Nov. 9, 1954 R. STEVENS 2,693,962

DICE GAME APPARATUS

Filed June 12, 1948 11 Sheets-Sheet 1

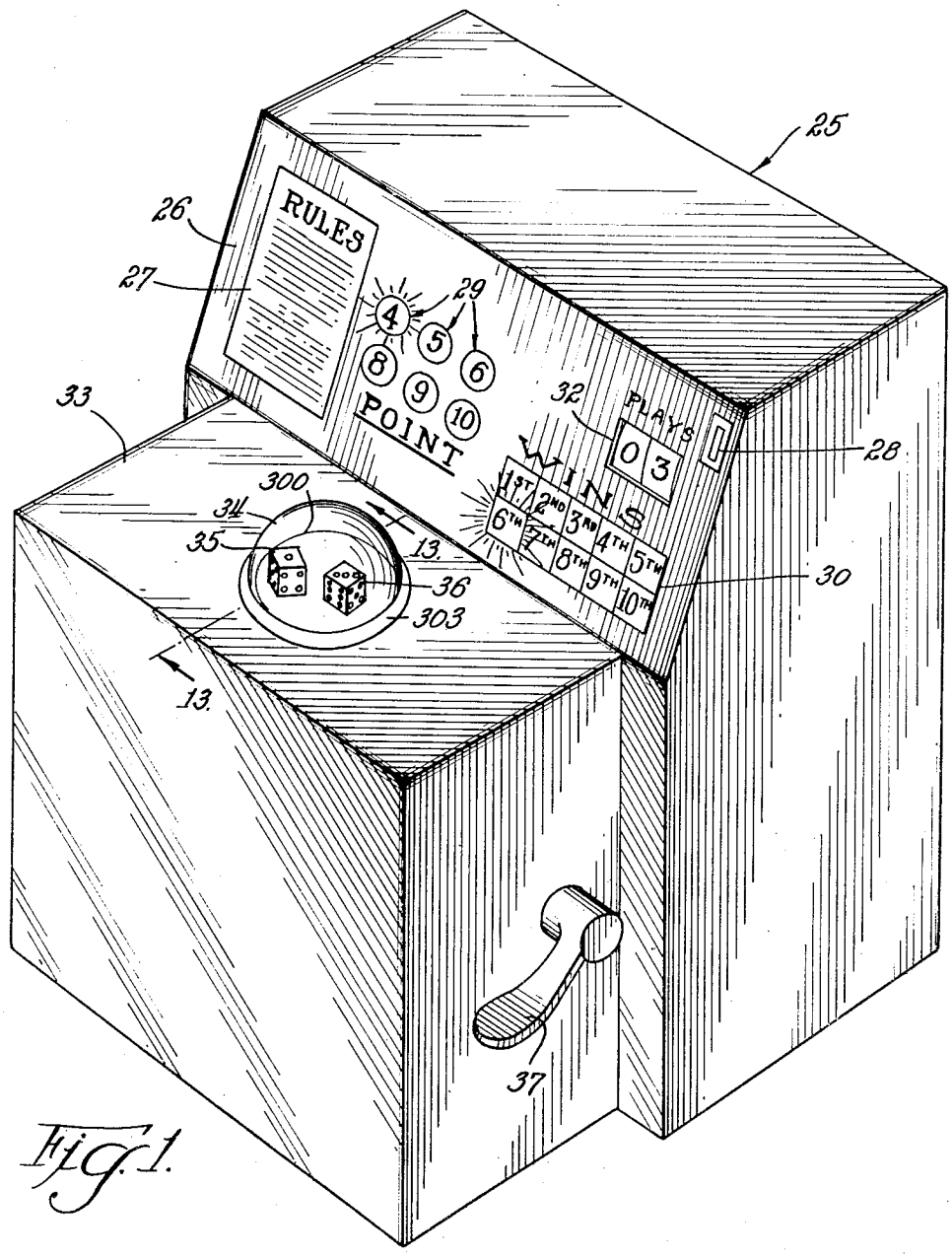


Fig. 1.

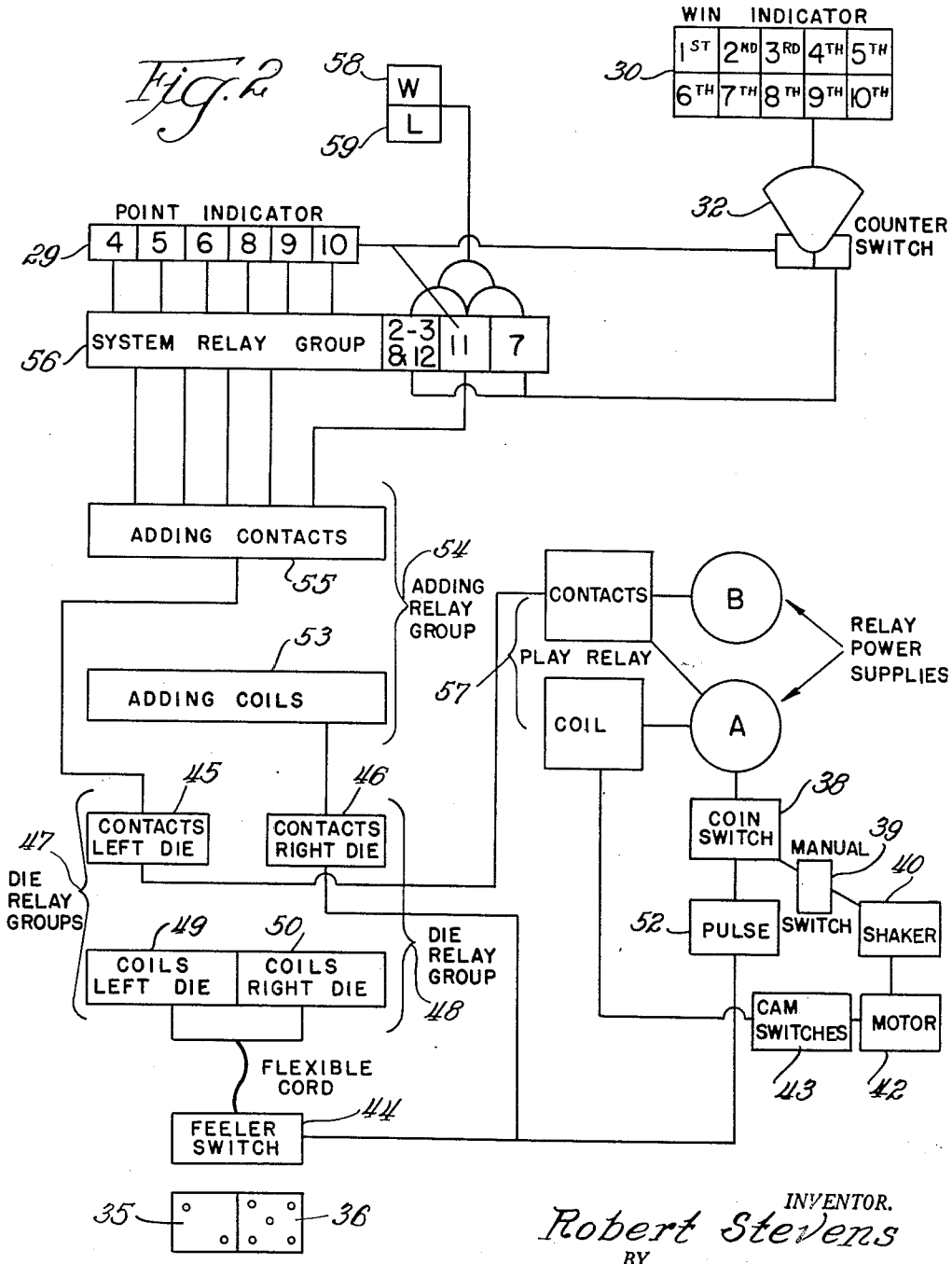
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DICE GAME APPARATUS

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Fig. 2



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DICE GAME APPARATUS

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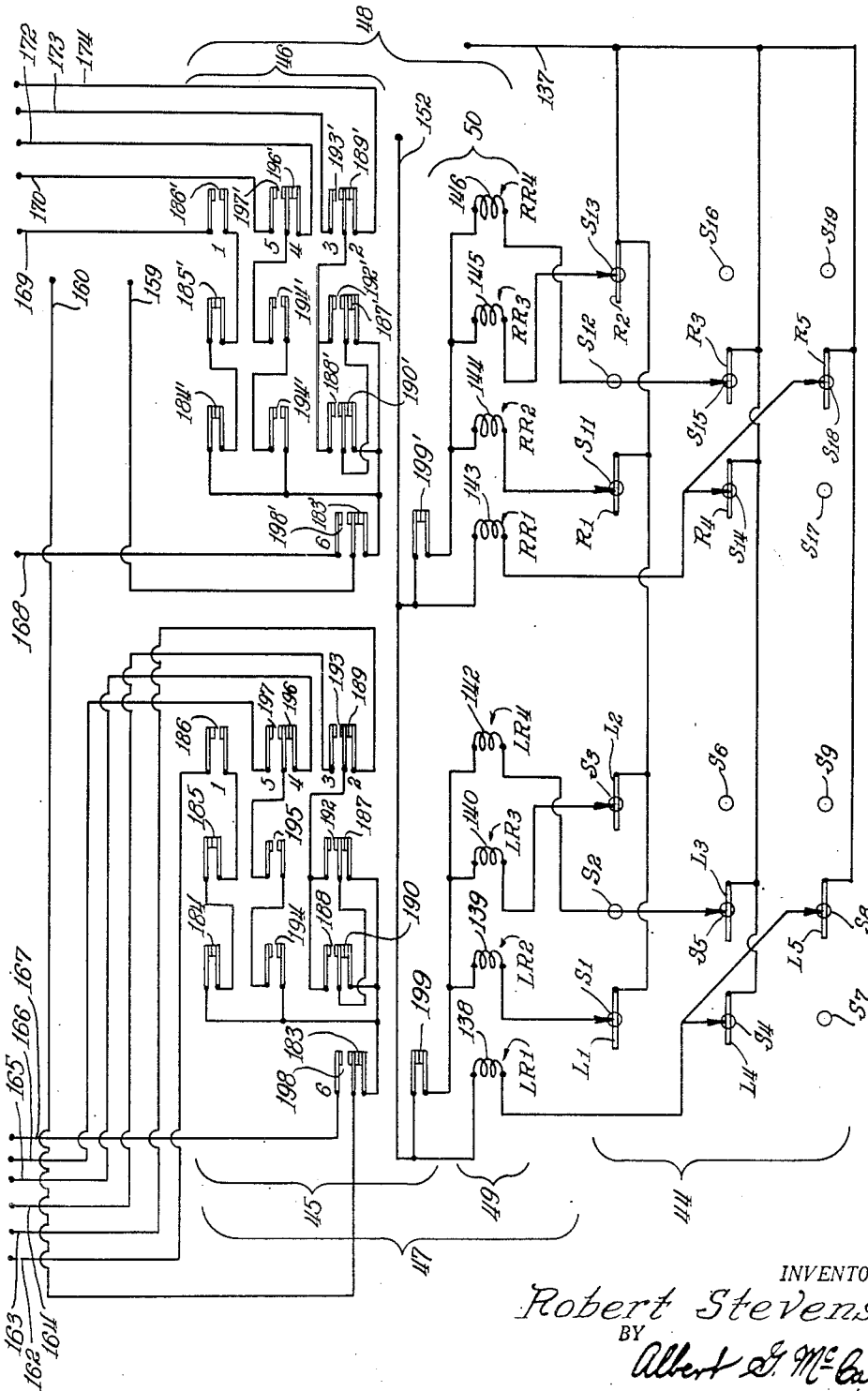


Fig. 3.

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DICE GAME APPARATUS

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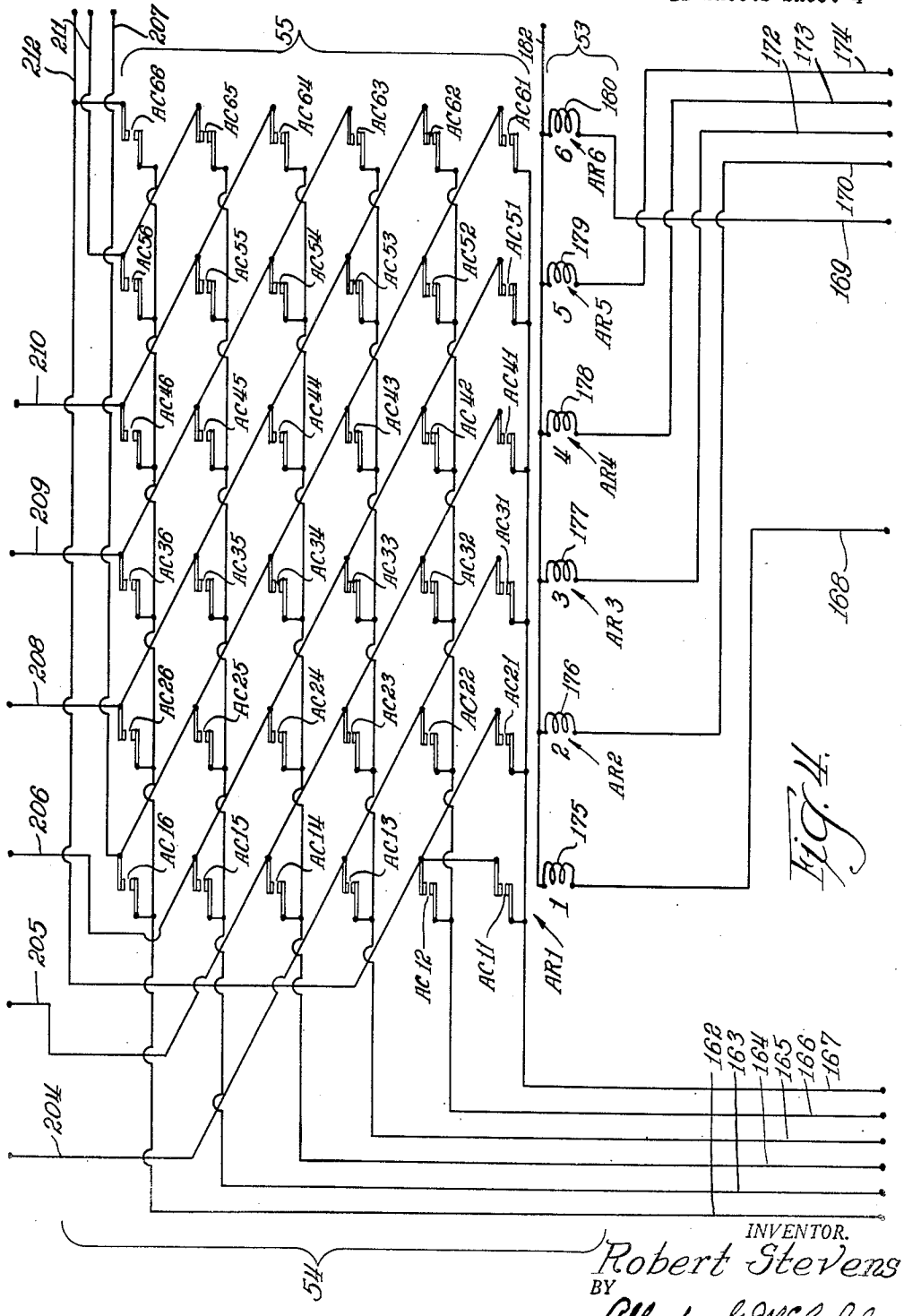


Fig. 4.

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DICE GAME APPARATUS

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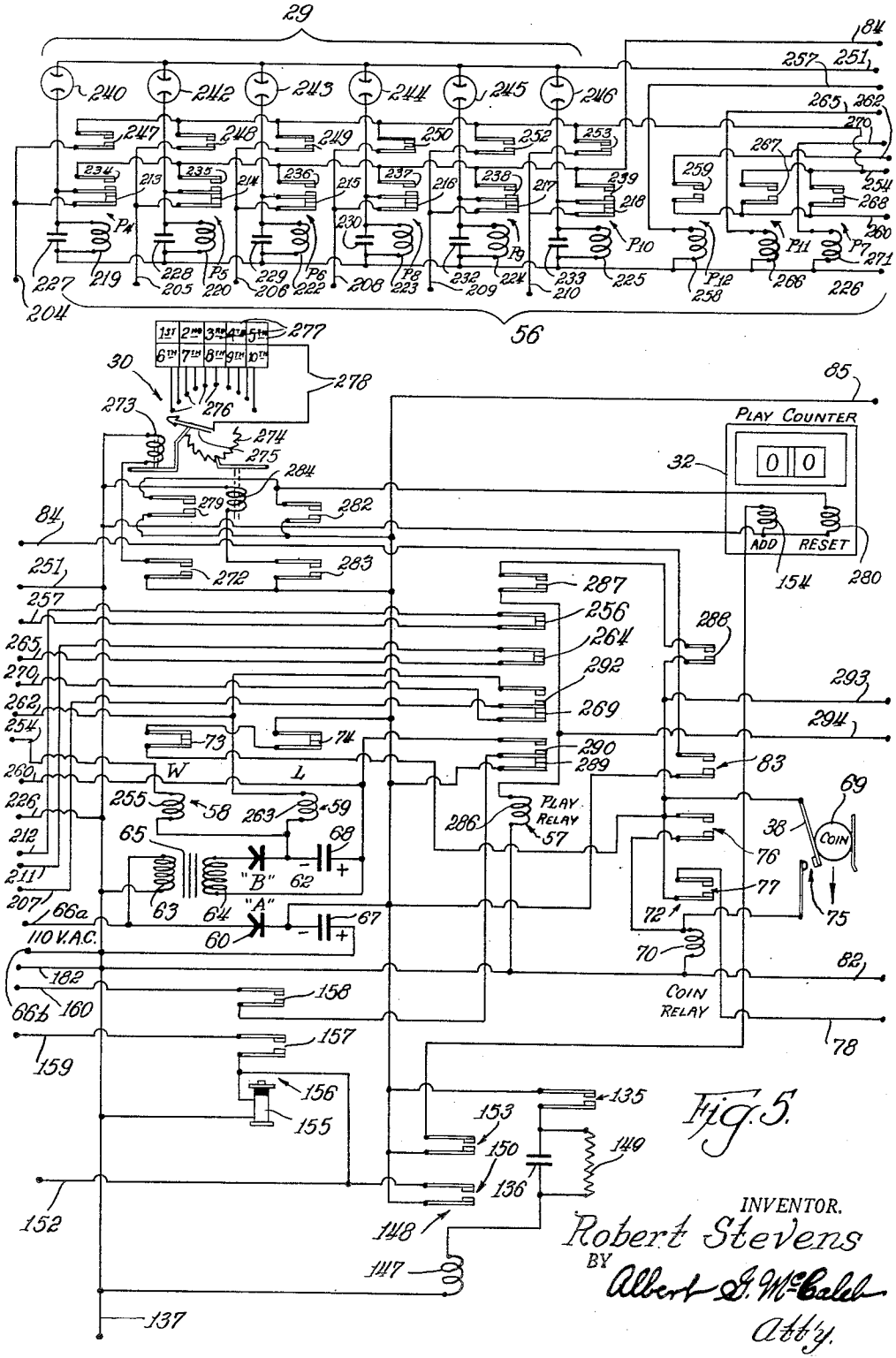


Fig. 5.

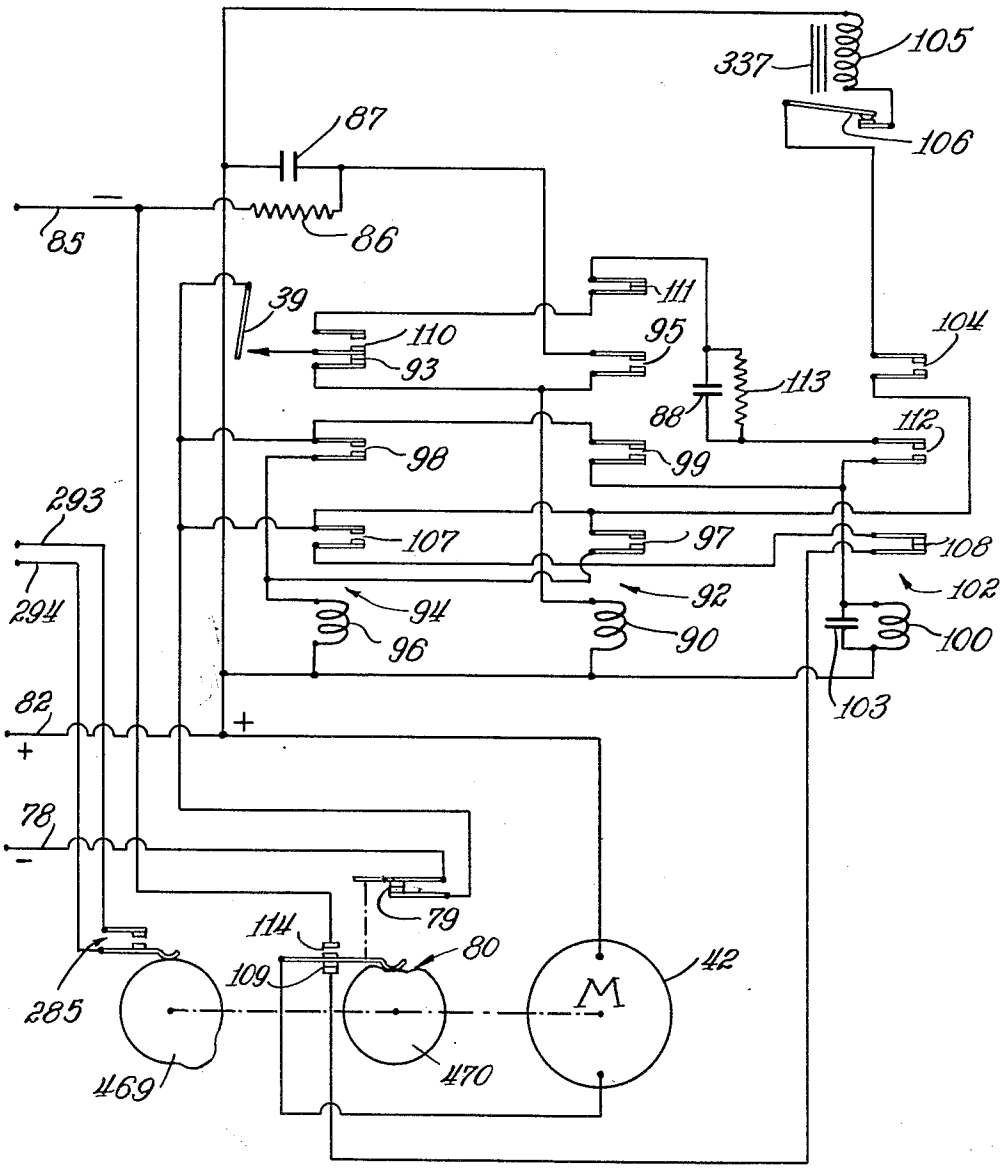
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Fig. 6.



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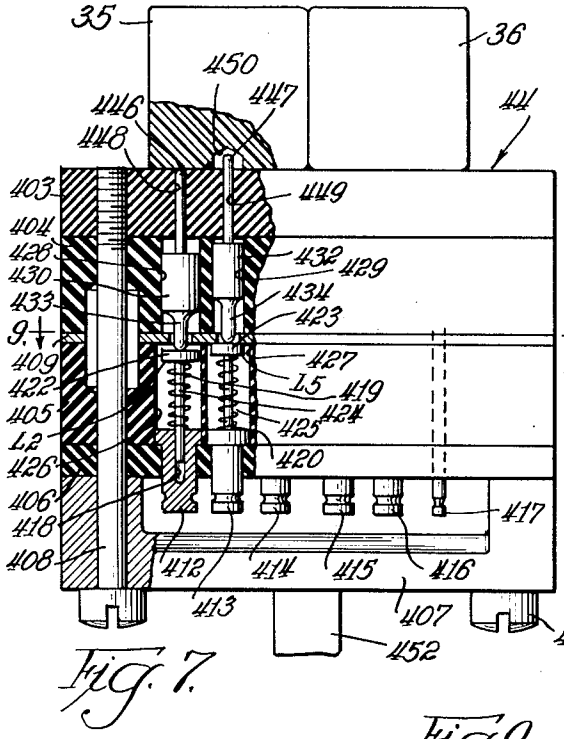


Fig. 7.

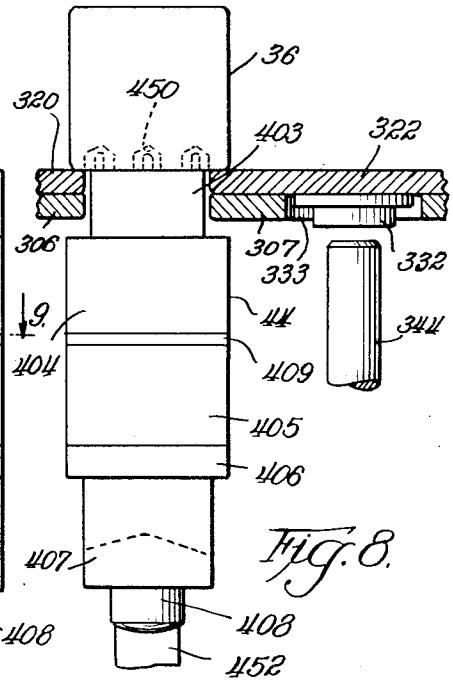


Fig. 8.

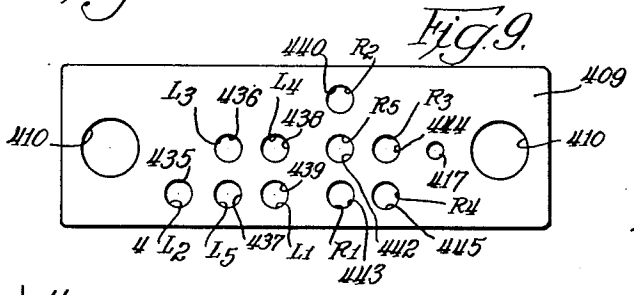


Fig. 9.

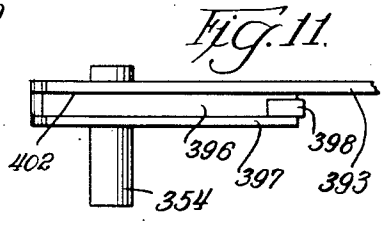


Fig. 11.

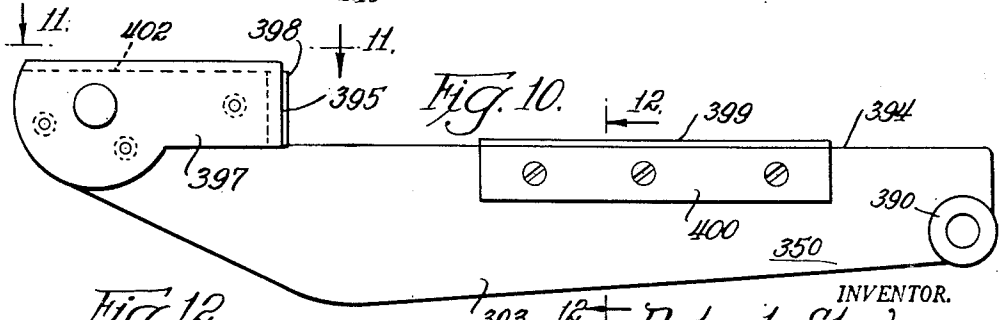


Fig. 10.

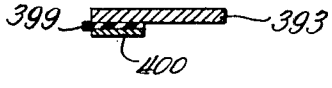


Fig. 12.

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DICE GAME APPARATUS

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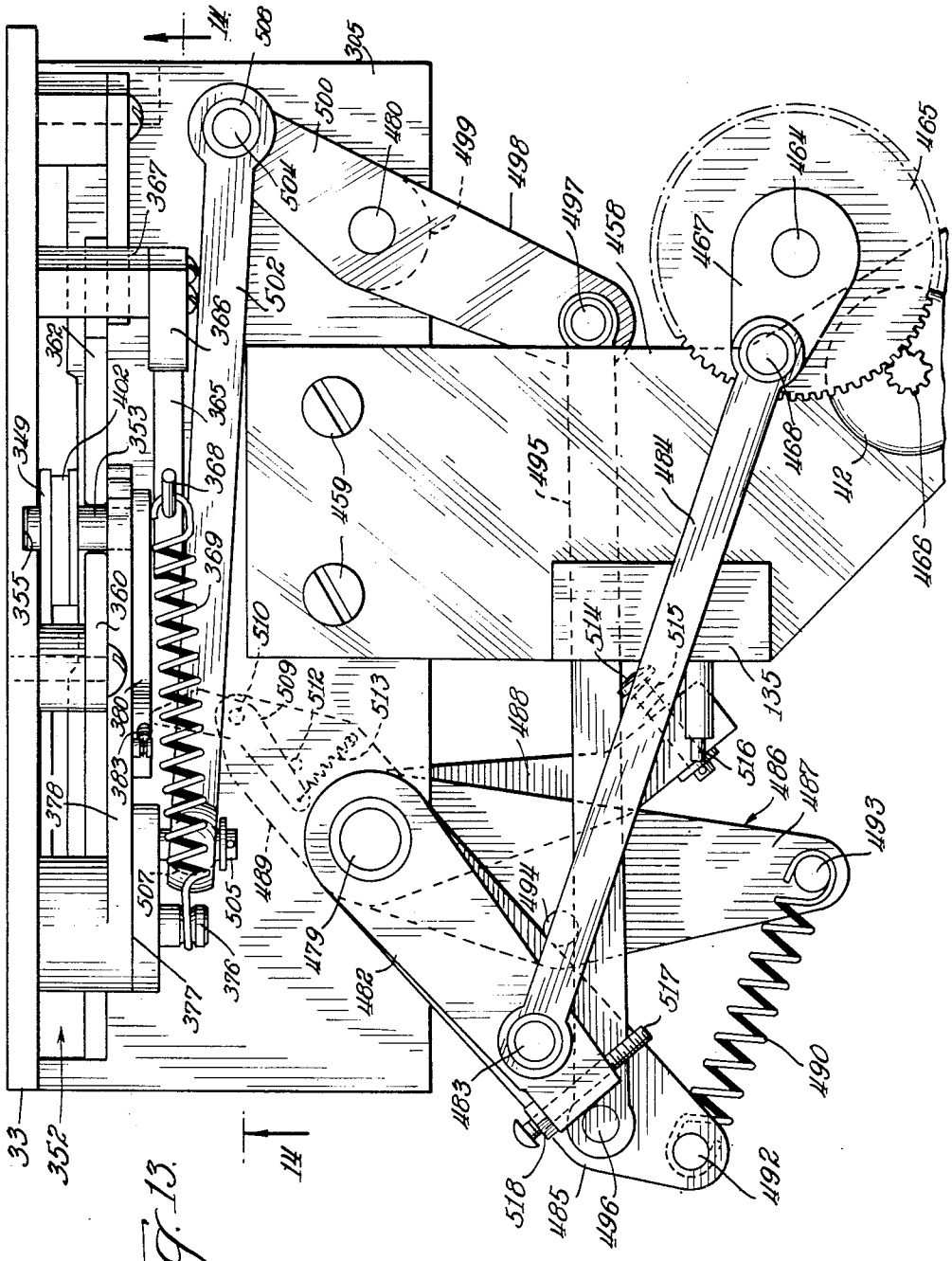


Fig. 13.

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DICE GAME APPARATUS

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Fig. 14.

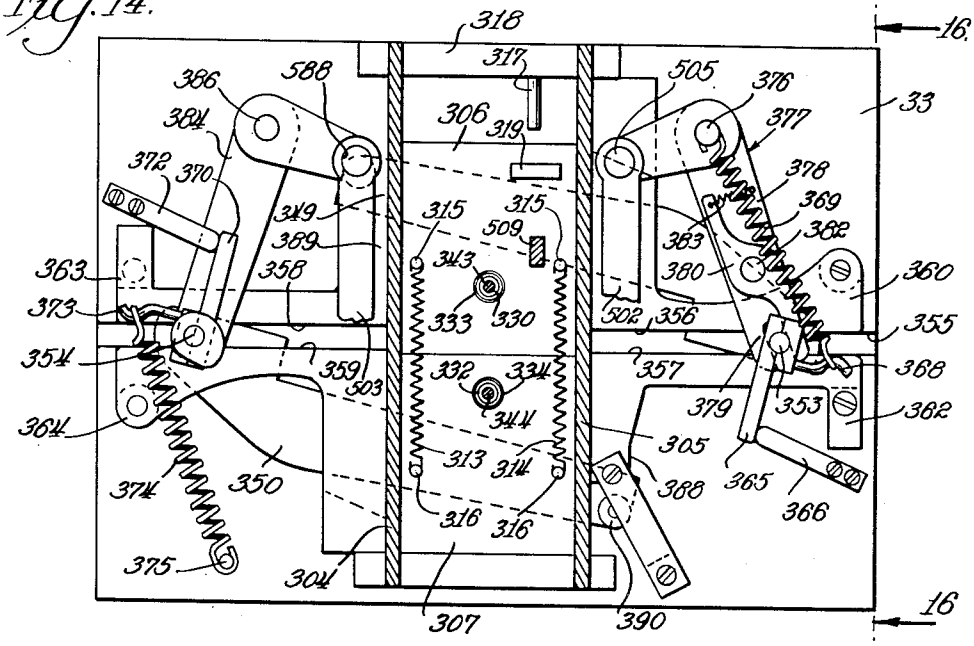
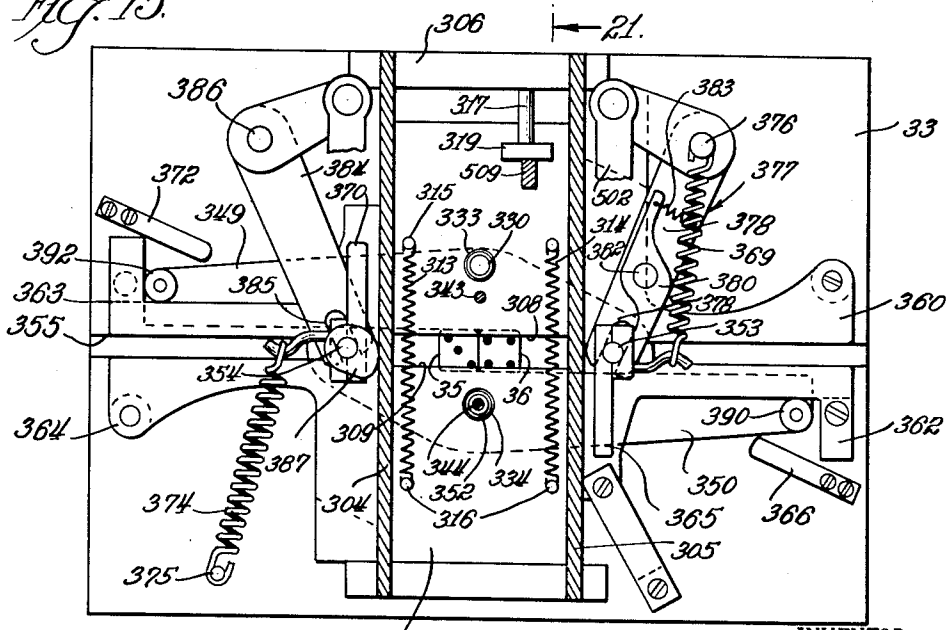


Fig. 15.



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DICE GAME APPARATUS

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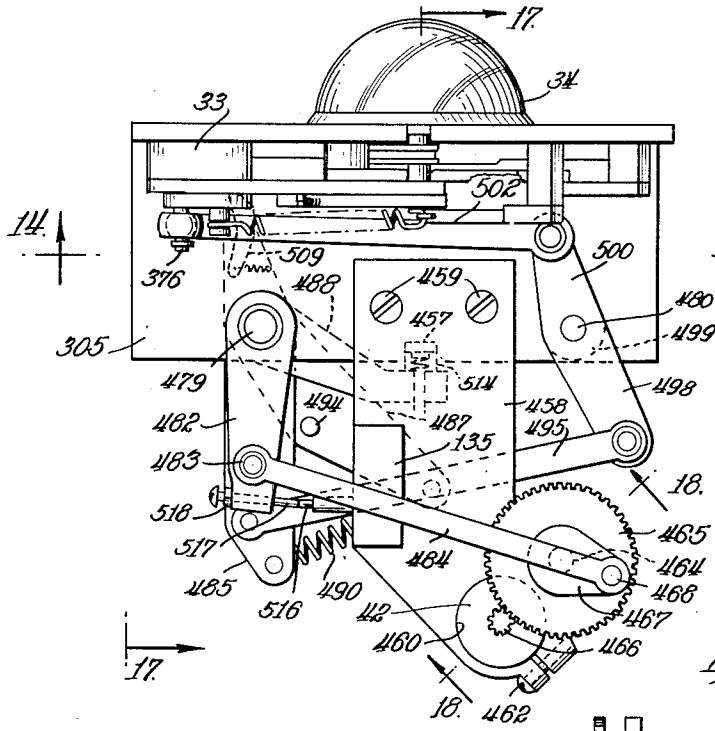


Fig. 16.

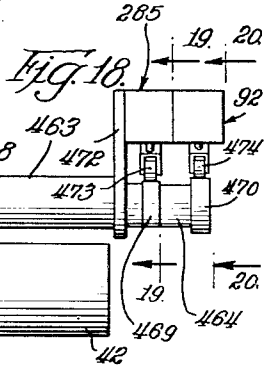


Fig. 18.

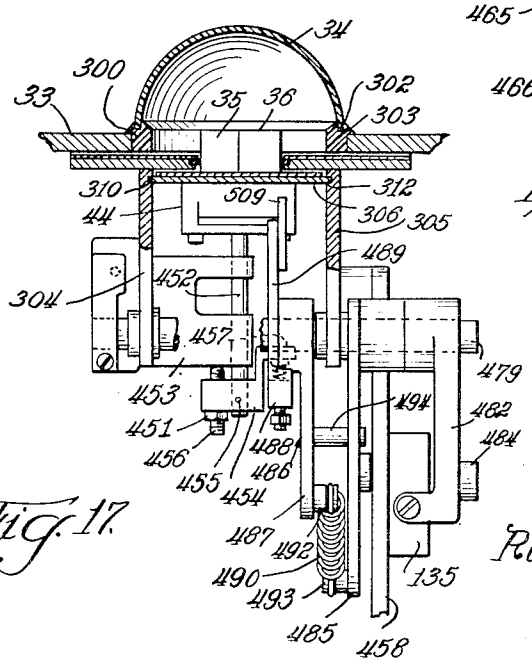


Fig. 17.

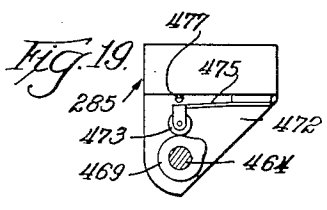


Fig. 19.

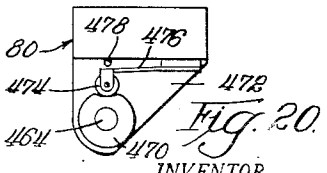


Fig. 20.

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DICE GAME APPARATUS

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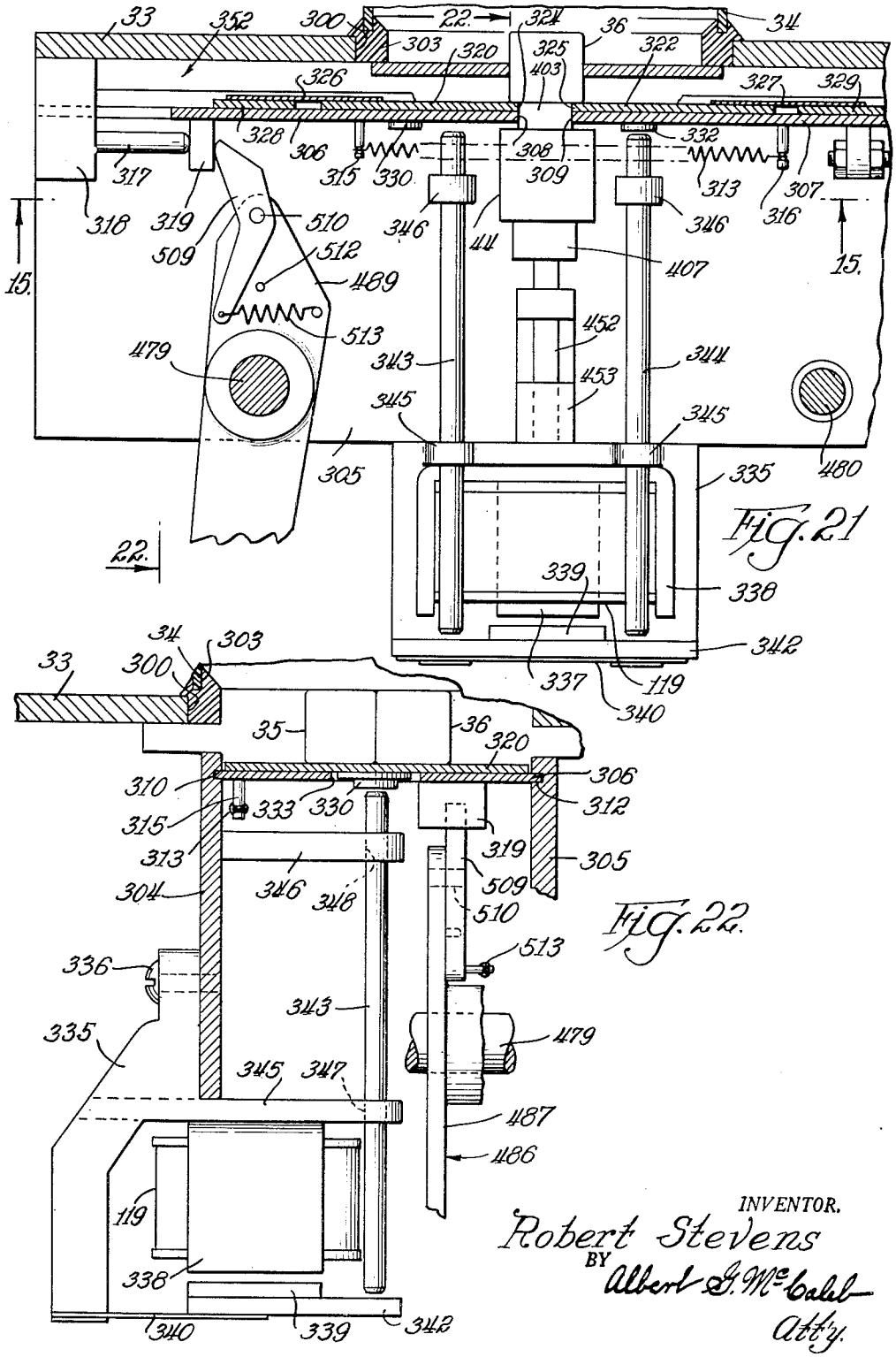


Fig. 21

Fig. 22.

United States Patent Office

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Patented Nov. 9, 1954

2,693,962

DICE GAME APPARATUS

Robert Stevens, Buffalo, N. Y.

Application June 12, 1948, Serial No. 32,681

16 Claims. (Cl. 273—145)

This invention relates to amusement apparatus and more particularly to certain combinations of mechanical, electro-mechanical and/or electrical apparatus adapted to use in playing a game.

One of the objects of my invention is to provide electrically operated apparatus with and against which a person may play a game similating and following the rules of craps in respect to the determination of "wins" and "losses."

My invention further has within its purview the provision of amusement apparatus wherein standard dice are shaken for each cast within clear view of a player and automatically read.

As another object, the invention comprehends a system of relays adapted to the addition of a plurality of variable digits.

A further object of this invention is to provide an electro-mechanical system for reading and totalizing the numbers on a plurality of dice.

It is another object of my invention to provide electro-mechanical apparatus for thoroughly shaking dice for each cast within the confines of a transparent closure, which apparatus further, and when desired, has selective periods of agitation of sufficient length and violence to frustrate any attempts at dishonest manipulation.

My amusement apparatus comprehends the provision of a coin controlled dice game wherein a coin is deposited for each series of plays and each play of a series is initiated manually.

In the presently disclosed embodiment, my invention further has within its purview the provision of a dice game wherein the number of plays of a series varies and is controlled by chance and the usual rules of playing craps, in that each series is terminated by the occurrence of any one of several events which would result in a "win" or "loss" in a crap game.

In the progress of a game of the type referred to, my disclosed apparatus has for another object of the provision of automatic and variable recording apparatus for keeping before the player and pertinent information relative to each series of plays.

My invention further has within its purview the provision of automatic apparatus for shaking and handling dice for each play of a game within the view of the player.

As another object, the invention comprehends the provision of a simple and effective form of feeler switch, as well as circuit and contact arrangements therefor to accomplish the reading of dice.

An additional object of my invention is to provide a vibratory mechanism for shaking dice at the beginning of each play.

A further object of this invention is to provide a mechanism for positioning and holding dice for the reading of the cast numbers at each play.

It is another object of my invention to provide unified apparatus wherein various of the aforementioned features, functions and operations are correlated into a system for use in accordance with prescribed rules of play to effect the indication of "wins" or "losses" by a player in accordance with rules and chance.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings in which similar characters of reference indicate similar parts through the several views.

Referring to the eleven sheets of drawings,

Fig. 1 is a perspective view looking downwardly from

in front and to one side of the exterior of an enclosed assembly which embodies a preferred form of my invention;

Fig. 2 is a schematic block diagram which indicates generally the electrical parts of the preferred embodiment of my invention and their association in the operating system;

Figs. 3, 4, 5 and 6 are each partial and schematic circuit diagrams which, together, make up a wiring diagram of the electrical parts embodied in the preferred form of my amusement apparatus which is illustrated generally in Figs. 1 and 2;

Fig. 7 is a front elevational view of a preferred form of switch utilized in the preferred embodiment of my invention, in which view a part of the switch is cut away to depict details of inner structure and the use of the switch in association with a pair of dice is indicated;

Fig. 8 is a side elevational view of the switch shown in Fig. 7 with an associated portion of my preferred apparatus indicated fragmentarily;

Fig. 9 is a plan view of a preferred type of contact plate utilized in the switch disclosed in Figs. 7 and 8;

Fig. 10 is a top plan view of a preferred form of dice positioning and gripping element adapted to use in the preferred embodiment of my invention;

Fig. 11 is a fragmentary side elevational view of an end portion of the dice positioning and gripping element shown in Fig. 10 and wherein the view is taken substantially as indicated by the line **11—11** in Fig. 10 and the associated arrows;

Fig. 12 is a sectional view wherein the section is taken substantially on a line **12—12** of Fig. 10 and in the direction indicated by the arrows;

Fig. 13 is a side sectional view of a portion of the mechanical operating mechanism embodied in the preferred form of my amusement apparatus wherein the section is taken at a position substantially as depicted by line **13—13** of Fig. 1 and in a direction indicated by the accompanying arrows; the parts being depicted in their normal positions of rest;

Fig. 14 is a sectional bottom view wherein the section is taken substantially as indicated by a line **14—14** in Fig. 13 and in a direction as indicated by the accompanying arrows;

Fig. 15 is a view similar to Fig. 14, but which illustrates a different operating position of the parts which occurs during the cycle of operation of the preferred embodiment of my amusement apparatus;

Fig. 16 is a side sectional view similar to Fig. 13, drawn to a somewhat smaller scale and depicting an operating position of the parts which corresponds to that of the parts shown in Fig. 15;

Fig. 17 is a sectional view taken substantially as indicated by a line **17—17** of Fig. 16 and in the direction indicated by the accompanying arrows;

Fig. 18 is a fragmentary sectional view taken substantially on a line **18—18** of Fig. 16 and in the direction indicated by the arrows;

Figs. 19 and 20 are respectively end sectional and end views taken substantially on lines **19—19** and **20—20** of Fig. 18 and in the directions indicated by arrows;

Fig. 21 is a fragmentary sectional view wherein the section is taken substantially at a position indicated by a line **21—21** in Fig. 15, the operating positions of the parts also corresponding to those depicted in Fig. 15 and

Fig. 22 is a fragmentary sectional view taken substantially at a position indicated by a line **22—22** in Fig. 21 and viewed as indicated by the accompanying arrows.

By way of preliminary understanding of the rules of the game of craps, to which the disclosed apparatus is particularly adapted, although not confined, the application of those rules to the game as played with the disclosed apparatus, and certain of their aspects will here be given consideration. In the presently disclosed amusement apparatus, the dice are confined to the machine at all times. Thus, there is no concern for the change of dice from one person to another or the circumstances bringing about such changes.

In accordance with the usual rules of craps, the following characteristics of play are followed by the preferred form of my apparatus which is herein disclosed. Essen-

tially, they may be summarized as follows: 1. If the sum of the uppermost digits indicated by the dice on the first throw of a series is seven or eleven, the player is accorded a "win." 2. If the summation of the die digits is 2, 3 or 12 on the first throw of a series, the player loses. 3. If the dice indicate a total of 4, 5, 6, 8, 9 or 10 on the first throw of a series, the indicated one of those numbers becomes a "point," which, if repeated in a series of plays before throwing a seven, counts as a "win." If a seven precedes the throwing of a predetermined "point" number, the player loses.

In the accompanying drawings, an illustrative embodiment of my invention is disclosed for exemplary purposes. Having particular reference to Fig. 1, for consideration of certain of the more general aspects and arrangements of a preferred form of my amusement apparatus, the operating parts are enclosed in a housing **25**, which housing is adapted to be supported by a suitable table or stand. As viewed by a player, the housing includes a sloping front panel **26** which, in the disclosed form of the apparatus, carries an instruction and rule card **27**, a coin slot **28** (used when the apparatus is to be coin operated), a "point" indicator **29**, an indicator **30** for showing the number of successive "wins," and a play indicator **32** which provides a designation of the number of plays made in a given series.

In front of the sloping panel **26**, and preferably on top of the horizontal housing panel **33**, is a transparent dome **34**, made of a transparent molded plastic material or the like, which encloses the playing elements of the game which, in the present instance, are dice **35** and **36**. These playing elements or dice remain at all times within the view of a player or observer.

At a convenient position for manual operation, as at one side of the housing **25**, a handle **37** is mounted for rotational movement. In the disclosed apparatus, and as will be more fully described, the deposit of a coin in the coin slot **28** effects initial energization of the operating parts of the apparatus while manual movement of the handle **37** in a prescribed manner initiates the cycle of operation of each play and provides some control of the length of time during which the dice are randomly shaken within the dome **34**.

From the standpoint of a player and after the player has deposited a coin of a given denomination in the coin slot **28**, the player depresses the handle **37** at will to initiate each play of a series; each series being terminated by a "win" or a "loss." Each successive "win" is recorded and designated by the "win" indicator **30**. Each "loss" returns all of the indicators to their zero or off positions.

In the disclosed apparatus, and by preference, in order to prevent the dice from being only slightly moved without turning over or merely nudged over with some practiced control by a player, the apparatus embodies a control for the minimum time of dice shaking which cannot be avoided by the player. Also, and by preference, the apparatus includes a control for the maximum time of shaking of the dice, in order to prevent undue abuse of the apparatus. Between the minimum and maximum limits, the dice shaking time is within the control of the player and is dependent upon the length of time during which the handle **37** is depressed.

During the process of play, each play involves a cycle of operations of the apparatus, which cycle is automatically carried out by the apparatus after the initiation of the play by depression of the handle **37**. That is, the dice are randomly and, by preference, quite violently shaken within the confines of the transparent dome **34**. Upon coming to rest after the shaking action, the dice are positioned within the dome without being turned over, the uppermost indicia or indicated digits of the dice are electro-mechanically ascertained by the apparatus and the results automatically indicated in accordance with the rules of the game. Following such indication, the apparatus automatically prepares for the succeeding play. The termination of a series of plays by "win" or "loss" effects the necessity for the deposit of a coin in order to continue playing. Within a series, however, when a player is attempting to make a predetermined "point," the successive plays are started by the mere depression of the operating handle **37**, without the deposit of coins.

The control system and operation of a preferred embodiment of my amusement apparatus may be considered

in greater detail, and for the purpose of obtaining a summarized understanding thereof without concern for the complete details of the electrical and mechanical parts and their arrangements, by reference to the schematic block diagram of Fig. 2. It is to be understood in connection with this block diagram that it is not strictly a wiring diagram, but merely a schematic illustration depicting parts and groups of parts by the blocks and the general organization or the relationships of those parts by connecting lines.

As an aid to effecting a distinction between the results produced by the occurrence of predetermined indicia on the dice on the first and subsequent plays of a series, as well as to divide certain controls, two power sources A and B are utilized. A coin switch **38**, actuated by placement of a coin in the coin slot **28** (Fig. 1), effects closure of what may be termed "preparatory" circuits through, or in consequence of which the functional parts of the apparatus are subsequently energized. After operation of the coin switch **38**, operation of a switch **39** by manual movement of the handle **37** (Fig. 1) closes a circuit to a shaker mechanism and control circuit **40** which, in turn, automatically closes a circuit to a motor **42** having a driven cam switch **43** actuated thereby. The motor **42**, in addition to driving the cam switch **43** which divides the cycles of operation and provides sequence control, also drives the mechanical parts of the apparatus by which the dice are positioned after being shaken, actuates parts making the dice accessible to a feeler switch **44** and moves the feeler switch to effect the electrical "reading" of the dice by the switch.

Circuits individualized to the number or indicia on the bottom face of each of the dice **35** and **36** are established by contacts **45** and **46** of die relay groups **47** and **48** having actuating coils **49** and **50** respectively energized by a pulse of current from source A and produced through a pulse relay circuit **52** in timed relationship to the operation of the feeler switch **44**, and after the circuits through the latter switch are completed. The contacts of one die relay group control the energization of actuating coils **53** of an adding relay group **54**; while the contacts of the other die relay group control circuits from one of the designated power sources to contacts **55** of the adding relay group **54**. It is the function of the adding relay group in conjunction with the contacts of the die relay groups to interpolate the numbers on the bottom faces of the dice to those on the top faces by subtraction of the bottom face numbers from seven, and effectively to add to the top face numbers.

A system relay group **56** translates the added numbers into play results and, in association with a play relay **57**, correlates the play results with the number of plays in a given series. That is, on the first play of a series, circuits are formed through contacts of one die relay group and the adding group contacts to the system group from source A. If there are subsequent plays in the series, the circuits through the contacts of the same die and adding groups to the system group are from source B. Relays in the system group control the point indicator **29**, the win indicator **30**, and the play indicator **32**, as well as "win" and "lose" relays **58** and **59** respectively. The "win" and "lose" relays terminate the series of plays, whether those series consist of one or more plays.

By way of indication of the relationship between the schematic block diagram of Fig. 2 and the actual circuit diagrams of Figs. 3, 4, 5 and 6, Fig. 3 shows schematicaly the circuits and contacts of the feeler switch **44**, the circuits of the actuating coils **49** and **50** and circuits of the contacts **45** and **46** of the die relay groups **47** and **48** respectively. Fig. 4 depicts the circuits of the actuating coils **53** and contacts **55** of the adding relay group **54**. Fig. 5 includes schematically portions of the circuits embodying the power sources A and B, coin switch **38**, play relay **57**, the system relay group **56**, win indicator **30**, play indicator **32** and the "win" and "lose" relays **58** and **59**. Fig. 6 embodies a diagrammatic representation of the portion of the circuit which includes the shaker timing and actuating parts **40**, the manually operated switch **39** and motor **42**.

Reference is now made to the circuit diagrams of Figs. 3 to 6 inclusive, wherein the various relays and switches are shown in their normal positions—such positions being those assumed when the apparatus is not in operation and the actuating parts are de-energized. The power sources A and B for the apparatus are depicted

in Fig. 5. In the disclosed apparatus, the power sources A and B respectively comprise half wave rectifiers **60** and **62** connected to windings **63** and **64** of a transformer **65** which preferably has a 1:1 ratio and is utilized principally for the purpose of electrically segregating the two D. C. power sources, although both are primarily energized from a single A. C. source through power supply line leads **66***a* and **66***b*. One side of the rectifier **60** is connected to one end of the winding **63** while one side of the rectifier **62** is connected to one end of the transformer winding **64**. A condenser **67** is connected across the other side of the rectifier **60** and the other end of the transformer winding **63**. Another condenser **68** is connected across the other side of the rectifier **62** and the other end of the transformer winding **64**. Thus, the two terminals of each of the condensers **67** and **68** serve as the positive and negative terminals of power sources A and B.

With the power sources of the apparatus thus defined, the operation of the electrical apparatus will be considered in an order following that which occurs in the playing of a game. When a coin **69** of predetermined denomination is dropped into the coin slot **28** (Fig. 1), it effects actuation of the coin switch **38** to close a circuit from power source A to an actuating coil **70** of a coin relay **72** through normally closed series connected contacts **73** and **74** of the "win" and "lose" relays **58** and **59** respectively. Momentary operation of the coin relay **72** through normally open contacts **75** of the coin switch **38** closes a holding circuit for the coin relay through normally open contacts **76** of that relay and the normally closed contacts **73** and **74** of the "win" and "lose" relays **58** and **59**. Contacts **77** of the coin relay **72** close a circuit to a lead **78** (Figs. 5 and 6) through which power is supplied to the manually operable switch **39**, by the actuation of which the dice shaker control circuit of Fig. 6 is put in operation. This circuit also passes through the normally closed contacts of the "win" and "lose" relays **58** and **59**, as well as the lead **78** in Figs. 5 and 6, and normally closed contacts **79** of a cam switch **80**. A lead **82** normally provides a connection from the positive terminal of power source A to the shaker control circuit of Fig. 6. Normally open contacts **83** of the coin relay **72** close a circuit from the negative terminal of power source A and a lead **84**, which appears in the upper and lower portions of Fig. 5, to prepare a locking circuit for certain relays of the system relay group **56**.

In the power connections between the portions of the circuit shown in Figs. 5 and 6, it may be noted that in addition to the connection from the positive terminal of power source A which is provided through the lead **82**, there are also connections to the negative terminal of source A through a lead **85** in Fig. 5 to lead **85** in Fig. 6. It is through leads **85** and **82** in Fig. 6, and through a bleeder resistor **86** in Fig. 6, which resistor has a relatively high resistance value, that a relatively large condenser **87** is normally kept charged from power source A.

The operation of the circuit as thus far described includes the preliminary functions which are accomplished as a result of the deposit of a coin and indicates the steps preparatory to the manual operation of the switch **39** by movement of handle **37** (Fig. 1). As has been previously indicated, there is a considered desirability of having time limits for the dice shaking, which time limits are preestablished and automatically determined, although leaving control between those time limits to the discretion of the player. In the disclosed circuit the condenser **87** and a condenser **88** (Fig. 6) are preselected in size to establish the dice shaking time limits.

When the manually operable switch **39** is closed by the player after the deposit of a coin, it completes a circuit to an actuating coil **90** of a relay **92** in the shaker timing control circuit, and as shown in Fig. 6. This initial actuating circuit for the relay **92** is through the normally closed contacts **79** of the cam switch **80** and through normally closed contacts **93** of a relay **94**. The initial actuation of the relay **90** from power source A and through the manually operable switch **39** connects the actuating coil **90** of that relay across the condenser **87** through normally open contacts **95** of the relay. The condenser **87** being normally charged from power source A through the bleeder resistor **86** and the leads **82** and **85**, the discharge of that condenser through the actuating coil **90** of relay **92** holds relay **90** in its actuated position for a period of time dependent upon the capacity of the condenser **87**; it being understood that the current flow through the resistor **86** is well below that required to effect operation of the relay **92**. The capacity of the condenser **87** thus determines the minimum time interval of operation of the dice shaking mechanism, and has a capacity preselected to hold the relay **92** for a predetermined time interval, such as one second.

The operation of relay **92** closes a circuit to an actuating coil **96** of the relay **94** and through normally open contacts **97** of the relay **92**. When the relay **94** is thus actuated, it is locked in the actuated position by a circuit closed through its normally open contacts **98**. Also, the opening of the normally closed contacts **93** of the relay **94** opens the initial actuating circuit for the relay **92**, although leaving the relay **92** held in its actuated position by the discharge of the timing condenser **87**. The operation of the relay **92**, in addition to effecting operation of the relay **94**, also closes an actuating circuit through its normally open contacts **99** to an actuating coil **100** of a relay **102**. A condenser **103** which is connected across the actuating coil **100** of the relay **102** is charged while the power circuit to the actuating coil **100** is closed. The operation of relay **102** closes a circuit through normally open contacts **104** of that relay to an actuating electromagnet **105** of a dice shaking mechanism which will be more fully described.

The actuating electromagnet **105** is provided with buzzer type contacts **106** connected in series with the electromagnet and actuated thereby to produce periodic energization of the electromagnet which effects vibratory action and random shaking of the dice. Thus, operation of relays **92**, **94** and **102** starts the shaking of the dice, which shaking action proceeds at least as long as the relay **92** remains operated as a result of its connection across the timing condenser **87**.

The operation of the relay **94** closes a circuit through normally open contacts **107** of that relay, normally closed contacts **108** of the relay **102** and normally closed contacts **109** of the cam switch **80** to the motor **42**. The latter circuit, however, is opened at practically the same instant by the opening of contacts **108** of the relay **102**, so that there is no effective operation of the motor **42** until the relay **102** becomes deenergized while the relay **94** is actuated. When the relays **92**, **94** and **102** are all operated, as is the case when the relay **92** is held in its actuated position by the discharge of the timing condenser **87**, normally closed contacts **93** of the relay **94** are opened, normally open contacts **110** of the relay **94** are closed, normally closed contacts **111** of the relay **92** are opened and normally open contacts **112** of the relay **102** are closed. Thus, the contacts **111** of the relay **92**, while they are open during the minimum operating time of the shaker electromagnet, prevent a circuit from being completed through the manually operated switch **39**, contacts **110** of relay **94**, contacts **112** of relay **102** and the timing condenser **88** to the actuating coil **100** of the relay **102** from power source A. The timing condenser **88** is normally kept discharged through a resistor **113** having a high resistance value and connected thereacross.

If the manually operated switch **39** has been released by the player prior to the expiration of the minimum holding time of the relay **92** which is determined by the condenser **87**, the opening of the contacts of relay **92** will break the circuit to the actuated coil **100** of the relay **102**, as well as the operating circuit to the actuating coil **96** of the relay **94**. The relay **102** remains operated for a short period of time because of the charge accumulated by the condenser **103** which is connected across the actuating coil of that relay. Also, the relay **94** remains actuated after the opening of the contacts of relay **92** and until its holding circuit is broken by the contacts **79** of the cam switch. However, although the closing of the contacts **111** occurs upon the deenergization of the relay **92** and before the contacts **112** of the relay **102** are opened, because of the slow release of the relay **102** caused by the condenser **103**, the power circuit to the actuating coil **100** of relay **102** through the timing condenser **88** is broken by the previous opening of the manually operated switch **39**. Following the aforementioned conditions, and upon the release of relay **102** while relay **94** is still operated, a starting circuit to the motor **42** is closed through the contacts **79** of cam

switch 80, contacts 107 of relay 94, contacts 108 of relay 102 and contacts 109 of cam switch 80.

If, on the other hand, the manually operated switch 39 is held closed for a period of time exceeding that required for the discharge of the timing condenser 87 through the actuating coil of the relay 92, the contacts 111 of the relay 92 will close at the end of the predetermined minimum time period and while the relays 94 and 102 are actuated; the relay 102 being held actuated by the charge of the condenser 103. In this instance, and either until the manually operated switch 39 is opened by the player or until the timing condenser 88 has acquired a charge of a magnitude such that the current flow thereto through the actuating coil 100 of the relay 102 is insufficient to keep the latter relay operated, whichever occurs first, the relay 102 will remain operated and keep the circuit to the shaker electromagnet 105 closed through the contacts 104. The capacity of the timing condenser 88 is preselected to determine the maximum holding time for the relay 102 and consequently the maximum dice shaking time. This time may be, for example, three seconds. If the manually operated switch 39 is opened by the player prior to the time in which the timing condenser 88 acquires a full charge, the holding circuit to the actuating coil of the relay 102 is broken by that manually operated switch, so that the dice shaking time between the minimum and maximum limits is under the control of the player.

As in the previously described instance, the deenergization of relay 102, either because the manually operated switch 39 has been opened or because the timing condenser 88 has become charged, opens a circuit through the contacts 104 to the shaker electromagnet and produces an additional break in the circuit connecting the actuating coil 100 to the timing condenser 88 through the contacts 112, so that the dice shaking action is stopped and cannot be restarted while the relay 94 is still actuated. The relay 94 remaining actuated until the motor 42 has been started, a starting circuit for that motor is closed by the closing of contacts 108 of the relay 102 as previously described.

The starting of the motor 42 which actuates the mechanical operating parts of the apparatus also effects actuation of the cam switch 80 to open the normally closed contacts 79 and 109 thereof and to close normally open contacts 114 of that switch. The opening of the normally closed contacts 79 of the cam switch 80 breaks the holding circuit of the relay 94 to effect its deenergization and also breaks the power circuit to the manually operated switch 39, so that the dice shaking mechanism cannot be operated during the progress of the cycle of operation of the apparatus after the dice have been once shaken for that cycle. Continued operation of the motor 42 for a complete cycle which is determined by the return of the cam switch 80 to its normal position is insured by a power circuit closed to the motor 42 through the contacts 114 of the cam switch. If a cycle of operation is interrupted by power failure, that cycle will be completed upon the resumption of power supply and before a new cycle of operation may be started. When the cam switch 80 returns to its normal position at the end of a cycle, the operating circuit to the motor 42 is broken by the contacts 114 and the shaker control apparatus may be restarted for another cycle by operation of the manually operated switch 39, the circuit to which is reestablished by the reclosing of the contacts 79 of the cam switch.

In addition to the actuation of switch 80, the operation of the motor 42 actuates certain other switches and mechanical parts of the apparatus, as will be more fully described, to position the dice within the dome 34, effect exposure of the indicia on the lower surfaces of the dice, actuate the feeler switch 44 to effect a determination of the exposed indicia and, while the feeler switch 44 is in position for determining the exposed indicia on the dice, a switch 135 (Fig. 5) is closed to connect one side of a relatively large condenser 136 to the negative terminal of power source A.

To facilitate an understanding of the operation of the feeler switch 44, particularly the contact arrangement of that switch by which the indicia of standard dice may be determined by a number of contacts considerably less than the possible positions of such indicia, attention is directed to the contact arrangement which is schematically illustrated for the feeler switch 44 at the lower portion of Fig. 3. When the dice are positioned by the apparatus after being shaken, the indicia or spots on each die are located at one or more of the positions designated by the circles at S1, S2, S3, S4, S5, S6, S7, S8, S9, S11, S12, S13, S14, S15, S16, S17, S18, and S19. In other words, when positioned, the possible positions of the spots corresponding to each of the die numbers are as follows: "1"—S5; "2"—S1 and S9 or S3 and S7; "3"—S1, S5 and S9 or S3, S5 and S7; "4"—S1, S3, S7 and S9; "5"—S1, S3, S5, S7 and S9; "6"—S1, S4, S7, S3, S6, and S9 or S1, S2, S3, S7, S8 and S9. The variations in some instances depend upon the rotation of the die about its vertical axis. Also, the spot positions corresponding to each digit of the other die are similar to those listed for the one die.

As is usual with most standard dice, the spot positions are depressed into the dice and with reference to the face surfaces thereof. This difference of the levels of the spot positions from the die surfaces is utilized in the disclosed apparatus for effecting actuation of feeler switch contacts. Furthermore, by judicious selection of the contact positions and circuit connections, circuits individualized to each of the six die digits and for any die position may be closed through only five switch contacts for each die. As viewed in Fig. 3, the contacts of the feeler switch 44 adapted to engage the die in the left hand position are designated as L1, L2, L3, L4 and L5; while similarly arranged contacts for the other die are designated by reference characters R1, R2, R3, R4 and R5. With the disclosed structure, the contact arrangement is such that feeler prongs on each of the contacts L1, L2, L3, L4, and L5, R1, R2, R3, R4 and R5 are aligned with spot positions S1, S3, S5, S4, S8, S11, S13, S15, S14 and S18 respectively. The arrangement is further, and by preference, such that engagement with the die surface other than at a spot position effects separation of normally closed contacts; while alignment with a spot position leaves the contact closed, as the result of the difference between spot and die face levels.

With the disclosed contact arrangements, the die digits corresponding to the feeler switch contacts closed when those digits appear on the surface of the die exposed to the feeler switch are as follows: "1"—L3 and R3; "2"—L1 or L2 and R1 or R2; "3"—L1 and L3 or L2 and L3 and R1 and R3 or R2 and R3; "4"—L1 and L2 and R1 and R2; "5"—L1, L2 and L3 and R1, R2 and R3; "6"—L4 or L5 and R4 or R5.

Corresponding ones of the contacts of the feeler switch are all connected in parallel and to a power bus 137, which bus, as shown in Fig. 5, is connected to the positive terminal of power source A. Each of the other and co-acting contacts of the feeler switch is connected to an actuating coil of a relay of the die relay groups 47 and 48. That is, contacts L4 and L5 are connected together and to an actuating coil 138 of a relay LR1. Contact L1 is connected to an actuating coil 139 of a relay LR2. Contact L2 is connected to an actuating coil 140 of a relay LR3, and contact L3 is connected to an actuating coil 142 of a relay LR4. Similarly, contacts R4 and R5 are connected together and to an actuating coil 143 of a relay RR1. Contact R1 is connected to an actuating coil 144 of a relay RR2. Contact R2 is connected to an actuating coil 145 of a relay RR3 and contact R3 is connected to an actuating coil 146 of a relay RR4. It is the purpose of the four relays LR1, LR2, LR3 and LR4, which comprise die relay group 47 and the circuit connections of those relays, to act in response to current flow through various of the feeler switch contacts L1, L2, L3, L4 and L5 to establish circuits individualized to the digits of one die; while the relays RR1, RR2, RR3 and RR4 which constitute die relay group 48 and the respective circuits of those relays establish circuits individualized to the digits of the other die.

For the present, it may suffice to state that the various die digits effect actuation of the relays of the die relay groups as follows: "1"—LR4 and RR4; "2"—LR2 or LR3 and RR2 or RR3; "3"—LR2 or LR3 and LR4 and RR2 or RR3 and RR4; "4"—LR2 and LR3 and RR2 and RR3; "5"—LR2, LR3 and LR4, RR2, RR3 and RR4; "6"—LR1 and RR1.

Returning to the more general aspects of the circuit operation, it may be recalled that closing of the contacts of switch 135 (Fig. 5) for a predetermined interval of time correlated with the movement of the feeler switch 44 is effected during the operating cycle of the motor 42 (Fig. 6). The contacts of switch 135 complete a cir-

cuit through an actuating coil **147** of a quick acting relay **148** from power source A to a condenser **136** of relatively large capacity. Condenser **136** is bridged by resistor **149**, the resistance value of which is sufficiently high that the current flow through the resistor and actuating coil **147** of the relay **148** from power source A will neither effect actuation of relay **148** nor hold that relay in its actuated position. On the other hand, resistor **149** provides a bleeder circuit across condenser **136** which normally keeps that condenser discharged. The current flow to the condenser **136** from power source A and the time required for charging that condenser are determined in part by the capacity of the condenser; that capacity being selected to effect actuation of the quick acting relay **148** for a predetermined time interval after and during which the selective circuits of the feeler switch contacts are established.

Normally open contacts **150** of the relay **148** complete a circuit through a lead **152** (Figs. 3 and 5) to the actuating coils of two or more of the relays LR1, LR2, LR3, LR4, RR1, RR2, RR3 and RR4 to which circuits are established by contacts of the feeler switch, as described. Also, normally open contacts **153** of the relay **148** (Fig. 5) close a circuit from power source A to an actuating coil **154** of the play indicator **32** to count the play of a series by moving that indicator up one digit.

At the same time that a circuit is completed to the actuating coils of the relays of the die relay groups through the contacts **150** of the relay **148** (Fig. 5) through lead **152**, those same contacts **150** close a circuit to an actuating coil **155** of a slow acting relay **156**. Although various types of slow acting relays are adapted to the uses intended the relay **156** is designated by illustration in the present embodiment of my invention as a copper slug on the core which makes it somewhat slow to respond and causes it to hold its contacts closed for an appreciable time interval after the circuit to the actuating coil **155** has been opened. Thus, the timing of the actuation of the relay **156** is such that it operates after the relays of the die relay groups have been actuated. The purpose of the actuation of relays **148** and **156** for predetermined time intervals correlated with the operation of the feeler switch is to send pulses of current of limited time duration through contacts **157** and **158** of the relay **156** and leads **159** and **160** respectively to and through the contacts and circuits of the die relay groups **48** and **47** respectively (Fig. 3) to the adding relay group shown in Fig. 4. It is to be noted that with the structure and arrangement of apparatus presently disclosed the feeler switch acts upon the bottom surfaces of the dice, while the digits of the opposed upper surfaces are subject to the usual visual reading. However, since the numbers on opposed faces of standard dice total seven, interpolation from the digits ascertained by the feeler switch may be readily effected.

Although the contact combinations of the corresponding relays of the die relay groups **47** and **48** and the interconnections of those are similarly arranged, it is to be noted that the contacts of die relay group **47** (Fig. 3) control circuits through leads **162, 163, 164, 165, 166** and **167** to the contacts of the relays of the adding groups **54**, shown in Fig. 4; while the contacts of die relay group **48** control circuits through leads **168, 169, 170, 172, 173** and **174** (Fig. 3) to actuating coils **175, 176, 177, 178, 179** and **180** of relays AR1, AR2, AR3, AR4, AR5 and AR6 of the adding relay group **54**. However, in view of the similarity of the contact arrangements and circuits for the relays of the die relay groups **47** and **48**, it is considered sufficient to outline the contact and circuit combinations for each die digit with respect to only one of the contact groups.

As has been explained, lead **160**, which is shown in Figs. 3 and 5, is energized by a pulse of current during the period of closure of the contacts **158** of relay **156** (Fig. 5). When the contacts of the play relay **57** are in their normal positions, as shown in Fig. 5, which is the case on the first play of any series, the aforementioned pulse of current is from the negative terminal of power source A. It is that pulse of current which passes through contact combinations of the relays of die relay group **47** to selected contacts of the adding group **54** (Fig. 4). On the other hand, the pulse of current provided through the contacts **150** and **157** of relays **148** and **156** respectively to lead **159** (Fig. 5) is always from the negative terminal of power source A and passes through actuated contact combinations of die relay group **48** to the actuating coils of the adding relay group (Fig. 4) to effect actuation of those relays of the adding group; the return circuit to power source A from the actuating coils of the adding group being through a lead **182** (Figs. 4 and 5).

Starting with die digit "1" which effects actuation of relay LR4, a circuit is provided from lead **160** through normally closed contacts **183, 184** and **185** of relays LR1, LR2 and LR3 respectively and normally open contacts **186** of relay LR4 to lead **162**. As shown in Fig. 4, lead **162** transmits the pulse of current to parallel connected ones of normally open contacts AC**16**, AC**26**, AC**36**, AC**46**, AC**56** and AC**66** of adding group relays AR1, AR2, AR3, AR4, AR5 and AR6 respectively.

Die digit "2" effects actuation of one or the other of relays LR2 and LR3. WWhen relay LR2 is actuated, the current pulse circuit from lead **160** is through the normally closed contacts **183** of relay LR1, normally closed contacts **187** of relay LR3, normally open contacts **188** of relay LR2 and normally closed contacts **189** of relay LR4 to the lead **163**. When the relay LR3 is actuated instead of LR2, the circuit from the lead **160** is through the normally closed contacts **183** of relay LR1, normally closed contacts **190** of relay LR2, normally open contacts **192** of relay LR3 and normally closed contacts **189** of relay LR4 to the lead **163**. In either instance, and as shown in Fig. 4, the pulse of current is transmitted by lead **163** to parallel connected contacts AC**15**, AC**25**, AC**35**, AC**45**, AC**55** and AC**65** of adding group relays AR1, AR2, AR3, AR4, AR5 and AR6 respectively.

When the die digit is "3," either relay LR2 or LR3 and relay LR4 are actuated. When relays LR2 and LR4 are actuated, a circuit is provided from lead **160** through the normally closed contacts **183** of relay LR1, normally closed contacts **187** of relay LR3, normally open contacts **188** of relay LR2 and normally open contacts **193** of relay LR4 to the lead **164**. When relays LR3 and LR4 are actuated, the circuit is the same, except that it is through the normally open contacts **192** of relay LR3 instead of through the normally open contacts **188** of relay LR2; the contacts **190** of relay LR2 and contacts **187** of relay LR3 also being alternated. As shown on Fig. 4, the pulse is transmitted by lead **164** to parallel connected ones of the contacts AC**14**, AC**24**, AC**34**, AC**44**, AC**54** and AC**64** of adding relays AR1, AR2, AR3, AR4, AR5 and AR6 respectively.

When the die digit is "4," relays LR2 and LR3 are actuated. In this instance, the pulse circuit from lead **160** is through normally closed contacts **183** of relay LR1, normally open contacts **194** of relay LR2, normally open contacts **195** of relay LR3 and normally closed contacts **196** of relay LR4 to the lead **165**. Through the lead **165**, as shown in Fig. 4, connection is made to parallel connected ones of contacts AC**13**, AC**23**, AC**33**, AC**43**, AC**53** and AC**63** of adding relays AR1, AR2, AR3, AR4, AR5 and AR6 respectively.

When the die digit is "5," relays LR2, LR3 and LR4 are actuated. In this event, the pulse circuit from the lead **160** is through the normally closed contacts **183** of relay LR1, normally open contacts **194** of relay LR2, normally open contacts **195** of relay LR3 and normally open contacts **197** of relay LR4 to the lead **166**. As depicted in Fig. 4, the lead **166** carries the pulse to parallel connected ones of the contacts AC**12**, AC**22**, AC**32**, AC**42**, AC**52** and AC**62** of adding relays AR1, AR2, AR3, AR4, AR5 and AR6.

When the die digit is "6," a pulse circuit is completed directly from the lead **160** to the lead **167** through normally open contacts **198** of the relay LR1, which relay is the only one of its die relay group that is actuated. Normally closed contacts **199** of the relay LR1 are opened when the die digit is "6," so that there is no possibility of the actuation of additional ones of the relays of the die relay group. As depicted in Fig. 4, a pulse of current carried by the lead **167** is transmitted to parallel connected ones of the contacts AC**11**, AC**21**, AC**31**, AC**41**, AC**51** and AC**61** of relays AR1, AR2, AR3, AR4, AR5 and AR6 respectively.

In die relay group **48**, as shown in Fig. 3, the numbers by which the contacts of relays RR1, RR2, RR3 and RR4 are designated correspond to the numbers applied to the contacts of relays LR1, LR2, LR3 and LR4 respectively, except that each of those contact numbers has a

prime mark appended thereto. By following the same numbers in connection with the description provided for the circuit connections of die relay group **47** corresponding to each die digit, the circuits through die relay group **48** may be traced for each die digit and between the lead **159** and leads **168, 169, 170, 172, 173** and **174** respectively.

The die digits referred to in tracing the circuits to the contacts and actuating coils of relays **AR1, AR2, AR3, AR4, AR5** and **AR6** of the adding group in Fig. 4, as described, are the digits of the bottom die faces, and not the digits designated by visible top faces. The interpolation is made in the adding group which is shown in Fig. 4. In other words, the numbers represented by the actuating coils **175, 176, 177, 178, 179** and **180** of relay coils **AR1, AR2, AR3, AR4, AR5** and **AR6** are 1, 2, 3, 4, 5 and 6 respectively. Thus a "6" on the bottom face of one die effects actuation of the relay **AR1** which represents the digit "1"; and "5" on the bottom face of that die effects actuation of the relay **AR2** which represents the digit "2," and so on. In like manner, a "6" on the bottom face of the other die sends a pulse of current to a contact of each of the adding relays **AR1, AR2, AR3, AR4, AR5** and **AR6**, which contact, in each instance, represents the digit "1."

From the description, at this point, it may be understood that a pulse of current transmitted to one of the relays **AR1, AR2, AR3, AR4, AR5** or **AR6** effects actuation of all of the six contacts of that relay. At the same time, a pulse of current responsive to the number on the other die is transmitted to a selected one of the contacts of the actuated relay. The actuated relay being thus selectively representative of the visible digit of one die and the energized contact of that relay being selectively representative of the visible digit on the other die, a pulse of current is transmitted through the energized contacts of the actuated relay to a lead which is thus individualized to the summation of the two visible die digits.

Having reference to Fig. 4, a digit "1" visible on one die effects actuation of relay **AR1** to close the six contacts of that relay. When the digit on the other die is one, the current pulse is transmitted through the contacts **AC11**. When the visible digit of the second die is "2" instead of "1," the pulse of current is transmitted through contacts **AC12**. In like manner, the adding group relay and its pulse transmitting contacts may be selected for each possible combination of die digits. There being various combinations of die digits which add to the same number, the contacts representative of like summations of the die digits are connected together and to output leads. For instance, contacts **AC13, AC22** and **AC31** are each representative of the summation of die digits which total "4" and are connected to a common output lead **204**. In like manner, contacts representative of each of the summarized die digits 5, 6, 7, 8, 9, 10 and 11 are connected together and to leads **205, 206, 207, 208, 209, 210** and **211** respectively. Since, in the present instance, and for the purposes of a crap game, the die digits totalling "2," "3" and "12" are of the same effect, contacts **AC11, AC12, AC21** and **AC66** which are representative of those numbers are connected together and to a common output lead **212**. It may also be pointed out that for the purposes of a game of craps, the numbers "7" and "11" may be considered "special" numbers, while the numbers "4," "5," "6," "8," "9" and "10" are those usually referred to as "point" numbers or "points."

By reference to the upper portion of Fig. 5, it may be observed that the leads **204, 205, 206, 208, 209** and **210** which correspond to the "point" numbers are respectively connected through normally closed contacts **213, 214, 215, 216, 217** and **218** of point relays **P4, P5, P6, P8, P9** and **P10** to terminals of actuating coils **219, 220, 222, 223, 224**, and **225** of those relays. The other terminals of those actuating coils are connected in parallel and to a lead **226**, which latter lead, as shown in the lower portion of Fig. 5, provides a return circuit to the positive terminal of power source A. Thus, when any of the "point" numbers are produced by the first play of a series, the corresponding one of relays **P4, P5, P6, P8, P9** or **P10** is energized by the pulse of current transmitted through the adding relay contacts from power source A. Condensers **227, 228, 229, 230, 232** and **233** are connected across the respective actuating coils **219, 220, 222, 223, 224** and **225** of the point relays to insure the actuation of those relays by the current pulse. Normally open contacts **234, 235, 236, 237, 238**, and **239** of the point relays **P4, P5, P6, P8, P9** and **P10** respectively are connected to the lead **84** which connects to the negative terminal of power source A through the contacts **83** of the coin relay to form a holding circuit which maintains an actuated one of the "point" relays in its operated position, after being initially actuated by the current pulse, as described.

In the disclosed apparatus, gas discharge glow lamps **240, 242, 243, 244, 245** and **246** are utilized as point indicators for each of the "points" 4, 5, 6, 8, 9 and 10 respectively. One electrode of each of the glow lamps is connected to a lead **251**, which lead provides a circuit to the positive terminal of power source A. The same lead **84** which provides the holding circuit for maintaining actuation of the point relays also provides a circuit through the normally open contacts **234, 235, 236, 237, 238** or **239** to the other electrode of each of the respective glow lamps, so that when a point relay is actuated, its associated glow lamp is lit. Also, normally open contacts **247, 248, 249, 250, 252** and **253** of the relays **P4, P5, P6, P8, P9** and **P10** respectively are each adapted to close a circuit from a respective one of the leads **204, 205, 206, 208, 209**, and **210** to a lead **254**, which latter lead, as shown in the lower portion of Fig. 5, is connected to one end of an actuating coil **255** of the "win" relay **58**. The other end of the actuating coil **255** of the "win" relay being connected to the negative terminal of power source B, the "win" relay will not be operated by the closing of one of the normally open contacts **247, 248, 249, 250, 252** or **253** of the "point" relays unless the pulse through the adding group relays and leads **204, 205, 206, 208, 209** or **210** is from the positive terminal of power source B. On the first play of a series and as was previously explained, the pulse through the relays of the adding group is from power source A. Hence, the occurrence of a "point" number on the first play of a series records the point by illumination of the appropriate glow lamp and prepares a circuit, as described, to the "win" relay which is effective to produce actuation of that relay if the "point" number occurs a second time before the occurrence of a "7" which effects operation of the "lose" relay **59**, thereby to return the circuit parts to their normal positions.

If the sum of the die digits is 2, 3 or 12 on the first play of a series, the pulse of current from power source A which is provided by the action of relays **148** and **156** (Fig. 5) is transmitted to appropriate contacts of the adding relay group **54** (Fig. 4), and thence through the lead **212** and normally closed contacts **256** of the play relay **57** (Fig. 5) to a lead **257**. The lead **257**, as shown in the upper portion of Fig. 5, is connected to one end of an actuating coil **258** of a relay **P12**. The other end of the actuating coil **258** being connected to power source A through the lead **226**, actuation of that relay is effected. The operation of relay **P12** closes normally open contacts **259** of that relay to complete a circuit from one terminal of power source B through a lead **260** (Fig. 5) to one end of an actuating coil **263** of the "lose" relay **59** through a lead **262**. Since the other end of the actuating coil **263** is connected to power source B, the "lose" relay will be actuated thereby effecting release of the coin relay **72** and the return of the circuit parts to their normal positions.

If the sum of the die digits is "11" on the first play of a series, the current pulse from power source A is transmitted from the adding relay group **54** (Fig. 4) through the lead **211**, which lead, as shown in Fig. 5, is connected through normally closed contacts **264** of the play relay **57** to a lead **265**. The last mentioned lead is connected to one end of an actuating coil **266** of a relay **P11** whereby actuation of the relay **P11** is effected by current from power source A to close its normally open contacts **267**. Contacts **267** of relay **P11** complete a circuit through leads **254** and **260** from power source B to the actuating winding **255** of the "win" relay **58**. It may be noted at this point that a relay **P7** has normally open contacts **268** connected in parallel to the normally open contacts **267** of the relay **P11** so that actuation of the relay **P7** closes a circuit to the "win" relay **58** in a manner similar to that of the relay **P11**.

When the total of the die digits on the first play of a series is "7," the current pulse from power source A is transmitted from the adding relay contacts through a circuit comprising the lead **207**, normally closed contacts **269** of the play relay **57** and a lead **270** to one

end of an actuating coil 271 of the relay P7, the other end of which actuating coil is connected to power source A through the lead 226. The resulting actuation of relay P7 effects operation of the "win" relay, as explained.

Each actuation of the "win" relay 58 closes its normally open contacts 272 (Fig. 5) to close a circuit from power source A to an actuating winding 273 to a step-by-step or ratchet switch 274 which comprises an operating part in the disclosed embodiment of my "win" indicator 30. Each such actuation of the ratchet switch moves a contact arm 275 into engagement with a succeeding one of a series of contacts 276; each contact being connected to a numerical indicator 277 which may, for example, comprise an electric lamp associated with an appropriate numerical indicator. The ratchet switch thus completes circuits from power supply leads 278 to individual and succeeding numerical indicators.

Normally open contacts 279 of the "win" relay close a circuit from power source A to a reset coil 280 of the play indicator to return that indicator to its zero position each time the "win" relay is operated. Normally open contacts 282 of the "lose" relay 59 are connected in parallel to the contacts 279 of the "win" relay, so that each operation of the "lose" relay also returns the play indicator to its zero position. The "lose" relay also has normally open contacts 283 which are connected in series with a reset coil 284 of the ratchet switch 274, so that each operation of the "lose" relay causes the ratchet switch of the "win" indicator 30 to return to its off position to which position it is normally biased.

The play results thus far considered have been related, in the main, and in their more final aspects, to the occurrences of the first of a series of plays. It being a peculiarity of the rules of playing craps that the first play is distinguished from others in respect to the appearance of various numbers comprising the sum of the die digits, it is necessary in the disclosed apparatus, and particularly the electrical operating portion thereof, to provide for the distinguishing of the results of first plays from those produced by later plays of a series. In the disclosed embodiment of my apparatus, a normally open cam switch 285 (Fig. 6) is actuated for a short interval of time by the operation of the motor 42 in timed relationship to the operations of the feeler switch 44 and current pulse producing relays 148 and 156. In relation to the provision of the current pulse through the circuits of the feeler switch contacts, die relay group contacts, adding relay group contacts and actuating coils of the relays of the system group, the cam switch 285 is momentarily closed after the occurrence of the current pulse, to close a circuit from power source A to an actuating coil 286 of the play relay 57. This circuit is through leads 293 and 294 in Figs. 5 and 6.

It being recalled that actuation of either the "win" or "lose" relays 58 and 59 effects de-energization of the coin relays 72, it becomes one of the functions of that coin relay to distinguish the plays of one series from the plays of another. Following the first play of a series which does not effect actuation of either the "win" or "lose" relays 58 and 59, and consequently does not de-energize the coin relay 72, actuation of the play relay 57 by cam switch 285 closes a holding circuit for that relay through normally open contacts 287 of that relay and normally open contacts 288 of the coin relay 72. It is the normally open contacts 288 of the coin relay 72 which prevent the play relay 57 from being locked in its actuated position following a "win" or "lose" on the first play of a series. On the other hand, in any series of play involving a "point," the play relay 57 is locked in its actuated position subsequent to the production of the results of the first play and until a play occurs which results in a "win" or a "loss" subsequent to that first play.

On the first play of a series, the current pulse carried by lead 160 to the contacts by relay group 47 (Fig. 3) and thence to selected contacts of the adding relay group 54 is from the negative terminal of power source A and passes through normally closed contacts 289 of the play relay 57. Upon being actuated after the recording of the first play, lead 160 is connected through normally open contacts 290 of the play relay 57 to the positive terminal of power source B. Hence, while the play relay is in its actuated position the current pulses transmitted through the contacts of die relay groups 47 to the selected contacts of the adding relay group 54 and to selected contacts of the system group relays are from power source B rather than power source A.

As was previously explained, the occurrence of a "point" number on the first play of a series effected actuation of one of the point relays P4, P5, P6, P8, P9, or P10 to close the normally open contacts 247, 248, 249, 250, 252 or 253 of the selected point relay, which relay was locked in its actuated position. The occurrence of that same "point" number on a later play of the same series and before the occurrence of a "7" causes a current pulse from power source B to pass through the closed contacts 247, 248, 249, 250, 252 or 253 of the actuated point relay P4, P5, P6, P8, P9 or P10. In this event, the current pulse from power source B is transmitted to lead 254 and through that lead to the actuating coil 255 of the "win" relay 58, to produce actuation of that relay.

If a "7" occurs prior to the repetition of a "point" number in any series, and after the first play of a series, the pulse of current from power source B which is carried from the contacts of the adding relay group 54 by lead 207 (Fig. 4) passes through normally open contacts 292 of the actuated play relay 57 to actuating coil 263 of the "lose" relay 59, to effect actuation of the latter relay.

If the summation of the die digits is "11" on a play subsequent to the first play of a series and before a "point" number is repeated in the series, the pulse of current from power source B which is carried by lead 211 (Figs. 4 and 5) produces no results, because the circuit through that lead is broken by the normally closed contacts 264 of the play relay 57 while the play relay is actuated. Likewise, on play subsequent to the first play of a series, the numbers "2," "3" and "12" produce no results because the circuit of lead 212 is broken by contacts 256 of the play relay 57 while that relay is operated.

Any play in a series which results in a "win" or a "loss" breaks the holding circuit of the coin relay 72 and, in turn, breaks the holding circuit of the play relay 57. When a "point" number has been established with the accompanying actuation of one of the point relays, a "win" or "loss" effects de-energization of the actuated one of those point relays as a result of the opening of contacts 83 of the coin relay. The relays of the die and adding groups 47, 48 and 54 being actuated for only relatively short periods of time by current pulses produced through the contacts of the relays 148 and 156, those relays return to their normal positions during the operating cycle of each play. As previously explained, the shaker control circuit of Fig. 6 is prevented from being operated after completion of a series of plays and before the deposit of a coin by the opening of contacts 77 of the coin relay. The motor driven cam switch 80 also returns to its normal position and stops the operation of the motor at the end of the operating cycle of each play.

Having described the electrical circuits and operation of a preferred embodiment of my invention, reference is now made more particularly to Figs. 1 and 7 to 22 inclusive of the drawings in connection with the following and more detailed description of preferred structural and mechanical aspects of my amusement apparatus. As shown in Figs. 1, 16, 17, 21 and 22, the top panel 33 of the housing 25 has a circular opening 300 therein over which the transparent dome 34 is located. For securing the dome 34 in place relative to the panel 33, it is secured in a groove 302 in the top surface of a mounting ring 303 and the mounting ring is secured in the panel opening 300.

Below the panel 33 and adjacent opposite sides of the mounting ring 303, support plates 304 and 305 are secured to the lower surface of the plate 33 and extend downwardly therefrom in substantially parallel relationship to one another. Dice supporting plates 306 and 307 are mounted between and carried by the support plates 304 and 305 below the opening 300 and in spaced relationship to the panel 33. By preference, the dice supporting plates 306 and 307 are disposed in coplanar relationship, substantially parallel to the surface of the panel 33 and have substantially straight end edges 308 and 309 respectively which abut in a plane extending substantially across a diameter of the opening 300. In order to provide for the exposure of the indicia on

the lower surfaces of the dice 35 and 36, as shown in Figs. 15 and 21, the plate 306 is slidably mounted in opposed channels 310 and 312 in the support plates 304 and 305. As depicted in Fig. 14, tension springs 313 and 314 having opposed ends secured to means such as downwardly projecting pins 315 and 316 on the lower surfaces of the plates 306 and 307 respectively bias the plate 306 to its normal position against the end of the plate 307. In its movement away from the plate 307, the plate 306 is limited by a stop pin 317 which is secured to a block 318 on the lower surface of the panel 33 and disposed for engagement with a projecting tab 319 secured to and projecting downwardly from the lower surface of the linearly movable plate 306. When separated to a position such that the tab 319 engages the stop pin 317, as illustrated in Figs. 15 and 21, the space between the edges 308 and 309 of the plates 306 and 307 is so related to the size of the dice used in the apparatus that when the dice are centrally positioned over that space, all of the spot positions are exposed through the space and marginal portions of the dice surfaces overlie the plates 306 and 307 for support.

In order to provide for the shaking or random agitation of the dice 35 and 36, within the dome 34, surface plates 320 and 322 of a combined size larger than the area of the opening 300 are disposed in face to face relationship against the upper surfaces of the supporting plates 306 and 307 and have substantially straight end edges 324 and 325 in flush relationship to the edges 308 and 309 respectively of plates 306 and 307. At ends opposed to the edges 324 and 325, the surface plates 320 and 322 are hingedly supported for swinging movement away from the plates 306 and 307 by relatively light resilient strips 326 and 327; the ends of the strips being secured to the surface plates and to leveling blocks 328 and 329, which blocks are secured to the supporting plates 306 and 307 respectively. By preference, buttons or pads 330 and 332 are secured to the lower surfaces of the surface plates 320 and 322 and are exposed through openings 333 and 334 in the support plates 306 and 307 respectively.

Below the line of division between the dice supporting plates 306 and 307, a bracket 335 is secured to the support plate 304 by fastening means such as a screw 336 (Fig. 22), which bracket has secured thereto and carries the dice shaking electromagnet 105 referred to in connection with the operation of the electrical circuit. Preferably the electromagnet 105 has a core 337 and a yoke 338 which form a magnetic circuit. An armature 339 is resiliently supported by a leaf spring 340 from bracket 335 and at a position normally spaced from and aligned with the core 337 and yoke 338. Projecting from the unsupported end of the armature 339 is a hammer plate 342 aligned for engagement with the ends of linearly movable rods 343 and 344, which rods are normally aligned for engagement with the buttons or pads 330 and 332 on the surface plates. The projecting portions 345 on the bracket 335 and projecting arms 346 secured to the support plate 304 provide bearings 347 and 348 in which the rods 343 and 344 are slidable so that vibratory movement of the armature 339 and hammer plate 342 causes that hammer plate to strike the ends of the rods 343 and 344 to drive them intermittently against the buttons 330 and 332 thereby to produce a vigorous vibratory movement of the surface plates 320 and 322. Such movement of those surface plates throws the dice about within the dome 34 in a random manner and with relatively vigorous action.

After the dice have been thus shaken within the dome 34 for a limited period, they come to rest on the surface plates 320 and 322 within the area of the mounting ring 303. Within that limiting area, the dice may fall to rest at any position. A mechanism is thus required for sliding the dice across the smooth upper surfaces of the surface plates 320 and 322 to adjacent positions over the abutting edges of the surface and supporting plates in alignment for engagement by the feeler switch 44. For positioning and gripping the dice 35 and 36 before and during the operation of the feeler switch 44, I prefer to utilize two relatively movable dice positioning and gripping fingers 349 and 350 which are depicted in different operating positions in Figs. 14 and 15 and one of which is shown in Fig. 10. As depicted in Figs. 13 and 21, the mid-portions of the support plates 304 and 305 are cut-away adjacent the panel 33 to provide spaces such as 352 through which the dice positioning and gripping fingers extend longitudinally in spaced relationship relative to the lower surface of the panel 33 and the edges of the support plates. By preference, the spacing of the dice positioning and gripping fingers 349 and 350 relative to the top surfaces of the surface plates 320 and 322 and the lower surface of the panel 33 is such that those fingers engage the vertical mid-portions of the dice so that they do not have an appreciable tendency to tip the dice over as they are moved or to have the dice slip therefrom as they are firmly gripped.

Each of the dice positioning and gripping fingers 349 and 350 is supported for both linear and swinging movement toward and from opposite sides of the area in which the dice are confined. That is, at one end the dice positioning and gripping finger 349 has a stud 353 secured thereto and projecting from opposite faces thereof. Likewise the dice positioning and gripping finger 350 has a stud 354 secured to one of its ends and projecting from opposite faces thereof. As depicted in Figs. 13, 14 and 15, the opposite end portions of the studs 353 and 354 are respectively slidable linearly in a channel 355 in the lower surface of the panel 33 and guided by and between opposed edges 356, 357, 358 and 359 of guide plates 360, 362, 363 and 364 respectively which guide plates, as shown in Fig. 13, are secured to the lower surface of the panel 33 in spaced relationship thereto. It is to be noted that the dice positioning and gripping finger 349 is retained and movable between the panel 33 and the guide plates 360 and 362, while the dice positioning and gripping finger 350 is movably carried by the panel 33 and the guide plates 363 and 364.

In the separated or open position of the dice positioning and gripping fingers which is depicted in Fig. 14 and which is the normal position of those fingers, the location thereof is established by stops. That is, a lever arm 365 is secured to the lower end of the stud 353 and projects angularly with reference to the longitudinal dimension of the finger to engage a locating stop 366 which is secured to the lower surface of the panel 33 through a spacing block 367 (Figs. 13 and 14). A hook 368 which is secured to and projects angularly from the lever arm 365 at a position near the stud 353 serves as an anchor for one end of a tension spring 369, which tension spring holds the lever arm 365 against the end of the stop 366 when the fingers are in their normal positions and swing the finger 349 inwardly of the dice carrying area as the finger is moved linearly toward the dice carrying area. Likewise, the dice positioning and gripping finger 350 is provided with a similarly constructed and mounted lever arm 370 which engages a stop 372 and has thereon a projecting hook 373 to which a tension spring 374 is connected. The other end of the tension spring 374 is anchored to a pin 375 secured to the lower surface of the panel 33, while the other end of the tension spring 369 is secured to the projecting end of a shaft 376 mounted on the panel 33 and which also provides a support for a part of an actuating linkage 377.

Movement and control of the position of the dice positioning and gripping finger 349 is accomplished through movement of a bell crank 378 supported for rotational movement by the shaft 376 and having an end portion 379 which engages the stud 353. In order to provide some flexibility in the gripping action of the fingers 349 and 350 against the opposite sides of the dice and in order to limit the accuracy required in the manufacture and adjustment of the gripping fingers, a lever 380 is mounted for rotational movement on and relative to the bell crank 378 by a pin 382 and has a surface opposed to the portion 379 of the bell crank, between which portion and surface the stud 353 is engaged. A spring 383 having one end connected to the lever 380 and its other end anchored to the bell crank biases the lever against the stud 353 and gives to allow some over-travel of the bell crank after the dice have been gripped, as shown in Fig. 15. A bell crank 384 has a bifurcated end 385 which straddles the stud 354 and is carried for rotational movement relative to the panel 33 by a shaft 386 secured to that panel. The latter bell crank comprises a part of a linkage adapted to the control and actuation of the dice positioning and gripping finger 350. A cam 387 adjustably secured to the stud 354 serves as a variable stop for controlling

the limit of inward movement of the dice positioning and gripping finger **350**. Between the extreme limits of movement which are illustrated in Figs. 14 and 15, the positioning of the fingers **349** and **350** are somewhat determined by cam surfaces **388** and **389** which are formed on the outer edges of the guide plates **362** and **363** respectively, and which cam surfaces are engaged by cam followers **390** and **392** rotatably secured to the extending ends of the dice positioning and gripping fingers **350** and **349** respectively.

In the preferred structure of my dice positioning and gripping fingers, per se, as depicted in Figs. 10, 11 and 12, the body of each dice positioning and gripping finger comprises an elongated and substantially flat sheet metal strip **393** cut away along one side to present dice engaging edges **394** and **395** disposed in substantially right angular relationship to one another. At the supported end of the finger, through which the supporting stud for the finger extends, the finger is reinforced by gripping plates **396** and **397** secured to one face thereof, which grpping plates preferably hold a dice gripping block **398** of a material which desirably has a relatively high friction coefficient and resilience. An example of one material satisfactory for the dice gripping purpose is cork. Another strip of the dice gripping material **399** is clamped to a face of the finger by clamping strip **400** and extends along the mid-portion of the edge **394**. The block **398** and strip **399** of the dice gripping material project beyond and present edges substantially parallel to the edges **395** and **394** of the finger. The strip **399** is utilized principally for turning the dice to a position for gripping during inward movement of the fingers, while the blocks **398** are used principally for applying the gripping force to the dice. As indicated in Figs. 10 and 11, a channel **402** is preferably provided along the edge of each finger at the end thereof which is supported so that the two opposed fingers may nest together when the dice are gripped therebetween

It is to be understood that the dice positioning and gripping fingers grip and firmly hold the dice **35** and **36** between their opposed gripping edges, and in proper relationship to the dividing line between the dice supporting plates **306** and **307**, while the dice supporting plate and its attached surface plate **320** are retracted to the position shown in Figs. 15 and 21 and while the feeler switch **44** is raised to a position of engagement with the dice.

Although there are various ways in which a feeler switch for this purpose might be constructed, a preferred structural embodiment of my feeler switch is illustrated in Figs. 7, 8 and 9. As there depicted, the switch comprises superposed blocks of insulating material **403**, **404**, **405** and **406** secured together and to a supporting yoke **407** by fastening means such as screws **408**, which screws extend through the yoke and blocks **406**, **405** and **404** and are threaded into the block **403**. An electrically conductive metal plate **409** which serves as the common contact of the various switches **L1**, **L2**, **L3**, **L4**, **L5**, **R1**, **R2**, **R3**, **R4** and **R5** (Fig. 3) is interposed between the insulating blocks **404** and **405**, and is secured in place by the screws **408** which extend through openings **410** therein and are preferably insulated therefrom. Although the positions of the switches are somewhat different in the circuit diagram of Fig. 3 and the structural embodiment shown in Figs. 7 and 9, those switches are referred to in the figures by like reference characters to associate switches having the same functional purposes.

In addition to the metal contact plate **409**, the switches each include terminal elements such as **412**, **413**, **414**, **415** and **416** carried by the block **406** and projecting therefrom for making external connections to the various switches. Also, a terminal element **417** is secured to the plate **409** and extends through the insulating blocks **405** and **406** for making circuit connections to the plate. Each terminal element, like the terminal element **412** in Fig. 7, preferably has a longitudinal bore **418** therein which serves as a bearing for movably supporting a stem such as **419** and **420** of a movable contact such as **422** and **423** having a mid-portion engageable with the plate **409** for making electrical contact therewith. The movable contacts such as **422** and **423** are biased into engagement with the metal plate **409** by resilient means such as compression springs **424** and **425** disposed between the heads of the contact elements and the terminal elements within bores **426** and **427** in the block **405**.

On the sides of the plate **409** opposite the movable contacts **422** and **423**, the block **404** has bores **428** and **429** which slidably support body portions of switch actuating plungers such as **430** and **432**. The portions of reduced diameter, such as **433** and **434** of the switch actuating plungers extend through openings **435**, **436**, **437**, **438**, **439**, **440**, **442**, **443**, **444** and **445** in the metal plate **409** and engage the aligned movable contacts of the switch. Each switch actuating plunger has a feeler stem such as **446** and **447** mounted for longitudinal movement in a bore such as **448** and **449** in the block **403** and normally biased to a position projecting beyond the surface of the block **403** by its co-acting movable contact such as **422** and **423**.

As previously explained, the feeler stems and switches of the feeler switch are relatively disposed for alignment with predetermined ones of the normal spot positions of dice of a predetermined size. As indicated in Figs. 7 and 8, the spots of the dice are preferably indented into the surface, as depicated at **450**. The size and the normal projecting lengths of the feeler stems are such that when aligned with a spot indentation, the stem will project into that indentation and will not move its co-acting movable contact away from its contacting position against the plate **409**. Thus, the movable contacts remain engaged with the contact plate when their respective plunger stems extend into aligned spot indentations of the dice. On the other hand, when no spot indentation is encountered by a plunger stem, that stem is moved inwardly against the biasing force of the compression spring of its co-acting movable contact to move that contact from its position of engagement with the plate **409**. In Fig. 7, the feeler stems **446** and **447** and their co-acting movable contacts are shown in open and closed positions respectively.

As indicated in Figs. 7 and 8, the yoke **407** is secured to the end of a shaft **452** which shaft, as depicted in Figs. 17 and 21, is carried for linear movement toward and from the support plates **306** and **307** by a yoke **453** secured to the support plate **304**. The normal position of the feeler switch **44** is such that the feeler stems are spaced below the surfaces of the dice supporting plates **306** and **307**. Upward movement of the shaft **452**, however, moves the feeler switch upwardly when the dice supporting plate **306** is retracted; the upper position thereof being shown in Figs. 8 and 21, wherein the block **403** is between the dice supporting plates **306** and **307** and the feeler stems are in engagement with the dice.

At the lower end of the shaft **452** and below the lower surface of the yoke **453**, a bracket **454** is fixedly secured thereto by fastening means such as a pin **455** (Fig. 17). At one side of the shaft **452**, a set screw **456** is threaded into the bracket **454** in alignment for engagement with the yoke **453** and is provided with a locknut **451** to provide an adjustable stop for determining the upper limit of movement of the feeler switch toward the dice. On the opposite side of the shaft, the bracket is provided with a projecting portion **457** (Figs. 16 and 17) disposed in angular relationship to the axis of the shaft **452**.

The actuation of the dice positioning and gripping fingers, movement of the dice supporting plate **306** and movement of the feeler switch **44** are accomplished in timed relationship to one another and to the operation of the electrical parts of the apparatus by the motor **42**. As depicted in Figs. 13 and 16, this motor is suspended below the operating mechanical parts of the apparatus by a motor supporting bracket **458** secured to the support plate **305** by fastening means such as screws **459**. By preference, the lower end of the bracket **458** is provided with a slotted motor receiving opening **460** in which the motor **42** is clamped by fastening means such as a screw **462**. As illustrated in Fig. 18, the motor supporting bracket **458** also carries at a position adjacent the motor a bearing sleeve **463** in which a shaft **464** is rotatably mounted. At one end of the shaft **464** a gear **465** is drivingly mounted in meshing relationship with a pinion **466** on the end of the motor shaft; said pinion and gear being of proportionate sizes to reduce the operating speed of the apparatus parts in relation to the normal motor speed. Adjacent the gear **465** and drivingly connected to the shaft is a crank arm **467** which, at a position eccentric to the axis of the shaft **464**, has a crank bearing **468**.

At the end of the shaft 464 opposite the gear 465, cams 469 and 470 are mounted in spaced relationship axially of the shaft to be driven thereby. Also, an arm 472 carries switches 285 and 80 in alignment transversely of the shaft with the cams 469 and 470 respectively. Cam following rollers 473 and 474 are carried for rotation in contact with cams 469 and 470 and are biased toward their respective cams by resilient arms 475 and 476 respectively. The cam rollers and their respective biasing arms serve as intermediate actuating elements between the respective cams and switch actuating plungers 477 and 478. As may be recalled from the previous description of the electrical portion of the apparatus, the cam operated switch 80 starts the motor in timed relationship to the operation of the dice shaking electromagnet and stops the motor at the end of each operating cycle, while the cam operated switch 285 effects actuation of the play relay 57 in timed relationship to the operations of the pulse relays and indicators.

The operating movements of the dice supporting plate 306, dice positioning and gripping fingers 349 and 350 and the feeler switch 44 being in the nature of reciprocating motions, their action is desirably produced by a mechanism actuated from the crank 467. The aforementioned mechanism includes a main shaft 479 and an auxiliary shaft 480, both of which extend in directions transverse to, and are supported for rotation by the support plates 304 and 305. As shown in Fig. 13, and arm 482 is drivingly connected to one end of the main shaft 479 and has a crank pin 483 mounted thereon in spaced relationship to the axis of the shaft 479. A drive rod 484 has its opposite ends rotatably mounted on the crank bearing 468 and crank pin 483 to provide a driving connection between the crank arm 467 and the arm 482 by which reciprocating motion of the main shaft 479 is effected.

A second arm 485 (Figs. 13 and 17) is carried by the main shaft 479 adjacent the arm 482, but is free to rotate relative to and about the axis of that shaft. On the opposite side of the support plate 305, and drivingly connected to the shaft 479, is a spider 486 which has three arm portions 487, 488 and 489 projecting outwardly from the axis of the shaft in different angular directions. A tension spring 490 has one end anchored to a pin 492 at one extremity of the arm 485 and its other end anchored to a pin 493 at the outer extremity of the arm portion 487 of the spider 486 to provide a resilient driving connection for actuating the arm 485 in response to movements of the arm portion 487 in a counter-clockwise direction, as viewed in Fig. 13. A stop pin 494 secured to and projecting from the arm portion 487 is adapted to engage the arm 485 to provide a positive driving connection between the arm portion 487 and arm 485 during movements of the arm portion 487 in the opposite direction. The stop pin 494 also establishes a definite angular relationship between the arm portion 487 and arm 485 when those parts are in their normal positions, as depicted in Fig. 13. A connecting rod 495 carried at one end by a crank pin 496 on the arm 485 and at its other end by a crank pin 497 on a bell crank 498 provides a driving connection for the auxiliary shaft 480; the bell crank 498 being drivingly connected to one end of the latter shaft. At its other end, the shaft 480 has drivingly connected thereto a crank arm 499 of a length substantially equal to that of an arm portion 500 of the bell crank 498.

As indicated in Figs. 13, 14 and 16, driving connections between the arm portion 500 of bell crank 498 and the bell crank 378 and between the crank arm 499 and the bell crank 384 are provided by connecting rods 502 and 503, respectively. In order to compensate for swinging movements of the bell cranks 498 and 378 in transverse planes, the crank pins 504 and 505 by which the connecting rod 502 is drivingly connected at its opposite ends to the bell cranks 498 and 378 are desirably provided with ball shaped bearing portions 506 and 507 which fit into complementary sockets in the connecting rod. The connecting bearings for the connecting rod 503 are likewise provided with ball and socket joints, such as 588 (Fig. 14).

With the driving mechanism thus far described, it may be understood that when the crank arm 467 on the motor drive gear is disposed in its normal position, as shown in Fig. 13, the main shaft 479 is turned to a position such that the pin 494 on the arm portion 487 of the spider 486 engages the arm 485 to hold the latter arm in a retracted position such that the bell crank 498, auxiliary shaft 480 and crank arm 499 are disposed to retract the respective bell cranks 378 and 384 and their respective dice positioning and gripping arms 349 and 350 to the positions shown in Fig. 14. When the crank arm 467 of the motor drive reaches its other extreme position, as depicted in Fig. 16, however, the arms, connecting rods and bell cranks are actuated to their other extreme position in which the dice are gripped between the dice positioning and gripping fingers 349 and 350 as shown in Fig. 15. In the latter position, as indicated in Fig. 16, the stop pin 494 may be drawn away from the arm 485 so that the latter arm is held through the spring 490, which latter spring has sufficient strength to produce firm gripping action of the dice but allows for some over-travel of the driving parts to avoid the necessity of critical accuracy.

The arm portion 489 of the spider 486 extends upwardly toward the dice supporting plate 306 and has mounted on its extreme end a projecting finger 509 which is supported for rotational swinging movement relative to the arm portion 489 by a pin 510 (Figs. 13 and 21). The finger 509 is biased to a normal position against a stop pin 512 on the arm portion 489 by spring 513. The projecting end of the finger 509 is aligned for engagement with the projecting tab 319 on the linearly movable dice supporting plate 306. Thus, with the main shaft 379 in its normal position, as illustrated in Fig. 13, the finger 509 is withdrawn from the tab 319 so that the movable supporting plate 306 is drawn into abutment with the plate 307 by the tension springs 313 and 314. When, however, the driving mechanism assumes the position illustrated in Fig. 16, the slidable dice supporting plate 306 is retracted from its normal position, as shown in Fig. 21. The spacing of the adjacent edges of the dice supporting plates 306 and 307 being somewhat critical, the stop pin 317 is set to effect that critical spacing; the spring 513 normally being sufficiently strong to move the slidable dice supporting plate against the biasing forces of the springs 313 and 314, it does provide for over-travel of the arm portion 489.

The remaining arm portion 488 of the spider 486 is utilized to actuate the feeler switch 44. At its end, the arm portion 488 carries a plunger 514 in alignment for engagement with the projecting portion 457 of the bracket 454 on the feeler switch supporting shaft 452. The plunger 514 is biased to an extended position by a compression spring 515, which spring has sufficient strength to effect actuation of the feeler switch to the point at which the adjustable stop screw 456 engages the yoke 453. Any subsequent over travel of the arm portion 488 is absorbed through relative movement between the arm portion and the plunger 514 against the biasing force of the spring 515.

As explained in connection with the operation of the electrical circuit and parts, the switch 135 initiates the production of a current pulse through the feeler switch contacts after that switch is brought into its operation position relative to the dice, and as shown in Fig. 21. The switch 135 is shown in Figs. 13 and 16, and is supported on the motor support bracket 458. An actuating plunger 516 of the switch 135 is aligned for engagement with the projecting end of a screw 517 which is carried by the arm 482 and provided with a locknut 518; whereby with the latter screw properly adjusted with reference to the arm 482, the plunger 516 is depressed to close the switch 135 in timed relationship to the movement of the feeler switch, so that the pulse of current through the feeler switch contacts occurs after the actuation of the feeler switch contacts.

As a brief résumé of the steps in the cycles of operations of the apparatus, the following outline is provided:

A. A coin dropped into the coin slot 28 produces actuation of the coin relay and effects preliminary energization of the dice shaker and shaker timing apparatus.

B. Manual movement of the handle 37 starts and produces some control over the timing of the dice shaking apparatus.

C. The completion of the dice shaking effects the starting of the motor 42, which motor controls and actuates the dice positioning and gripping fingers, the movable dice supporting plate and the feeler switch, as well as cam switches 80 and 285 and the pulse initiating switch 135.

D. In sequence the dice are positioned and gripped by the positioning and gripping fingers, after which the movable dice supporting plate is retracted and the feeler switch is brought into engagement with the bottom faces of the dice.

E. While the feeler switch is in the last mentioned position, the pulse initiated by the closing of motor operated switch 135 passes through the feeler switch contacts, relay group contacts, adding group contacts and to the system group to effect actuation of an appropriate one of the relays of that group or the "win" or "lose" relays, as described for particular plays in a series.

F. Subsequent to the operating current pulse and its actuation of the electrical parts of the apparatus, continued operation of the motor 42 actuates the switch 285 to close a circuit through the play relay and effects retraction of the feeler switch and dice positioning and gripping fingers to their normal positions, as well as return of the movable dice supporting plate to its normal position.

G. The cam switch 80 stops the motor at the end of a cycle of playing operation, such as that outlined.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In coin controlled amusement apparatus for playing a game with a pair of standard dice and following predetermined rules for the determination "wins" and "losses," the combination comprising a power source, a coin operated switch, a coin relay energized and having a locking circuit closed from said power source by actuation of the coin operated switch, "win" and "lose" relays having normally closed contacts connected in series and included in said locking circuit of the coin relay, an electromagnetically actuated dice shaker, an electrical driving motor, a manually operable switch for effecting closure of a circuit from said power source to said dice shaker, means including a relay in the circuit of the dice shaker for effecting operation of the driving motor after the dice shaker has stopped, dice gripping elements, mechanism actuated by the motor for moving the dice gripping elements to and from gripping engagement with the dice, a feeler switch having contacts for each die, mechanism actuated by said motor for moving the feeler switch to read the dice, means comprising a system of relays for adding the die numbers, a switch actuated by the motor for stopping said motor at the end of one cycle of operation, means comprising a second system of relays and counters including said "win" and "lose" relays and responsive to the added die numbers for selectively effecting actuation of said counters and said "win" and "lose" relays in accordance with predetermined rules of play.

2. In coin controlled amusement apparatus as defined in claim 1, the combination being further characterized by a shaker timing circuit including relays and condensers energized from said power source in response to closure of said manually operable switch for effecting operation of the dice shaker for at least a predetermined time even though said manually operable switch is closed for a time less than said predetermined time.

3. In coin controlled amusement apparatus as defined in claim 1, the contacts of the feeler switch for each die comprising spring biased feeler pins less in number than the possible die spot positions for the various sides of the die and disposed at positions such that different ones or combinations of the contacts are aligned with die spots for each of the sides of the die.

4. In coin controlled amusement apparatus as defined in claim 1, said system of relays for adding the die numbers comprising a group of relays for each die connected for actuation from said power source through circuits including the contacts of said feeler switch, and a second group of relays each having an actuating coil and a plurality of contacts, the actuating coils of the relays of the second group being energized through circuits controlled by the relays of one die group, and the contacts of the relays of the second group being included in circuits controlled by the relays of another die group.

5. In coin controlled amusement apparatus as defined in claim 1, the combination being further characterized by means including a relay and a condenser for providing a pulse of current at a time to act through the contacts of said feeler switch for initiating the operation of said system of relays for adding the die numbers.

6. In coin controlled amusement apparatus as defined in claim 1, the combination being further characterized by indicating elements selectively operable by certain of the relays of said second system, and said counters being connected to record the number of operations of the "win" relay preceding each operation of the "lose" relay and the number of cycles of operation preceding each actuation of either the "win" or "lose" relays.

7. In amusement apparatus for playing a game with a pair of standard dice and following predetermined rules for the determination of "wins" and "losses," the combination comprising a power source, a game initiating switch for effecting initial energization of the apparatus, a control relay energized by operation of said game initiating switch and having a locking circuit closed from said power source upon operation of the said control relay, "win" and "lose" relays having normally closed contacts connected in series and included in said locking circuit of the control relay, means for shaking and casting the dice within a predetermined space, means for moving the dice with their uppermost sides retained as cast to a predetermined position within the space and holding them at said position, a feeler switch having contacts aligned with predetermined spot positions for each die, means for bringing said contacts into engagement with the dice for effecting a determination of the number indicated in the uppermost position of each die, means comprising a system of relays for adding the die numbers, and means comprising a second system of relays including said "win" and "lose" relays and responsive to the added die numbers for selectively effecting actuation of said "win" and "lose" relays in accordance with predetermined rules of play.

8. In amusement apparatus for playing a game with a pair of standard dice and following predetermined rules for the determination of "wins" and "losses," a combination comprising a power source, a game initiating switch effecting initial energization of the apparatus, a control relay energized from the power source by operation of said game initiating switch and having a locking circuit closed from said power source upon operation of the said control relay, "win" and "lose" relays having normally closed contacts in series with said locking circuit of the control relay, means for shaking and casting the dice, means for moving the dice to a predetermined position within the area while retaining the uppermost sides thereof as cast and holding them at said position, means for effecting a determination of the uppermost numbers indicated by each die, means comprising a system of relays, for adding the die numbers, and means comprising a second system of relays including said "win" and "lose" relays, responsive to the added die numbers for selectively effecting actuation of said "win" and "lose" relays in accordance with predetermined rules of play.

9. In amusement apparatus for playing a game with dice, the combination with means providing a smooth supporting surface for the dice, means for confining the dice to a predetermined space on the surface, and means for effecting a random throwing action of the dice, of dice positioning and gripping members, and a mechanism for supporting each of said members adjacent the supporting surface for swinging and linear movements parallel thereto between separated retracted positions outside of said space and dice gripping positions extending across the mid-portion of the space from opposed sides of that space, said members each comprising elongated and substantially flat strips disposed with their flat surfaces substantially parallel to said supporting surfaces and being shaped on one side to provide adjacent edges in right angular relationship, said members being so relatively disposed and movable that said adjacent edges thereof are in opposed relationship for gripping the dice therebetween when the members are in said gripping positions.

10. In amusement apparatus as defined in claim 9, said dice positioning and gripping members being further characterized by strips of compressible friction material secured thereto and exposed at said adjacent edges.

11. In amusement apparatus as defined in claim 9, said mechanism for movably supporting each of the dice posi-

tioning and gripping members including support studs secured to end portions of the members in spaced relationship to said adjacent edges thereof, plates providing slots on opposed sides of said predetermined space in which said studs are linearly movable toward and from one another, said members also being swingable toward and from one another about the axes of said studs, a spring biasing each of said members in one direction about its supporting stud, a bell crank supported for rotational movement at a position near the stud supported end of each of the members and having a bifurcated end straddling one of said studs for moving the stud in said slot, and a stationary cam engaging a cam follower on each of said members for effecting control of the swinging movement of the members in accord with the position of linear movement, whereby said members are moved to said positions in response to actuation by movements of the bell cranks.

12. In amusement apparatus for playing a game with dice, the combination comprising dice positioning and gripping members, and a mechanism for supporting one of said members for coplanar swinging and linear movements relative to the other and between positions such that the members are respectively separated and adjacent, said members having opposed dice gripping surfaces between which the dice are gripped when the members are brought to the adjacent position, said mechanism including an actuating element connected to said one of the members for effecting the said movements of that member, and the connection between said actuating element and said one of the members including a part movably mounted on the actuating element and spring biased in a direction to maintain limited pressure on dice gripped between the gripping surfaces during movement of the actuating element beyond the position at which the gripping pressure is initially effected.

13. In amusement apparatus for playing a game with dice, a dice positioning and gripping member comprising an elongated and generally flat metal finger having a long positioning and gripping edge extending longitudinally thereof and a short positioning and gripping edge disposed adjacent and at a right angle to said long edge, a piece of compressible material having a relatively high friction coefficient and secured to the finger so as to present a narrow marginal portion projecting beyond and extending along the short edge in substantially parallel relationship thereto, and a second piece of compressible material having a relatively high friction coefficient secured to the finger and presenting a narrow marginal portion spaced from the short edge and projecting beyond and extending along the long edge in substantially parallel relationship thereto.

14. In amusement apparatus adapted to energization from an electrical power source for playing a game with dice, said apparatus including means for confining the dice to a given space, means for effecting random shaking action of the dice within said space, means for gripping the dice while retaining their upright positions following said shaking action, and movable switch means engageable with the dice while they are gripped for effecting a determination of indicia on predetermined faces of the dice, and electrical apparatus responsive to the indicia thus determined, the combination of a coin operated switch for effecting initial energization of the apparatus from the power source, a manually operable switch for initiating operation of said means for effecting random shaking action of the dice, a motor for operating the means for gripping the dice, said motor also actuating the movable switch means in timed relationship to the operation of the dice gripping means, a switch included in said means for effecting random shaking action of the dice for initiating operation of said motor, and a cam switch actuated by the motor for limiting the operation of the motor to a cycle of operation of the gripping means and movable switch means.

15. In amusement apparatus embodying electrical and mechanical elements for playing a game with dice or the like and wherein said elements include a switch mechanism for reading the dice by contact with the bottoms thereof, the combination comprising a supporting structure, a dice platform carried by the supporting structure and including two upper surface forming parts presenting a smooth upper surface against which the dice normally rest, said parts being adjacent a mid-line and having opposite edges opposed to the mid-line hingedly supported for upward swinging movement by resilient straps, means including a transparent dome for confining the dice to a predetermined space relative to the dice platform, and an electrically actuated mechanism having striker members for effectively and intermittently engaging the lower surfaces of said parts to produce vibratory movements thereof which throw the dice about randomly within said space, said supporting structure including a plate and a slide disposed in coplanar relationship beneath said surface forming parts and having a line of separation immediately under said mid-line, said plate and slide normally having end surfaces abutting at said line of separation, said slide being supported for limited linear movement away from the plate and having one of said surface forming parts connected thereto for movement therewith, and dice positioning and holding elements operable in sequential relationship with respect to said electrically actuated mechanism and slide for positioning and holding the dice relative to said mid-line to expose the lower surfaces thereof for engagement by said switch mechanism when the slide moves away from the plate.

16. In coin controlled amusement apparatus for playing a game with a pair of standard dice and following predetermined rules for the determination of "wins" and "losses," the combination comprising a plurality of power sources, a coin operated switch, a coin relay energized and having a locking circuit closed from one of said power sources by actuation of the coin operated switch, "win" and "lose" relays having normally closed contacts connected in series and included in said locking circuit of the coin relay, an electromagnetically actuated dice shaker, an electrical driving motor, a manually operable switch for effecting closure of a circuit from said one of the power sources to said dice shaker, means including a relay in the circuit of the dice shaker for effecting operation of the driving motor after the dice shaker has stopped, dice gripping elements, mechanism actuated by the motor, for moving the dice gripping elements to and from gripping engagement with the dice, a feeler switch having contacts for each die, mechanism actuated by said motor for moving the feeler switch to read the dice, means comprising a system of relays for adding the die numbers, a switch actuated by the motor for stopping said motor at the end of one cycle of operation, means comprising a second system of relays and counters including said "win" and "lose" relays and responsive to the added die numbers for selectively effecting actuation of said counters and said "win" and "lose" relays in accordance with predetermined rules of play, a relay energized from one power source by means responsive to the operation of said second system of relays, the last mentioned relay having a holding circuit including the series connected normally closed contacts of the "win" and "lose" relays, and said last mentioned relay also having contacts for changing the power source which acts upon the second system of relays so as functionally to distinguish the first cycle of operation following actuation of the "win" and "lose" relays from succeeding cycles of operation.

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