Feb. 3, 1959 J. B. ANDERSEN 2,872,038

RECORD CONTROLLED MACHINE

Filed Nov. 28, 1952 3 Sheets-Sheet 1

Fig. 1.

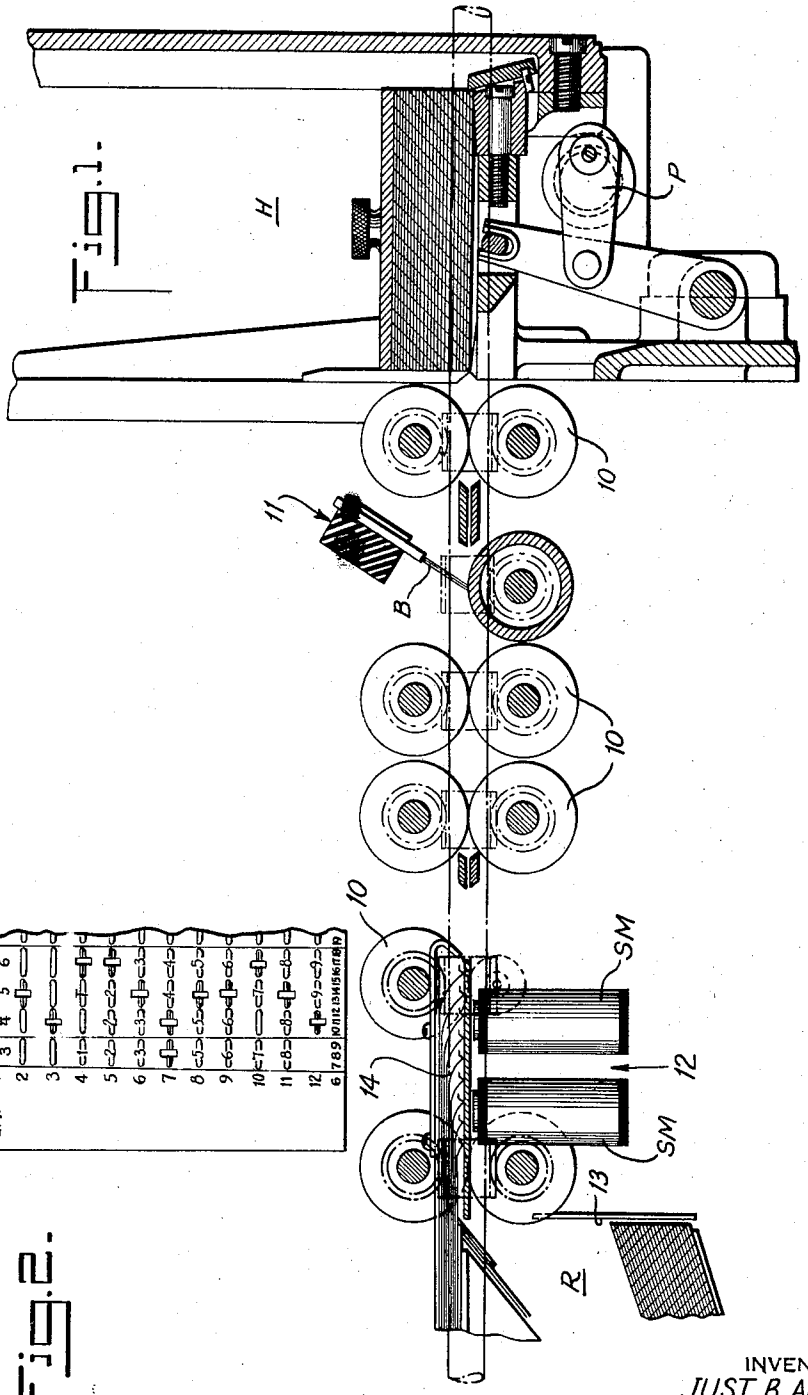


Fig. 2.

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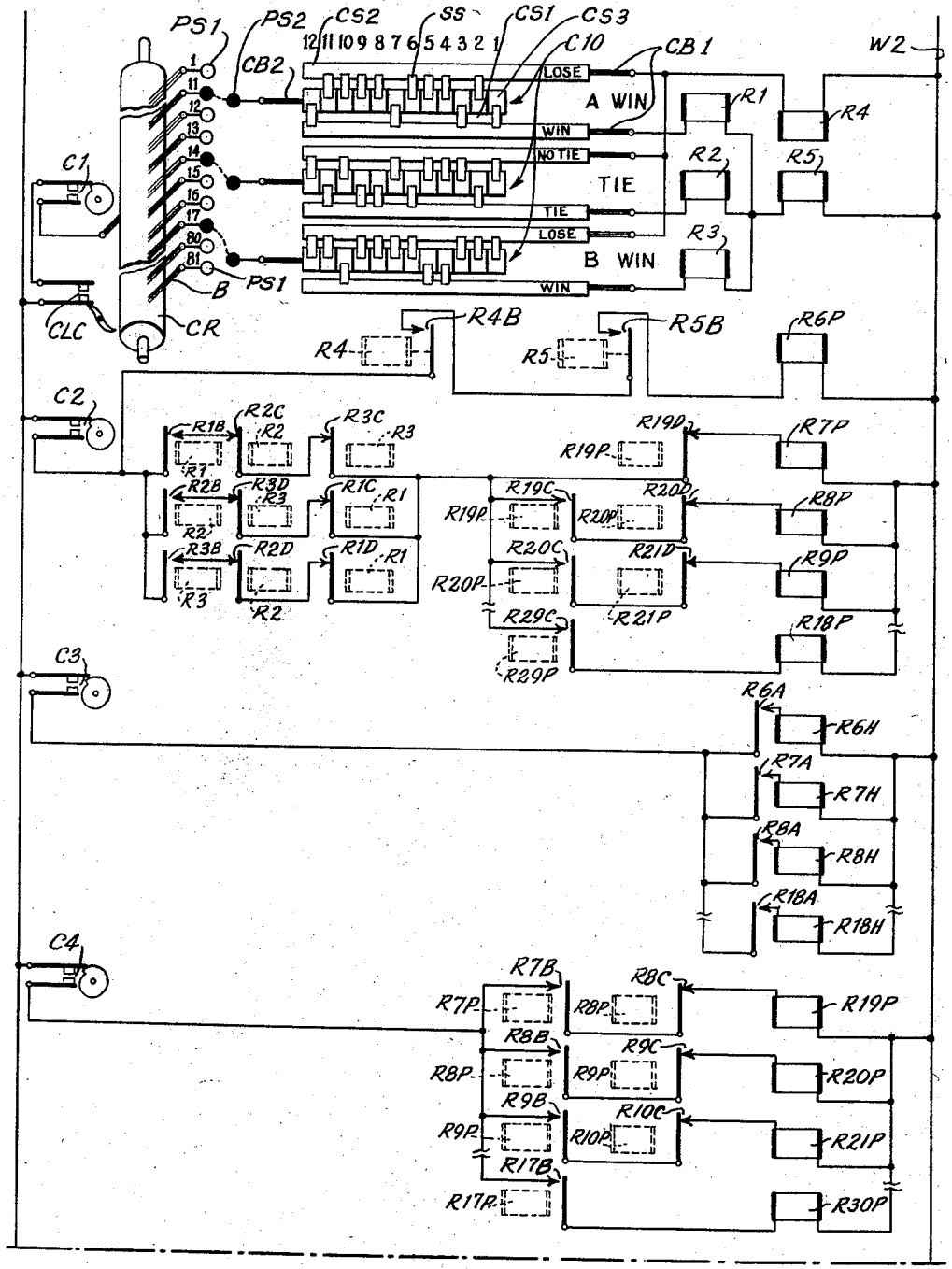


Fig. 3A.

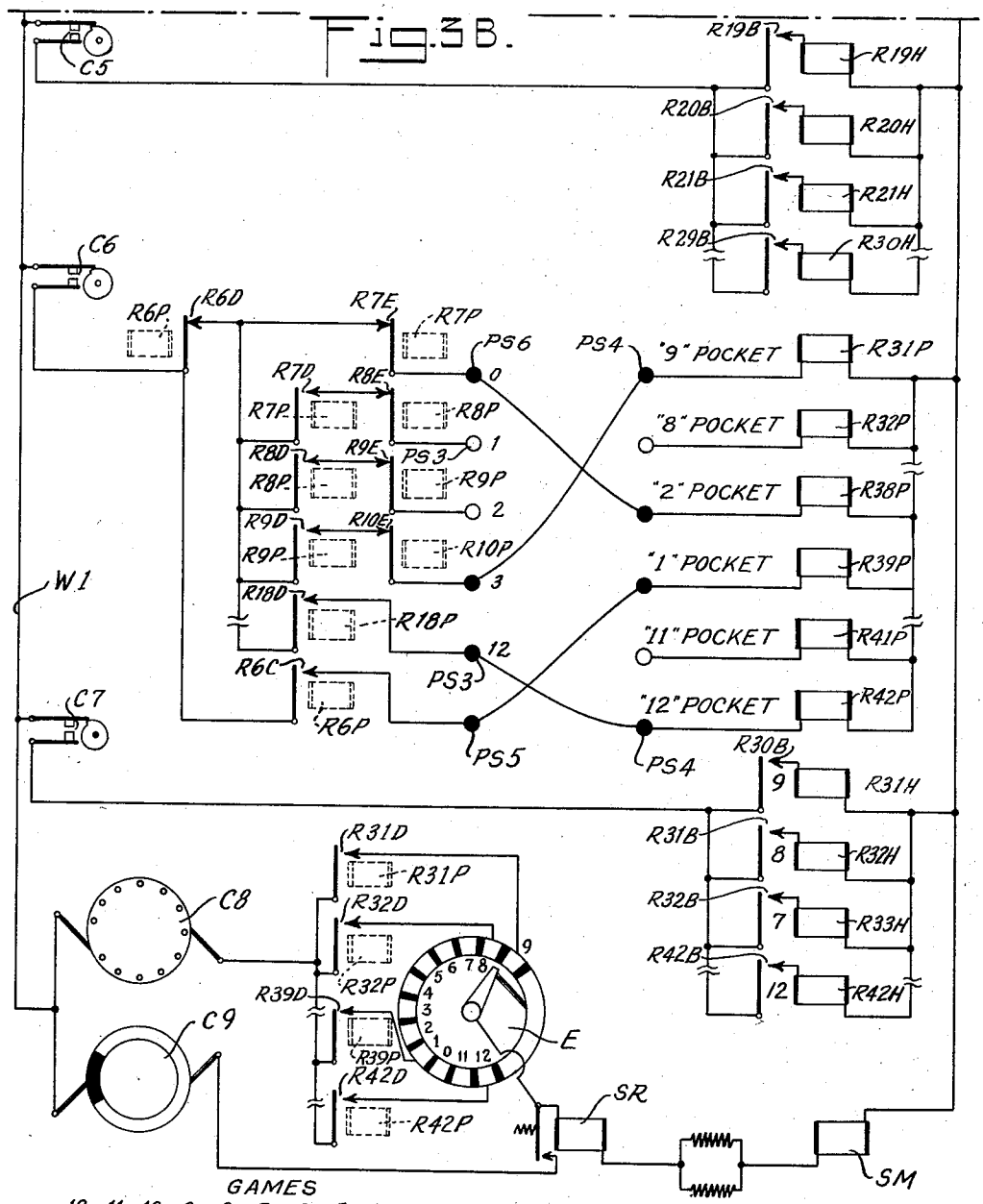
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Fig. 3B.



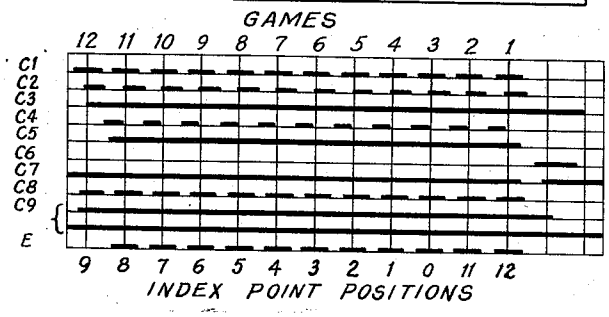


Fig. 4.

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RECORD CONTROLLED MACHINE

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Application November 28, 1952, Serial No. 323,023

8 Claims. (Cl. 209—110)

This invention relates to record controlled machines and more particularly to sorting machines.

The principal object of the invention is to sort or otherwise dispose of records and similar control elements in accordance with the number of correct selections on the basis of multiple choices.

For purposes of illustrating the invention, it may be explained with reference to a league of teams engaged in athletic sports on the basis of win, tie, or lose and the object is to sort the control elements, such as perforated cards, into the pockets of the sorting machine in accordance with the number of correct multiple choices of the results of league games. This type of selection has certain advantages particularly where it is desirable to compare original multiple choice selections with correct selections and sort the individual records on the basis of correct multiple choice selections.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a vertical section through a portion of a sorting machine, with which the present invention may be used.

Fig. 2 shows a portion of a record card suitable for use with the invention described herein.

Figs. 3A and 3B together comprise a wiring diagram.

Fig. 4 comprises a timing chart.

Fig. 1 shows a sorting machine of the general type disclosed in Patent 1,741,985, which has been modified to the extent of separating the card sensing station from the sorting station a physical distance equivalent in time to one card cycle of analysis of the cards in order that the entire card may be sensed prior to determining its destination in a sorting pocket. This sorting mechanism, in the specific form shown in Fig. 1, is disclosed in Patent 2,307,100; consequently, a detailed description thereof will not be given herein.

The machine is equipped with a supply hopper H (Fig. 1) in which the cards are placed face down, "9" positions at the left. They are advanced one at a time from the hopper H by a card picker mechanism of well known form generally designated P in Fig. 1. From the hopper H the cards are transported to the left by the feed rollers **10** past the card sensing station **11** and the sorting station **12** to the card receiving pockets, one of which is designated **13** in Fig. 1. There are thirteen of these pockets, one of which is the usual reject pocket R shown in Fig. 1, whereas the others correspond to the twelve index-point positions of the card (Fig. 2).

The cards are selectively distributed to the pockets **13** (Fig. 1) by means of the sorting blades **14** which are controlled by the usual sorting magnet SM. The cards pass under the ends of the blades **14** and the sorting magnet SM is energized differentially at different times in the cycle to drop the blades **14**. The position of the left-

hand edge of each card at the time of energization of the sorting magnet SM determines the distribution of the card to the pockets by holding up the blades selectively when the magnet SM is energized, in a well known way.

In the present case, the sorting magnet SM is energized under control of an emitter E (Fig. 3B) which in turn is controlled by the sorting relays designated R31H to R42H, there being provided a relay for each pocket and blade **14**.

The machine is equipped with the usual digital sorting commutator which is designated C8, C9 and shown diagrammatically in Fig. 3B. In the present instance, all of the segments of this commutator are made current-conducting in a well known way.

The machine is provided with a series of timing contacts designated C1 to C7, the relative timing of which is shown in Fig. 4, the heavy dark lines designating the current conducting periods of the different contacts.

The machine is also equipped with a multiple choice selector including a series of three special comparing commutators collectively designated C10 which are shown diagrammatically in Fig. 3A. Each commutator with its associated control relays forms a comparing section and comprises a pair of common contact strips designated CS1, CS2 of which the strips CS1 may be considered as associated with correct answers or responses and CS2 with incorrect responses. The commutators C10 each have a series of individual segments CS3, which correspond in number to the index-point positions of a single card column there being twelve index-point positions and consequently twelve segments CS3 and a pair of common strips CS1, CS2 for each commutator. Each of the segments CS3 is provided with a movable switching elements SS arranged so that the associated segments CS3 may be electrically connected to either the associated strip CS1 or to the strip CS2 by sliding the switching elements SS down or up, as the case may be, in Fig. 3A. The common strips CS1, CS2 for each commutator are provided with the common brushes CB1, which continually ride over the common strips CS1, CS2, respectively, and also with a center brush CB2 which traverses the segments CS3. As usual with selector devices of this type, the commutators C10 are synchronized with the sensing of the card, index point by index point. This may may be accomplished by mounting commutators C10 on the same shaft as sorting commutator C8.

The card sensing station 11 is provided with the brushes B of which there is one for each card column, the record cards normally having eighty columns. The brushes B are spaced from the end of the extreme right-hand blade 14 which leads to the "9" pocket so that the left-hand edge of a card which precedes one being traversed by the brushes B will be about to pass under the aforesaid blade and when the brushes B are sensing the "9" positions of the card thereunder. However, this timing is not critical so long as the analysis of each card is completed before the left-hand edge of such card can pass under the end of any blade 14.

The record card, a portion of which is shown in Fig. 2, may be of the type known as a mark sensing card and, for present purposes, it may be considered as divided into a plurality of fields, each field being headed with a caption "Section 1," "Section 2," etc., and includes three mark sensing columns each mark sensing column comprising three ordinary record columns. These record columns are arranged in a well known way with mark receiving boxes so that conductive marks may be made with a pencil for the purpose of recording values. For example, in the mark sensing column designated "4" at the top in Fig. 2, there are twelve blank positions or boxes, each denoted by an elongated printed oval and aligned with one of the twelve index-point positions of

the three card columns assigned to that particular mark sensing column. Each box extends over the index-point positions of three ordinary columns.

For present purposes, it may be assumed that the object is to guess the results of twelve athletic games to indicate whether given teams in a leauge will win, lose, or tie, there being twelve games and twenty-four teams involved for each "section" on the card. The mark sensing column 4 of Section 1 may be considered as the "win" column, column 5 the "tie" column, and column 6 the "lose" column, for team A of each pair of teams involved in the league of twelve games designated 1 to 12 in the vertical column at the extreme left in Fig. 2. The three possible choices for each game (Fig. 2) are treated as a multiple choice group.

If the person marking the card expects team A to win, a heavy horizontal pencil mark will be made in the box opposite the game number in column 4. In Fig. 2 the card has been marked for team A to win in games 1, 3, 7, and 12. If team A is expected to tie, a horizontal mark will be made in the box for column 5 opposite the game number. Thus, team A is expected to tie in games 2, 6, 8, 9, and 11. If it is expected that team A will lose, the box in column 6 will be marked. Thus, it is expected that team A will lose in games 4, 5, and 10. After each field designated by a section number has been so marked, the number of sections so marked will be designated in the mark sensing column 3 by drawing a horizontal line in the appropriate box. Thus, in Fig. 2 only seven sections have been assumed to be marked to indicate that ratings are being made in only seven leagues.

After the card has been so marked, it will be run through a machine known in the art as a mark sensing reproducer in which the horizontal pencil marks will be translated into punched holes and in the present case, these holes may be conveniently made in the middle column in each group of three mark sensing columns. In Fig. 2 the small rectangles located at the centers of the boxes are the perforations made by the mark sensing reproducer in accordance with the pencil marks. Thus, it will be seen that there is a perforation in mark sensing column positions 1, 3, 7, and 12 to correspond with the pencil marks in the "win" boxes of Section 1. It is not necessary that the perforations be made in the marked columns but in the present case, this has been assumed in order to simplify the description and also to assist in identifying the pencil mark positions.

These cards are placed face down in the hopper H (Fig. 1) in the usual way with the well known "9" positions, corresponding to game 12, at the left, so that the cards are sensed in the usual order 9, 8, 7, . . . 0, 11, and 12. In the present case, this sensing will be in the inverse order of the game numbers although this has no particular significance as the game numbers could be printed in ascending order instead of descending order from bottom to the top in Fig. 2.

It will be noted in Fig. 2 that the "win," "tie," and "lose" perforations for Team A for the respective games of league 1 appear in card columns 11, 14, and 17. The brushes B are connected to suitable plug sockets PS1 so that the common brushes CB2 for the commutators C10 may be connected by plugwires to the plug sockets PS2. The plug sockets PS2 are plugged as shown in Fig. 3A to the plug sockets PS1 for columns 11, 14, and 17 to render the comparing relays R1, R2, and R3 responsive to the perforations which represent the ratings of the teams. The commutators C10 are manually set to designate the correct answers, which in this case means the actual results of the games. In Fig. 2, for example, it will be assumed that in game 1 team A won. In order to set up this condition in the machine, the switch SS of the topmost commutator C10 which corresponds to the 12 index-point position on the card, game 1, will be positioned downwardly as shown at the extreme right in Fig. 3A, so that relay R1 will be made responsive to perforations in the 12 position of mark sensing column 4, card column 11, providing, of course, such column and index-point position have been correctly pencil marked and correspondingly punched in the 12 index-point position of column 11. This will be assumed. In other words, in Fig. 3A, the devices SS of the "A win" commutator C10 will be pulled down for all cases where team A actually won.

In a similar manner, the other switching devices SS of the "A win" commutator C10 will be pushed upwardly to designate that team A did not win. Thus, in Fig. 3A, the correct answers are for team A to win in games 1, 3, 7, 12 and to lose in games 2, 4, 5, 6, 8, 9, 10, and 11. In other words, the commutator C10 for each mark sensing column is set not only to indicate the correct answers, but also to indicate the incorrect answers.

The other two commutators C10 are similarly set up for the same twelve games. Take game 1, for example. The top or "A win" commutator C10 has its switch element SS pulled down for A to win, the switch SS for the middle or "Tie" commutator is pushed up to signify "no tie," and switch SS for the bottom commutator is pushed up to represent "B lose."

The object of making these complementary settings is to control in the cases where more than one pencil mark has been made for a game. For example, in the case of game 1, the boxes for mark sensing columns 4 and 5 might both be marked and would include the correct answer in column 4 which would set up a correct selection in the machine, but actually on the card it would then be impossible to tell which was intended to be correct by the marker of the card, and if no means were provided to prevent it, more than one guess could be made per game.

When the machine is started in operation, the cards will be sensed in the order 9, 8, 7, in the usual way, and the marking for game 12 will be analyzed first. Let it be assumed that game 12 has been correctly marked for team A to win (Fig. 2) by a pencil mark in mark sensing column 4 so that a "9" hole appears in column 11. The hole appearing in column 11 associated with mark sensing column 4 will be sensed by the brush B for column 11 which is the second one from the top in Fig. 3A, shown plugged to the common brush CB2 for the topmost or "A win" commutator C10 in Fig. 3A. The switch member SS for the "9" index-point position that corresponds to game 12 is set in lower position to indicate a correct answer to the analyzing means, in which comparing relay R1 will be energized by a circuit traced as follows: line wire W1 (Fig. 3A), the usual card lever contacts CLC, the usual circuit breaker contacts C1, the common brush CB for the contact roll CR, the contact roll, the brush B for column 11, the plugwire, common brush CB2, the segment CS3 of commutator C10 for the "9" index-point position associated with game 12, the switch member SS, the common strip CS1 of commutator C10, the common brush CB1, the relays R1 and R5, to the line wire W2.

Since only one choice, which happens to be the correct one, has been made in Section 1, game 12, none of the other comparing relays R2, R3, R4 will be energized through the brushes B for columns 14 and 17. Relay R1 will close its contacts R1B and cause the energization of counting relay R7P over a circuit traced from line wire W1 (Fig. 3A), through contacts C2, relay contacts R1B, R2C, R3C, R19D, and the coil of relay R7P, to line wire W2. The contacts R7A close and establish a temporary holding circuit for the holding coil R7H of the relay R7P through the contacts C3.

Relay R7P also closes its contacts R7B (Fig. 3A) to energize relay R19P through contacts C4 and the contacts R8C. Relay R19P opens contacts R19D and closes its contacts R19B (Fig. 3B) to set up a holding circuit for its holding coil R19H through contacts C5,

The brushes for columns 11, 14, and 17 now pass to the "8" index-point positions and it will be noted in Fig. 2, that mark sensing column 5 is punched in the "8" index-point position corresponding to game 11 to "tie" and is also a correct answer, since the switch member SS for the "tie" commutator C10, associated with the mark sensing column 5 and card column 14, is in the lower position (Fig. 3A) thereby energizing relays R2 and R5, by a circuit traced similarly to the one initially traced above. Relay R2 closes contacts R2B but relay R7P cannot now be energized because contacts R19D are now open. Instead, counting relay R8P is energized through contacts R19C and R20D.

Relay R8P similarly closes its contacts R8A (Fig. 3A) to establish a holding circuit to the coil R8H and also closes the contacts R8B to energize relay R20P through the contacts C4 and R9C. Contacts R20D also open and prevent a second energization of relay R8P. A holding circuit for R20H (Fig. 3B) also is set up as for relay R19H.

If the entire Section 1 is correctly marked and perforated to represent correct guesses in all twelve games, all of the counting relays R7P to R18P and R19P to R30P will be energized in succession to represent twelve correct guesses. As each relay is energized to indicate a correct guess, the related ones of contacts R7D to R18D (Fig. 3B) are closed and the contacts R8E to R17E are opened, respectively.

Let it be assumed that the card in Fig. 2 is correctly marked for all twelve games. Contacts R18D will be closed (Fig. 3B) to connect one of the plug sockets PS3, which corresponds to twelve correct choices, to the timing contacts C6 through the contacts R6D. The contacts R7E to R17E will all be open to prevent any of the other plug sockets PS3 for a lesser number of correct choices from being operative since relays R7P to R18H are now all energized. There are twelve plug sockets PS3 provided for correct choices; a thirteenth PS5 is provided for cards which are not marked for any game; and a fourteenth PS6 for those which may have two choices for a single game.

The selection of the sorting blades through the sorting magnet SM is effective by the emitter E and the relays R31P to R42P. These relays are connected to the plug sockets PS4 which, in turn, are plugged to the plug sockets PS3. For example, the plug socket PS3, corresponding to twelve choices controlled by the relay R18P may be plugged to the relay R42P corresponding to the "12" pocket. Thus, if the person marking the card has predicted correctly the results of all twelve games and relay R18P has been energized, relay R42P (Fig. 3B) will be energized at the end of the cycle of the analysis of the card by a circuit from line wire W1 through contacts C6, relay contacts R6D, R18D, the plug wire, and the relay R42P, to line wire W2. Relay contacts R42B and contacts C7 hold relay R42H through most of the following cycle (Fig. 4). Relay R42P will close contacts R42D by the end of the cycle in which the card in Fig. 2 is sensed and the relay R18P energized.

At "12" time during the following cycle, the emitter E will close a circuit to the sorting magnet SM which may be traced as follows: line wire W1 (Fig. 3B), the sorting commutator C8, contacts R42D, the "12" segment of emitter E, and the brush thereof, the sorting relay SR, and the sorting magnet SM, to line wire W2. This causes the card shown in Fig. 2 to be deposited in the "12" pocket, the sorting mechanism operating in the usual way.

If an incorrect choice is made, relay R4 will be energized but will not have any effect. For example, let it be supposed that team B was picked to win in game 12 or tie, resulting in a perforation appearing in columns 14 or 17. Since the switches SS for the lower two commutators C10 are set in the upper position corresponding to game 12, none of the relays R1 to R3 can be energized but only

relay R4 which has no effect. If the person marking the card fails to make any selection for a particular game, then none of the relays R1 to R5 will be energized, also without effect. In these two cases none of the relays R7P to R18P will be energized.

If the card is completely unmarked for Section 1, none of the relays R1 to R5 will be energized throughout the entire cycle and relay R38P (Fig. 3B) will be energized when contacts C6 close at the end of the card sensing cycle, a circuit being established thereby through the contacts R6D and R7E to the plug socket PS6 thence through the plugwire to the plug socket PS4 corresponding to the "2" pocket and relay R38P. Thus such card will become deposited in the "2" pocket.

It may happen that two choices, one correct and the other incorrect, are made for a particular game. For example, in Fig. 2, game 12 might have been marked for both teams "A" and "B" to win. The presence of the perforation in column 11 will cause the relays R1, R5 to be correctly selected as described above and due to the second perforation in column 17 relay R4 will be energized. Thus, relays R4 and R5 will both be energized closing the contacts R4B, R5B. There will be nothing to prevent the energization of relay R7P as described above. However, detecting relay R6P will be energized and will set up a holding circuit for its hold coil R6H through contacts C3 and R6A. Contacts R6D (Fig. 3D) will open and disconnect all of the contacts R7D to R18D from contacts C6 and contacts R6C will close, resulting in the energization of relay R39P associated with the "1" pocket during the next succeeding cycle when commutator E closes a circuit through the contacts R39D. Thus any card which has a single incorrect choice marked in combination with a correct choice will be deposited in the "1" pocket for special treatment.

The plug sockets PS3 may be plugged to the plug sockets PS4 in such fashion that cards with three correct choices go to the "3" pocket, those with four choices go to the "4" pocket, etc., with the cards having twelve correct choices to the "12" pocket and ten choices to the "0" pocket. Less than three choices may be ignored making the "1" and "2" pockets available for the no-choice and combination correct and incorrect cards. It will be understood that this plugging is purely illustrative as the "12" pocket, for example, could be used for five correct choices or any arbitrary arrangement.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a machine of the class described, controlled by control elements having a plurality of multiple choice groups of positions, each position representing a choice by means of a designation placed in said position: the combination of means to sense said multiple choice groups of positions, a choice selector operating synchronously with said sensing means and having a plurality of rows of control devices each row corresponding to a multiple choice group in the control element, each control device being settable to represent either a correct choice or a complementary incorrect choice, comparing means jointly responsive to said sensing means and said control devices for comparing the settings of each of said devices with the corresponding position of said element, detecting means responsive to the presence of both a correct choice and an incorrect choice in any multiple choice group, counting means controlled by said comparing means for counting the number of multiple choice groups containing correct choices, and nullifying means controlled by

said detecting means for nullifying said counting means upon detecting the presence of both a correct choice and an incorrect choice in any multiple choice group.

2. In a machine of the class described, means to sense records having a plurality of separate choice columns of index-point positions in which a choice selection is recorded by placing a designation in one of the corresponding index-point positions of said plurality of columns whereby each column contains representations for a plurality of separate choices, a selector operating synchronously with the sensing means and having a plurality of separate choice sections, one for each choice column, each section being provided with a series of individual manual selector devices, one for each index-point position and settable in one position to represent a correct choice and in another position to represent an incorrect choice, whereby correct choice settings and complementary incorrect choice settings for each single choice may be made by means of all of the selector devices corresponding to each index-point position, and machine control means including elements separately responsive to both the sensing means and the correct choice and incorrect choice settings of said devices.

3. In a machine of the class described, a series of electrical sensing devices each for successively sensing the index-point positions of one of a plurality of choice columns of index-point positions, each choice column receiving designations representing a different predetermined choice, a choice being indicated by placing a designation in a predetermined index-point position in a selected one of said choice columns; a selecting commutator having a plurality of separate choice sections, one for each choice column, each choice section having a pair of common contact strips representing a correct choice and an incorrect choice, a series of contact segments, one for each index-point position in a choice column, a series of switches one for each index-point position for connecting one or the other of said common strips to said segments to represent either a correct choice or an incorrect choice, and a common contact brush connected to one of said sensing devices and traversing said segments, said selecting commutator being operated in synchronism with the sensing of the corresponding choice column; a plurality of relays connected to said common strips and selectively responsive to the occurrence of both correct and incorrect choices in said choice columns, electrical means responsive to the correct choice relays for integrating the number of correct choices, record distributing mechanism controlled by the aforesaid electrical integrating means to select destinations for said records on the basis of the number of correct choices, and means responsive to the incorrect choice relays for causing the distributing means to select a separate destination for records having an incorrect choice in combination with a correct choice.

4. In a machine of the class described, means to sense records having multiple choice groups each having a plurality of positions in which designations may be placed to represent choices, one of which positions for each group represents a correct choice, at least one other position of the same group representing an incorrect choice, a multiple choice selector device operating in synchronism with said sensing means and settable to represent the correct choices and the incorrect choices for each group, means jointly controlled by the sensing means and said selector for analyzing the choices designated in the records, record distributing means controlled by said analyzing means, said analyzing means being adapted to select for a record one of a plurality of destinations, the selection normally being in accordance with the number of correct choices; and said analyzing means being adapted to detect records having in the same group both a correct and an incorrect choice, and to select for such records a special destination while suppressing the normal selection.

5. In a machine of the class described, means for sensing a control record having control areas arranged in transverse and longitudinal rows, each of which transverse rows represents a multiplicity of things a choice of which is indicated by a designation in one of the areas of a row, said longitudinal rows representing all of a similar type of thing; a selector operating synchronously with said sensing means and having selector devices arranged in transverse rows to correspond with the first named rows and longitudinal rows to correspond with the second named rows, each device being made operable to represent either a correct choice or a complementary incorrect choice, means jointly responding to said designations and the selector for comparing the correct choice settings with said control areas, means rendered effective by the sensing means and selector for comparing the incorrect choice settings with said areas, means made effective by the first comparing means to count the number of correct choice settings agreeing with the designations in said areas, and means made effective by the second comparing means for rendering the counting means ineffective when a transverse row is designated with both a correct and an incorrect choice.

6. In a machine controlled by a multiple choice record sheet having a plurality of transverse rows of multiple choice control positions each row representing a choice of a plurality of things by means of a single designation placed in one of said control positions, means to sense successively said positions, a choice selector operating in synchronism with said sensing means and having a plurality of transverse rows of control devices, each row corresponding to a row of the control positions in the record sheet, each control device being settable to represent either a correct choice or a complementary incorrect choice, means coacting with the sensing means and choice selector for successively comparing the settings of each of said devices with the corresponding control positions of said record sheet, said comparing means having detection means responsive to the presence of both a correct choice and an incorrect choice in any transverse row, and means for counting the number of transverse rows containing correct choices.

7. In a machine controlled by a record sheet having a plurality of vertical columns of differently designated index-point positions arranged in transverse rows of related index-point positions representing different possible answers of which a choice is made by placing a designation on one of the index-point positions of a horizontal row; electrical sensing devices, one for each column; a selecting commutator having a plurality of separate choice sections, one for each choice column, each choice section having (1) a pair of common contact strips representing a correct choice and an incorrect choice, (2) a series of contact segments, one for each index-point position in a choice column, (3) a series of switches one for each index-point position for connecting one or the other of said common strips to said segments to represent either a correct choice or an incorrect choice, and (4) a common contact brush connected to one of said sensing devices and traversing said segments, said selecting commutator being operated in synchronism with the sensing of the corresponding choice column; a plurality of relays connected to said common strips and selectively responsive to the occurrence of both correct and incorrect choices in said choice columns, and electrical means responsive to the correct choice relays for integrating the number of correct choices.

8. In a machine of the class described: means to sense records having multiple choice groups each having a plurality of positions in which designations may be placed to represent choices, one of which positions for each group represents a correct choice, at least one other position of the same group representing an incorrect choice; a selector device operating synchronously with said means to sense records, said selector device

being settable to represent the correct choices and the incorrect choices for each group; comparing means, controlled by said means to sense records, for successively comparing the choice designations with the settings of said selector device; means controlled by said comparing means for counting the number of groups containing correct choices; record distributing means controlled by said counting means for selecting destinations for said records on the basis of the count of groups containing correct choices; and detecting means controlled by said comparing means to select a special destination for any record having an incorrect choice in combination with a correct choice in the same multiple choice group.

References Cited in the file of this patent

UNITED STATES PATENTS

2,025,602	Maul	Dec. 24, 1935
2,078,090	Maschmeyer	Apr. 20, 1937
2,150,256	Warren	Mar. 14, 1939
2,189,024	Bryce	Feb. 6, 1940
2,307,100	Blakely	Jan. 5, 1943
2,531,874	Dean	Nov. 28, 1950

FOREIGN PATENTS

496,133	Great Britain	Nov. 24, 1938