April 29, 1969 J. E. LALLY ET AL 3,441,279

BALL DELIVERY AND CONTROL MEANS

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Fig. 1.

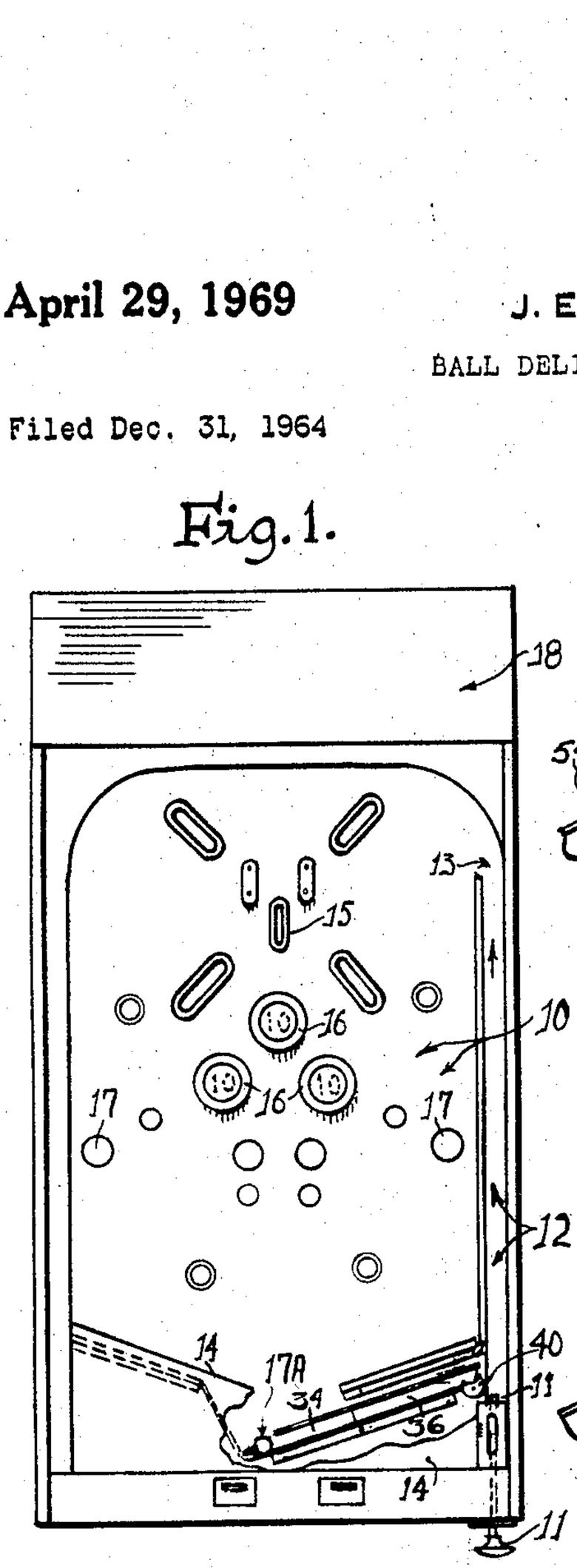


Fig. 4.

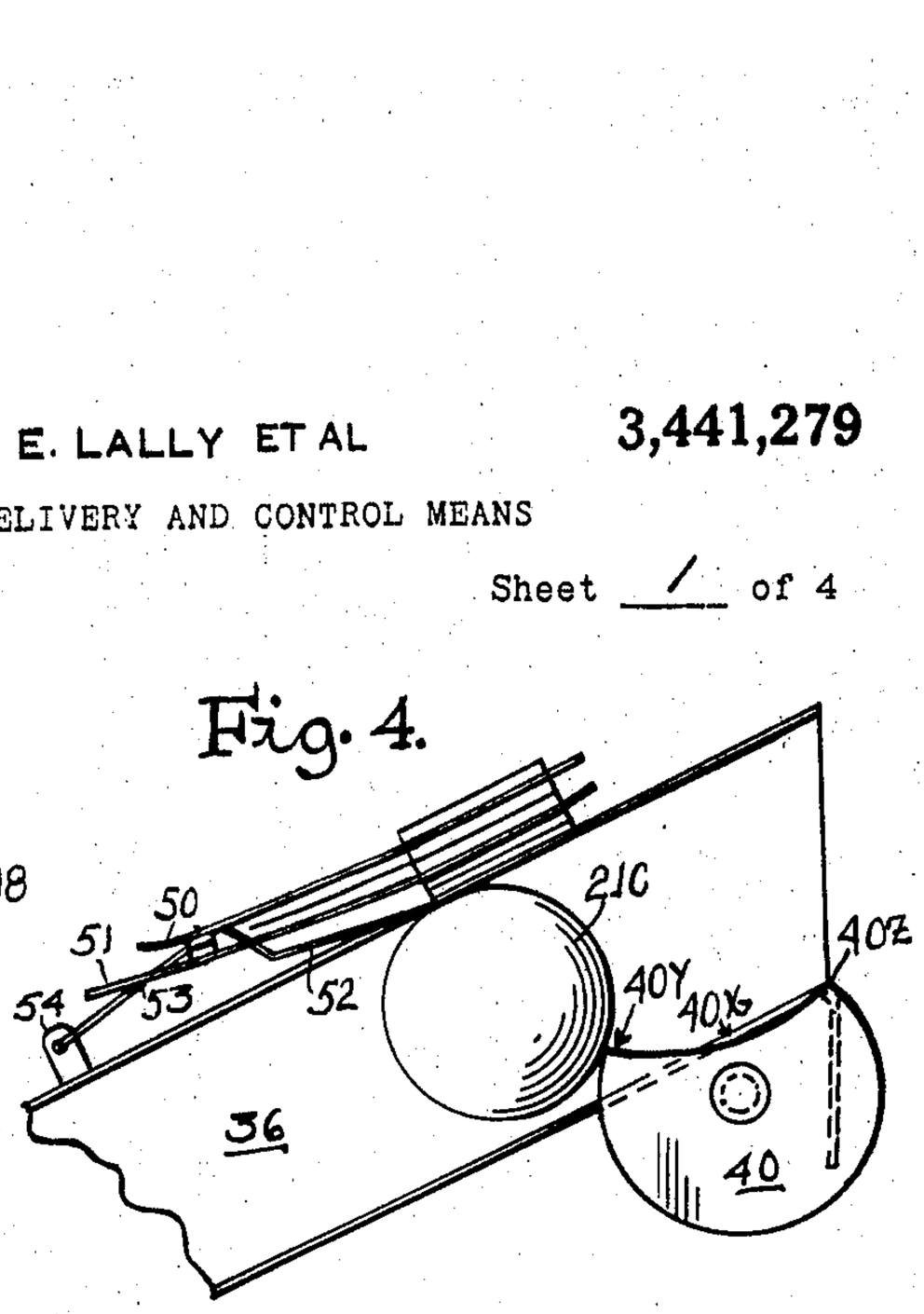
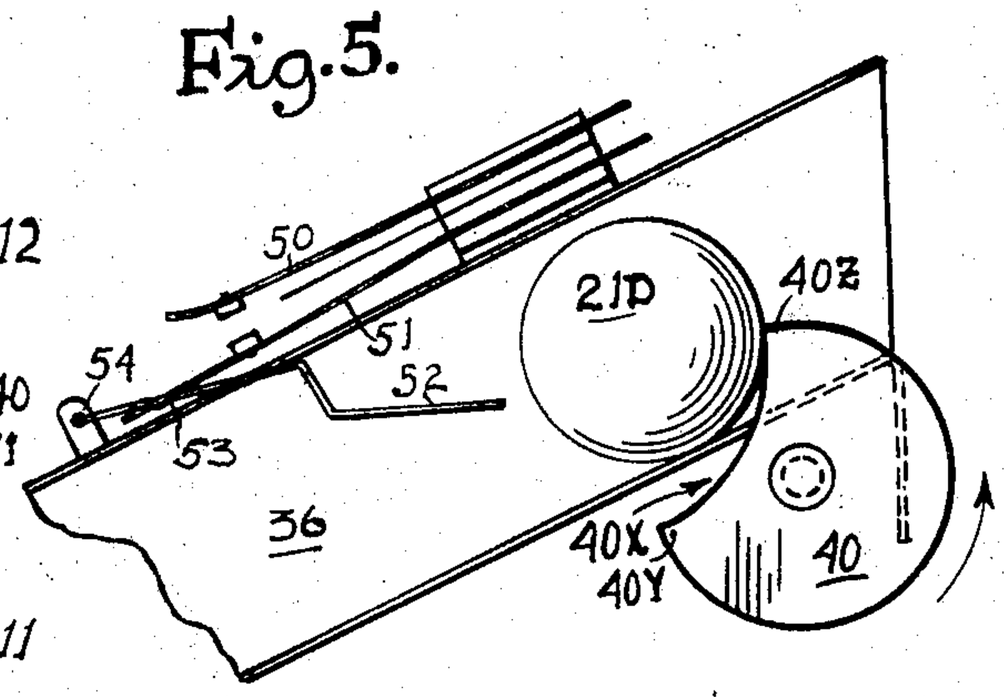


Fig. 5.



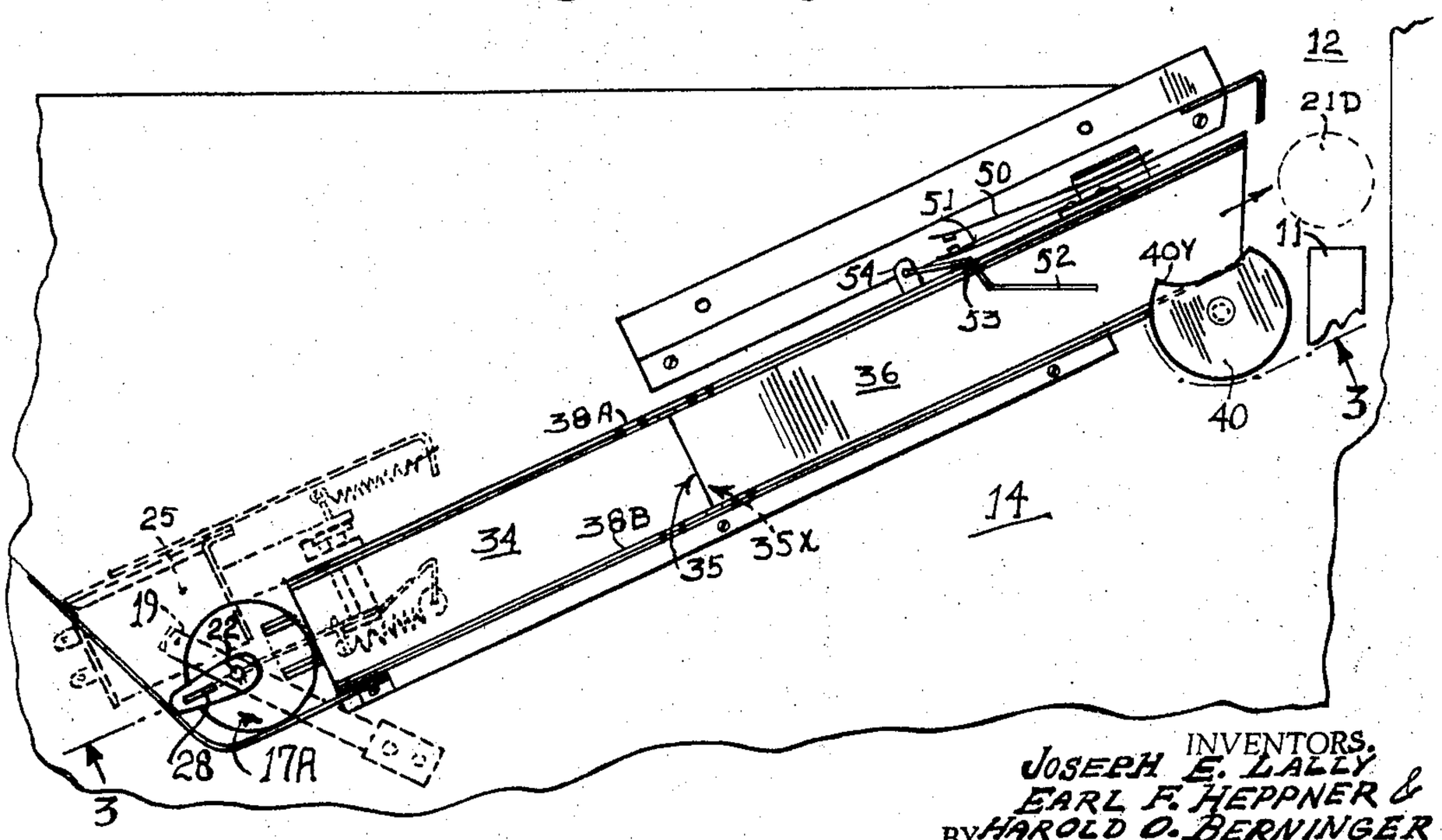


Fig. 2.

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Fig. 3.

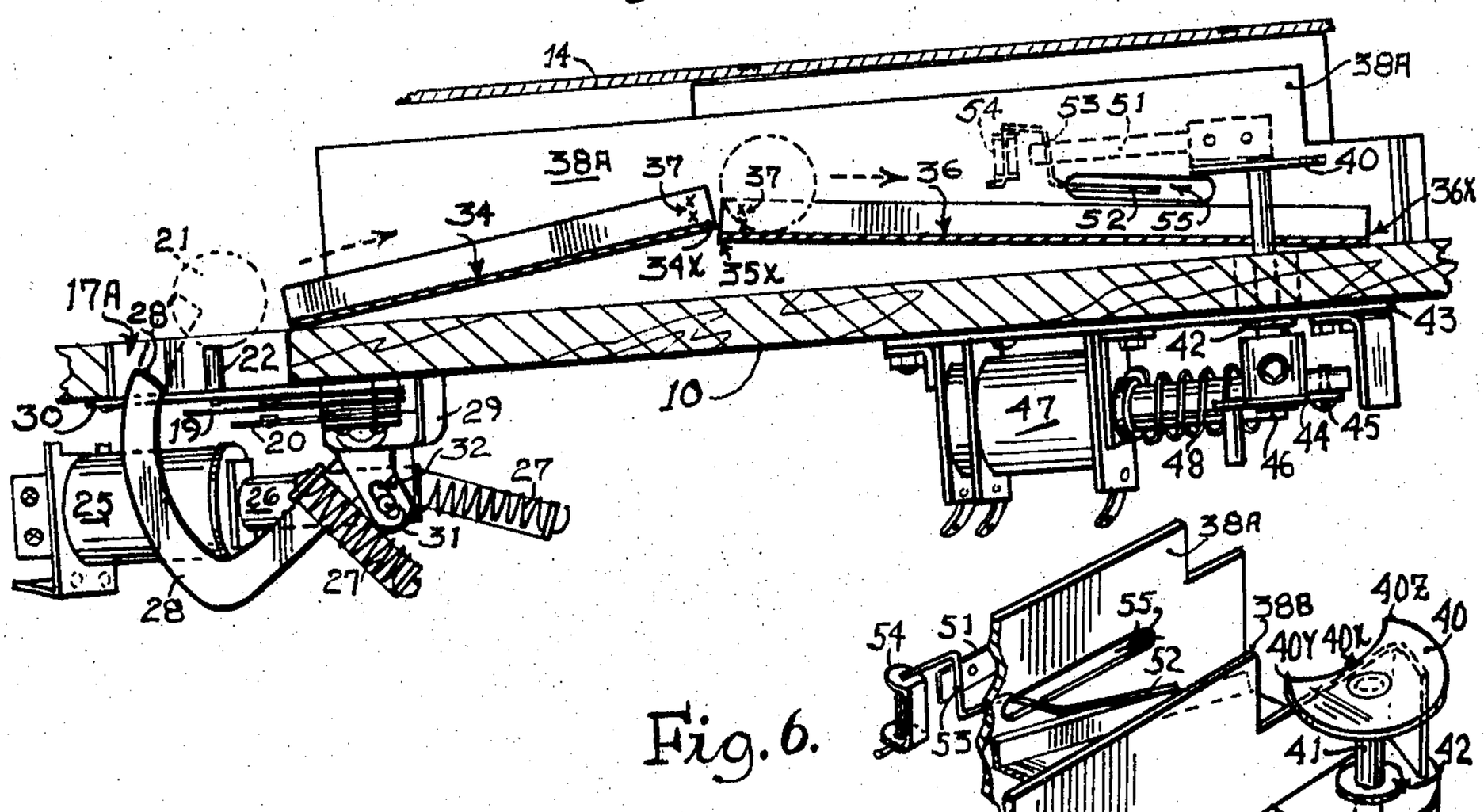

Fig. 6.

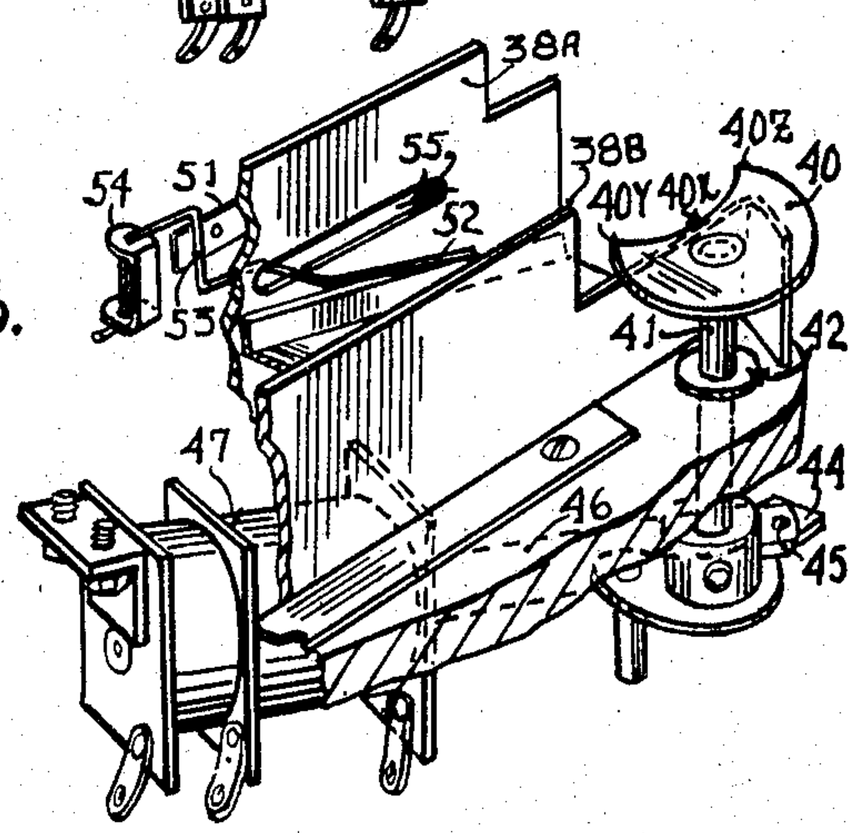

Fig. 2-A.

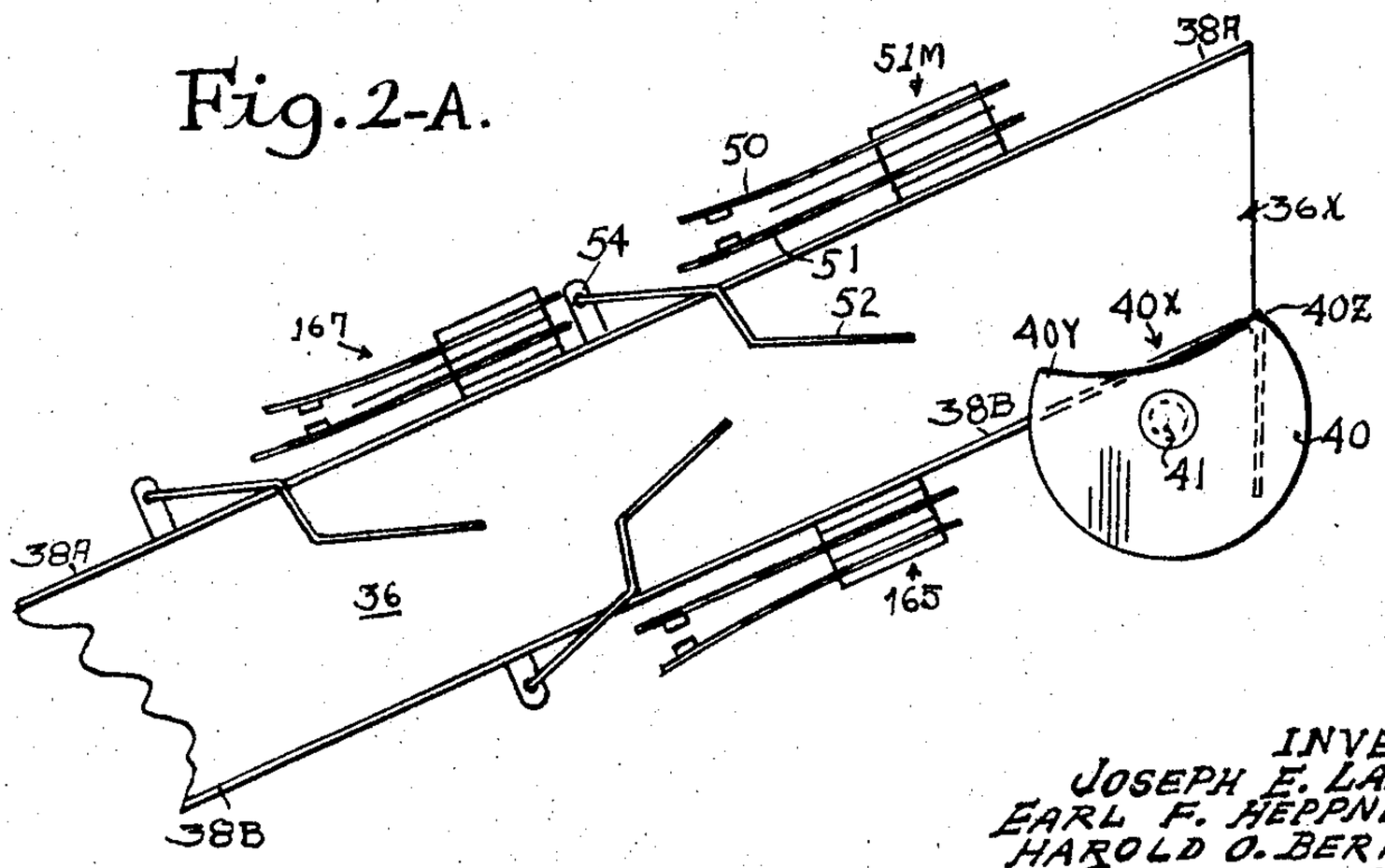

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Fig. 7

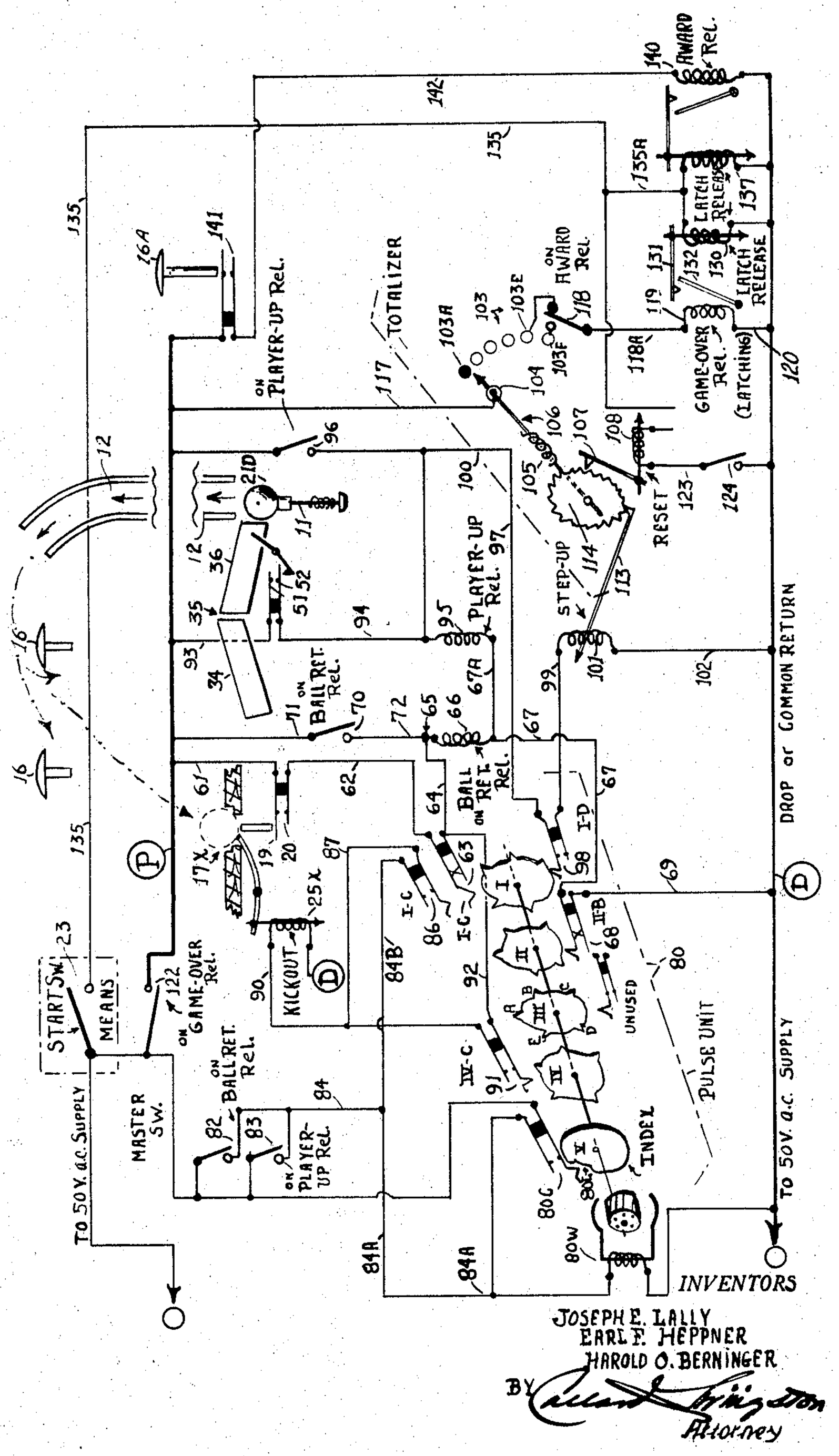

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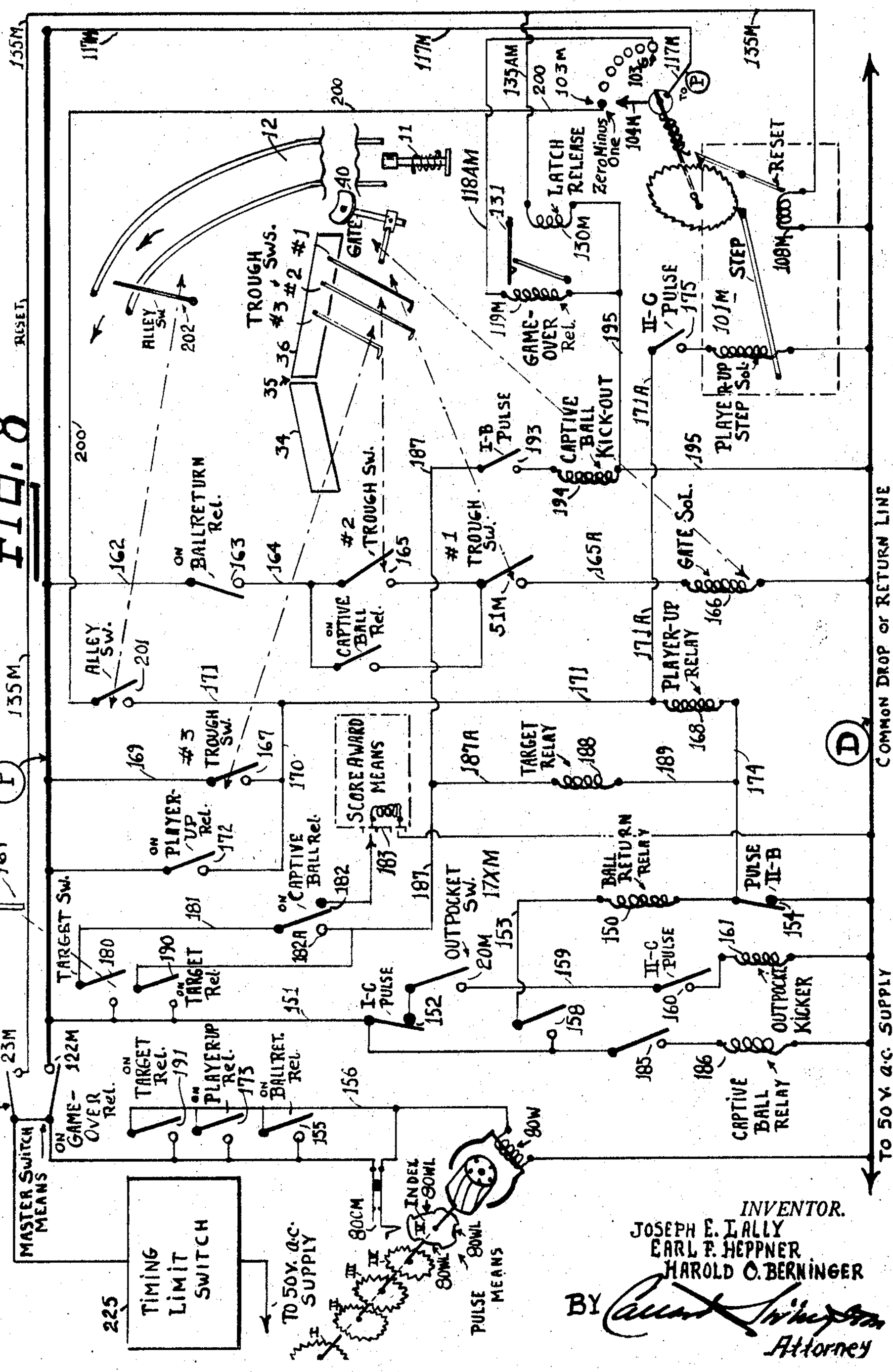
Fig. 8



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3,441,279

Patented Apr. 29, 1969

3,441,279

BALL DELIVERY AND CONTROL MEANS

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Filed Dec. 31, 1964, Ser. No. 422,699

Int. Cl. A63f 7/10; A63d 3/02; A63b 71/00

U.S. Cl. 273—121

13 Claims

This invention provides an improved ball return and delivery mechanism for use in ball rolling games and like amusement apparatus, particularly the coin controlled type in which balls are moved one at a time into position to be played or propelled onto an inclined playing field by the actuation of a spring-plunger ball projecting means.

Ball delivery mechanisms for such games have assumed a variety of forms depending in part upon whether the balls are to be returned from a lower level beneath the playing field, or directly to the projector from the playing field. The presently described system is of the latter type wherein the spent or played balls gravitate to the lower end of the inclined ball rolling field or board and are collected, usually in a serial alignment, for release, one at a time, into the shooting or projecting position, such delivery being effected by electromagnetic means which propels the leading ball of the series into a guideway adapted to direct the same into the playing position.

More particularly, the present improvements provide a special ball ramp and guideway structure in which oppositely inclined ramp portions in the ball-directing runway prove a simple anti-return means preventing the delivered ball from returning to the collecting end of the chute or trough, once it has been propelled, by automatic means, toward the delivery end of the special guideway structure.

The improved system further provides a novel supervisory switch and circuit means actuated by delivered balls, and/or scoring or played balls, in conjunction with a novel gating means, all of which provides a variety of possible control and playing features involving the release or return of balls, and which further makes possible playing more shots than there are balls actually in the game, for example, a five-ball or five-shot round of play using only three balls, etc.

The detailed character of the foregoing and other objects and aspects of novelty and utility inherent in the invention will become more apparent as the following description proceeds in view of the annexed drawings in which:

FIGURE 1 is a top plan view of a ball rolling game with shield portions broken away at the lower end thereof to disclose the relative position of parts of the novel ball-delivery mechanism;

FIGURE 2 is an enlarged plan detail of the delivery mechanism seen in FIGURE 1; FIGURE 2A being a modification of the same;

FIGURE 3 is a vertical section of the delivery mechanism, with parts shown in elevation, taken along lines 3—3 of FIGURE 2;

FIGURE 4 is an enlarged fragmentary plan detail of certain switch and gating means at the delivery end of the ball chute or runway;

FIGURE 5 is an operational variation of FIGURE 4 showing the ball gate in a different condition of operation;

FIGURE 6 is a fragmentary perspective detail of the terminal or delivery end of the ball runway and the gating means and the actuating mechanism therefor;

FIGURE 7 is a schematic circuit diagram of one form of a two-ball automatic ball return system;

FIGURE 8 is a schematic wiring diagram for a modified game apparatus affording a three-ball automatic ball return system.

FIGURE 1 depicts the top plan view of a conventional coin-controlled ball rolling game comprising the inclined playing field **10** onto the upper end of which the usual steel balls are launched by manipultion of a spring-driven plunger **11** situated at the lower end of the table in the shooting alley **12**, which guides the ball to its launching exit **13** at said upper end, from thence the ball begins a meandering travel downwardly toward the lower end and ultimately beneath a masking panel **14** (shown partially broken away) the ball striking various targets **15**, deflecting bumpers **16**, or lodging in scoring pockets **17**.

Electrically-actuated scoring devices, counters, totalizers and display lamps (not shown) are commonly housed in the back or score-cabinet **18**, upstanding at the upper end of the play field, such instrumentalities being controlled by ball-actuated switches associated with the various bumpers **16** and the pockets **17** in the well-known manner.

In the embodiment shown for illustrative purposes, the scoring pockets **17** may be of the type of the special ball-return pocket **17A** in FIGURE 3, with which is associated a leaf-spring control switch having normally-open contacts **19** and **20** adapted to be closed by the weight of a ball, shown in dotted lines at **21**, resting in the pocket and upon the switch-operating pin **22**, the result of such switch closure being referred to more particularly hereinafter.

Also associated with the ball switch for pocket **17A** is an electromagnetic means for expelling a ball therefrom, FIGURES 2 and 3, including a solenoid **25** having a plunger **46** normally withdrawn from the solenoid bore by spring means **27** to lower or withdraw a ball kickout lever **28** from the pocket, said lever being pivotally supported on a bracket means **29** forming part of a mounting plate **30** for both the switch and the solenoid, a drive pin **31** on the plunger engaging in a slot **32** of the kickout lever to elevate the latter to the dotted-line position of FIGURE 3 with a sufficiently abrupt and vigorous blow to expel the ball and drive it upwardly onto a first section **34** of a ball delivery or return ramp.

As viewed in FIGURE 3, the ball ramp is preferably constructed from an assembly of metal stampings consisting, as in FIGURE 2, of two ramp sections **34** and **36** spot-welded, as at **37**, FIGURE 3, to a pair of upstanding side wall plates **38A**, **38B**, which complete a channel-like guideway for the returned balls.

While the construction illustrated shows one method of joining the two ramp sections **34** and **36** at their bi-level juncture by means of welding, it is contemplated that other means may be emloyed for securing these oppositely pitched guide channels in proper blocking relationship.

The floor of this guideway, as defined by the two reversely-inclined ramp portions **34** and **36**, is especially provided with an interruption **35** at a point about one-third the way along the length of the guide channel, at which point the initial portion of the second section **36** of the ramp is dropped in level slightly and inclined downwardly to extend a distance of about twice that of the length of the first section, it being particularly observed in FIGURE 3 that the drop in level at the interruption **35**, as indicated at **35X**, is such that the lateral terminal margin or edge **34X** of the first ramp, FIGURES 2 and 3, affords a backstop which will positively present the delivered ball from rolling back into the first section.

The terminal margin **36X** of the second ramp section, FIGURE 1, is disposed opposite the plunger end of the ball projector **11** in the projecting alley **12**; however, a ball which has passed the backstop means **34X**, **35X** is

not permitted to enter the alley directly, but will be stopped by a novel gating means including a gate disc **40**, FIGURES 2, 4 and 5, mounted on an upright spindle **41**, FIGURES 3 and 6, this spindle being supported in a bushing **42** carried by a mounting plate **43** secured to the underside of the playfield.

A drive lever **44** is affixed to the lower end of the spindle and has pivotal connection at **45** with the end of a solenoid plunger **46** which is normally withdrawn from the bore of a solenoid **47** by spring means **48**.

As viewed in FIGURES 2, 4, 5 and 6, the gate disc **40** is provided with a concave recess or pocket **40X** having approximately the radius of curvature of the balls negotiating the ramp, the normal position of this gate being that shown in FIGURES 2 and 4 wherein a stopping protuberance **40Y** formed by the conjunction of the concave relief or arc with the peripheral margin of the disc, affords a blocking salient which projects into the path of the ball **21C** and prevents it from leaving the ramp.

When the solenoid **47** is energized to attract its plunger, the spindle **41** is turned by drive lever **44** to turn the gate disc into the position shown in FIGURE 5, wherein the ball **21C** is permitted to advance slightly into the concavity or pocket **40X** where it will again be arrested until such time as the solenoid is deenergized and the gate is restored to the normal stopping position shown in FIGURES 2 and 4, the ball **21D** in the concave recess at this time being free to advance and depart from the ramp into the projecting alley **12**, since the opposite salient **40Z** is spaced from the sidewall **38B** sufficiently to permit the ball to roll past the gate.

Thus, it will be observed that since the gate is normally closed, the action of the ball-returning kicker means **28** in launching the ball onto the return ramp is independent of the actual delivery or return of the ball to playing position before the projecting means in the alley **12** and the ball gating or releasing means **40–47** may be operated functionally independently of the kicker means **25**, **28**, so that a variety of control circuits becomes possible in contriving different scoring and control features, as will be more particularly pointed out hereinafter.

An adjunct to the foregoing control feature flexibility comprises a supervisory switch means for detecting or signalling the presence or absence of a ball at the delivery end of the second ramp section. In the simplest form of control system utilizing this ramp structure, this switch means may take the form of a simple blade switch mounted on the wall plate **38A** and having normally open-circuit contact blades **50**, **51** adapted to be closed by a feeler lever **52** pivoted on lug means **54** on the wall plate, said feeler lever having an offset end portion **53** projecting, as in FIGURES 3 and 6, through a slot **55** in said wall **38A** and into the path of a ball arrested by the blocking salient **40Y** of the gate in its normally closed position, whereby to close the supervisory switch contacts in the manner depicted in FIGURE 4, said switch contacts returning to open-circuit condition again, as in FIGURE 5, when the gate turns back in its releasing motion.

In addition to affording improvements in a ball-returning and delivering structure and actuating mechanism therefor, the disclosure provides supervisory circuit control features through the number and location of ball-actuated switches in the kick-out pocket and delivery runway section, together with circuit connections, depending upon the number of balls provided for playing a given game, such that there can always be a predetermined number of balls in play or available for playing under appropriate scoring conditions; and as a corollary to this, it is possible to give the player a total number of shots, for example five, which is greater than the number of actual balls present in the game apparatus. Thus, a player may be permitted or awarded five shots although there are only three balls present in the game.

Viewed from another aspect, the ball delivery and control possibilities are such that a given number of balls

may automatically be kept in play or recirculated, or returned to the player in a number in excess of the number of balls actually in the game apparatus.

It will now be understood that we have produced what in effect is a non-return or one-way ball delivery ramp system adapted for use on a ball rolling field and cooperable with electromagnetic ball propelling means, at an entrance end thereof, and circuit means, both controlled by played balls, for recirculating one or more balls in repeated play; and that such a system additionally employing a supervisory ball switch means at the exit end of the trough or ramp means, together with the disclosed ball gating means, makes possible the use of one or several balls to permit multiple ball play giving the player in effect a number of balls to shoot which is in excess of the number of actual balls present in the game, so that a variety of ball control and playing arrangements becomes possible.

One of the simpler applications of the novel ball delivery and control means is depicted in FIGURE 7 to illustrate the use of a single ball for multiple play without necessity of any kind of gate mechanism to prevent roll-back or retrograde movement of the ball and failure of delivery of the ball to projecting position owing, for example, to momentary low voltage or similar transient conditions in the power lines or some momentary disturbance of the game apparatus tending to prevent a ball from completing its normal travel to the delivery position.

Since only one ball is actually present in the game of FIGURE 7, and it is not necessary to confine control balls in the trough or ramp for the actuation of supervisory switches or other control means, the gate means **40** may be omitted; and for purposes of still further simplifying the illustration, the usual coin control and score-registering and display means has likewise been omitted.

Assuming that some form of master switch means **23**, whether coin-controlled or otherwise, is actuated to connect power for the supply lines P and D (respectively signifying the "Power" and "Drop" or "Return" sides of the circuit), and assuming further that a player approaches the game with the single ball **21D** standing in the projection alley **12** in readiness for propulsion by the plunger **11**, and that this ball is launched onto the playfield in the usual manner where it may engage the usual scoring and like instrumentalities, such as the bumper **16**, and that such ball ultimately lodges in the ball pocket **17X**, such ball will be automatically projected into the ramp means **34**, **35**, **36** and be returned to shooting position in the alley **12** as a result of closure of the ball switch contacts **19–20** associated with the pocket **17X** and the consequent actuation of a Ball Return Relay by connection of power from line P via conductor **61**, said contacts **19–20**, conductor **62**, normally closed pulse switch **63**, conductor **64**, the winding **66** of said relay, conductor **67**, the normally closed pulse switch **68**, and conductor **69** to the drop side D of the line.

Operation of the Ball Return Relay by energization of its winding **66** as aforesaid, causes closure of switch or contact means **70** of said relay to provide a parallel energizing circuit around the pocket switch contacts **19–20** via conductors **71**, **72** to winding terminal **65**, another relay switch or contact means **82** also connecting power from line P to conductor **84** and branch **84A** to energize the winding **80W** of the motor of a pulsing unit **80** adapted to afford a source of control pulses to be utilized in the various circuit systems using the ball delivery means.

In its essential aspects, the pulsing means or unit **80** may consist of the motor **80W** driving a shaft at a predetermined slow rate which shaft carries a plurality of switch-operating cam discs respectively bearing legends I to V, each said disc having a desired number, for example five, cam or lobe portions adapted to actuate an associated switch means, such as the switches **63** and **98**

located at any of five positions around each disc, one or more times per revolution at desired intervals, for example once every five-tenths second per revolution or cycle of the shaft means **86**. In the example illustrated, the five cam lobes on each of the discs I to V may conveniently be assigned the identifying characters A, B, C, D and E, from a given starting position of the shaft cycle and therefore of the disc cycles; thus, the first pulse on all discs will be that produced by the A-cam or lobe in any cycle, and the last pulse will be that provided by the E-cam or lobe. Accordingly, the third pulse in any cycle to be provided by the fourth switch-actuating disc would be identified as IV–C, and on the second disc the pulse at the same instant during the cycle would be identified as II–C, and so on, the actual pulses required for the operation of the particular pulse switches in FIGURE 7 being indicated in this manner in each case, so that further details of the construction of the pulsing switch means is unnecessary. The type of pulsing unit portrayed schematically in FIGURE 7 is utilized in a variety of games and normally comes supplied with five gang switches arranged circumambiently about each of the discs, but in most games, many of these switches may remain unused.

Thus, it will appear that the normally closed pulse switch **68** is designated in FIGURE 7 as II–B, signifying that this switch will open when the cam lobe B on disc II reaches said switch in any cycle, while the switch **63** is designated I–C, signifying that it will be opened when the third or C-lobe of the first disc reaches it.

The described closure of ball pocket contacts **19**, **20** by the played ball having resulted in operation as aforesaid of the Ball Return Relay with consequent closure of relay contacts **70**, will afford a momentary holding circuit for this relay to enable other circuit connections controlled thereby to take full effect; while closure of relay contacts **82** initiates a pulsing cycle of unit **80**.

Almost immediately on entering the ball pocket **17X**, the ball will be expelled by the kickout mechanism heretofore described owing to energization of the kickout coil **25X** via conductor **90**, pulse switch **91** closed by the third (C) pulse of pulsing disc IV near the end of the cycle initiated as aforesaid, but the opening of the ball switch contacts **19**, **20** will not drop out the pulse motor at this time owing to the parallel or shunt holding circuit at contacts **70** of the Ball Return Relay.

The ejected ball traverses the delivery ramps sections **34** and **36**, closing the supervisory ramp switch contacts **50**, **51** which now apply power from line P via conductors **93**, **94**, to coil **95** of a relay called the "Player-Up" Relay because it is associated with the delivery of the balls to the shooting or playing position and tallys the shots permitted in conjunction with other circuit means to be described, the operating circuit for the coil of this relay being completed to the drop side D of the power line via conductors **67A**, **67** and **69**.

Operation of the Player-Up Relay as aforesaid keeps the pulsing motor running by closure of its contacts **83**, **84**, **84A** to **80W**, and the delivery of this ball is tallied by a step-up totalizing switch means **100** which may be of the rotary step-by-step solenoid operated variety including stationary contacts **103**, successively engaged by a stepping contact **104** from a starting position to which it is reset by action of the usual return spring means **105** restoring the stepping shaft **106** to starting position on release of a holding pawl **107** by energization of its release coil **108**, said stepping contact being advanced from such starting position by action of a stepping solenoid **101** actuating a stepping pawl **113** to engage drivingly in the ratchet teeth of a ratchet wheel **114**, the gain of which is held by the holding pawl **107**.

Stepping operation of the ball-counting or tallying means **100** by energization of the stepping solenoid **101** as aforesaid occurs as the result of pulling in of the Player-Up Relay, as just described, to close its contacts **96**, thereby applying power via conductors **97**, pulse switch **98** closed on pulse I–D, conductor **99** to the step-up coil **101**, returned to the drop side of the line via conductor **102**. In order to assure a sufficient pulse to cause reliable stepping action of the totalizing step-up means, the supervisory trough or ramp switch **50**, **51** is shunted by the Player-Up Relay contacts **96**, assuring that the Player-Up Relay coil **95** will be sufficiently energized following the transitory and somewhat rapid closure of said trough switch **50**, **51** by passage of the ball, to cause the step-up solenoid to advance the step-up contactor properly.

The foregoing ball delivery operations will be repeated as often as the played ball lands in the pocket **17X** until the permitted number of plays is exhausted. If the player is to have five shots only, the ball totalizing means **100** and associated control circuits will be connected to shut off the play and disable the circuit after the fifth ball has been shot, this being accomplished by lodgement of the stepping contact **104** on the fifth contact **103E** from starting position at **103A**, thereby connecting power from line P via conductor **117**, stepping contact **104**, said fifth contact **103E**, switch **118**, conductor **118A**, Game-Over Relay coil **119**, and return connection **120** to line D, thus opening the Game-Over Relay switch **122** which is the Master Switch Means for disconnecting the power side P of the line from the indicated 50 volt A.C. supply and drops all relays except those which are of the latching type, such as the Game-Over and Award relays, it being observed, however, that the pulsing motor will nevertheless remain connected with the supply side of the power conductor and will thereby be enabled to complete its cycle until its Indexing switch **80C** is opened at the conclusion of any pulsing operation in progress.

The Game-Over Relay is of the latching type with a latch-release coil **130** energizable to release the latch means **131** and restore a switch- or contact-actuating armature means **132** to normal condition (e.g. switch **122**). Thus, when the Game-Over Relay coil **119** is energized to terminate the game as aforesaid, the latch means **131** locks the armature against restoration until the associated release coil **130** is energized.

The normal number of shots, for example five, may be extended in various ways, for instance as an award for scoring hits on certain bumpers, such as the bumper **16A**, the closure of the switch **141** of which will apply power via conductor **142** to the coil of an Award Relay **140**, the normally closed transfer switch **118** of which will shift the operating connection for the Game-Over relay from the fifth contact **103E** to the sixth contact **103F**, so that the Step-Up switch will take an extra step before the Master Switch **122** ends the game.

In order to reset the game for another round of play, the Start Switch means **23** is required to be closed by some means to apply power to the resetting conductor **135** as aforesaid, which will energize the Reset coil **108** of the Step-Up unit, this same signal energizing the Latch Release coil **130** of the Game-Over relay and the Latch Release coil **137** for the Award Relay via branch conductor **135A**, so that the stepping contactor **104** will return to its index or starting position on contact **103A**, and the Master Switch Means **122** will reclose.

An application of the novel ball delivery and control means to a plural-ball, multiple-play system employing a total of two actual balls in the game, but affording a larger number of plays in addition to a "captive ball" feature, is illustrated in FIGURE 8, wherein components which are identical to those employed in FIGURE 7 are identified by the same reference characters, whereas those which are essentially similar are identified by the same reference characters with the suffix M added thereto.

The so-called "captive ball" feature provides at least one more ball kickout pocket in addition to the out-pocket **17A** or **17X**, described in view of FIGURES 3 and 7,

of the Outpocket Switch **20**M and operation of the Ball-Return Relay **150** and ensuing results leading to the operation of the Ball Gate for release of another ball, until the permitted number of plays or balls have been counted off by the Totalizing means in the form of the Stepping Switch Means **101**M, **103**M, etc.

When the last of the permitted plays, for example the fifth, has been taken and the stepping contact **104**M lodges upon the contact designated **103**G, power will be applied from wiper conductor **117**M, wiper or stepping contactor **104**M, said contact **103**G conductor **118**AM, to energize the coil **119**M of the Game-Over Relay with resultant shutting off of the game by opening of the Master Switch **122**, as previously described.

In general, the scoring operations which may result from meander of a played ball over the playfield to actuate any of the numerous scoring and target devices and switches **15**, **16**, commonly supplied in such games, will be indicated or tallied in the manner well-understood in the art; but special scoring features and awards are also possible in conjunction with the novel ball-delivery and control means disclosed, examples of which have been described in view of FIGURE 7 and which may be duplicated in the circuit of FIGURE 8, as desired.

Further examples of such special scoring possibilities are provided in the more complex control circuit means shown in FIGURE 8, wherein a hit scored on a particular bumper device **16**T will cause closure of its target switch **180**, thereby applying power via conductor **181**, and a normally closed relay switch **182** on the Captive-Ball Relay to energize a relay coil or other score device **183** as a part of or associated with a desired "Score Award Means," such an award, however, being arbitrarily subject to the condition that there is no ball in a certain Captive Ball Pocket to operate the appertaining Capitve Ball Switch **185**, so that the Relay Switch **182** stands in its normally closed condition.

In the latter scoring arrangement, if a ball lodges in the Captive Ball Pocket associated with said Captive Ball Switch **185** to close the latter, power would be applied from conductor **151**, said captive switch **185**, to the coil **186** of a Captive-Ball Relay so that the aforesaid Captive-Ball Relay Switch **182** would open the circuit to the Score Award Means **183** and transfer this circuit to contact **182**A, thereby applying power to conductors **187**, **187**A to energize the coil **188** of a Target Relay returned to the drop side of the line via conductors **189**, **174** and closed Pulse Switch **154**, this Target Relay circuit being held in at Target-Relay Switch **190**, and another Target Relay Switch **191** closing to start the pulse motor via conductor **156**.

The captive ball which was presumed to be the cause of the transfer of the previously described scoring circuit at relay switch **182** to contact **182**A will be kicked out by energization from said conductor **187**, pulse switch **193**, next closed on a pulse designated I–B, the solenoid coil **194** for the kickout mechanism at the particular Captive Ball Pocket associated with said Captive-Ball Switch **185**, this circuit being returned to the drop side of the line via the common return **195** for the Game-Over Relay and its latch release coil. In consequence, the Captive-Ball Pocket Switch **185** will open to drop out the Captive Ball Relay and reclose the Score Award Circuit at switch **182**.

Ball rolling games of the class described, particularly when coin-controlled, usually are provided with some kind of automatic cut-out Timing Switch **225**, FIGURE 8, operable to disconnect the power if the last shot is not taken within a predetermined time limit after starting, and it is not uncommon that a player will abondon the game without taking the allotted number of shots, and may leave a ball standing in the projecting alley **12** to be shot by the next player to approach the game after the usual starting and resetting operations have occurred. In such cases it is desirable not to count the first shot as a part of the allotted number of shots to which the new player would be entitled, particularly where such a game is coin-controlled. Accordingly, the so-called Zero Minus One Index Contact **103**M on the Step-Up unit will apply power from the stepping contact **104**M, conductor **200**, an "Alley Switch" **201**, having an actuating feeler **202** located in the projecting alley **12**, to conductor **171** connecting with the coil **168** of the Player-Up Relay, which will cause a stepping operation of the Step-Up unit by the operating circuits controlled by this relay, as previously described, thus counting off the first shot under direct control of the projected ball which was left standing in the alley, so that the counting of the subsequent shots will properly be under control of the ball delivery and control means comprising the Outpocket kickout means, the delivery ramp system and its associated ball trough switches operative to return spent balls automatically to the player responsive to the permitted number of shots controlled by the totalizing or step-up unit, modified or not, as the case may be, by extra shots awarded in conjunction with special scoring features.

FIGURE 2–A shows the preferred arrangement of the plurality of trough or ramp switches **51**M, **165**, **167**, utilized in a plural ball recirculating delivery circuit such as described in view of FIGURE 8.

Any suitable source of pulses may be employed for actuating or triggering purposes, in lieu of the Motor Cam Switch pulsing means **80**, or **80**W of FIGURES 7 and 8. The unit **80** of FIGURE 7 is depicted schematically as having one index lobe **80**L per revolution, so that each cam disc has five pulsing lobes A, B . . . E. But the cam discs I–V of FIGURE 8 will desirably be of the kind having 15 lobes or 5 per ⅓ revolution, the disc V accordingly having three indexing lobes **80**WL per revolution, thus providing an increased pulsing potential per complete shaft revolution for the more complex control circuit.

Thus, the indexing cam V of FIGURE 8 indexes 3 times per revolution; or stated otherwise, will have three pulsing phases per full shaft revolution, and each cam disc I to IV in this arrangement must therefore have five cam lobes per one-third revolution in order to give the five pulses per indexing operation or phase, this being the reason for use of the expression "cycle" in describing the pulsing indexing in view of FIGURE 7, and the expression "Index Phase" or "Pulsing Phase" in referring to the pulsing means of FIGURE 8. Other pulsing devices and arrangements, however, may be substituted, as will be understood by those skilled in the art.

We claim:

1. A ball delivery trough structure for ball rolling games characterized in that the trough has two elongated sections extending in approximate longitudinal alignment the same being respectively pitched upwardly from a lower end with elevated upper ends meeting at a higher elevation in substantially confronting abutment with a bottom edge of a first section at a level above the confronting bottom edge of the second section affording a blocking ledge, the lower end of one section constituting a ball entrance for the trough structure, and the lower end of the other section constituting a ball exit for the trough structure, and said elevated upper ends constituting a region of inflection in which a ball moving from said entrance toward said exit can change direction from an upward to a downward course whereby to interfere with the tendency of such ball to gravitate retrogressively toward said entrance and said ledge blocking retrogression once a ball has passed the same.

2. A ball delivery trough according to claim **1** wherein the ball exit includes a movable gate member having a normal ball-blocking position and a ball-passing movement from and back to said position, wherein there is provided at said entrance electromagnetic means operable to launch a ball upwardly into said one section for transit past said ledge; wherein there is further provided electromagnetic means operable to effect ball-passing movement

of the gate member as aforesaid, and ball-actuated switch means connected in circuit with said electromagnetic means to energize the same dependently upon the presence or absence of at least one ball in said trough.

3. In a ball rolling game having a playfield inclined from an upper end to a lower end with means at said lower end and at one side of the playfield for projecting balls to said upper end to gravitate to the lower end, ball delivery and control means comprising an elongated ball trough having an entrance and an exit and wide enough to pass only one ball at a time, said trough being located at said lower end of the playfield with said exit thereof in juxtaposition with said one side of the playfield and said projecting means to deliver balls one at a time to the latter; an electromagnetically actuated ball gate at said exit of the trough; means for receiving spent balls at said lower end of the playfield in juxtaposition to said trough entrance; electromagnetically actuated means at said receiving means operable to engage and forcibly dislodge a spent ball therefrom along a trajectory into said entrance of the trough and with force sufficient to traverse the length of the trough; ball-operated supervisory switch means operably associated with said trough; circuit means for actuating said ball gate and said dislodging means; ball-actuated playfield switch means disposed in the path of a ball moving from said upper end of the playfield generally toward said lower end thereof and said ball receiving means and connected with said circuit means and with said supervisory switch means for actuation of said ball dislodging means and said gate to cause delivery of a ball to said projecting means dependently upon a predetermined sequence of operation of said playfield switch means and said supervisory switch means.

4. Apparatus according to claim **3** further characterized by the provision of electrically-actuated and reset totalizing switch means having a starting condition and a cut-off condition and connected with said control circuit means for operation a predetermined number of times from said starting condition responsive to each ball delivered as aforesaid, and further operable to cut-off further ball delivery when a predetermined total number of delivered balls is totalized corresponding to said cut-off condition; and a starting circuit connected with said control circuit and including a starting switch operable to reset said totalizing switch means to said starting condition.

5. Apparatus according to claim **3** in which said trough comprises two sections along its length respectively pitched upwardly toward each other one from said entrance and the other from said exit whereby said sections respectively have upper ends in confronting relation at an elevation higher respectively than said entrance and exit so that a ball moving from the entrance to the exit changes from an upward course to a downward course to interfere with retrograde motion of a ball.

6. For a ball rolling game having a confined area comprising a playing field, means for delivering balls unidirectionally one at a time from a first position to a second position, said means including an elongated guideway structure having an entrance end disposed at said first position and an exit end disposed at said second position and being of a width to confine balls of given diameter for movement seriatim from one toward the other of said ends, said structure having a first portion beginning with said entrance end which is inclined upwardly in a direction generally toward said exit end for a distance terminating substantially short of said exit end; said structure further comprising a second portion pitched downwardly toward said exit end from a junction approximately at, but stepped down from the terminus of said first portion; the elevation of the terminal part of the first portion being higher than that at the beginning part of the second portion; and defining a blocking obstacle such that a ball launched into the first portion and departing from the latter to the lower elevation of the second portion cannot reenter the first portion by gravitational retrogression; together with electromagnetic projecting means for directively propelling balls one at a time and with approximately the same initial velocity into the entrance end of the first portion of said guide structure with a force normally sufficient to carry a ball past said junction.

7. For ball-rolling games, in combination, means providing a ball guide comprising oppositely pitched ramps, one of which has a lower end constituting an entrance and the other of which has a lower end constituting an exit for movement of balls in single file between said ends, the first of said ramps beginning at said entrance being upwardly inclined and the second of said ramps being downwardly inclined toward its said exit from a point of inflection which is situated between said ends; means adjacent said point of inflection presenting an obstacle to retrograde ball movement back toward the entrance end after passing such point; electromagnetic means adjacent said entrance operable to forcibly strike and propel a ball along a trajectory leading upwardly onto the first ramp with force sufficient normally to enable a ball to reach and pass said point of inflection; electromagnetically actuated means adjacent said exit end operable to bar departure of a predetermined normal ball from said exit and in a releasing operation to permit one ball to depart from said exit; supervisory guide switch means including an actuating instrumentality engaged by a ball in said second ramp for circuit controlling purposes; and circuit means interconnecting with said electromagnetically actuated means and a ball-controlled game switch for actuating both said electromagnetic means and electromagnetically actuated means for causing operation of the ball propelling means and the ball releasing means responsive to an operation of said supervisory switch means.

8. In a ball-rolling game, ball-control and delivery means for playing multiple shots exceeding in number the number of balls actually provided in the game, said means comprising, in combination with a ball projecting means for launching a ball to roll upon a playfield, a ball pocket on said field to receive a played ball, pocket switch means actuated by a ball in said pocket; ball kickout means operable under control of said pocket switch means to expel a ball in a direction generally back into the playfield with propulsive force in a predetermined direction from said pocket; a ball delivery ramp means on said playfield having an entrance located on the playfield with respect to said pocket and said ejecting direction to receive an ejected ball and to guide movement of said ball to an exit therefrom juxtaposed with said ball projecting means to deliver a ball negotiating said ramp means into playing position relative to the projecting means; said kickout means imparting to the ball ejected thereby a force in said direction sufficient to cause said ball to travel from said entrance to the exit of said ramp means for the purposes aforesaid, and means defining a barrier across said ramp means between said entrance and exit thereof to block return of an ejected ball which has passed said barrier toward said exit.

9. Apparatus according to claim **8** further characterized in that said ramp means comprises a first ramp section inclined upwardly to a predetermined point of elevation from said entrance, and a second ramp section inclined downwardly from said point of elevation toward said exit, whereby to change the direction of ball travel in negotiating the delivery ramp means and impede retrograde movement of said ball and said barrier being defined by a portion of the bottom at the end of the first ramp section.

10. Apparatus according to claim **9** further characterized in that said ramp sections at said point of elevation are at a different level, the second section commencing at a lower elevation than a terminal lateral edge portion of the first section such that said terminal edge portion defines said barrier above said commencing part of the second section to impede retrograde movement of the ball as set forth.

11. Apparatus according to claim **8** further charac-

terized in that said second ramp section includes a supervisory switch means operable by the presence of a ball adjacent said exit thereof.

12. Apparatus according to claim **9** further characterized in that said second ramp section includes a supervisory switch means operable by the presence of a ball adjacent said exit thereof and connected in a circuit with relay means adapted to be actuated by operation of said supervisory switch means dependently upon the passage of a ball in delivery movement to and from said exit.

13. Apparatus according to claim **12** further including electrically actuated totalizing means and circuit connections controlled by operation at least in part by said relay means for actuating the totalizing means in response to the ball delivery operation of said supervisory switch means.

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U.S. Cl. X.R.

273—122, 129

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,441,279 April 29, 1969

Joseph E. Lally et al

It is certified that error appears in the above-numbered Letters Patent requiring correction and that said Letters Patent should read as corrected below:

Column 2, line 34, for "46" read --26--;
column 2, line 67, for "present" read --prevent--;
column 7, line 40, for "be come" read --become--; and
column 12, line 42 (claim 8), for "into" read --onto--.

Signed and sealed this 24th day of March 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents