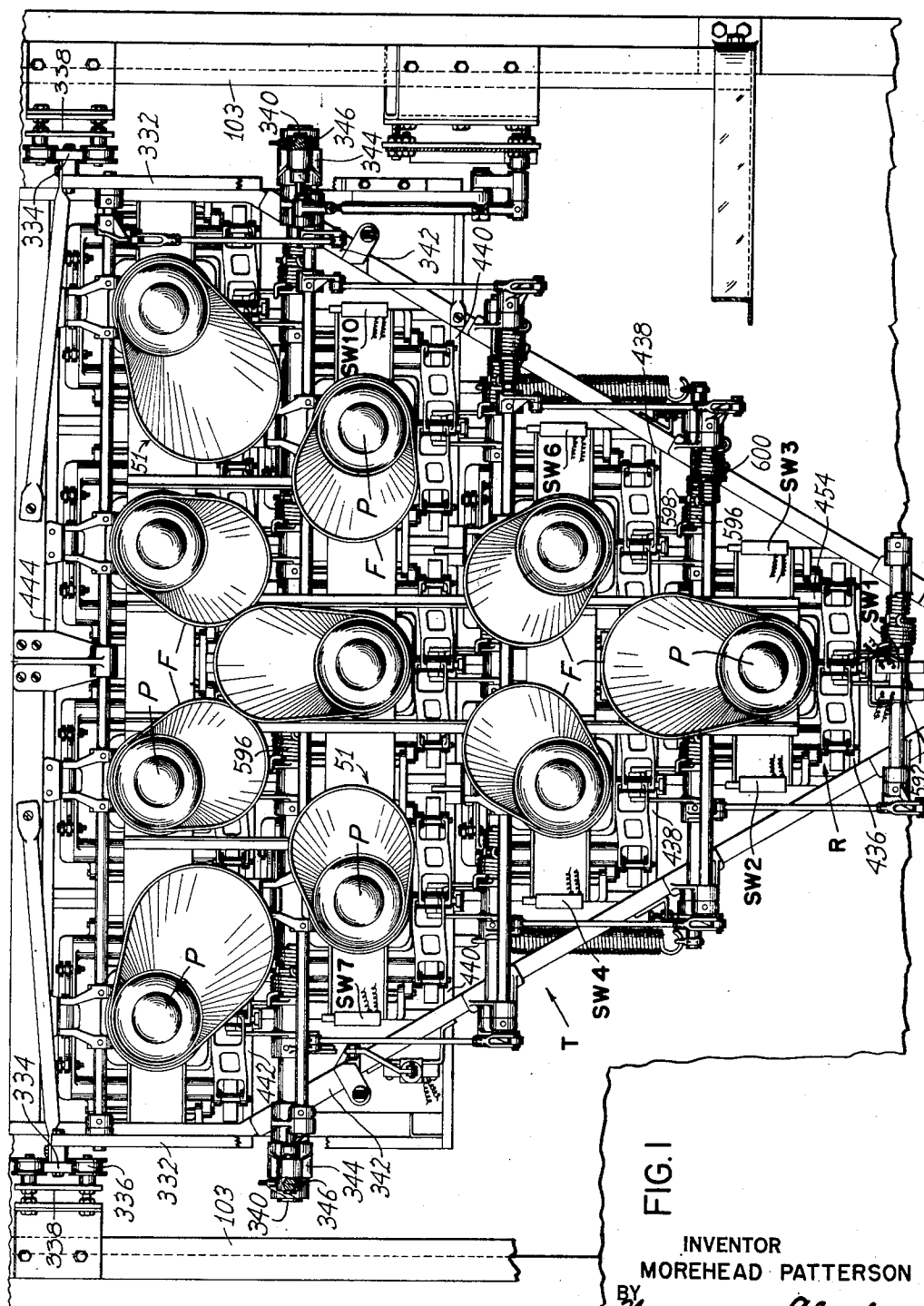


FIG. 1

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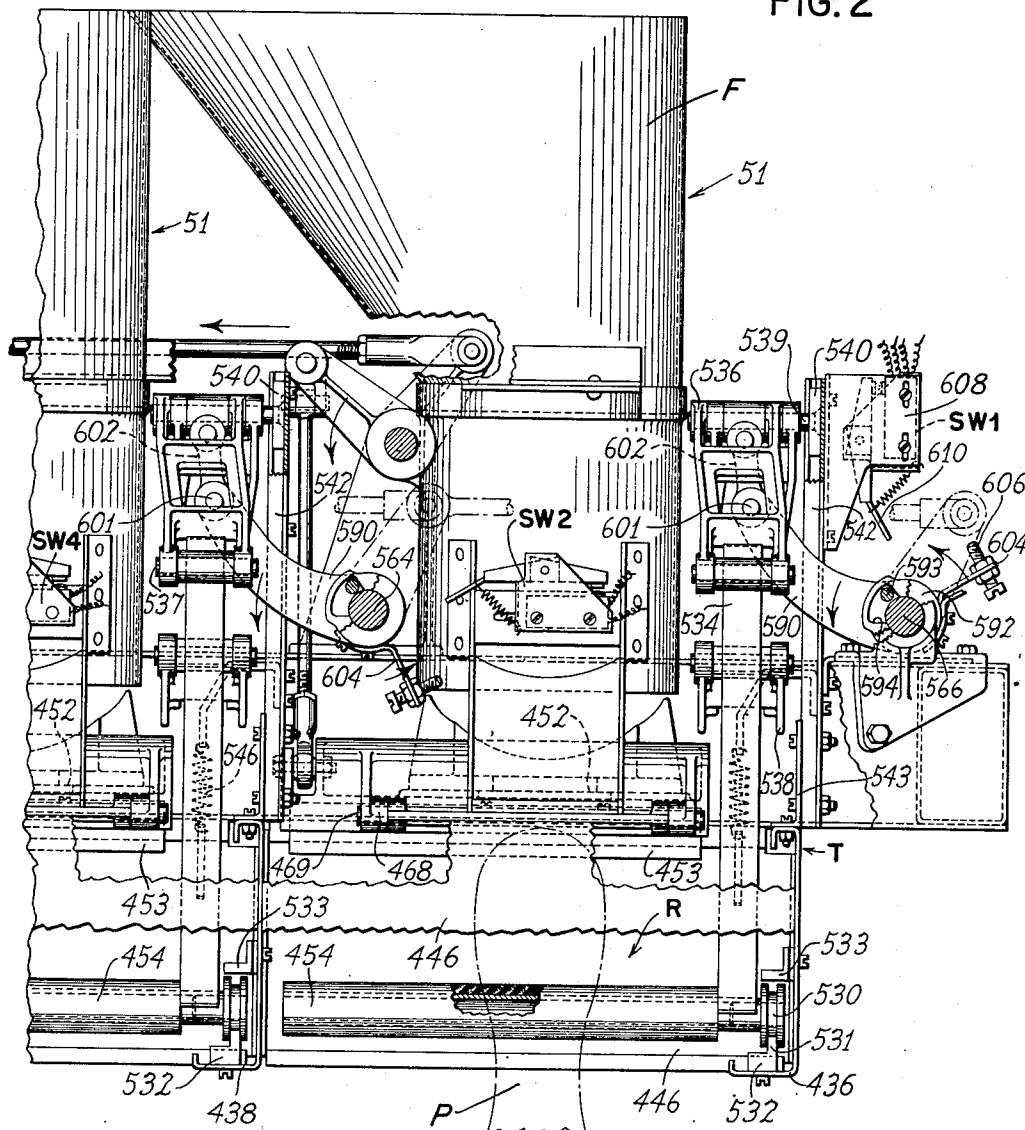
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3 Sheets-Sheet 2

FIG. 2



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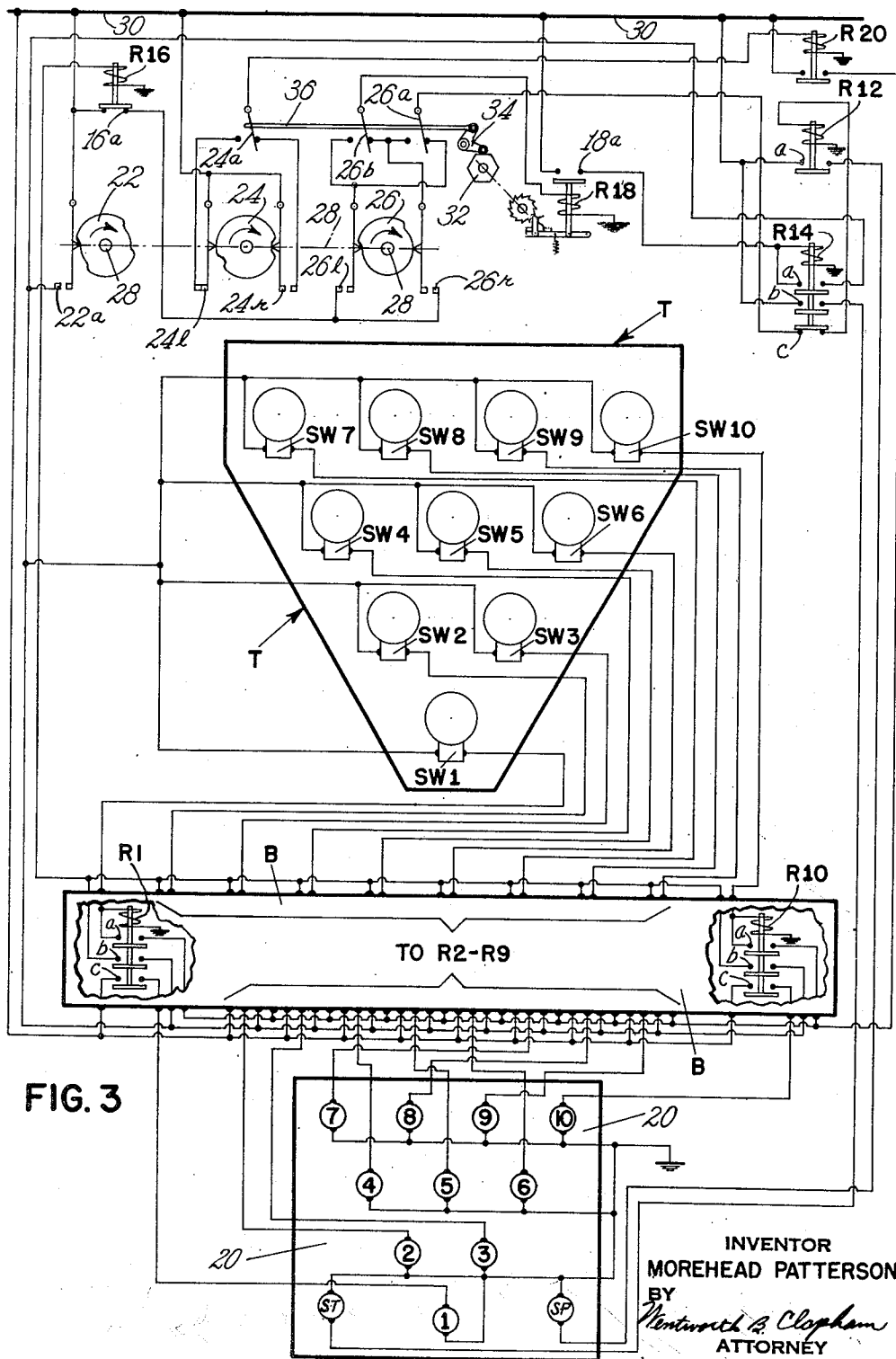
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PINFALL SIGNALING MECHANISM

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UNITED STATES PATENT OFFICE

2,646,984

PINFALL SIGNALING MECHANISM

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Application November 12, 1948, Serial No. 59,739

6 Claims. (Cl. 273—42)

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This invention relates to the art of bowling, and more particularly to mechanism for indicating or signalling the pin-fall results obtained by each ball of a frame rolled by a bowler.

The invention creates generally to improve-
ments in means for use in a bowling pin spot-
ting machine such as shown in copending Fluke
and Flint application, S. N. 59,706, filed Novem-
ber 12, 1948, for Bowling Pin Spotting Machine,
in which after each ball of a frame is rolled,
mechanism is actuated to test for the presence
or absence of standing pins, and selectively actu-
ated signalling means operatively associated
therewith is operated to indicate visibly by means
of an annunciator or similar device, the number
of pins knocked down by each ball, the positions
of standing and fallen pins, and also the occur-
rence of strikes and spares.

The problem solved by the present invention
is that of providing a device for placing bowling
pins on a bowling alley having mechanism asso-
ciated therewith, such as each set of movable
grippers forming a part of each respotter unit
of the type disclosed in the above referred to
application, such that the several sets of grip-
pers when located in gripper operating position
are moved towards each other, or into gripping
relationship relative to standing on or off-spot
pins, and selectively operated detecting devices
operate signals in an annunciator and indicate
the presence or absence of standing pins. In
this manner, positive visual information is given
that certain pins are standing or that a strike
or a spare has been made, as the case may be.
The pin respotting units are carried by a table
movable into testing or pin gripping position ad-
jacent a bowling alley after each ball of a frame
is rolled, so that the signalling mechanism can
be operated. In this way a complete visual pic-
ture is given to the bowler of the results obtained
for every ball he rolls. While reference is made
to the co-pending Fluke and Flint application, as
disclosing a machine in which the subject matter
of the invention is readily adaptable, it is within
the contemplation of this invention to use my
improved indicating and signalling mechanism
on other machines of the same general type with
which it can be adapted.

It is an object of my invention to provide
an improved pin-fall detecting and indicating
mechanism including an annunciator for use in
signalling the pin-fall resulting from each ball
rolled by a bowler.

It is a further object of my invention to pro-
vide a novel pin-fall signalling device including
detecting elements which test for the presence
or absence of standing pins on a bowling alley
after each ball of a frame is rolled, and control
mechanism operatively connected with the de-
tecting elements for operating the signalling de-

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vice to show the pin-fall results for each ball,
and the positions of standing pins on the alley.

The invention also consists in improvements
in detecting elements and devices associated
therewith for placing bowling pins on the play-
ing bed of a bowling alley, wherein the testing
devices are actuated after each ball of a frame
is rolled to test for the presence or absence of
standing bowling pins, and selective mechanism
operated in response to the operation of the de-
tecting elements to actuate signals in order to
make known visually play by play results, in-
cluding the occurrence of spares and strikes.

My invention is further characterized by the
provision of bowling pin detecting and signalling
mechanism which is operative to detect auto-
matically the presence or absence of non-con-
ducting, unmodified bowling pins, and after each
ball of a frame is rolled, to actuate signalling
mechanism to inform a bowler of the presence
or absence of pins standing on a bowling alley.

My invention also consists in the provision of
detecting devices associated with sets of opposed
grippers whereby during the play of a game, the
engagement or non-engagement of standing pins
by the grippers selectively actuates an annun-
ciator which apprises a bowler and those watching
the game of the pinfall results obtained by each
ball of a frame rolled.

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

In the accompanying drawings which form a
part of this specification, and wherein the sev-
eral reference characters designate the same or
like elements:

Figure 1 is a plan view of a pin spotting and re-
spotting device embodying the pin detecting and
signalling means operating mechanism of the
invention;

Figure 2 is a side elevation, partly in section,
of a portion of the mechanism shown in Fig-
ure 1; and

Figure 3 is a wiring diagram showing a pre-
ferred system for operating and controlling the
operation of the signalling mechanism of the
invention.

Referring to the drawings which show a pre-
ferred embodiment of the invention in Figures
1 and 2, there is disclosed a pin spotting and re-
spotting table designated generally T.

The construction of table T may be the same
as that disclosed and described in detail in the
above referred to copending Fluke and Flint ap-
plication. The description and showing of this
mechanism in this application is therefore lim-
ited to what is deemed necessary to a full under-
standing of the invention.

Table T preferably has the form of a generally triangular framework which supports the spotting and respotting devices. Attached to the opposite rear corners of table T, as viewed at the top of Figure 1, are supports 332, each of which mounts a guide plate 334 which engages and runs in spaced sets of guide rollers 336 mounted in brackets 338 attached to side frames 103. In this manner table T is guided in its movement to and from a pin receiving position beneath a pin assembling mechanism (not shown), a pin spotting position, and a pin respotting position relative to a bowling alley upon which bowling pins are spotted and respotted.

In order to lower, raise and position table T for testing for the presence or absence of standing pins after each ball of a frame is rolled, there is provided a cross shaft 340 mounted in bearings in brackets 342 attached to the frame structure of table T. At its extremities, shaft 340 supports crank arms 344 mounted for free rotation thereon. Connecting rods 346 connect the free ends of crank arms 344 to driving arms (not shown) fixed to the ends of a drive shaft (not shown) which, with other actuating mechanism (not shown), is operative to lower and raise table T, and locate it at the desired position where gripper bars 454 are actuated to engage standing on and off-spot pins to be respotted, and also to test for the presence or absence of pins standing on the alley after each ball of a frame is rolled. The specific operating connections and mechanisms for moving table T upwardly and downwardly and holding it positioned at signal operating position are not a part of the present invention and are therefore omitted in the interest of brevity. Reference is made to the co-pending Fluke and Flint application for a complete disclosure of this mechanism.

Mounted on the upper part of table T is a triangularly arranged plurality of pin spotting units 51, each of which includes a pin guiding funnel F and a set of movable pin supporting plates or trap doors 452 located therebeneath constructed and operated as disclosed in said Fluke and Flint application. Bowling pins to be placed in triangular spotted playing positions on a bowling alley are delivered by doors 452 at the proper time in spotted playing arrangement on the alley.

Table T is provided with a lower frame consisting of spaced transverse channel sections 436, 438, 440, 442 and 444 connected by laterally spaced longitudinal channels 446 to form an assembly which makes up a series of ten substantially rectangular cells R. Each cell R has its central vertical axis disposed in substantially vertical alignment with the axis of one of a set of ten pins P supported in spotter units 51 corresponding to the playing positions the pins occupy on the alley.

Mounted in the lower frame of table T within each cell R is a pair of opposed bars or rods 454 which perform the functions of gripping pins to be lifted and respotted, and also testing for the presence or absence of standing pins after each ball of a frame is rolled. Bars or rods 454 are located beneath and in symmetrical arrangement with each set of doors 452. They may be formed of wood, metal, plastic or combinations. Each bar preferably is provided with a covering, such as a resilient material, usually rubber, which insures a firm grip on the neck of a pin and tends to prevent marring or other damage thereto.

It is evident that since each bar 454 is elongated, the presence or absence of a pin, which may be quite far off-spot, can be detected, and

made known on the annunciator 20. It is also to be noted that my improved mechanism operates with free, conventional types of bowling pins and does not require that they be modified or provided with conducting elements in order to obtain the desired results.

Referring to Figures 1 and 2, each of the doors 452 of a pin spotter unit 51 consists essentially of a rectangular support, attached to or formed integrally with a hinge member 468 pivotally mounted on hinge pin 469. Doors 452 perform the dual function of supporting and guiding pins to be spotted, and also holding pins to be lifted and respotted in their respective on or off-spot positions so that such pins can be gripped properly for lifting and respotting. For this reason, the underside of each door preferably is provided with an undersurface which, when table T is lowered to respotting position, engages the head end of a standing pin and holds it firmly against lateral movement on the alley. A resilient material, such as sponge rubber pad 453, has been found to be satisfactory for this purpose.

The gripper bars 454 of each set in cells R are operated at the proper time to move towards each other in a plane substantially parallel with the surface of the playing bed of a bowling alley for gripping and holding any standing pins for lifting and respotting on the bowling alley. Gripper bars 454 are actuated, as described herein-after, to grip and hold such standing on and off-spot pins after each ball of a frame, except the last ball. After each ball, however, gripper bars 454 are moved towards each other and in this manner, they test for the presence or absence of any standing on or off-spot pins and actuate mechanism described hereinbelow to indicate the pin-fall effected by each ball rolled.

The opposed pairs of gripper bars 454, as indicated in Figure 1, extend longitudinally relative to a bowling alley, although if desired, they could extend transversely or at an angle to the longitudinal axis of the frame of table T. In their full open or inoperative positions, bars 454 are located adjacent the opposite sides of cells R. One end of each gripper bar 454 is provided with a freely rotatable roller 530, located beneath a guide bar 533 attached to a channel section, as for example 436. Roller 530 runs on a flange 531 formed on a transverse horizontal track bar 532 attached to a transverse member of a cell R.

In the illustrated embodiment, see Figures 1 and 2, actuation of each set of gripper bars 454 is effected by a self-centering five-bar linkage unit consisting of a pair of downwardly extending links 534, a pair of links 536, and a cross link 538. A common pivot 539 between links 536 is attached to a slide 540 mounted for movement in a vertical guide track 542 attached to the upper flange of one of the transverse channels 436—444 by a clip 543, depending on the location of each slide 540 in relation to the triangularly arranged sets of actuating links and levers. The outer ends of links 536 are pivotally attached at 537 to the upper ends of links 534, which in turn are pivotally connected between their ends to link 538. The structure of and means for operating the five bar linkage unit are essentially the same as shown and described in said Fluke et al. application. Since this structure and means form no specific part of the present invention, further description and showing herein are deemed unnecessary.

Tension springs 544 are attached to the lower end of track 542 and to clips (not shown) on

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pendant links 534. Springs 546 are used to balance out the otherwise unbalanced forces occurring when the linkage mechanism is in one or another of its off center positions.

In operation, the simultaneous upward movement of the several slides 540 causes an angular displacement of the five-bar linkages described, such that gripper bars 454 will be urged away from each other into their inoperative positions. This movement of gripper bars 454 is confined to a straight line motion in a horizontal plane by virtue of the roller and track arrangements 530, 532. Similarly, a downward motion of slide 540 causes gripper bars 454 to move towards each other. When this occurs, each pair of gripper bars 454 can assume any position between the sides of its cell R depending upon the on- or off-spot position of the pin engaged, or engaged and gripped by them. In the embodiment illustrated and as mentioned above, there are provided compressible clamping surfaces which clamp pins engaged by bars 454 upon the alley. In the operation of the pin detecting and signalling mechanism of the present invention, these clamping surfaces can be omitted if desired. Thus, when a normal on-spot pin is to be engaged by bars 454, or gripped and held thereby, each of the bars 454 moves substantially the same distance from its inoperative position adjacent the side of a cell R into gripping engagement with the opposite sides of the neck of a pin. Gripping bars 454 are so located that when table T is located in position to test for the presence or absence of standing pins, or pin gripping position, bars 454 can engage and grip the necks of any standing pins to be lifted, or release the necks of any respotted pins.

If a pin to be lifted and respotted occupies an off-spot position, each bar 454 of a set of bars in a cell R is moved in such a manner that as soon as the bar 454 nearest the pin engages it, the movement of the bar is arrested. The other gripper bar 454 of the pair, however, continues its forward movement into gripping engagement with the opposite side of the neck of the pin, whereupon its motion is arrested and the pin is firmly gripped for lifting. The same operation takes place simultaneously with each of the ten pairs of gripper bars 454. It will be seen, therefore, that because of its operating connections, each bar 454 is given an on-spot, off-spot range which allows each pair of bars to grip a pin anywhere within the general area of a cell R. The provision of elongated gripper bars or rollers 454 makes possible the positive gripping of on and off-spot pins over substantially the entire area occupied by bowling pins on the pin supporting deck of an alley, which is a greater area than heretofore available for this purpose. Parallelism of gripper bars 454 is maintained by the inherent torsional rigidity of pendant links 534 coupled with the resistance to bending and torsion of the rest of the five-bar linkage, and its associated parts and attachments, which make possible the individual and differential travel of each bar 454 of a pair of gripper bars 454 towards an on or off-spot pin.

Since the operation of the gripper mechanism in each cell R is identical, the description is limited to the operation of one set of gripper bars 454, such as shown in cell R, Figures 1 and 2, corresponding to #1 pin position.

A crank arm 590 is freely journaled on shaft 566 near its center. A collar 592 is secured to shaft 566 adjacent crank arm 590. A drive pin

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593, Figure 2, fixed to collar 592 engages slot 594 in crank arm 590. A torque spring 596 surrounding shaft 566 has one end attached to crank arm 590 and its opposite end to an adjusting sleeve 598 encircling shaft 566 and terminating at a point adjacent the hub of arm 590. Also attached to sleeve 598 is one end of locking spring 600 which frictionally engages shaft 566 to positively position and lock spring 596 with respect to shaft 566. The spring force exerted by spring 596 is such as to urge the outer end of crank arm 590 in a downward direction with respect to shaft 566, but such movement is normally prevented by drive pin 593 engaging the end of slot 594, as indicated in Figure 2. The outer end of crank arm 590 is pivotally attached at 601 to one end of a connecting link 602. The other end of connecting link 602 is attached by a cross-pin to pivot 539 between slide 540 and links 536. It can be seen that a counterclockwise motion of crank arm 590 will, through connecting link 602, cause a downward movement of slide 540. Conversely, a clockwise motion of crank arm 590 will cause an upward movement of slide 540. This is the motion necessary for the operation of the five-bar linkage which in turn actuates gripper arms 454 in the manner described.

As slide 540 is moved downwardly, gripper bars 454 engage and grip the neck of a pin; further counter-clockwise motion of crank arm 590 is arrested. Drive pin 593 attached to collar 592 on shaft 566, may, however, continue its counter-clockwise motion within the space provided by slot 594. This allows, in a cell where no pin is present, continued counter-clockwise motion of crank arm 590, drive pin 593, and the accompanying shaft as contrasted to an arrested or shorter stroke motion of crank arm 590.

The operating crank arm 590 for each set of gripper bars 454 is provided with a tab 604, Figure 2. A switch bracket 608, on which is mounted an operating switch, such as switch SW1 for #1 pin grippers, and a switch actuator 610 are also provided for each set of grippers 454. Each tab 604 is provided with an adjustable operating set screw 606. Since there are ten sets of grippers 454, ten switches SW1-SW10 inclusive are provided. These switches are connected in the operating control circuit shown in Figure 3 and described in detail hereinbelow.

In operation, when table T is located at pin testing position after a ball is rolled, which is also the respotting position, each set of grippers is actuated and gripper bars 454 move towards each other. In the event that a set of gripper bars 454 engage a standing on or off-spot pin as they move together, the set screw 606 of this set of grippers is prevented from engaging its switch actuator, say actuator 610 of switch SW1. Therefore switch SW1 is not operated and a signal, such as the signal light corresponding to pin #1, glows, thereby indicating in annunciator 20 that #1 pin is standing. Because of the relatively wide operating range of elongated gripper bars 454, it is immaterial whether pin #1 is on or off-spot. A similar operation takes place for all other standing pins; the engagement of any set of gripper bars with a standing pin preventing the operation of the switch which controls the operation of a suitable signal, such as a light in annunciator 20 corresponding to the position of that standing pin.

If any pin, say pin #1, has been knocked down,

gripper bars 454 continue their movement towards and into engagement with each other. In this case, crank arm 590, which operates the set of grippers 454 corresponding to #1 pin position, moves tab 604 to such an extent that set screw 606 thereon engages and operates switch actuator 610 for the corresponding switch SW1, operating the switch and preventing signal light No. 1 from glowing. A similar operation takes place with all other sets of grippers 454 where pins have been knocked down by the same ball. It can be seen that the presence or absence of standing pins after each ball of a frame is rolled, is detected automatically and an electrically operated control circuit is employed to visually indicate in annunciator 20 the pin-fall result. In the case of a strike or when all pins are knocked down by the first ball of a frame, all switches SW1-SW10 are operated and none of the pin signals 1-10 inclusive is operated. Instead, a signal, such as a separate strike light ST, see Figure 3, is energized to show that a strike has been made. If a spare is made or when all pins not knocked down by the first ball are felled by the second ball of a frame, a separate spare signal, such as light SP, is operated to indicate visually the result obtained. While the pin-fall signals have been described as being lights, if desired, other suitable types of visual signals could be employed. It will be noted, as shown in Figure 3, that the ten signal lights, which are used to indicate visually the pin-fall results of each ball thrown, are arranged in conformity with the customary playing arrangement of pins on a bowling alley. Obviously, any other desired arrangement could be employed.

In the description hereinabove, the selective signal operating mechanism is operated in such a manner that the pin position signals or lights in annunciator 20 are operated to indicate the pins which remain standing after each ball is rolled. It is possible that it might be desirable to indicate instead, the pins which have been knocked down. In this case, switches SW1-SW10 inclusive can be so connected in the control circuit that pin signals or lights corresponding to fallen pins can be energized, and pin signals or lights corresponding to standing pins remain inoperative.

A wiring diagram of a control system suitable for carrying out the desired operations of the detecting and signalling mechanisms described hereinabove, is shown in Figure 3. The operation is as follows:

Pin spotting-respotting table T carries ten normally closed pin switches SW1-SW10 inclusive, each of which is connected to a relay R1-R10 inclusive, respectively. All ten relays are assembled in a control box B, and each individual relay, in a manner described below, is connected to a pin signal lamp 1-10 inclusive, respectively, assembled in an annunciator 20. Each relay R1-R10 is provided with three sets of normally open contacts. Contacts "a" may be called hold-in contacts. Contacts "b" can be termed no-pin standing contacts, and contacts "c," pin light energizing contacts.

Annunciator 20 also supports a spare signal lamp SP and a strike indicator lamp ST. Signal light SP is connected to a set of normally open contacts of spare relay R12, and signal light ST is connected to a set of normally open contacts of strike relay R14. The circuit includes also a so-called no-pin standing relay R16, a ratchet relay R18 of any suitable well-known design, and

a pin light hold-in relay R20. The circuit furthermore includes three control cams 22, 24 and 26, all of which are secured to a shaft 28 which is driven by suitable mechanism from the table drive (not shown) and in proper timed relation with the movement of table T. Each cam rotates 180° for each cycle of the table, i. e. for each ball of a frame rolled by a bowler.

It is assumed that ten pins are standing on the alley and the player rolls his first ball and knocks down the #1 and #10 pins. After the ball reaches the end of the alley, the machine is set in operation and table T descends toward the alley. The movement of the table also starts the turning of cam shaft 28, and cams 22, 24, and 26 turn in the direction indicated by the arrows. When table T reaches a predetermined height above the alley, grippers 454 close and securely hold those pins which are now standing, namely, pins #2-#9 inclusive. Those grippers which find no standing pins, close together, and in so doing, set screws 606 on tabs 604, corresponding to pins #1 and #10, engage switch actuators 610 and open normally closed pin switches SW1 and SW10. At this point, the control cams 22 and 24 have advanced sufficiently to cause cam 22 to close contacts 22a, and cam 24 to close contacts 24r. The closing of contacts 22a permits current to flow from the power line 30 through closed switches SW2-SW9 inclusive and through the coils of their respective light relays R2-R9 inclusive, thereby energizing these relays. The closing of contacts 24r permits current to flow through a switch 24a which energizes hold-in relay R20, the closing of which in turn provides power through the now closed contacts R2a-R9a of relays R2-R9 inclusive, which are held in. The energization of these relays causes the closing of contacts R2b-R9b, and also contacts R2c-R9c inclusive. The closing of the latter effects a lighting of the pin indicator lights 2-9 in annunciator 20. The R1b-R10b contacts on R1-R10 relays are provided for the purpose of causing energization of the no-pin standing relay R16 if one or more of the R1-R10 relays are energized. The energization of relay R16 causes the opening of contacts 16a which prevents the flow of power to either contacts 26r or 26l.

It is evident from the foregoing that the opening of switches SW1 and SW10 prevents current from flowing to their respective relays R1 and R10, which in turn prevent the #1 and #10 pin signal lights in annunciator 20 from glowing while signal lights #2-#9 inclusive are energized and give visible indication that all pins but Nos. 1 and 10 remain standing on the alley after the first ball is thrown by the player. Table T then rises, lifting pins Nos. 2-9 inclusive, and the alley is cleared of the fallen pins by means of a suitable sweep (not shown), after which table T descends and respots pins Nos. 2-9 inclusive on the alley. Table T then rises and remains in an up position, thereby ending what may be termed the first ball cycle of the machine. As soon as the table comes to rest, shaft 28 also comes to rest, and cam 22 stops in a position which causes contacts 22a to open, thereby preventing power from flowing through contacts 22a to relays R2-R9, which were formerly energized by this means.

Since it may be desirable to keep the pin signal lights, indicating standing pins, lighted until the bowler has thrown his second ball, cam 24 is so designed that contacts 24r remain closed until table T starts to move downwardly again at the

beginning of the second ball cycle. As mentioned heretofore, the closing of contacts 24r effects a hold-in of all formerly energized relays R2-R9. After the bowler has thrown the second ball of the frame, table T descends again. This effects the rotation of contact cam shaft 28, causing cam 24 to open contacts 24r, permitting relays R2-R9 inclusive, which were locked-in, to fall out before table T reaches the alley to test for the presence or absence of pins on the alley during the second ball cycle.

When table T reaches its predetermined position above the alley and grippers 454 close to contact any pins remaining standing after the second ball of a frame is rolled, the same operation takes place as during the first ball cycle, namely: cam 22 recloses contacts 22a, cam 24 recloses contacts 24r, and only those relays R1-R10 inclusive are energized which are supplied with current through their respective switches SW1-SW10, which remain closed because their respective grippers engage standing pins. This will therefore cause an energization of their respective relays, which in turn will light only the respective pin signal lights in annunciator 20 indicating which pin or pins remain standing after the second ball is thrown by a bowler. During a second ball cycle, grippers 454 are only closed for the purpose of detecting the presence or absence of standing pins, after which they open again and table T rises above the alley, which is then cleared of all fallen and/or standing pins by means of a suitable sweep (not shown). Table T then descends a second time and places a new set of pins on the alley, after which the table rises again and remains in an up position above the alley. The machine is now ready for a new frame of bowling. Cam 24 is so designed as to permit all relays R1-R10 to drop out at the end of the second cycle, while at the end of the first cycle, the energized relays are held in locked-in position until the beginning of the second cycle.

Spare.—In case the player has knocked down all pins during the second ball cycle, all grippers 454, finding no standing pins, close together and cause the opening of all switches SW1-SW10 inclusive, thereby preventing the energization of all relays R1-R10 inclusive. Since none of these relays is energized, relay contact 16a remains closed. In the meantime, the high portion of cam 26 has reached a position where it effects a closing of its left side contact 26l, permitting current to flow from the power line 30 through contacts 16a, 26l, switch 26a, and a normally closed contact R14c of relay R14 to energize spare signal light relay R12. The energization of relay R12 closes its contacts R12a, resulting in the lighting of the spare signal light SP in annunciator 20. At the end of the second ball cycle, the power is interrupted again as contacts 26l are opened again by the low portion of cam 26.

Strike.—In case all pins are knocked down by the first ball after table T descends to the alley, all grippers 454 move towards each other to test for the presence or absence of standing pins in the usual manner. Since no pins are standing, grippers 454 close all the way, causing the opening of all switches SW1-SW10 inclusive, and none of the relay R1-R10 is energized. Therefore, relay R16 remains inactive and contacts 16a remain in closed position. Since the turning of shaft 28 causes the high portion of cam 26 to close contacts 26r, current is now supplied from the power line 30 through contacts 16a, 26r, and switch 26b to ratchet relay R18, causing energiza-

tion of the latter. The ratchet relay R18 actuates a cam 32 provided with equally spaced alternating high and low portions which engage a cam follower on one end of a bell crank lever 34 while the other end of bell crank lever 34 is connected to a rod 36 which engages with the switches 24a, 26b and 26a. The hook-up is arranged in such a manner that all switches 24a, 26b and 26a close their right side contacts when bell crank lever 34 engages a low portion of cam 32, and switch over and close their left side contacts when lever 34 engages a high portion of cam 32. The action of the ratchet relay R18 is such that upon each energization, cam 32 is turned in such a manner as to alternately engage a high and low portion with bell crank lever 34. Ratchet relay R18 is also provided with a normally open contact 18a, which is momentarily closed upon each energization of relay R18. Therefore, when ratchet relay R18 is energized, as described above, contacts 18a are closed momentarily and provide power for the energization of strike relay R14. The latter is locked-in immediately by power provided through contacts 22a which are closed due to the rotation of cam 22. As mentioned heretofore, the energization of ratchet relay R18 causes the movement of bell crank lever 34 to shift switches 24a, 26b, and 26a. Although switch 26b caused the energization of ratchet relay R18, due to the shifting of switch 26b, power to relay R18 is interrupted and it is almost immediately de-energized. Since strike relay R14, as described above, is locked-in through its contacts R14a, its second set of contacts R14b remain also closed and cause the strike signal light ST in annunciator 20 to glow. The third set of contacts R14c remain open so long as relay R14 is energized, thus preventing any current from reaching spare light SP. Strike light ST is extinguished near the end of the cycle when cam 22 causes the opening of contacts 22a and interrupts the current to strike relay R14. It is evident that the shifting of switches 24a, 26b, and 26a is of importance in order to shift the signal control mechanism back to a first ball cycle each time after a strike is made by the bowler.

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 the invention may assume. The invention, therefore, is not to be restricted to the precise details of the structures shown and described.

What is claimed is:

1. Pin signalling mechanism for use with a bowling pin spotting machine comprising a member movable to and from the playing bed of a bowling alley, an annunciator, said annunciator including a plurality of pin signal lights arranged in conformity with the playing arrangement of pins on said alley bed, pin holding units on said member, said units including sets of opposed grippers carried by said member and arranged in a pattern conforming to the playing arrangement of pins on said alley bed, annunciator operating mechanism for energizing said lights subsequent to the positioning of said member in pin gripping position above said alley, said mechanism including individual switch means normally operable to energize corresponding signal lights, means operative in response to the throwing of a ball for moving said sets of grippers towards each other, and means operative in response to the movement of said gripper moving means be-

yond a position necessary to engage said grippers with standing pins for incapacitating said switch means corresponding to sets of grippers not gripping pins.

2. In a bowling pin spotting machine for use with a bowling alley, a device adapted to be moved to and from said alley for placing pins in playing arrangement thereon, sets of opposed pin holding grippers mounted on said device, individual operating means for said sets of grippers, individual switches for connection in a signal circuit, and means for operating corresponding switches in response to closing movement of any of said gripper operating means beyond the position necessary for bringing the grippers of a set of grippers into engagement with a standing pin.

3. In a bowling pin-fall signalling mechanism, a device for spotting and respotting bowling pins on the playing bed of a bowling alley, an annunciator, said annunciator having a strike signal and a plurality of signals for registering pin-fall, each of said signals representing the position a pin corresponding thereto occupies on said bed of said bowling alley, sets of pin grippers carried by said device, means for operating each of said sets of grippers, switch operating means connected to each of said gripper operating means, a switch mounted in position to be engaged by each of said operating means, an electric circuit connecting said strike signal and said switches and said pin-fall registering signals, and means individual to each set of grippers operative in response to the rolling of a ball for actuating said gripper operating means to move said grippers towards each other to test for the presence or absence of standing pins on said alley bed, mechanism actuated by said gripper operating means in response to the movement of said gripper operating means beyond a position necessary to engage said grippers with a standing pin for operating the switches corresponding to grippers not engaging standing pins for actuating signals corresponding to the positions of fallen pins, and other means operative in response to the falling of all pins for operating said strike signal.

4. In a bowling pin spotting machine for use with a bowling alley having a bed adapted to support a plurality of bowling pins, a device adapted to be moved to and from said bed for placing bowling pins in playing arrangement on said alley bed and for testing for the presence or absence of pins standing thereon after the rolling of a ball, an annunciator, said annunciator including a separate strike light, a separate spare light and a plurality of pin signal lights arranged in conformity with the playing arrangement of pins on said alley bed, sets of opposed pin grippers mounted on said device, an annunciator operating element operatively connected with each of said sets of grippers, means mounting said sets of grippers on said device in an arrangement conforming substantially with the playing arrangement of bowling pins on said alley bed, means individual to each set of grippers operative in response to the rolling of a ball for moving said opposed grippers toward each other into position to engage opposite sides of the neck portions of standing pins, and selective control mechanism actuated in response to the movement of said last-named means beyond a position necessary to engage said grippers with a standing pin for selectively operating selected signals corresponding to pins not stand-

ing on said alley to indicate visibly the result of each ball of a frame rolled, and other means operative in response to the movement of said last-named means of all sets of grippers beyond said position for actuating said strike or said spare light.

5. In a bowling pin spotting machine for use with a bowling alley having a bed adapted to support a plurality of bowling pins, a device for placing bowling pins in playing arrangement on said alley bed, an annunciator, said annunciator including a separate strike light, a separate spare light and a plurality of pin signal lights arranged in conformity with the playing arrangement of pins on said alley bed, sets of opposed pin grippers mounted on said device, an annunciator operating element operatively connected with each of said sets of grippers, means mounting said sets of grippers on said device in an arrangement conforming substantially with the playing arrangement of bowling pins on said alley bed, means individual to each set of grippers operative in response to the throwing of a ball for moving said opposed grippers towards each other into position to engage the opposite sides of the handle ends of standing pins, selective control mechanism actuated by said last-named means in response to the movement of any of said last-named means beyond a position necessary to engage said grippers with a standing pin for selectively operating signals corresponding to fallen pins not gripped by said grippers to indicate visibly the result of each ball of a frame rolled, and other selective control mechanism operative by said last-named means if all pins are knocked down by the first ball of a frame for actuating said strike signal or for actuating said spare signal if all pins are knocked down by the second ball of a frame.

6. In a bowling pin spotting machine, a bowling pin spotting table, a plurality of sets of substantially triangularly arranged spotting units mounted on said table, each of said units including clamping means, and a set of opposed grippers, said table being adapted to be located in position to engage said means in clamping relationship with pins standing on a bowling alley after a ball is rolled, gripper operating means operative while said pins are held clamped against lateral movement on said alley to move said sets of grippers adjacent standing on or off-spot pins into gripping engagement with opposite sides of said standing pins, an annunciator including individual signals for each of said sets of grippers, an annunciator operating mechanism, and selectively operated means actuated by said gripper operating means in response to the movement of said gripper operating means beyond a point necessary to engage a set of grippers with a standing pin for actuating said annunciator operating mechanism to energize a signal corresponding to a fallen pin not gripped by the grippers of said set of grippers and indicate the pinfall results of said ball.

MOREHEAD PATTERSON.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,300,802	Parra et al. _____	Nov. 3, 1942
2,338,733	Patterson et al. _____	Jan. 11, 1944
2,388,708	Bates _____	Nov. 13, 1945