

July 25, 1939.

A. J. JOHNSTON

2,167,513

AUTOMATIC TOTALIZING SYSTEM

Filed March 26, 1935

9 Sheets-Sheet 1

Fig. 1.

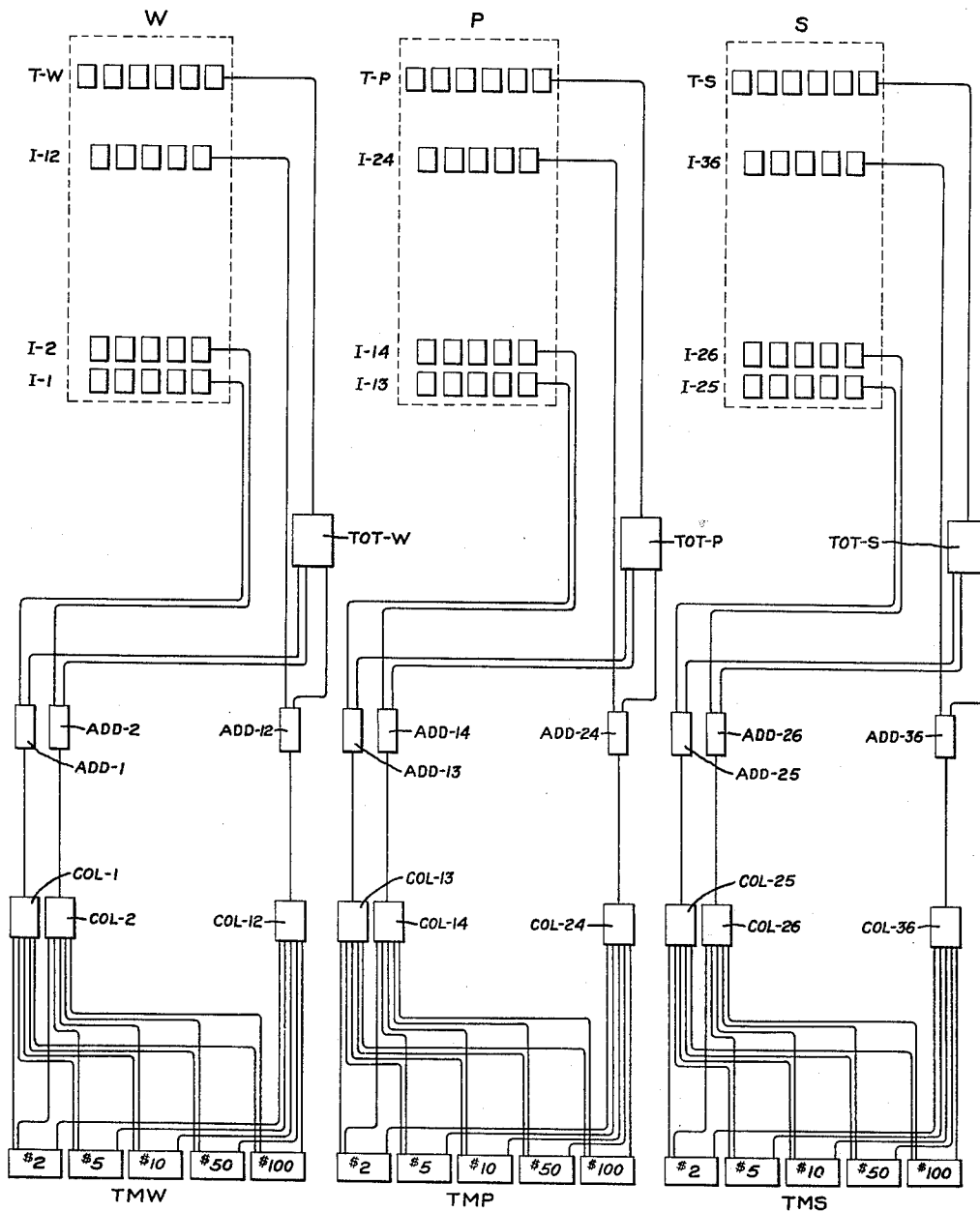


Fig. 10.

FIG. 2.						
FIG. 3.	FIG. 4.	FIG. 5.	FIG. 6.	FIG. 7.	FIG. 8.	FIG. 9.

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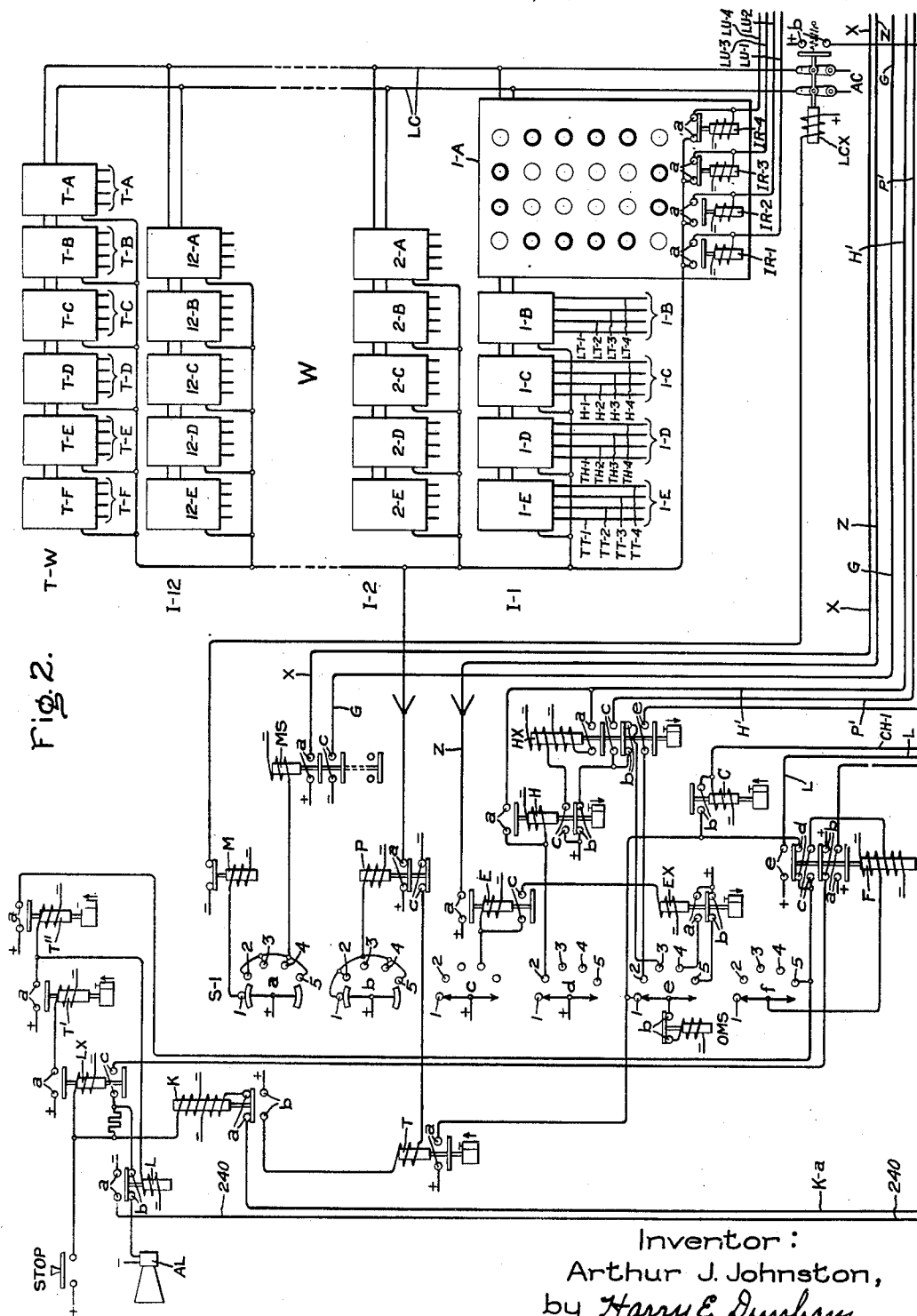


Fig. 2.

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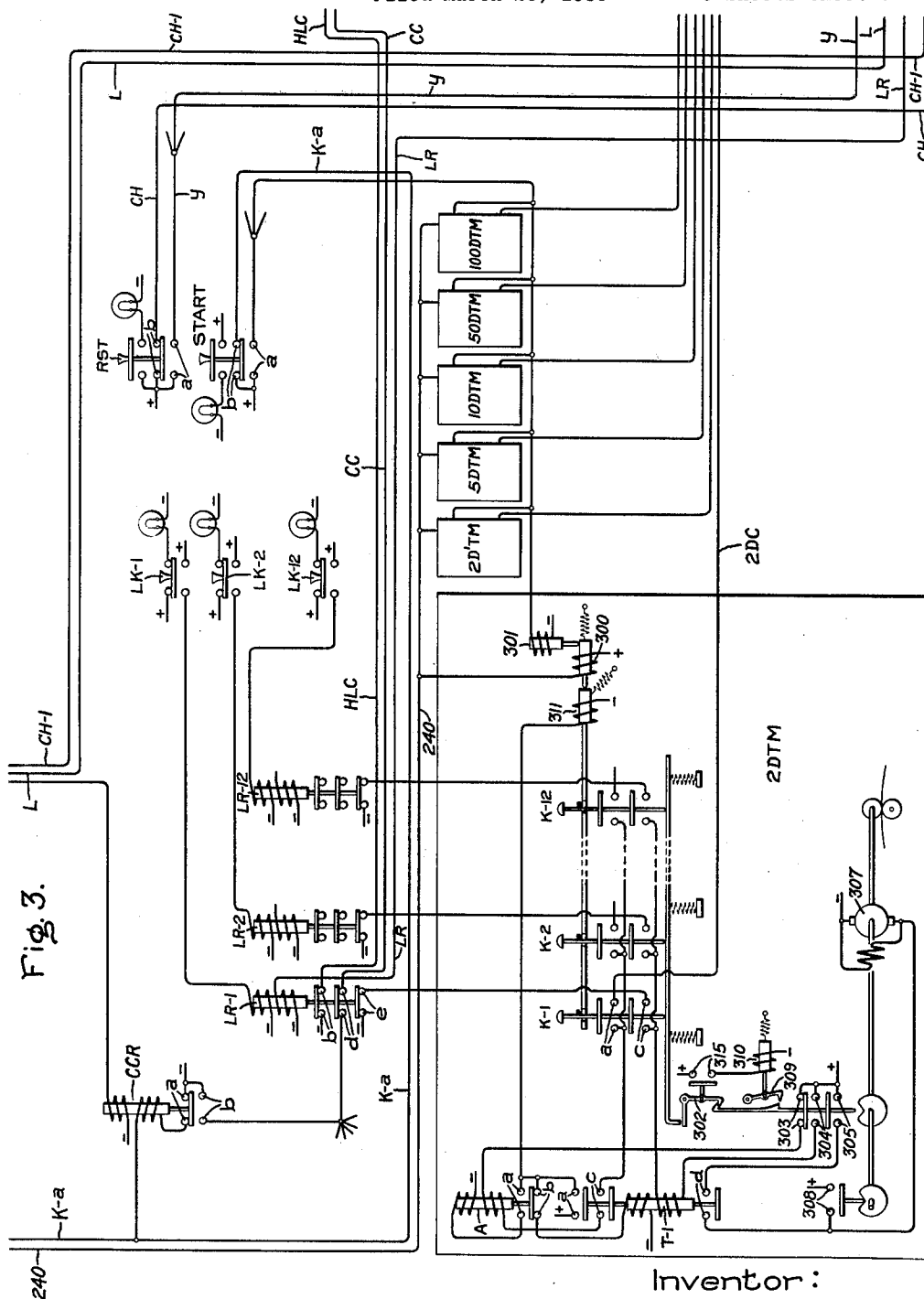
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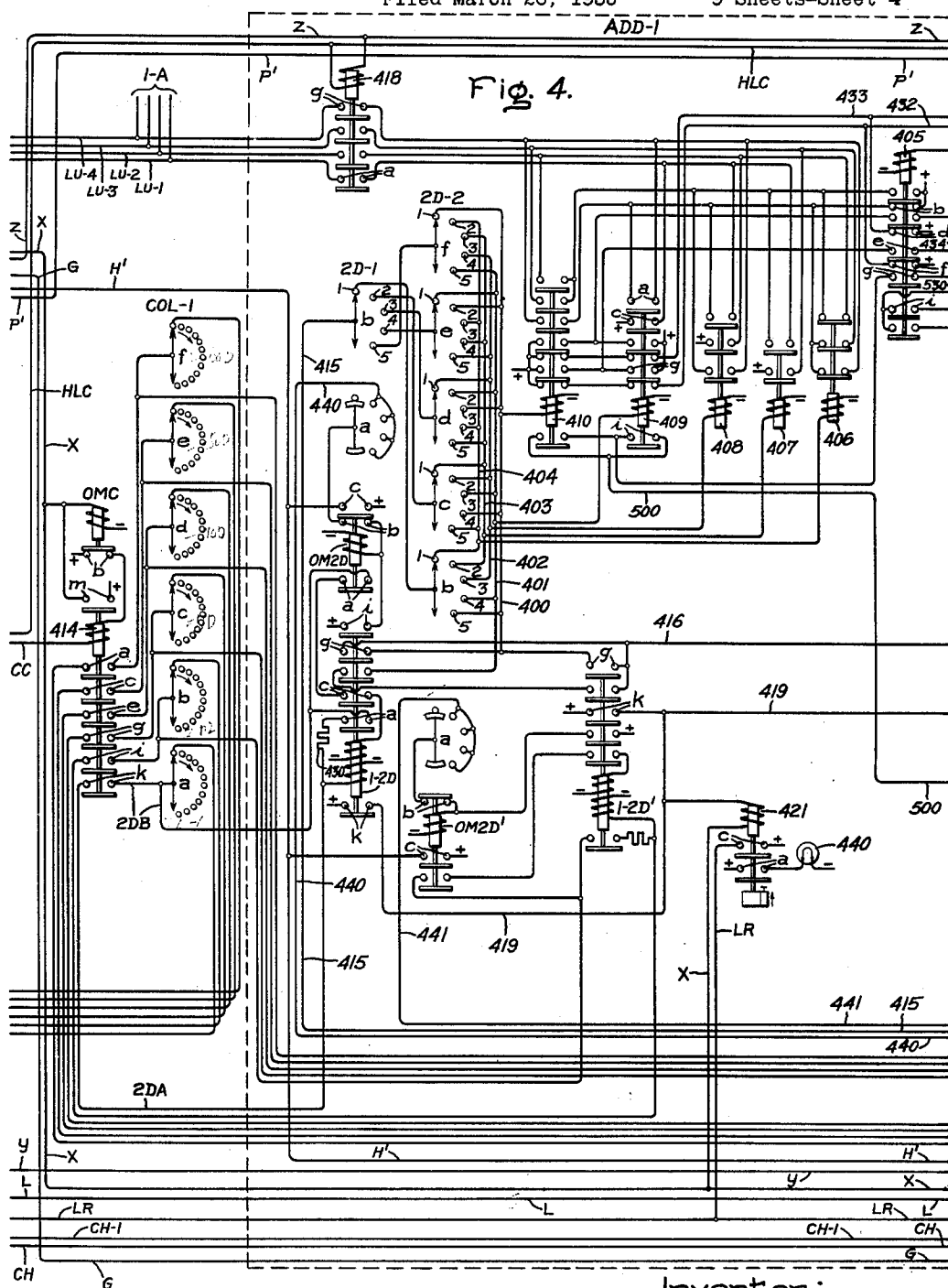
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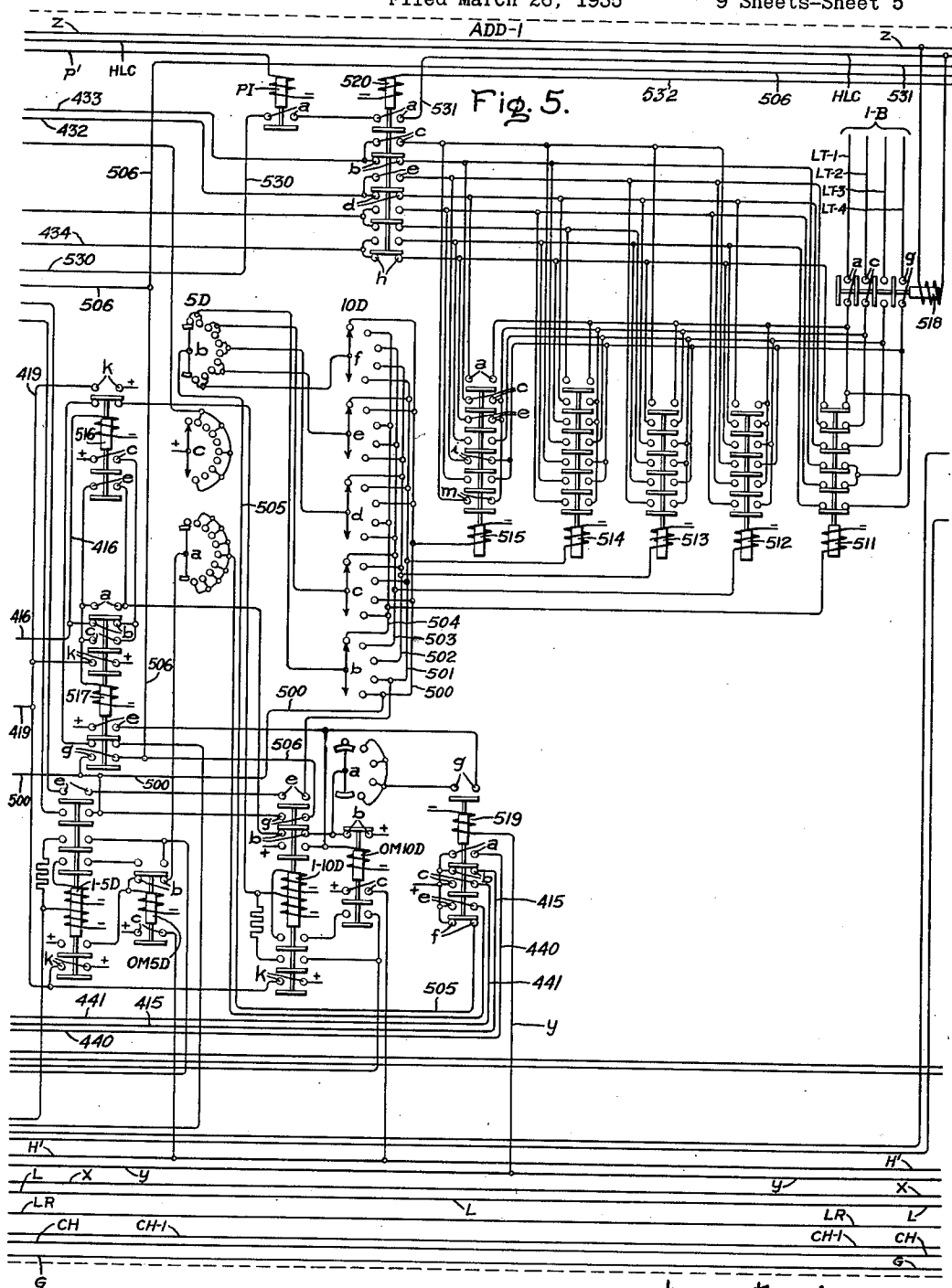
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AUTOMATIC TOTALIZING SYSTEM

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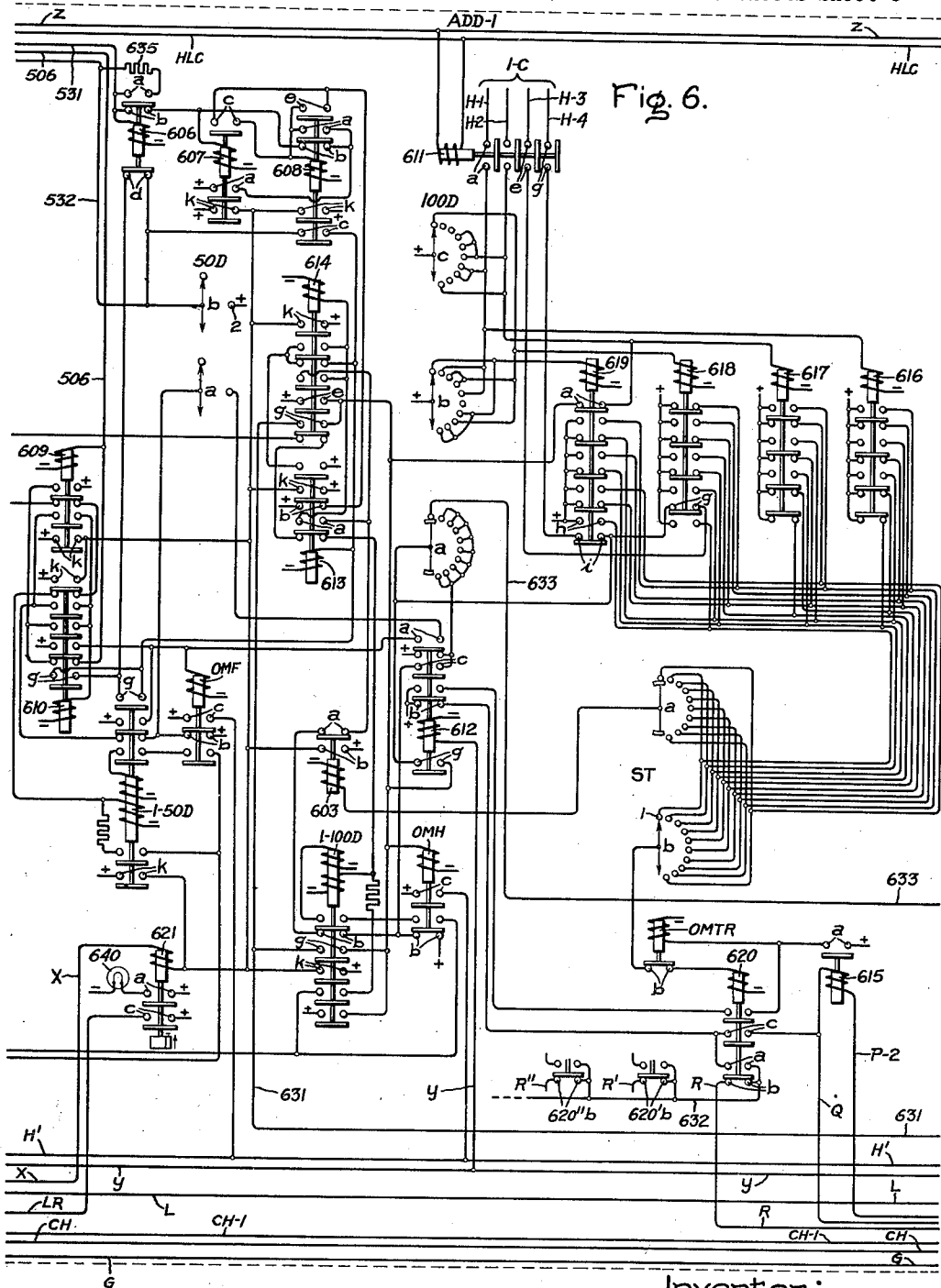
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9 Sheets-Sheet 6



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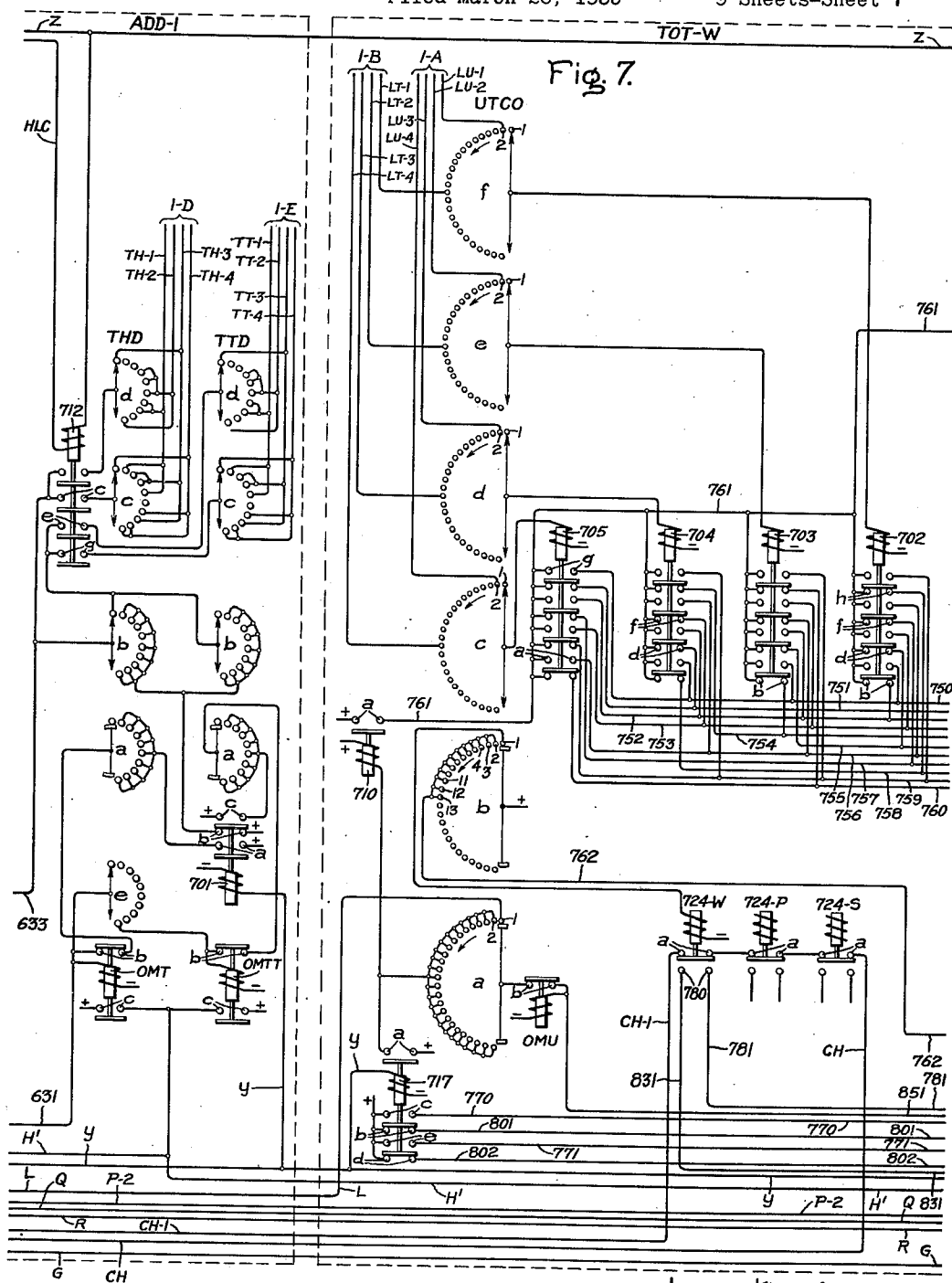
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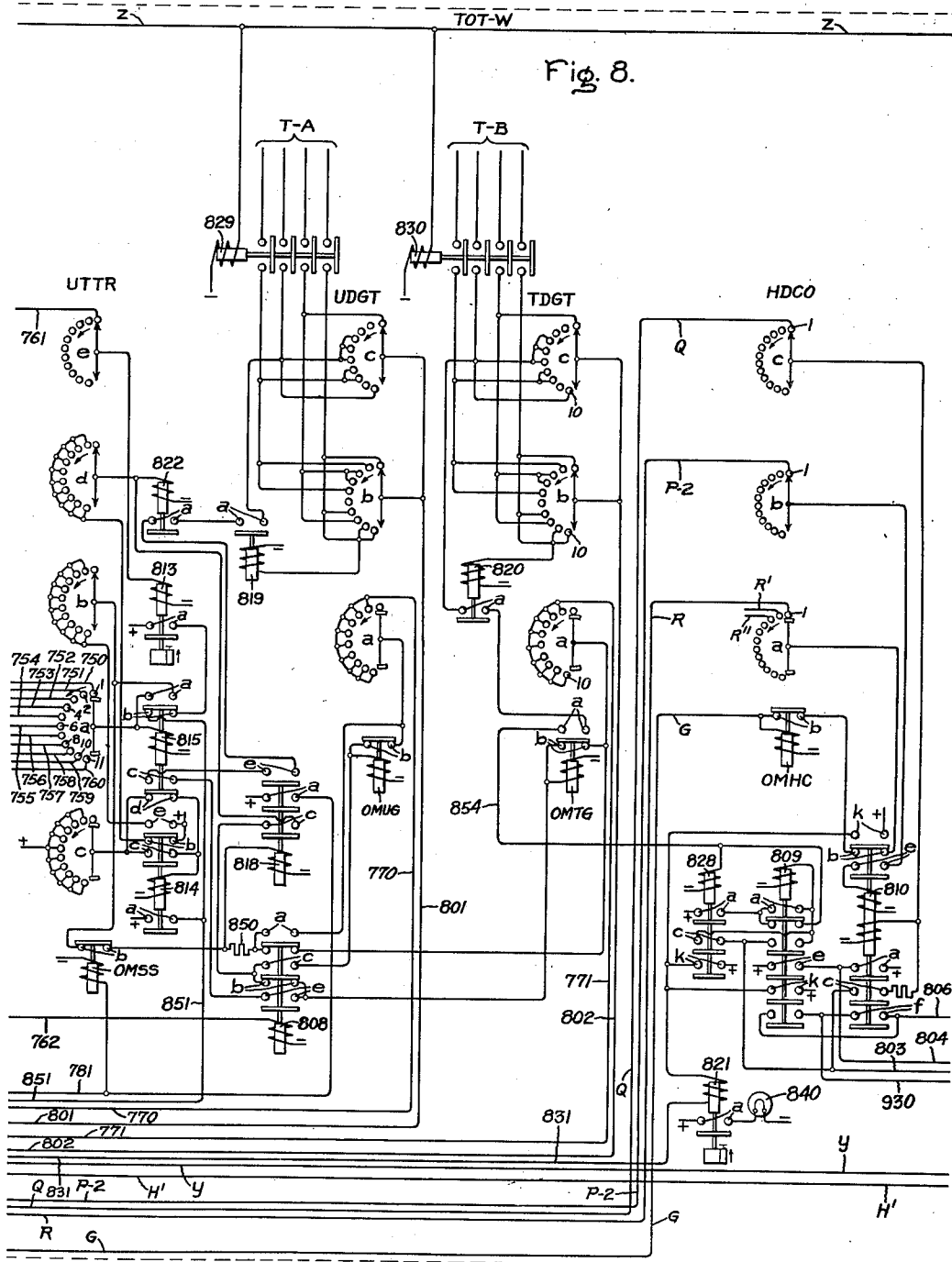
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2,167,513

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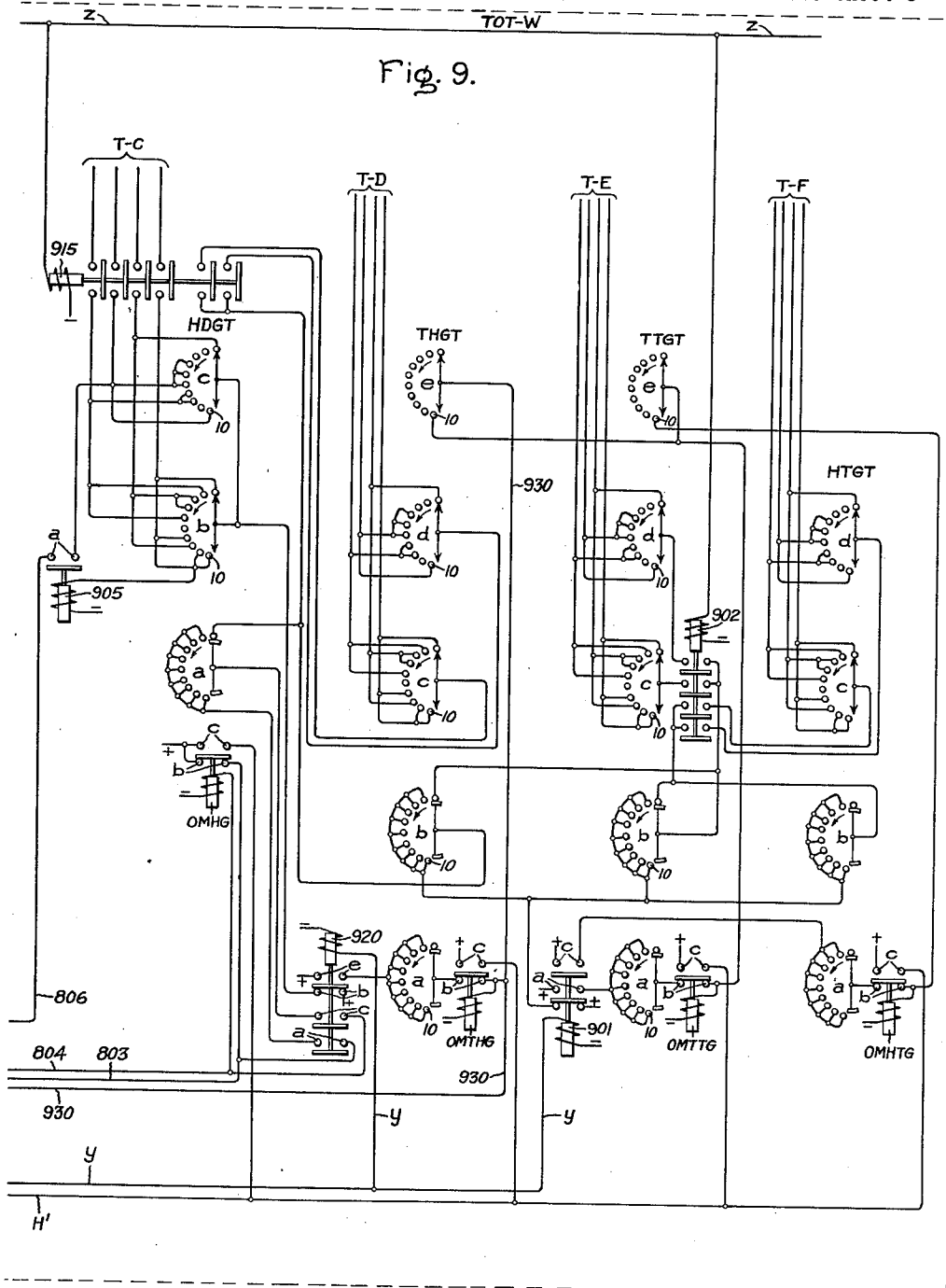
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9 Sheets-Sheet 9



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UNITED STATES PATENT OFFICE

2,167,513

AUTOMATIC TOTALIZING SYSTEM

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Application March 26, 1935, Serial No. 13,077

37 Claims. (Cl. 235—92)

My invention relates to automatic totalizing systems and its object is to provide an improved arrangement of apparatus for rapidly and accurately totalizing the values of tickets of different denominations which are sold for different features at public places whereby there is simultaneously obtained and indicated the total value of all the tickets sold for each of the features, and the total value of all the tickets sold for predetermined groups of features.

Another object of my invention is to provide an improved arrangement for controlling a ticket issuing machine so that the machine may initiate its ticket issuing function before the electric impulse representing the value of the ticket being issued has been transmitted to the proper electric impulse counting device.

Another object of my invention is to provide an improved arrangement for insuring that a ticket issuing machine is not released to issue another ticket until the value of the ticket last issued by the machine has been properly counted.

Another object of my invention is to provide an improved arrangement for simultaneously counting electric impulses representing either the same or different values.

Another object of my invention is to provide an improved arrangement for totalizing the values which have been counted by a plurality of different adding machines.

Another object of my invention is to provide an arrangement for sequentially associating a totalizing machine to different adding machines so as to totalize the totals above a predetermined amount registered on each adding machine.

A further object of my invention is to provide an arrangement whereby under certain conditions the totalizing machine which normally totalizes only the totals above a predetermined amount registered on the adding machines also totalizes all the values below this predetermined amount that are then registered on the adding machines.

Another object of my invention is to provide an improved sequence control arrangement for periodically changing the totals displayed by the indicating units in accordance with the totals then registered on the various adding and totalizing machines.

Other objects will appear and my invention will be better understood from the following description when taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

In the accompanying drawings, Fig. 1 is a schematic diagram showing the general layout of an

automatic totalizing system embodying my invention; and Figs. 2 to 9 inclusive, when combined in the manner illustrated in Fig. 10, diagrammatically illustrate the control apparatus and circuits of a portion of the totalizing system outlined in Fig. 1.

My invention is particularly applicable to totalizing systems which are arranged to totalize and indicate for each one of a relatively large number of features the value of all the tickets, which may be of different denominations, that are sold therefor, and also the value of all the tickets which are sold for various groups of features. Fig. 1 illustrates a general outline of such a system. In this system it is assumed that there are thirty-six features, Nos. 1 to 36, inclusive, arranged in three groups, W, P and S, of twelve features each. Three groups of ticket issuing machines, TMW, TMP and TMS are provided for issuing tickets of different denominations for the features in groups W, P and S respectively. The number of ticket issuing machines in each group depends upon the demand for tickets. In actual practice, the demand for tickets usually varies inversely with the denomination thereof, so that it is necessary to provide facilities for issuing more tickets of the lower than of the higher denominations. Each ticket issuing machine may be arranged so that it can issue a ticket of any one of several different denominations for each feature in the associated group, or it may be arranged so as to issue a ticket of only one denomination for each feature in the associated group. For the purpose of this application, it is assumed that the latter type of ticket issuing machine is used in the totalizing system illustrated in the drawings. Each ticket issuing machine is arranged in any suitable manner, examples of which are well known in the art so that only one ticket can be issued at any one time. Also each ticket issuing machine is arranged so that after any key thereof has been depressed to effect the issuance of a particular ticket, no other key thereof can be operated to effect the issuance of another ticket until an electric impulse representing the value of the issued ticket has been transmitted to and has been successively received by a suitable adding machine.

For the purpose of this description it will be assumed that each group of ticket issuing machines is arranged to issue tickets for five different denominations, namely, \$2, \$5, \$10, \$50 and \$100, for each feature in the respective group.

For each feature, there is a separate adding machine, such as ADD—1 for feature No. 1; 55

ADD—2, for feature No. 2, etc. Each adding machine has associated therewith suitable switching means, such as switch COL—1 for adding machine ADD—1; switch COL—2 for adding machine ADD—2, etc., for sequentially connecting to it, in predetermined combinations, the ticket issuing machines which are arranged to issue tickets for its respective feature. These switching means are independently operable so that the various adding machines operate independently of each other. Each adding machine is arranged so that when it is connected to any ticket issuing machine which has been operated to issue a ticket for its respective feature it adds to its total the value of the ticket issued by the operated machine to which it is connected.

Each adding machine controls a group of lamps or other suitable indicating means so that it indicates the total value of the tickets which have been issued for the corresponding feature. For example, the adding machine ADD—1 controls a group of lamps I—1, so that this group of lamps is lighted to display the total value of all the tickets that have been issued for feature No. 1; adding machine ADD—2 controls a similar group of lamps I—2 etc.

For each group of features there is a separate totalizing machine, such as TOT—W for group W, TOT—P for group P, and TOT—S for group S. Each totalizing machine is arranged to be successively connected to the separate adding machines for the various features in the associated group so that the totalizing machine totalizes certain values registered on these adding machines and causes the grand total to be indicated by suitable indicating means. For example, totalizing machine TOT—W is arranged to totalize all of the values which have been added by adding machines ADD—1 to ADD—12, inclusive, and to cause this grand total to be indicated by a group of lamps which constitutes indicating means T—W.

Since adding machines ADD—1, ADD—2, etc. are duplicates and totalizing machines TOT—W, TOT—P and TOT—S are also duplicates as well as the indicating means for each of the three groups, W, P, and S, it is obvious that the drawings would be unnecessarily complicated if they disclosed the detail circuits for all of these devices. Therefore, in order to simplify the disclosure of my invention, I have diagrammatically illustrated in the accompanying Figs. 2 to 9, inclusive, only the control circuits for adding machine ADD—1, for totalizing machine TOT—W and for the indicators for feature No. 1 and group W, together with as much of the control apparatus and circuits which are common to all of the adding and totalizing machines and all of the indicators as is deemed necessary for a complete understanding of my invention.

The right portion of Fig. 2 diagrammatically illustrates the indicators for displaying the totals of all the tickets sold for each of the features Nos. 1 to 12, inclusive, which constitute group W, and the grand total of all the tickets sold for these twelve features. The left portion of this figure shows the sequence control apparatus for causing the indicators to be changed periodically so that they correctly display the various totals. For indicating the total value of the tickets sold for feature No. 1, indicator I—1 consists of five banks of lamps, I—A, I—B, I—C, I—D, and I—E, for respectively showing the units, tens, hundreds, thousands, and ten thousands digits of the total. Each bank of lamps has associated therewith suit-

able means, examples of which are well known in the art, whereby the lamps may be selectively lighted in various combinations to form the outline of any one of the ten digits. For example, each bank of lamps may consist of twenty-four lamps and four relays which are interconnected in the manner disclosed in United States Letters Patent 1,967,887, granted July 24, 1934, and assigned to the assignee of this application. For the purpose of this application, it will be assumed that each indicator unit is constructed and arranged in the manner disclosed in the aforesaid Letters Patent so that any one of the ten digits may be displayed by each indicator unit by simultaneously energizing the four conductors associated therewith in the following combinations:—

Digit	Conductors energized
0	3 and 4
1	1
2	3
3	2 and 3
4	1 and 2
5	2
6	1 and 4
7	1 and 3
8	4
9	2 and 4

Indicator I—2 for feature No. 2 consists of similar lamp indicator units 2—A to 2—E inclusive, and the indicator for each of the other ten features in group 1 consists of similar lamp indicator units. Also the grand total indicator T—W for group 1 includes similar indicator units T—A to T—F, inclusive, for respectively indicating the various digits of the grand total.

The sequence control apparatus shown on the left side of Fig. 2 comprises a suitable multiple position switch S—1 of any suitable type, examples of which are well-known in the art, which, as it moves through its various positions, effects the sequential operation of suitable control devices associated therewith. As shown in Fig. 2, switch S—1 is of the well-known rotary selector type and comprises six banks, a to f, inclusive, of five stationary contacts each, and six cooperating wipers which are mounted on a common shaft so as to engage corresponding contacts in their respective banks and which are arranged to be operated by a common operating magnet OMS. This sequence control arrangement periodically changes, in a manner hereinafter described in detail, all of the indicator units so that they correspond to the total values of the tickets which have been issued for the various features and groups at the time the indicators are changed. The indicator units are changed periodically rather than continuously in order that the totals may be more readily observed.

Also associated with the sequence control arrangement is a suitable switch STOP which, when closed, effects the operation of suitable apparatus associated therewith for locking all of the ticket machines so as to render them inoperative to issue any more tickets and for causing the totalizing machines to totalize all of the ticket values which have not already been included in the totals of the totalizing machines and to have these final grand totals displayed by the various indicators.

Fig. 3 diagrammatically illustrates six of the ticket issuing machines constituting the group TMW in Fig. 1. These six machines include two machines 2DTM and 2D'TM for issuing \$2

tickets, a single machine 5DTM for issuing \$5 tickets, a single machine 10DTM for issuing \$10 tickets, a single machine 50DTM for issuing \$50 tickets, and a single machine 100DTM for issuing \$100 tickets for any of the twelve features Nos. 1-12 inclusive. These ticket issuing machines may be of any suitable type, examples of which are well known in the art. British Patent 339,278 discloses a representative construction of a ticket issuing machine which may be employed. While I have shown only six machines, each of which is arranged to issue tickets of a predetermined denomination only, it is evident that there will be as many more machines used in actual practice as the demand for tickets requires. Two machines for issuing \$2 tickets are shown since more tickets of the lowest denomination are usually sold than of any other denomination.

The ticket issuing machines are provided with suitable control means for rendering each ticket issuing machine inoperative to issue tickets for any of the twelve features for which it is normally arranged to issue tickets and for rendering inoperative the indicators of any such features which may be locked out. The control means include a suitable switch, LK—1 for feature No. 1, LK—2 for feature No. 2, etc., which, when operated, effects the operation of suitable associated devices for preventing all of the ticket issuing machines from issuing tickets for that particular feature.

Also, there is provided a suitable switch START which, when closed, unlocks the ticket issuing machines so that they can again issue tickets after they have been locked out by the operation of the switch STOP.

Each ticket issuing machine, as diagrammatically indicated in connection with machine 2DTM, has an operating key K—1, K—2, etc., for each of the features No. 1-12 inclusive. When any one of these keys is depressed and the associated feature has not been locked out, the ticket issuing machine operates in any suitable manner to issue a ticket of a particular denomination for that particular feature. Also, the depressed key closes contacts in a circuit which is periodically extended to the adding machine for the corresponding feature and over which an electric impulse representing the value of the issued ticket is transmitted to operate the adding machine so that it adds to its total the value of the issued ticket. After a key is depressed it is mechanically locked in its depressed position until the electric impulse representing the value of the issued ticket is transmitted, at which time suitable apparatus effects the release of the depressed key so that it returns to its normal position. Each ticket issuing machine is so constructed that only one ticket can be issued in response to each operation of a key and while any one key is depressed it is impossible to operate any of the other keys thereof to effect the issuance of a ticket for some other feature.

Also, there is shown in Fig. 3 a switch RST which, when closed, effects the operation of the necessary devices to restore the whole equipment to its normal position. The switches START, STOP, and RST are preferably located at the point where the person having complete supervision over the sale of tickets is located so that he can start and stop the sale of tickets at the various remote points where the ticket issuing machines are located and can restore the

whole totalizing equipment to its normal condition whenever he so desires.

Figs. 4, 5, 6 and the left portion of Fig. 7 diagrammatically illustrate the control apparatus and circuits of adding machine ADD—1 of Fig. 1 for adding the values represented by the various electric impulses which are produced in response to the issuance of tickets for feature No. 1. As previously mentioned, similar apparatus and circuits (not shown) are also provided for each of the other eleven features comprising group W as well as for each of the features in the other two groups P and S in Fig. 1.

The adding machine ADD—1 which includes the apparatus diagrammatically illustrated within the dotted rectangle enclosing the major portion of Fig. 4, all of Figs. 5 and 6, and the left portion of Fig. 7 comprises a plurality of separate adding machines, each of which is arranged to add impulses representing a particular value. In the portion of this adding machine ADD—1 shown in Fig. 4 there is diagrammatically illustrated an adding machine 2D—1 for adding the impulses which are produced in response to the issuance of \$2 tickets for feature No. 1 by one group of \$2 ticket issuing machines, and another adding machine, 2D—2, for adding the impulses which are produced in response to the issuance of \$2 tickets for feature No. 1 by the remaining \$2 ticket issuing machines. In Fig. 5 there is shown an adding machine 5D for adding the impulses which are produced in response to the issuance of \$5 tickets for feature No. 1 by the \$5 ticket issuing machines, and an adding machine 10D for adding the impulses which are produced in response to the issuance of \$10 tickets for feature No. 1 by the \$10 ticket issuing machines. In Fig. 6 there is shown an adding machine 50D for adding the impulses which are produced in response to the issuance of \$50 tickets for feature No. 1 by the \$50 ticket issuing machines, and an adding machine 100D for adding the impulses which are produced in response to the issuance of \$100 tickets for feature No. 1 by the \$100 ticket issuing machines. In Fig. 7 there is shown an adding machine THD to which an electric impulse representing \$1000 is transmitted to effect the operation thereof each time the \$100 adding machine 100D has received ten impulses and also an adding machine TTD to which an electric impulse representing \$10,000 is transmitted to effect the operation thereof each time the adding machine THD has received ten impulses.

These adding machines may be multiple position selector switches of any suitable type, examples of which are well known in the art. For example, they may be of the well known chain relay type or the rotary type. As shown in the drawings, each adding machine is of the rotary selector type and comprises a plurality of banks of stationary contacts having associated therewith cooperating movable wipers. These wipers are arranged to be moved simultaneously into engagement with corresponding contacts in the respective banks by means of a common operating magnet. The number of banks of contacts in each adding machine varies, depending upon the circuits to be controlled thereby, there being two banks, *a* and *b*, in adding machine 2D—1, six banks, *a* to *f*, inclusive, in adding machine 2D—2, three banks, *a*, *b* and *c*, in adding machine 5D, six banks, *a* to *f*, inclusive, in adding machine 10D, two banks *a* and *b*, in adding machine 50D, three banks, *a*, *b* and *c*, in adding machine 100D, five banks *a* to *e* inclusive in adding machine

THD and four banks *a* to *d* inclusive in adding machine TTD. While in the drawings adding machines 2D—1, 2D—2 and 10D are shown as five position switches, adding machines 5D, 100D, THD and TTD are shown as ten position switches, and adding machine 50D is shown as a two-position switch, in order to simplify the drawings, these switches, as well as the other switches of the same general type diagrammatically shown in the drawings, in actual practice would probably be of the twenty-five position type and the contacts thereof would be arranged in a well known manner so that they would, in effect, be either a two, five or ten position switch as required.

In order that impulses representing different values may be simultaneously transmitted from different ticket issuing machines to the adding machines 2D—1, 2D—2, 5D, 10D, 50D, and 100D, there is provided a multiple position selector switch COL—1 shown diagrammatically near the left edge of Fig. 4 for simultaneously connecting these adding machines to different ticket issuing machines in the various positions thereof. This switch may be of the chain relay type, the rotary type or any other suitable type, examples of which are well known in the art. As shown in the drawings, switch COL—1 is of the rotary type and comprises six banks, *a* to *f*, inclusive, of twelve stationary contacts each and a movable wiper for each bank. These movable wipers are mounted on a common shaft and are arranged to be moved simultaneously into engagement with corresponding bank contacts by means of a common operating magnet OMC. In each of the twelve positions of switch COL—1, adding machine 2D—1 is connected to a \$2 ticket issuing machine through the movable wiper and a stationary contact of bank *a* of switch COL—1, adding machine 2D—2 is connected to a \$2 ticket issuing machine through the movable wiper and a stationary contact of bank *b* of switch COL—1, adding machine 5D is connected to a \$5 ticket issuing machine through the wiper and a stationary contact of bank *c* of switch COL—1, adding machine 10D is connected to a \$10 ticket issuing machine through the wiper and a stationary contact on bank *d* of switch COL—1, adding machine 50D is connected to a \$50 ticket issuing machine through the wiper and stationary contact of bank *e* of switch COL—1 and adding machine 100D is connected to a \$100 ticket issuing machine through the wiper and a stationary contact of bank *f* of switch COL—1.

For the purpose of this application, it will be assumed that when the wipers of the switch COL—1 are in position 1, which is the position in which it is shown in the drawings, adding machine 2D—1 is connected to the ticket issuing machine 2DTM so that, if this ticket machine has issued a ticket for feature No. 1, an impulse is transmitted to adding machine 2D—1, and adding machines 2D—2, 5D, 10D, 50D, and 100D are connected in a similar manner to ticket issuing machines 2D'TM, 5DTM, 10DTM, 50DTM and 100DTM respectively.

Also interposed between the two \$2 adding machines 2D—1 and 2D—2 and the \$10 adding machine 10D are suitable control means, which will be described in detail hereafter, whereby an impulse representing a value of \$10 is transferred from the two \$2 adding machines to the \$10 adding machine 10D each time the total registered on both of the \$2 adding machines equals a value of \$10. Also, there is interposed between adding machines 5D, 10D and 50D suitable means

whereby an impulse representing \$10 is transmitted to adding machine 10D in response to every other impulse transmitted to adding machine 5D and an impulse representing \$50 is transmitted to adding machine 50D each time the total value registered on the two adding machines 5D and 10D equal \$50. Adding machines 50D and 100D are also interconnected so that an impulse representing \$100 is transmitted to adding machine 100D in response to every other impulse transmitted to the \$50 adding machine 50D.

Also associated with adding machines 2D—1, 2D—2, 5D, 10D and 50D are suitable control devices which control the units digit indicator I—A, and the tens digit indicator I—B, so that each time they are periodically changed by the sequence control apparatus they correctly indicate the units digit and the tens digit of the total value of all the tickets sold for feature #1 at the time the indicator change is made. Adding machines 100D, THD, and TTD also have associated therewith suitable apparatus for similarly controlling indicators I—C, I—D and I—E respectively so that they correctly display the hundreds, thousands and ten thousands digits of the total value of all the tickets sold for feature No. 1.

Within the dotted rectangle which includes the major portion of Fig. 7 and all of Figs. 8 and 9 are shown the control circuits and apparatus for totalizing machine TOT—W of Fig. 1. Each totalizing machine is arranged so that while the tickets are being sold, it totalizes only the values registered on the \$100 adding machines for the various features in the respective group. However, when the sale of tickets is stopped by the operation of the switch STOP shown in Fig. 2, each totalizing machine is operated automatically to add to its total all of the values which are registered on the various \$2, \$5, \$10 and \$50 adding machines for the various features in the respective groups at the time the sale of tickets was stopped but which have not been transferred to the respective \$100 adding machines.

As shown in the drawings, totalizing machine TOT—W comprises six adding machines, UDTG, TDGT, (shown in Fig. 8) HDGT, THGT, TTGT and HTGT (shown in Fig. 9). These adding machines may be multiple position switches of either the chain relay type such as disclosed in United States Patent No. 1,226,184, granted May 15, 1917, or the rotary selector type such as disclosed in United States Patent No. 1,472,465, granted October 30, 1923, or any other suitable type, examples of which are well known in the art. In the arrangement shown in the drawings, they are of the well known rotary selector type.

Adding machines UDTG and TDGT (shown in Fig. 8) are only used during the final totalization, when the units and tens of the various totals registered on the separate adding machines for features Nos. 1 to 12 inclusive are added to the total previously registered on totalizing machine TOT—W. Adding machine HDGT (shown in Fig. 9) is used to totalize the \$100 impulses which have been received by the \$100 adding machines for the various features in group W. Associated with totalizing machine HDGT is a suitable multiple position switch HDGO for sequentially connecting totalizing machine HDGT to the \$100 adding machines for the twelve different features in group W. This switch may be of the chain relay type, the rotary selector type or any other suitable type, examples of which are well known in the art. As shown in the drawings,

switch HDCO (shown in Fig. 8) is of the well known rotary selector type and comprises three banks, *a*, *b* and *c* of twelve stationary contacts each, and a common operating magnet OMHC for the three movable wipers which respectively engage the contacts in the three stationary banks. In each of the twelve positions of switch HDCO, totalizing machine HDGT is connected to a different \$100 adding machine. As shown in the drawings, switch HDCO, in its position 1, connects totalizing machine HDGT to adding machine 100D for feature No. 1 so that each time switch HDCO is in its position 1, an impulse is transmitted to totalizing machine HDGT to advance it one step if the number of impulses which adding machine 100D has received is greater than the number which has been transmitted from adding machine 100D to totalizing machine HDGT. In position 2 of switch HDCO, totalizing machine HDGT is connected to the \$100 adding machine associated with another feature in group W, such for example as feature No. 2, so that each time switch HDCO is in its position 2 an impulse is transmitted to the totalizing machine HDGT to advance it one step if the number of impulses already received by the \$100 adding machine, to which it is connected, is greater than the number which has been transmitted from it to the totalizing machine HDGT. Similarly, in each of the other positions of the switch HDCO, the totalizing machine HDGT receives an impulse if the number of impulses received by the \$100 adding machine, to which it is connected, is greater than the number of impulses which have been transmitted from it to the totalizing machine HDGT.

The \$100 totalizing machine HDGT, the \$1,000 adding machine THGT, the \$10,000 totalizing machine TTGT and the \$100,000 totalizing machine HTGT are interconnected so that in response to each tenth impulse transmitted to the \$100 totalizing machine HDGT, an impulse is transmitted to the \$1,000 totalizing machine THGT and in response to each tenth impulse transmitted to the \$1,000 totalizing machine THGT an impulse is transmitted to the \$10,000 totalizing machine TTGT and in response to each tenth impulse transmitted to the \$10,000 totalizing machine, an impulse is transmitted to the \$100,000 totalizing machine HTGT.

Totalizing machines HDGT, THGT, TTGT and HTGT also are arranged to control indicators T—C, T—D, T—E, and T—F respectively, so that each time the indicators are changed they display the hundreds, thousands, ten thousands and hundred thousands digits respectively of the grand total of all the tickets sold, up to the time the indicators are changed, for all the features in group W.

In order that all of the units and tens digits of the values registered on the twelve adding machines, which digits are not included in the grand total while the tickets are being sold, may be added to the grand total after the sale of tickets has been stopped, suitable control means, which includes a multiple position selector switch UTCO shown in Fig. 7 and an impulse transmitter UTTR shown in Fig. 8, are provided so that, when the sale of tickets is stopped, these switches and their associated devices operate automatically to cause the unit totalizing machine UDGT to totalize all of the unit digits of the values registered on the twelve adding machines for features Nos. 1–12 and then to cause the tens totalizing machine TDGT to totalize all of the tens digits of the

values registered on the twelve adding machines for features Nos. 1–12.

Switch UTCO, which may be of any suitable type, examples of which are well-known in the art, is shown as being of the well known rotary selector type and includes six banks, *a* to *f*, inclusive, of twenty-five stationary contacts each, and a common operating magnet OMU for simultaneously operating the movable cooperating contacts associated with the respective banks. In each of the positions 2 to 13, of switch UTCO, impulse transmitter UTTR is controlled in accordance with the units digit of the total registered on a different adding machine. Impulse transmitter UTTR, which is shown as a multiple position switch of the well-known rotary selector type, is arranged so that it transmits to the unit totalizing machine UDGT impulses corresponding in number to the units digit of the total registered on the adding machine with which it is connected. For example, in position 2 of switch UTCO, transmitter UTTR is controlled in accordance with the units digit of the total registered on adding machine ADD—I for feature No. 1. Therefore if the units digit of the total registered on this adding machine ADD—I is, for example, five, transmitter UTTR operates, while switch UTCO is in position 2, to transmit five impulses to totalizing machine UDGT. Similarly, in each of the positions 14–25 of switch UTCO impulse transmitter UTTR is controlled in accordance with the tens digit of the total registered on a different adding machine so that it transmits to the tens totalizing machine TDGT impulses corresponding in number to the tens digit of the total registered on the adding machine with which it is then associated. For example, in position 14 of switch UTCO, transmitter UTTR is controlled in accordance with the tens digit of the total registered on adding machine ADD—I for feature No. 1. Therefore, if, for example, the tens digit of the total registered on this adding machine ADD—I is three, transmitter UTTR operates, while switch UTCO is in position 14, to transmit three impulses to totalizing machine TDGT.

Totalizing machines UDGT, TDGT and HDGT are interconnected so that in response to each tenth impulse transmitted to totalizing machine UDGT an impulse is transmitted to totalizing machine TDGT and in response to each tenth impulse transmitted to totalizing machine TDGT, an impulse is transmitted to totalizing machine HDGT.

The units totalizing machine UDGT and the tens totalizing machine TDGT also respectively control indicators T—A and T—B so that they display the units digit and the tens digit of the grand total of all the tickets sold for all the features in group W. While the tickets are being sold these indicators are controlled so that they display the digit 0 and only display the exact unit and tens digits of the grand total after the sale of tickets has been stopped.

The operation of the system disclosed in Figs. 2 to 9, inclusive, is as follows:

It will be assumed, first, that the sale of tickets has been previously stopped by the momentary closing of switch STOP, and that after the various totals have been posted on the indicators, reset key RST is closed to effect, in a manner which will be hereinafter described, the resetting of all of the adding and totalizing machines to their respective normal positions. The steward, who has full charge of the sale of tickets, maintains reset key RST closed until the

units and tens digits indicating units of the various indicators for the features for which tickets are to be sold and of the group indicators all display the digit 0 and no digit is displayed by the other indicator units. When this condition occurs, the steward knows that the various adding and totalizing machines are then reset to their normal positions. After reset key RST is released, the various control devices are in the position shown in the drawings. Under these conditions, a circuit is completed through the lower winding and contact *a* of relay K, conductors K—*a* and contacts *b* of switch START, so that relay K is energized and thereby maintains switch S—1 of the sequence control apparatus in its normal position. In this normal position of switch S—1, an energizing circuit is completed for a relay M through the normal contact and wiper of bank *a* of switch S—1; and an energizing circuit is completed for a relay P through the normal contact and wiper of bank *b* of switch S—1. Relay M, when energized, completes an energizing circuit for the operating coil of a suitable switch LCX so that a suitable source of current AC is connected to the lamp circuit LC, to which the lamps of the various indicator units are selectively connected by relays IR—1, IR—2, IR—3 and IR—4 associated therewith.

Relay P, when energized, completes through its contacts a holding circuit for the relays of the various indicator units. Since, under the conditions assumed, the units and tens digit indicators, are displaying the digit 0 and in the type of indicator assumed relays IR—3 and IR—4 of each indicator unit are energized in order to display the digit 0, these two particular relays of each units and tens digit indicator unit are maintained energized by a holding circuit which is completed through the contacts *a* of relay P.

Also, under the assumed conditions, a circuit is completed through the lower winding and contacts *a* of relay CCR, conductor K—*a* and contacts *b* of switch START so that relay CCR is in its energized position. Contacts *b* of relay CCR, which are open when the relay is energized, control the energizing circuit of operating magnet OMC of switch COL—1 so that when these relay contacts are open operating magnet OMC is inoperative to move the switch through its various positions. Switch COL—1, therefore, will be stopped in one of its twelve positions and this position will depend upon the position in which it was in at the time relay CCR became energized.

Also under the assumed conditions each ticket issuing machine is locked out so that it cannot issue any tickets. This was effected in response to the operation of switch STOP, which, when it was operated to stop the sale of tickets, effected in a manner which will be hereinafter described, the energization of a lockout magnet 300 in each ticket issuing machine. This lockout magnet 300 prevents, in any suitable manner examples of which are well known in the art, the issuance of any other tickets until an unlocking magnet 301 is subsequently energized. For a complete disclosure of suitable locking means which may be operated by the magnets 300 and 301 to prevent any key from being operated, reference is made to the heretofore mentioned British Patent 339,278.

It will now be assumed that with the apparatus in the condition shown in the drawings, the steward desires to start the sale of tickets for certain of the features. First, he will operate the lockout keys individual to the particular fea-

tures for which he does not desire tickets to be issued. For example, if he does not want any tickets to be sold for feature No. 1, he will depress lockout key LK—1 and leave it in its depressed position. The lockout key LK—1 in its depressed position completes an energizing circuit for the upper winding of an associated lockout relay LR—1 so that it opens its contacts *b*, *d* and *e*. By opening its contacts *b*, relay LR—1 interrupts the circuit through conductor HLC so that current cannot be supplied through it periodically in a manner hereinafter described to effect changes in the posting of the indicator units of the indicator I—1 when the sequence control apparatus is in operation. Therefore, as soon as the sequence control apparatus is started into operation, the units and tens indicator I—A and I—B no longer display any digit, thereby indicating to anyone looking at the indicator I—1 that no tickets can be purchased for feature No. 1.

By opening its contacts *e*, lockout relay LR—1 interrupts the circuit through certain contacts associated with each ticket issuing machine so that it cannot issue any tickets for feature No. 1. By opening its contacts *d*, lockout relay LR—1 interrupts the control circuit through which current is supplied to effect the step-by-step operation of collector switch COL—1.

Therefore, it will be seen that when any lockout key is maintained in its depressed position the ticket issuing machines are prevented from issuing any tickets for the corresponding feature and the associated feature indicators are prevented from posting any totals for that particular feature and the associated collecting switch remains idle.

After operating the desired lockout keys, the steward momentarily operates reset switch RST which effects in a manner hereinafter described the operation of the sequence control apparatus so that the units and tens digits indicating units for the features for which tickets cannot be sold, do not display any digits. The steward then closes momentarily switch START, which, by opening its contacts *b*, interrupts the above described circuits for the lower windings of relays K and CCR so that these relays become deenergized. By closing its contacts *a*, switch START effects the completion of an energizing circuit for the unlocking magnets 301 of all the ticket issuing machines so that they can be operated to issue tickets for all the features which have not been locked out. For the purpose of this description it will be assumed that lockout key LK—1 has not been depressed and therefore tickets of five different denominations can be issued for feature No. 1.

As soon as relay CCR closes its contacts *b*, a circuit is completed to start into operation the collector switches associated with the various adding machines of the features for which tickets are being sold. Collector switch COL—1 is started into operation in the following manner:

As soon as relay CCR closes its contacts *b*, a circuit is completed through the contacts *d* of relay LR—1, conductor CC, winding of relay 414, and contacts *b* of the operating magnet OMC of switch COL—1. By closing its contacts *m*, relay 414 completes an energizing circuit for operating magnet OMC which in turn, by opening its contacts *b*, effects the deenergization of relay 414, which in turn, by opening its contacts *m* effects the deenergization of operating magnet OMC. In this manner, operating magnet OMC is intermittently energized and deenergized and

in a well known manner effects in response to each deenergization thereof the movement of the wipers of switch COL—1 over the respective banks of contacts in a step by step manner.

Sale of tickets for feature No. 1

It will now be assumed that after switch START has been reset to its normal position, key K—1 of ticket issuing machine 2DTM is depressed to effect the issuance of a \$2 ticket for feature No. 1. This operation of key K—1 effects the closure of its associated contacts *a* and *c* and also the operation of a latch 302, which effects the operation of contacts 303, 304 and 305, common to all the keys of this machine, so that contacts 303 are opened and contacts 304 and 305 are closed. The closing of contacts 304 completes an energizing circuit through the lower winding of relay T—1, contacts *c* of key K—1 and contacts *e* of relay LR—1. By closing its contacts *a*, relay T—1 completes a circuit for its upper winding through the contacts *b* of relay A. Also an energizing circuit is completed for lockout magnet 311 through the contacts *a* of relay T—1. This lockout magnet is arranged to operate suitable locking means such as that disclosed in the heretofore mentioned British Patent 339,278 so that it maintains the depressed key K—1 in its depressed position and prevents any of the other keys from being depressed as long as it is energized. By closing its contacts *d*, relay T—1 effects the energization of an electric motor 307 which operates suitable mechanism, such for example, as that disclosed in the heretofore mentioned British Patent 339,278 to effect the issuance of a \$2 ticket for feature No. 1. Since the present invention does not relate to the constructional details of the ticket issuing machine whereby the operating motor 307, when energized, effects the printing and issuance of a ticket, such details have been omitted from the drawings. Associated with the motor 307 is a suitable switch 308 which is mechanically closed by the motor immediately after it has started to operate. This switch 308 completes an energizing circuit for motor 307, which is maintained completed until the cycle of issuing a ticket has been completed. Also as soon as motor 307 starts to operate, suitable mechanism controlled by the motor shown as cams operated by the motor causes contacts 303, 304 and 305 to be restored to their respective normal positions, in which positions they are held by a latch 309 as long as key K—1 remains in its depressed position, and by latch 302 when key K—1 is restored to its normal position. Latch 309 is arranged to be maintained in a position to hold contacts 303 to 305, inclusive, in their normal positions by a magnet 310 the circuit for which is arranged to be completed through contacts 315, whenever latch 302 is held in its released position, due to any one of the keys of ticket issuing machine 2DTM being in its depressed position.

When collector switch COL—1 reaches the position in which ticket issuing machine 2DTM is connected to adding machine 2D—1 which, in the arrangement shown in the drawings, is position 1 of switch COL—1, and relay 414 is energized, a circuit is completed through contacts 303 of ticket issuing machine 2DTM, lower winding of relay A, contacts *c* of relay T—1, contacts *a* of key K—1, conductor 2DC, first contact and wiper of bank *a* of switch COL—1, conductor 2DB, contacts *k* of relay 414, conductor 2DA and lower winding of relay 1—2D. The current

in this circuit is sufficient to effect the operation of relay 1—2D, but due to the relatively high resistance of the lower winding of this relay, sufficient current does not flow to effect the operation of relay A. By closing its contacts *k*, relay 1—2D completes through conductor 419, winding of relay 421 and conductor X a holding circuit for the winding of operating magnet OMC so that as long as relay 1—2D remains energized, the operating magnet OMC remains energized and thereby prevents further movement of the switch COL—1 until the issuance of the \$2 ticket for feature No. 1 by ticket issuing machine 2DTM has been registered on the adding machine 2D—1. By closing its contacts *a*, relay 1—2D connects a relatively high resistance 430 in a shunt circuit around the contacts *k* of relay 414 so that the lower winding of relay 1—2D remains energized after the relay 414 becomes deenergized due to the energization of the operating magnet OMC. By closing its contacts *i*, relay 1—2D completes an energizing circuit for the operating magnet OM2D of adding machine 2D—1. By closing its contacts *a*, operating magnet OM2D completes a circuit from conductor 2DB through the contacts *c* of relay 1—2D, and the upper winding of relay 1—2D, which circuit is in parallel with the circuit through the lower winding of relay 1—2D. Since the resistance of the upper winding of relay 1—2D is relatively low, the increased current, which flows when the circuit through this winding is completed, causes relay A in ticket issuing machine 2DTM to operate and open its contacts *b*, thereby effecting the deenergization of relay T—1. In order to insure that relay A does not return to its normal position until relay T—1 has first returned to its normal position, an energizing circuit is completed for the upper winding of relay A through contacts *a* of relay A and contacts *a* of relay T—1. When relay T—1 opens its contacts *a* and *c*, it effects the deenergization of relay A and locking magnet 311 so that key K—1 may return to its normal position and any other key may then be depressed to effect the issuance of its corresponding ticket. The opening of contacts *c* of relay T—1 also interrupts the circuits through the windings of relay 1—2D of adding machine 2D—1 so that relay 1—2D opens its contacts *i* and effects the deenergization of operating magnet OM2D which causes adding machine 2D—1 to advance one step, thereby registering the sale of one \$2 ticket for feature No. 1. By opening its contacts *k*, relay 1—2D effects the deenergization of operating magnet OMC so that the step by step operation of switch COL—1 is again started.

Therefore, it will be seen that every time key K—1 is operated, or a similar key of any one of a group of other \$2 ticket issuing machines is operated, to effect the issuance of a \$2 ticket for feature No. 1, adding machine 2D—1 is advanced one step to register the issuance of the ticket when collector switch COL—1 connects the operated ticket issuing machine to adding machine 2D—1.

Also it will be evident from the drawings that each time ticket issuing machine 2DTM or any one of another group of \$2 ticket issuing machines is operated to issue a ticket for feature No. 1, an impulse will be sent through the wiper and a contact of bank *b* of switch COL—1 to effect in a similar manner the operation of relay 1—2D' and operating magnet OM2D' to cause adding machine 2D—2 to register the issuance of each of these tickets. Also relay 1—5D and

operating magnet OM5D are operated in a similar manner in response to the issuance of \$5 tickets for feature No. 1 by each \$5 ticket issuing machine, such as 5DTM, to cause adding machine 5D to register the issuance of each such ticket. Relay 1—10D and operating magnet OM10D are operated in a similar manner in response to the issuance of \$10 tickets for feature No. 1 by each \$10 ticket issuing machines, such as 10DTM, to cause adding machine 10D to register the issuance of each such ticket. Relay 1—50D and operating magnet OMF are operated in a similar manner in response to the issuance of \$50 tickets for feature No. 1 by each \$50 ticket issuing machines, such as 50DTM, to cause adding machine 50D to register the issuance of each such ticket, and relay 1—100D and operating magnet OMH are operated in a similar manner in response to the issuance of \$100 tickets for feature No. 1 by each \$100 ticket issuing machines, such as 100DTM, to cause the adding machine 100D to register the issuance of each such ticket.

It will be seen that when a key of a ticket issuing machine is depressed, the ticket issuing machine immediately starts to issue a ticket provided the associated lockout key has not been operated. However, the depressed key cannot return to its normal position and no other key of that particular machine can be operated until the proper adding machine has registered the sale of the ticket which was issued as a result of the operation of the depressed key. The locking arrangement which is provided to accomplish this result is an important feature as it does not require that the ticket issuing machine wait until the adding machine has registered the sale before the ticket can be issued. Therefore, considerable time is saved in issuing successive tickets from the same machine.

Transfer of values from adding machines 2D—1 and 2D—2 to adding machine 10D

When the sum of the values registered on the two \$2 adding machines 2D—1 and 2D—2 equals \$10, an impulse is transmitted to effect a transfer of this value from these two adding machines to \$10 adding machine 10D. This result is obtained by interconnecting adding machines 2D—1, 2D—2, and 10D so that in response to every fifth impulse transmitted to adding machines 2D—1 and 2D—2 an impulse is transmitted to adding machine 10D to effect the operation thereof. In the particular arrangement shown in the drawings, this result is accomplished in the following manner:

The contacts 1 to 5 of bank *b* of adding machine 2D—1 are respectively connected to the wipers of banks *b* to *f* inclusive of adding machine 2D—2, and the contacts of the banks *b* to *f* inclusive of adding machine 2D—2 are interconnected so that contact 5 of bank *b*, contact 4 of bank *c*, contact 3 of bank *d*, contact 2 of bank *e*, and contact 1 of bank *f* are interconnected by a common conductor 400; contact 4 of bank *b*, contact 3 of bank *c*, contact 2 of bank *d*, contact 1 of bank *e*, and contact 5 of bank *f* are interconnected by a common conductor 401; contact 3 of bank *b*, contact 2 of bank *c*, contact 1 of bank *d*, contact 5 of bank *e*, and contact 4 of bank *f* are interconnected by a common conductor 402; contact 2 of bank *b*, contact 1 of bank *c*, contact 5 of bank *d*, contact 4 of bank *e*, and contact 3 of bank *f* are interconnected by a common conductor 403; and contact 1 of bank *b*,

contact 5 of bank *c*, contact 4 of bank *d*, contact 3 of bank *e*, and contact 2 of bank *f* are interconnected by a common conductor 404. Therefore, with a total of no impulses representing the value of zero dollars registered on the two adding machines 2D—1 and 2D—2, the conductor 415, which is normally connected to a source of control current through contact *b* of relay 519, is connected by the contacts of these two adding machines to conductor 404. With a total of one impulse representing a value of \$2 registered on the two adding machines 2D—1 and 2D—2, conductor 415 is connected to conductor 403. With a total of two impulses representing a value of \$4 registered on the two adding machines, the conductor 415 is connected to conductor 402. With a total of three impulses representing a value of \$6 registered on the two adding machines, the conductor 415 is connected to conductor 401. With a total of four impulses representing a value of \$8 registered on the two adding machines, the conductor 415 is connected to the conductor 400.

The conductors 400 to 404, inclusive, are respectively connected to relays 410, 409, 408, 407 and 406, so that each of these relays is energized when the corresponding conductor is connected by the contacts of the \$2 adding machines 2D—1 and 2D—2 to energized conductor 415. These relays 406 to 410, inclusive, control, in a manner which will be hereinafter described, the units digit displayed by indicator 1—A.

In order that the next \$2 impulse will cause an impulse to be transmitted to the \$10 adding machine 10D when there are already four impulses representing a total of \$8 registered on the two \$2 adding machines 2D—1 and 2D—2, relay 1—2D is so arranged that when it is energized to effect the operation of the adding machine 2D—1, its contacts *g* connect the conductor 400 to conductor 416, to which is connected the winding of relay 516 associated with the \$10 adding machine 10D. The relay 1—2D' is similarly arranged so that when it is energized its contacts *g* interconnect the conductors 400 and 416.

In order to explain how a transfer from the \$2 adding machines 2D—1 and 2D—2 to adding machine 10D is effected it will be assumed that there are two impulses registered on each of the adding machines 2D—1 and 2D—2 so that each of these machines is in its third position and that an impulse is transmitted to relay 1—2D so that it effects in the manner above described the movement of adding machine 2D—1 from its position 3 to its position 4. However, before the adding machine 2D—1 moves to its position 4, the relay 1—2D completes a circuit through the contacts *b* of relay 519, conductor 415, wiper and contact 3 of bank *b* of adding machine 2D—1, wiper and contact 3 of bank *d* of adding machine 2D—2, conductor 400, contact *g* of relay 1—2D, conductor 416 and winding of relay 516. If the fifth impulse had been transmitted to the relay 1—2D' instead of relay 1—2D, under the assumed conditions, the same circuit for relay 516 would have been completed except that it would have been completed through the contact *g* of relay 1—2D' instead of through contacts *g* of relay 1—2D.

By closing its contacts *c*, relay 516 completes a holding circuit for itself through contact *b* of relay 517 so that relay 516 remains energized until relay 517 is subsequently energized. By closing its contacts *k*, relay 516 completes through conductor 419, winding of time relay 421 and conductor *x* a holding circuit for operating

magnet OMC of collecting switch COL—1 so that this switch remains, in which ever position it has stopped, until the transfer from the \$2 adding machines to the \$10 adding machine has been completed.

- As soon as relay 516 becomes energized and relay 1—10D and operating magnet OM10D associated with adding machine 10D are simultaneously deenergized, thereby indicating that no other impulse is being transmitted to adding machine 10D, a circuit is completed through contacts *b* of operating magnet OM10D, contacts *b* of relay 1—10D, contacts *e* of relay 516 and the winding of relay 517. By closing its contacts *a*, relay 517 completes a holding circuit for itself around the contacts *e* of relay 516 and by closing its contacts *c* it completes another holding circuit for itself through the contacts *c* of relay 516, thereby insuring that relay 517 does not become deenergized until after relay 516 has become deenergized. By closing its contacts *k*, relay 517 completes through conductor 419, winding of time relay 421 and conductor *x* a holding circuit for the operating magnet OMC of switch COL—1 so as to insure that this switch remains in which-ever position it has stopped until relay 517 is deenergized. By opening its contacts *b*, relay 517 interrupts the above described holding circuit for relay 516 so that as soon as the contacts *g* of relays 1—2D and 1—2D' are both open, the relay 516 becomes deenergized. By closing its contacts *e*, relay 517 completes an energizing circuit for operating magnet OM10D of adding machine 10D.
- By opening its contacts *b*, operating magnet OM10D interrupts the above described holding circuit for relay 517, which in turn, by opening its contacts *e*, effects the deenergization of operating magnet OM10D so that adding machine 10D is advanced one step to register the transfer of \$10 from the two \$2 adding machines 2D—1 and 2D—2.

Transfer from adding machines 5D and 10D to adding machine 50D

- When the sum of the totals registered on the \$5 adding machine 5D and the \$10 adding machine 10D together equal a value of \$50, an impulse is transmitted to transfer this value to the total registered on the \$50 adding machine 50D. This transfer is effected in substantially the same manner as the transfer from the two \$2 adding machines 2D—1 and 2D—2 to the \$10 adding machine 10D is effected.
- The contacts of bank *b* of adding machine 5D and the wipers and contacts of banks *b* to *f*, inclusive, of adding machine 10D are interconnected in the same manner as the contacts of bank *b* of adding machine 2D—1 and the wipers and contacts of banks *b* to *f*, inclusive, of adding machine 2D—2 are interconnected, with the exception that the wipers of banks *b* to *f*, inclusive, of adding machine 10D are respectively connected to successive pairs of contacts of bank *b* of adding machine 5D whereas the wipers of banks *b* to *f*, inclusive, of adding machine 2D—2 are respectively connected to successive contacts of bank *b* of adding machine 2D—1. Consequently, adding machine 5D must receive two impulses representing a total of \$10 to effect the same change in adding machine 10D that one step of adding machine 2D—1 effects in adding machine 2D—2.

With adding machines 5D and 10D interconnected in the manner shown in the drawings, a

total of zero or \$5 registered on the two adding machines 5D and 10D causes conductor 505, which is normally connected to a source of control current through contacts *f* of relay 519, to be connected to conductor 504. With a total of \$10 or \$15 registered on the two machines 5D and 10D, conductor 505 is connected to conductor 503. With \$20 or \$25 registered on the two machines 5D and 10D, conductor 505 is connected to conductor 502. With \$30 or \$35 registered on the two machines 5D and 10D, conductor 505 is connected to conductor 501. With \$40 or \$45 registered on the two machines 5D and 10D, conductor 505 is connected to conductor 500.

Conductors 500 to 504, inclusive, are respectively connected to relay 515, 514, 513, 512 and 511, so that each of these relays is energized when the respective conductor is connected to conductor 505. These relays 511 to 515 control, in a manner which will be hereinafter described, the tens digit indicator 1B so that it displays the tens digit of the total value of all the tickets sold for feature No. 1.

Each impulse which brings the total registered on the two adding machines 5D and 10D to a value equal to or greater than \$50 is also arranged to effect the transmission of an impulse over conductor 506 to relay 609 associated with adding machine 50D so as to cause this adding machine to advance one step. For example, let it be assumed that seven impulses representing a total value of \$35 have been registered on adding machine 5D so that it is in its eighth position and one impulse representing a value of \$10 has been received by adding machine 10D so that it is in its second position, thereby making a total of \$45 is registered on the two adding machines, and that an impulse representing \$10 is transmitted from one of the \$10 ticket issuing machines to relay 1—10D. Relay 1—10D will effect in a manner similar to that heretofore described in detail in connection with relay 1—2D, the movement of the adding machine 10D from its second position to its third position. Also by closing its contacts *g*, relay 1—10D completes while adding machine 10D is in its second position, a circuit for relay 609 through contacts *f* of relay 519, conductor 505, wiper and eighth contact of bank *b* of adding machine 5D, wiper and second contact of bank *e* of adding machine 10D, conductor 500, contacts *g* of relay 1—10D, conductor 506 and winding of relay 609.

Relay 609 and its associated relay 610 which is energized when relay 609 is energized and relay 1—50D and operating magnet OMF are simultaneously deenergized, operate to effect the energization and deenergization of operating magnet OMF to cause adding machine 50D to advance one step, in exactly the same manner that relay 516 and 517, as heretofore described in detail, effect the advancement of adding machine 10D one step when relays 1—10D and operating magnet OM10D are simultaneously deenergized.

Similarly, if under the assumed conditions of adding machines 5D and 10D relays 516 and 517 operate to transmit in the manner above described an impulse to adding machine 10D to effect the movement thereof to its next position, the above described circuit for relay 609 is completed through contacts *g* of the relay 517 instead of through contacts *g* of relay 1—10D.

Also the circuit of the relay 609 is arranged to be completed to effect a transfer of \$50 to adding machine 50D when there is a total of \$35 registered on the two adding machines 5D and 10D

and impulses representing a total of \$15 are simultaneously transmitted from the ticket issuing machines to effect the simultaneous energization of relays 1—5D and 1—10D. For example, let it be assumed that three impulses representing a value of \$15 have been registered on adding machine 5D so that it is in its fourth position and that a total of two impulses representing a value of \$20 have been registered on adding machine 10D so that it is in its third position and that impulses are simultaneously transmitted to adding machines 5D and 10D so that relays 1—5D and 1—10D are simultaneously energized. Relays 1—5D and 1—10D effect, in a manner similar to that described above in connection with relay 1—2D the advancement of their respective adding machines one step. Also, while both of these relays are simultaneously energized under the conditions assumed a circuit is completed for relay 609 through the contacts *f* of relay 519, conductor 505, wiper and fourth contacts of bank *b* of adding machine 5D, wiper and third contact of bank *c* of adding machine 10D, conductor 501, contacts *e* of relay 1—10D, contacts *e* of relay 1—5D, contacts *i* of relay 405, conductor 506 and winding of relay 609. Relay 405 is energized under the conditions assumed since it is connected to alternate contacts of bank *c* of adding machine 5D so that it is energized each time there is an odd \$5 registered on adding machine 5D.

Transfer from adding machine 50D to adding machine 100D

When the total registered on the \$50 adding machine equals a value of \$100, an impulse is transmitted to adding machine 100D to transfer this value to the total registered on adding machine 100D. This result is effected by arranging relays 1—50D and 610 so that the energization of either of them when there is already a total of \$50 registered on adding machine 50D effects the energization of a relay 613 associated with adding machine 100D to cause this adding machine to advance one step. This relay 613 and its associated relay 614, which is energized when relay 613 is energized and relay 1—100D and operating magnet OMH are simultaneously deenergized, operate to effect the energization and deenergization of operating magnet OMH to cause adding machine 100D to advance one step in the same manner that relay 516 and 517, as heretofore described in detail, effect the advancement of adding machine 10D one step. For example, when adding machine 50D is in its second position, thereby indicating that there is a total of \$50 registered thereon and relay 1—50D is energized due to an impulse being transmitted thereto from a \$50 ticket issuing machine, a circuit is completed through the wiper and contact 2 of bank *b* of adding machine 50D, contacts *d* of relay 606, contacts *g* of relay 1—50D and winding of relay 613. Similarly, when relay 610 is energized to effect a transfer from adding machines 5D and 10D to adding machine 50D at a time when adding machine 50D is in its second position, the above-described circuit for relay 613 is completed through the contacts *g* of relay 610 instead of through the contacts *g* of relay 1—50D.

Transfer from adding machine 100D to adding machine THD and from adding machine THD to adding machine TTD

Each time the value registered on the adding

machine 100D equals \$1000, an impulse is transmitted to the \$1000 adding machine THD to cause it to advance one step and thereby add a thousand to the total registered thereby. This is accomplished in the arrangement shown in the drawings by having adding machine 100D so arranged that when \$900 is registered thereon, the next energization of either relay 1—100D or relay 614 to effect the movement of adding machine 100D to its normal position also effects the operation of operating magnet OMT to move the \$1000 adding machine THD to its next position.

For example, assume that \$900 is registered on adding machine 100D so that it is in its tenth position and relay 619 is energized through the wiper and tenth contact of bank *b* of adding machine 100D, and an impulse is transmitted from a \$100 ticket issuing machine to relay 1—100D. Relay 1—100D will then effect, in a manner similar to that heretofore described in connection with relay 1—2D, the movement of adding machine 100D from its tenth position to its normal position. Also by closing its contacts *g*, relay 1—100D completes a circuit through the wiper and tenth contact of bank *c* of adding machine 100D, contacts *a* of relay 619, contacts *g* of relay 1—100D, conductor 631 and operating magnet OMT of adding machine THD. As soon as the relay 1—100D becomes deenergized, the operating magnet OMT is deenergized and effects the movement of adding machine THD to its next position.

Also under the same assumed conditions of adding machine 100D, the energization of relay 614 during a transfer from adding machine 50D to adding machine 100D completes the above described circuit for operating magnet OMT through the contacts *g* of relay 614 instead of contacts *g* of relay 1—100D.

Each time the value registered on adding machine THD equals \$10,000 an impulse representing this value is transmitted to adding machine TTD to cause it to advance one step, thereby adding \$10,000 to the value registered thereon. This is accomplished by connecting the operating magnet OMTT of adding machine TTD to the tenth contact of bank *e* of adding machine THD and connecting the wiper of bank *e* to conductor 631. Therefore, an impulse is transmitted to the operating magnet OMTT to effect the advancement of the adding machine TTD one step at the same time each tenth impulse is transmitted to the operating magnet OMT of adding machine THD.

From the above description it will be evident that the apparatus is so arranged that when collecting switch COL—1 reaches any one of its positions, each of the adding machines 2D1, 2D2, 5D, 10D, 50D, and 100D first registers any impulse it may receive from the ticket issuing machine to which it may be then connected and then after registering such an impulse, if one is transmitted to it, each adding machine registers any other impulse which may be transferred to it from the other adding machines.

Collection of \$100 values from adding machine ADD—1 by totalizing machine TOT—W

While tickets are being sold, the totalizing machine TOT—W totalizes only the values registered on the various \$100 adding machines for features 1 to 12, inclusive. Since each of these \$100 adding machines is connected only periodically to the \$100 totalizing machine HDGT by the collecting switch HDGO, it is evident that during

the interval that each adding machine is not connected to totalizing machine HDGT it may receive a number of impulses. Therefore it is necessary to provide each of the \$100 adding machines with suitable impulse storage means which will store up the impulses received thereby while it is not connected to the \$100 totalizing machine HDGT and will cause the stored up impulses to be transmitted to totalizing machine HDGT when it is in a condition to receive them.

In the particular arrangement shown in the drawings, the impulse storage and transmitting means between the adding machine ADD—1 and the totalizing machine TOT—W includes four relays, 616 to 619, inclusive, and a suitable multiple position switch ST of any suitable type. As shown in the drawings, switch ST is a ten-position switch of the rotary type having two banks, *a* and *b*, of stationary contacts with cooperating wipers which are simultaneously operated by an operating magnet OMTR. The windings of relays 616 to 619, inclusive, are connected to the contacts of banks *b* and *c* of the \$100 adding machine 100D so that these relays are energized in the following combinations in the various positions of adding machine 100D:

Position	Relays energized
1.....	618 and 619
2.....	616
3.....	618
4.....	617 and 618
5.....	616 and 617
6.....	617
7.....	616 and 619
8.....	616 and 618
9.....	619
10.....	617 and 619

The contacts of relays 616 and 619 inclusive and the contacts of switch ST are so interconnected that when adding machine 100D is in any one of its ten positions all of the contacts in both banks of switch ST, except one in each bank, are connected to a source of current, and the contacts which are not connected to the source of current are different ones for each position of the adding machine. For example, when adding machine 100D is in position 1, all of the contacts of switch ST except the first contact of bank *b* and the second contact of bank *a* are connected to a source of current. When adding machine 100D is in position 2, all of the contacts of switch ST, except the second contact of bank *b* and the third contact of bank *a*, are connected to a source of current. When adding machine 100D is in position 3, all of the contacts of switch ST except the third contact of bank *b* and the fourth contact of bank *a* are connected to a source of current, etc. Relays 620 and 603 are respectively connected to the wipers for banks *b* and *a* so that when adding machine 100D and switch ST are in corresponding positions relay 620 is deenergized and relay 603 is energized and when they are not in corresponding positions both of these relays are energized unless switch ST is nine positions behind adding machine 100D, in which case relay 603 is deenergized. Therefore, whenever adding machine 100D has a total of \$900 registered thereon which has not been transferred to the total registered on totalizing machine TOT—W, relay 603 becomes deenergized. By closing its contacts *b*, relay 603 completes through winding of time relay 621 and conductor *x* a holding circuit for operating magnet OMC so as to stop collecting switch COL—1 and thereby prevents any

more impulses from being sent from the \$100 ticket issuing machine to relay 1—100D to effect the operation of adding machine 100D. By opening its contacts *a*, which are in the circuit of the winding of relay 614, relay 603 prevents this relay 614 from being energized to transfer a \$100 registered on adding machine 50D to adding machine 100D. Therefore as long as relay 603 remains deenergized, adding machine ADD—1 is prevented from registering the sale of any more tickets for feature No. 1 until \$100 has been transferred to the \$100 totalizing machine HDGT from the \$900 already registered on adding machine 100D.

In order to explain how each \$100 registered on adding machine 100D is added to the total registered on the \$100 totalizing machine HDGT, it will be assumed that adding machine 100D is in its position 1 and that an impulse is transmitted to it so that it moves to its position 2, thereby registering \$100. In position 2 of adding machine 100D, relay 616 is energized through the second contact of bank *b* of adding machine 100D and relays 617 to 619 inclusive are not energized. A circuit is completed under these conditions through the contacts *h* of relay 619, contact 1 of bank *b* of switch ST, contacts *b* of operating magnet OMTR of switch ST and winding of relay 620. By opening its contacts *b*, relay 620 interrupts the circuit through conductor R which is connected to one of the contacts of bank *a* of collecting switch HDCC of totalizer TOT—W and by closing its contacts *a*, relay 620 energized the R conductors of all the other eleven adding machines except those that may have their relay, corresponding to relay 620 of adding machine ADD—1, energized. For the purpose of this description, it will be assumed that when relay 620 is energized, the corresponding relays associated with the other eleven adding machines are all deenergized so that a circuit is completed through contacts *b* of relay 612, contacts *a* of relay 620, conductor 632 common to all of the adding machines in group W and then through contacts *b* and the associated R conductor of each relay associated with each \$100 adding machine and corresponding to relay 620 of adding machine ADD—1. Each of these R conductors is connected to a different contact of bank *a* of collecting switch HDCC so that if the wiper for this bank *a* is in engagement with any of these contacts a circuit is completed through this wiper, contacts *b* of relay 810, and contacts *b* and winding of operating magnet OMHC of the collecting switch HDCC. Magnet OMHC is thereby intermittently energized and deenergized to cause the switch HDCC to move through its various positions until it reaches the position thereof corresponding to adding machine ADD—1 which, in the arrangement shown in the drawings, is position 1. In that position of switch HDCC, the circuit for operating magnet OMHC is open at the contacts *b* of relay 620, which is energized under the conditions assumed. When switch HDCC stops in position 1, a circuit is completed through contacts *b* of relay 612, contacts *c* of relay 620, conductor Q, contact 1 and wiper of bank *c* of switch HDCC and lower winding of relay 810. By closing its contacts *c*, relay 810 completes a locking circuit for its lower winding through conductor 803 the contacts *b* of operating magnet OMHC of the \$100 totalizing machine HDGT. By closing its contacts *a*, relay 810 completes through conductor 804 an energizing circuit for operating magnet OMHC of totalizing machine HDGT and by closing

ing its contacts *e*, completes a circuit through contacts *b* of relay 612, contacts *c* of relay 620, winding of relay 615, conductor P—2, contact 1 and wiper of bank *b* of switch HDGO, and contacts *e* and upper winding of relay 810. The current in this circuit causes relay 615 to close its contacts *a* and complete an energizing circuit for operating magnet OMTR of switch ST. By opening its contacts *b*, magnet OMTR interrupts the above described circuit for relay 620, which in turn, by opening its contacts *c*, effects the deenergization of relays 615 and 810 so that operating magnets OMTR and OMHG are deenergized to move switch ST and totalizing machine HDGT one step, thereby causing a \$100 to be added to the total registered on totalizing machine TOT—W. A similar amount is added to the total registered on totalizing machine TOT—W in each of the other positions of switch HDGO if there is a \$100 registered on the associated \$100 adding machine which has not already been added to the total registered on the totalizing machine.

Transfer from totalizing machine HDGT to the totalizing machines THGT, TTGT and HTGT

Each time the total registered on totalizing machine HDGT equals \$1000 an impulse is transmitted to the \$1,000 totalizing machine THGT to cause it to advance one step and thereby add \$1,000 to the total registered thereon. This is accomplished in the arrangement shown in the drawings by having totalizing machine HDGT so arranged that when \$900 is registered thereon, the next energization of relay 810 that effects the movement of totalizing machine HDGT to its next position also effects the operation of operating magnet OMTHG to move the \$1,000 totalizing machine THGT to its next position.

For example, assume that \$900 is registered on totalizing machine HDGT so that it is in its position 10. Under these conditions a circuit is completed through the contacts *b* of relay 920, wiper and contact 10 of bank *b* of totalizing machine HDGT and winding of relay 905 so that this relay is energized and its contacts *a* are closed. Now, let it be assumed that under these conditions an impulse is transmitted to the relay 810 so that it becomes energized to effect the movement of the \$100 totalizing machine HDGT to its normal position in the manner above described. At the same time, relay 810 completes a circuit through contacts *b* of relay 920, contact 10 and wiper of bank *c* of totalizing machine HDGT, contacts *a* of relay 905, conductor 806, contacts *f* of relay 810, conductor 930 and winding of operating magnet OMTHG of totalizing machine THGT. As soon as relay 810 becomes deenergized, operating magnet OMTHG effects the movement of totalizing machine THGT to its next position.

Each time the value registered on totalizing machine THGT equals \$10,000, an impulse representing this value is transmitted to totalizing machine TTGT to cause it to advance one step, thereby adding \$10,000 to the value registered thereon. This is accomplished by connecting operating magnet OMTTG of totalizing machine TTGT to the tenth contact of bank *e* of totalizing machine THGT and connecting the wiper of this bank *e* to conductor 930. Therefore, an impulse is transmitted to operating magnet OMTTG to effect the advancement of the totalizing machine TTGT one step at the same time each tenth impulse is transmitted to operating

magnet OMTHG of the totalizing machine THGT.

Operating magnet OMHTG for the \$100,000 totalizing machine HTGT is connected in a similar manner through the tenth contact and wiper of bank *e* of totalizing machine TTGT to the circuit for operating magnet OMTTG so that totalizing machine HTGT is advanced one step in response to each tenth impulse transmitted to totalizing machine TTGT.

Operation of sequence control apparatus

It will be remembered that when switch START was operated to initiate the sale of tickets, the holding circuit for the lower winding of relay K was interrupted so that relay K closed its contacts *b*. The closing of these contacts *b* completes a circuit through the winding of relay T and contacts *c* of relay P. A predetermined time after relay T is energized, it closes its contacts *a* and thereby completes a circuit through contact 1 and wiper of bank *e* of switch S—1 and contacts *b* and winding of operating magnet OMS so that the switch S—1 is moved from its position 1 to its position 2.

When the wiper of bank *a* of switch S—1 leaves contact 1, relay M becomes deenergized and thereby interrupts the circuits of switch LCX so that the source AC is disconnected from the load circuit LC which supplies current to the lamps of all of the indicators.

In positions 2 to 5, inclusive, of switch S—1, a circuit is completed through the wiper of bank *a* for relay MS, which, when energized, stops all of the collecting switches in the adding and totalizing machines. For example, a circuit is completed through contacts *a* of relay MS, conductor X and winding of operating magnet OMC so as to maintain collecting switch COL—1 of adding machine ADD—1 in whatever position it may be in at the time switch S—1 moves into position 2. A similar circuit is completed through the contacts *c* of relay MS and conductor G to maintain operating magnet OMHC of the \$100 collecting switch HDGO associated with the totalizing machine TOT—W. Similar holding circuits (not shown) are closed in response to the energization of relay MS for the operating magnets of the other collecting switches (not shown).

In position 2 of switch S—1 a circuit is completed for relay H through the wiper and contact 2 of bank *d*. By closing its contacts *c*, relay H completes an energizing circuit for the upper winding of relay HX. Relay HX, by closing its contacts *a*, completes a circuit for its lower winding through contacts *a* of relay H and contact 2 and wiper of bank *d* of switch S—1.

As soon as switch LCX, which controls the supply of current to the lamps of the indicators, opens and relay HX is energized, a notching circuit for operating magnet OMS is completed through contacts *b* of switch LCX, contacts *c* of relay HX, contact 2 and wiper of bank *e* of switch S—1. The completion of this circuit causes the operating magnet OMS to move the switch S—1 from position 2 to position 3.

In moving from position 2 to position 3, the circuit of relay P is opened. By opening its contacts *a*, relay P opens the holding circuit for all of the indicator relays so that they are deenergized and can be reenergized in the proper combinations in accordance with the new total to be displayed, and by opening its contacts *c* relay P effects the deenergization of time relay T.

Also when switch S—1 leaves position 2, the

original energizing circuit for relay H is interrupted. However, as long as any one of the operating magnets for the various adding machines is energized, a holding circuit is completed for the relay H through its contacts *a*, conductor H' and contacts *c* of the energized operating magnet. Therefore, it will be seen that all of the operating magnets for the various adding and totalizing machines must be deenergized before the new totals can be displayed by the indicators.

Since the relays H and HX are designed so that they remain in their energized positions for a predetermined time after they have become deenergized and since a circuit for the upper winding of relay HX is completed through the contacts *c* of relay H as long as it remains in its energized position, both relays remain in their energized positions for a predetermined time after the winding of relay H becomes deenergized. Furthermore, it will be noted that after relay H has moved to its deenergized position a predetermined time interval has to elapse before relay HX moves to its deenergized position. During the time interval that relay H is in its deenergized position and relay HX is in its energized position, a circuit is completed through contacts *b* of relay H, contacts *c* of relay HX, conductor P' and winding of relay PI associated with each \$100 adding machine. Relay PI effects, in a manner which will be hereinafter described, a premature transfer of \$100 to the associated \$100 adding machine in case there is a \$100 or more registered on the associated \$2, \$5, \$10 and \$50 adding machines and a normal transfer of this \$100 has not been made. The time interval during which relay H is in its deenergized position and relay HX is in its energized position is made long enough to permit this premature transfer to be made. As soon as both of the relays H and HX are simultaneously in their deenergized position, a notching circuit for operating magnet OMS is completed through the contacts *b* of relay H, contacts *b* of relay HX, contact 3 and wiper of bank *e* of switch S—1 to effect the movement of switch S—1 from position 3 to position 4.

In position 4, the circuit for relay P is again completed through the wiper and contact 4 of bank *b* of switch S—1 to establish the holding circuit to all of the indicator relays. Also, in position 4, a circuit is completed through wiper and contact 4 of bank *c* to effect the energization of relay E. By closing its contacts *a*, relay E completes a circuit through conductor Z, windings of relays 418, 518, 611 and 712 in parallel, conductor HLC and contacts *b* of relay LR—1. Relay E also completes a circuit through conductor Z and the windings of relays 829, 830, 915 and 902 in parallel. These relays connect in a manner which will be hereinafter described the various units of the indicator I—1 for feature No. 1 and the indicator T—W for group W so that these indicators show the new totals for feature No. 1 and group W respectively.

By closing its contacts *c*, relay E completes a circuit for relay EX which after being energized for a predetermined time completes through its contacts a contact 4 and wiper of bank *e* of switch S—1 a notching circuit for operating magnet OMS to effect the movement of switch S—1 from position 4 to position 5.

When switch S—1 moves from position 4 to position 5, relay E becomes deenergized to effect the deenergization of relays 418, 518, 611, 702, 829, 830, 915 and 902 but the relays of the various indicating units, which were energized to indicate

the new totals, are maintained energized by the holding circuits therefor, which are completed through the contacts *a* of relay P, which also remains energized in positions 5, 1 and 2 of switch S—1.

A predetermined time after relay E becomes deenergized and opens its contacts *c*, relay EX closes its contacts *b* and completes through contact 5 and wiper of bank *e* of switch S—1, a notching circuit for operating magnet OMS to move switch S—1 from position 5 to position 1.

As soon as switch S—1 leaves position 5, relay MS is deenergized and thereby allows the collecting switches for the various adding machines and totalizing machines to start rotating again. Also when switch S—1 reaches position 1, relay M is reenergized to effect the energization of the operating winding of switch LCX so that the lamps in the various indicator units are selectively operated to display the new totals in accordance with the energization of the associated indicator relays.

The above-described operation of the sequence control apparatus takes place in a very short time so that there is no appreciable holdup in the issuance of tickets. This operation of the sequence control apparatus is repeated in order to post new totals on all the indicators at intervals which depend upon the time setting of relay T.

Control of units indicator unit 1—A

In order that the units indicator unit 1—A for feature No. 1 may display the correct digit, it is necessary to add five to the total registered on the two \$2 adding machines 2D—1 and 2D—2 whenever there is an odd \$5 registered on the \$5 adding machine 5D and if the total registered on the \$2 and \$5 adding machines equals \$10 or more, the tens indicator unit 1—B should display an additional \$10 and the unit indicator 1—A should display only the remainder.

As described heretofore, the relay 405 is connected to alternate contacts of bank *c* of adding machine 5D so that it is energized whenever there is an odd \$5 registered on adding machine 5D. Also, it will be remembered that the relays 406 to 410, inclusive, are connected to adding machines 2D—1 and 2D—2, so that when a total of zero dollars is registered on both adding machines, relay 406 is energized; when a total of \$2 is registered, relay 407 is energized; when a total of \$4 is registered, relay 408 is energized; when a total of \$6 is registered, relay 409 is energized; when a total of \$8 is registered, relay 410 is energized. The contacts of these relays, 406 to 410, inclusive, are so interconnected that, when any one of these relays is energized at the same time relay 405 is deenergized, and the associated relay 418 is energized in position 4 of switch S—1 of the sequence control apparatus, relays 1R—1 to 1R—4 are selectively energized in the proper combination to display the corresponding digit. For example, assume that when relay 418 is energized by the sequence control apparatus there is a total of \$6 registered on the two adding machines 2D—1 and 2D—2 so that relay 409 is energized and that relay 405 is deenergized because there is no odd \$5 total registered on the adding machine 5D. Under these conditions a circuit is completed through the contacts *c* of relay 409, contacts *a* of relay 418, conductor LU—1 and winding of relay 1R—1. Also, a circuit is completed through contacts *b* of relay 405, contacts *a* of relay 409, contacts *g* of relay 418, conductor LU—4 and winding of relay 1R—4. Relays

IR—1 and IR—4, by closing their respective contacts *a*, complete through the contacts *a* of relay P holding circuits for themselves so that they remain in their energized positions until relay P is subsequently deenergized in position 3 of switch S—1 during the next cycle of operation of the sequence control apparatus. Relays IR—1 and IR—4 also, when simultaneously energized, complete through contacts (not shown in the drawings) suitable circuits to the lamps of indicator I—A so that these lamps are lighted to display the digit 6 when switch LCX is subsequently closed in position 1 of switch S—1 of the sequence control apparatus.

It will now be assumed that there is a total of \$5 registered on adding machine 5D at the time relays 409 and 418 are energized so that relay 405 is energized at the same time. Under these conditions, there will be a total of \$11 instead of \$6 registered on the two \$2 adding machines 2D—1, 2D—2 and the \$5 adding machine 5D. Since relay 409 is energized, the above-described circuit for relay IR—1 is completed through contacts *c* of relay 409 but since relay 405 is energized, the above-described circuit for relay IR—4 is not completed. Consequently, only relay IR—1 of indicator unit I—A is energized and thereby effects the display of the digit 1 instead of the digit 6 when switch LCX is subsequently closed. Relay 405, in its energized position, also causes, in a manner which will be hereinafter described, the tens indicator unit I—B to display the correct tens digit.

Control of the tens indicator unit I—B

In order for the tens digit unit I—B of indicator I—1 for feature No. 1 to display the correct digit, it is necessary to add \$50 to the total registered on the \$10 adding machine 10D when adding machine 50D has \$50 registered thereon and to add \$10 to the total registered on adding machine 10D when the total registered on adding machines 2D—1, 2D—2 and 5D equals or exceeds \$10. This result is obtained by the interconnections between the various contacts of relays 511 to 515 inclusive, which are respectively arranged in a manner heretofore described so that they are respectively energized in positions 1 to 5 of adding machine 10D, relay 520, which is energized through the wiper and contact 2 of bank *b* of adding machine 50D whenever there is a total of \$50 registered on adding machine 50D, relay 405, which is energized when there is a total of \$5 registered on adding machine 5D, and relays 409 and 410 which are respectively energized when the total registered on both of the adding machines 2D—1 and 2D—2 are \$6 and \$8.

For example, it will be assumed that when relay 518 is energized in the manner heretofore described by the sequence control apparatus to effect a new posting of the tens digit unit I—B, there is no \$50 total registered on 50D, that there is no \$5 total registered on 5D, that a total of \$8 is registered on the two adding machines 2D—1 and 2D—2 and there is a total of \$40 registered on adding machine 10D so that its associated relay 515 is energized. When relay 518 is energized under these conditions, a circuit is completed through contacts *f* of relay 405, conductor 432, contacts *d* of relay 520, contacts *a* of relay 515, contacts *a* of relay 518 and conductor LT—1, which is connected in the indicator unit I—B to a relay similar to relay IR—1 in indicator unit I—A. Also, there is a circuit completed under these assumed conditions through contacts

d of relay 405, conductor 433, contacts *b* of relay 520, contacts *c* of relay 515, contacts *c* of relay 518 and conductor LT—2, which is connected in indicator unit I—B to a relay similar to relay IR—2 in indicator unit I—A. The simultaneous energization of these two relays IR—1 and IR—2 in the indicator unit I—B effects in a well-known manner the display of the digit 4 when the switch S—1 again reaches its position 1.

It will now be assumed that when the relay 518 is energized to post a new tens digit, not only is the relay 515 energized, but relay 520 is also energized thereby indicating that there is a total of \$50 registered on 50D so that there is a total of \$90 registered on the two adding machines 10D and 50D. Under these conditions the tens indicator I—B should display the digit 9 instead of the digit 4 and in order to accomplish this result relay 520, when energized is arranged to complete circuits through conductors LT—2 and LT—4 instead of conductors LT—1 and LT—2. When relay 520 is energized, the above-described circuits through conductors LT—1 and LT—2 are open at contacts *d* and *b* of relay 520. By closing its contacts *c*, relay 520 completes a circuit through contacts *d* of relay 405, conductor 433, contacts *c* of relay 520, contacts *m* of relay 515, contacts *c* of relay 518, and conductor LT—2, and by closing its contacts *e*, relay 520 completes a circuit from contacts *f* of relay 405, conductor 432, contacts *e* of relay 520, contacts *i* of relay 515, contacts *g* of relay 518, and conductor LT—4. The completion of these circuits through conductors LT—4 and LT—2 effect the energization of relays in the tens digit indicator I—B corresponding to relays IR—2 and IR—4 in indicator I—A which when simultaneously energized effect the display of the digit 9 when switch S—1 of the sequence control apparatus again reaches its position 1.

It will now be assumed that when the relay 518 is energized to cause a new digit to be displayed by the tens indicator unit I—B, relay 405, as well as relays 515 and 409 are energized, and relay 520 is deenergized, thereby indicating a total of \$51 registered on the 2D—1, 2D—2, 5D, 10D and 50D adding machines. Under these conditions, conductor LT—2 is the only one of the four conductors leading to indicator unit I—B that should be energized in order to effect the display of the digit 5. The units digit indicator I—A will, under the assumed conditions, be controlled in the manner heretofore described so that it displays the digit 1.

Under the conditions assumed, the only circuit to indicator I—B is completed through contacts *g* of relay 409, contacts *e* of relay 405, conductor 434, contacts *h* of relay 520, contacts *e* of relay 515, contacts *c* of relay 518 and conductor LT—2. The circuits through the other three conductors of relay 520 leading to indicator unit I—B are open either at the contacts of relay 520 or at the contacts of relay 405. Therefore, under these assumed conditions, the indicator unit I—B displays the digit 5.

Control of indicator units I—C, I—D, and I—E

Circuits through the four conductors H—1 to H—4 inclusive leading to the hundreds indicator unit I—C are simultaneously completed in various combinations in accordance with the position of the adding machine 100D so that the indicator I—C displays the proper digit. This result is accomplished by having the relay 611 when it is energized by the sequence control apparatus

connect these four conductors H—1 to H—4 inclusive to the contacts of banks b and c of adding machine 100D so that, depending upon the position of adding machine 100D, these contacts are properly energized to cause the indicator unit I—C to display the corresponding digit. For example, if adding machine 100D is in position 2 due to \$100 being registered thereon, the conductor H—1 is energized through contacts a of relay 611, second contact and wiper of bank b of adding machine 100D. Since this is the only one of the four conductors H—1 to H—4 which is energized under these conditions, the proper indicating relay of indicator unit I—C is energized to effect the display of the digit 1.

Circuits through the four conductors TH—1 to TH—4 leading to the thousand indicator unit I—D are simultaneously completed in various combinations in accordance with the position of adding machine THD and circuits through conductors TT—1 to TT—4 inclusive leading to the ten thousand indicator unit I—E are simultaneously completed in various combinations in accordance with the position of adding machine TTD so that these two indicator units display the proper digits. This result is accomplished by having the four conductors TH—1 to TH—4 inclusive connected to the contacts of banks c and d of adding machine THD and the conductors TT—1 to TT—4 connected to the contacts of banks c and d of adding machine TTD in such a manner that when the relay 712 is energized by the sequence control apparatus, these conductors are properly energized to cause the indicators I—D and I—E to display the corresponding digits. For example, if adding machine THD is in position 3 due to \$2000 being registered thereon, the conductor TH—3 is energized through the wiper and third contact of bank c of adding machine THD, contacts c of relay 712 and wiper and third contact of bank b of adding machine THD and contacts b of relay 701. Since conductor TH—3 is the only one of the four conductors TH—1 to TH—4 that is energized under the assumed conditions the proper indicating relay of indicator unit I—D is energized to effect the display of the digit 2. If adding machine TTD is in position 5 due to \$40,000 being registered thereon when the relay 712 is energized, conductor TT—1 is energized through fifth contact and wiper of bank c of adding machine TTD, contacts g of relay 712, wiper and fifth contact of bank b of adding machine TTD and contacts b of relay 701. Also conductor TT—2 is energized through wiper and fifth contact of bank d of adding machine TTD, contacts e of relay 712, wiper and fifth contact of bank b of adding machine TTD and contacts b of relay 701. Since conductors TT—1 and TT—2 are simultaneously energized, the proper indicating relays of indicator unit I—E are energized to effect the display of the digit 4.

In order for the conductors H3 and H4 to be simultaneously energized to cause indicator unit I—C, to display a zero, it is necessary for adding machine THD or TTD to be out of its normal position. When adding machine 100D is in its position 1, the circuit from conductor H—4 through contacts g of relay 611, contacts i of relay 619, which is energized when adding machine 100D is in position 1, wiper and first contact of bank a of adding machine 100D to conductor 633 can be completed through the wiper and an off-normal contact of bank b of adding machine THD and contacts b of relay 701, if

adding machine THD is not in its normal position, or if adding machine THD is in its normal position, this circuit from conductor 633 can be completed through the wiper and first contact of bank b of adding machine THD, wiper and an off-normal contact of bank b of adding machine TTD and contacts b of relay 701 if adding machine TTD is in an off-normal position. Also the circuit from conductor H—3 can be completed through contacts e of relay 611, contacts g of relay 618, wiper and normal contact of bank a of adding machine 100D and conductor 633 only in case adding machine THD or adding machine TTD has moved out of its normal position. Similarly, the circuits through conductors TH—3 and TH—4, when adding machine THD is in its normal position and relay 712 is energized, can be completed only through the wiper and an off-normal contact of bank b of adding machine TTD.

Therefore, it will be seen that indicator I—C can display a zero only in case some other digit than zero is being displayed by either indicator unit I—D or I—E and indicator I—D can display as zero only in case indicator unit I—E is displaying some other digit than zero. In the arrangement shown indicator unit I—E never will display the zero digit.

Control of indicator units T—A to T—F, inclusive

Indicator units T—A to T—F, inclusive, are respectively connected to contacts of totalizing machines UDGT, TDGT, HDGT, THGT, TTGT and HTGT in substantially the same manner that the conductors leading to indicator unit I—D are connected to contacts of adding machine THD so that when relays 829, 830, 915 and 902 are energized by the sequence control apparatus in the manner above described, indicator units T—A to T—F, inclusive, are controlled by the positions of the respective totalizing machines so that they display the proper digits.

The wipers of banks b and c of totalizing machine UDGT are normally energized through conductor 801 and contacts b of relay 717 and the wipers of banks b and c of totalizing machine TDGT are normally energized through conductor 802 and contacts d of relay 717 so that whenever these totalizing machines are in their normal positions the corresponding indicator units display a zero. The wipers of banks b and c of totalizing machine HDGT and the wipers of banks c and d of totalizing machines THGT, and TTGT are connected in the normal positions of the respective machine to the wiper of bank b of the totalizing machine of the next higher denomination in the same way that the wipers c and d of adding machine THD are connected to the wiper of bank b of adding machine TTD so that the indicators associated with these totalizing machines display a zero only when a totalizing machine of a higher denomination has been moved from its normal position.

Premature transfer to adding machine 100D

Due to the fact that the transfers from the two \$2 adding machines, 2D—1 and 2D—2, and from the \$5 adding machine 5D to the \$10 adding machine 10D are made independently of each other, it is evident that it is possible to have a total of \$101 and \$103 registered on adding machines 2D—1, 2D—2, 5D, 10D and 50D without effecting a transfer to the \$100 adding machine 100D. For example, with a total of \$8 registered on adding machines 2D—1 and 2D—2,

\$5 registered on adding machine 5D, \$40 registered on adding machine 10D, and \$50 registered on adding machine 50D, there is under these conditions no transfer of \$100 to the adding machine 100D although the total value registered on these adding machines is \$103. The only time this condition becomes important is when a change in the indicators is being made. Since the totalizing machines only totalize the values registered on the \$100 adding machines for the associated group of features, it is evident that the total displayed by indicator T—W would be several hundred dollars too small if several of the feature adding machines each had more than \$100 registered thereon which had not been transferred to the respective \$100 adding machines. In order to prevent such an inaccurate display by indicator T—W, the sequence control apparatus is arranged to effect a premature transfer to each \$100 adding machine if associated adding machines of lower denominations have a total of \$100 or more registered thereon which has not been transferred at the time the indicator change is being made.

It will be recalled that when switch S—1 moved from its position 2 to its position 3 during the cycle of operation of the sequence control apparatus, a circuit was completed for relay PI as long as relay HX remained in its energized position after the relay H had returned to its deenergized position. This relay PI, when energized, is arranged to cause, in the arrangement shown in the drawings, the \$100 adding machine 100D to advance one step, if there is a total of either \$101 or \$103 registered on adding machines 2D—1, 2D—2, 5D, 10D and 50D which has not been transferred to adding machine 100D. For example, assume that there is a total of \$6 registered on the two \$2 adding machines 2D—1 and 2D—2 so that relay 409 is energized; that there is a total of \$5 registered on adding machine 5D so that it is in one of its even positions, such for example, as position 2 and relay 405 is energized; that there is a total of \$40 registered on adding machine 10D so that it is in position 5 and that there is a total of \$50 registered on adding machine 50D so that it is in position 2 and relay 520 is energized through conductor 532 and wiper and contact 2 of adding machine 50D. Therefore, it will be seen that although there is a total of \$101 registered on the various adding machines, no transfer is normally effected under these conditions to adding machine 100D. When, however, relay PI is energized under these conditions, a circuit is completed through contacts *f* of relay 519, conductor 505, wiper and second contact of bank *b* of adding machine 5D, wiper and fifth contact of bank *b* of adding machine 10D, conductor 500, contacts *i* of relay 409, contacts *g* of relay 405, conductor 530, contacts *a* of relay PI, contacts *a* of relay 520, conductor 531 and winding of relay 606. Also, a circuit is completed from conductor 531 through contacts *b* of relay 606 and winding of relay 607. By closing its contacts *a*, relay 606 completes a locking circuit for itself through resistance 635, conductor 532 and wiper and contact 2 of bank *b* of adding machine 50D so that relay 606 remains energized until adding machine 50D is moved out of its position 2. By closing its contacts *a*, relay 607 completes a locking circuit for itself through the contacts *b* of relay 608. By closing its contacts *c*, relay 607 completes a circuit for the winding of relay 608 through the contacts *b* of relay 613. By closing its contacts *a*, relay 608

completes a locking circuit for itself through the contacts *a* of relay 607 and by closing its contacts *e* it completes another locking circuit for itself through contacts *b* of relay 613. By opening its contacts *b*, relay 608 opens the locking circuit for relay 607 and by closing its contacts *c*, relay 608 completes a circuit through the winding of relay 613, and the wiper and contact 2 of bank *b* of adding machine 50D. By opening its contacts *a*, relay 607 interrupts the above described locking circuit for relay 608 through its contacts *a*. By closing its contacts *a*, relay 613 completes a circuit through the winding of relay 614, contacts *a* of relay 613, contacts *a* of relay 603, contacts *b* of relay 1—100D, and contacts *b* of operating magnet OMH of adding machine 100D. By closing its contacts *c*, relay 614 completes an energizing circuit for operating magnet OMH.

By opening its contacts *b*, relay 613 interrupts the above-described locking circuit for relay 608 through its contacts *e*, which in turn, by opening its contacts *c*, effects the deenergization of the relays 613 and 614 so that the operating magnet OMH becomes deenergized and thereby advances adding machine 100D to its next position.

It will be observed that since the above-described locking circuit for relay 606 remains completed through the wiper and contact 2 of bank *b* of 50D until adding machine 50D has been advanced to its next position, this relay 606, by maintaining its contacts *d* open, prevents the next impulse, which effects the energization and deenergization of either relay 610 or 1—50D to cause the \$50 adding machine 50D to move to its next position, from operating relays 613 and 614 to cause adding machine 100D to advance another step. Thus, it will be seen that if relay PI, when energized, effects a premature transfer to the \$100 adding machine 100D, the next normal transfer from the \$50 adding machine 50D to the \$100 adding machine 100D does not take place.

Automatic feature lockout

In case any adding machine fails to operate properly it is essential that an alarm or signal be given whereby the trouble may be located quickly and also that the ticket issuing machines be locked out so that no tickets can be issued for the feature whose adding machine is not operating properly. In the arrangement shown in the drawings adding machine ADD—1 has associated therewith a time relay 421 which is connected in the holding circuit for operating magnet OMC for collecting switch COL—1, when this circuit is completed through contacts *k* of relay 1—2D, 1—2D', 516, 517, 1—5D or 1—10D and a time relay 621, which is connected in the holding circuit for operating magnet OMC, when this circuit is completed through contacts *k* of relay 1—50D, 1—100D, 607, 608, 609, 610, 613 or 614, when any one of these relays is energized and contacts *b* of relay 603 when it is deenergized.

The relays 421 and 621 are designed so that during the normal operation of the adding machines the holding circuits which are closed through the windings of these relays are not energized for a sufficient length of time to effect the operation thereof. However, if trouble develops in any one of the adding machines so that it does not register the receipt of an impulse transmitted thereto within a predetermined time, either relay 421 or 621 operates to close its contacts. For example, assume that when an

impulse is transmitted to relay 1-2D, the relay remains energized due to some improper operation of adding machine 2D-1 and its associated control apparatus. Since the circuit of relay 421 is completed through the contacts *k* of relay 1-2D when it is energized, relay 421 will, after a predetermined time interval, close its contacts and thereby complete through its contacts *a* a circuit for a suitable signal 440, which when operated indicates that the trouble is somewhere in the adding machines 2D-1, 2D-2, 5D or 10D. Also, by closing its contacts *c*, relay 421 completes a circuit through conductor LR to the lower winding of relay LR-1, which when energized prevents all of the ticket issuing machines from issuing any tickets for feature No. 1. Similarly, when relay 621 is operated, it effects by closing its contacts *a* the operation of a suitable signal 640 which when operated indicates that the trouble is somewhere in either adding machine 50D or 100D and effects, by closing its contacts *c*, a circuit for the lower winding of lockout relay LR-1 through the conductor LR.

Stopping sale of tickets

When it is desired to stop the sale of tickets for all of the features, switch STOP is closed by the steward so that circuits are completed through the winding of relay LX and the upper winding of relay K. By opening its contacts *b*, relay K interrupts the circuit of time relay T' so that this relay cannot effect in the manner above described the movement of switch S-1 from its normal position. By closing its contacts *a*, relay K completes a holding circuit for its lower winding through conductor K-a and contacts *b* of switch START.

By closing its contacts *c*, relay LX completes a locking circuit for itself through contacts *b* of relay F' and also a circuit for an alarm AL through contacts *b* of relay L. The alarm notifies the ticket sellers to stop receiving any more money for tickets. By closing its contacts *a*, relay LX completes a circuit for time relay T'. After a predetermined time interval which is long enough to allow any ticket issuing machine to complete its ticket issuing operation, relay T' closes its contacts *a* and completes thereby an energizing circuit for relay L and for time relay T''. By opening its contacts *b*, relay L interrupts the alarm circuit and by closing its contacts *a* completes through conductor 240 an energizing circuit to the ticket issuing machine lockout magnets 300 so that all of the keys of the various ticket issuing machines are prevented from being operated.

After being energized for a sufficient length of time to allow switch S-1 to return to its position 1, relay T'' closes its contacts *a* and thereby completes a circuit through contacts *d* of relay F', wiper and contact 1 of bank *e* of switch S-1, contacts *b* and winding of operating magnet OMS, so that operating magnet OMS operates to move switch S-1 through its various positions in the manner heretofore described. During this cycle of operation of the sequence control apparatus, the indicators I-1 to I-12, inclusive, are controlled so that they indicate the total values of the tickets sold respectively for features 1 to 12, inclusive. While switch S-1 is in position 5, during this cycle of operation of the sequence control apparatus, a circuit is completed through the upper winding of relay F' through the wiper and contact 5 of bank *f* of switch S-1 and contacts *a* of relay T''. By closing

its contacts *c*, relay F' completes a locking circuit for itself through its lower winding and the contacts *a* of relay T'' so that relay F' remains energized as long as relay T'' remains energized. By closing its contacts *a*, relay F' completes a circuit through the upper winding of relay CCR. By closing its contacts *a*, relay CCR completes a locking circuit for itself through its lower winding, conductor K-a and contacts *b* of switch START, and by opening its contacts *b*, relay CCR prevents any further movement of any of the collecting switches associated with the adding machines, such for example as COL-1.

Final collection by totalizing machines

Since each totalizing machine only totalizes the values registered on its associated \$100 adding machines while tickets are being sold, it is necessary to totalize all the values on the associated adding machines of lower denominations after the sale of tickets has been stopped in order that the group indicator may accurately indicate the total value of all the tickets sold for all the features in the associated group. After the sale of tickets has been stopped in a manner above described, totalizing machine TOT-W in the arrangement shown in the drawings is arranged to add to its total, first, the unit digits of the totals registered on the adding machines for features 1 to 12, inclusive, and then the tens digits of the same totals, and then the sequence control apparatus is again operated to cause group indicator T-W to indicate this new and final total registered on totalizing machine TOT-W.

This final operation of totalizing machine TOT-W is started by relay F closing its contacts *e* and thereby completing a circuit through conductor L, normal contact and wiper of bank *a* of collecting switch UTCO, contact *b* and winding of operating magnet OMU so that the magnet OMU is operated to effect the movement of switch UTCO from position 1 to position 2. By disengaging its contact 1, when the switch UTCO leaves position 1, the wiper associated with bank *b* of switch UTCO effects the deenergization of relay 724-W and by engaging its contact 2 when the switch reaches position 2, this wiper completes an energizing circuit through conductor 762 for relay 808. This circuit for relay 808 is also completed in positions 3 to 13, inclusive, of switch UTCO.

In each of the off-normal positions of switch UTCO a circuit is completed through the winding of relay 710, an off-normal contact and wiper of bank *a* of switch UTCO, contacts *b* and winding of operating magnet OMU. The current in this circuit is sufficient to effect the operation of relay 710, but is not sufficient to cause operating magnet OMU to open to contacts *b*.

Since contacts 2 of banks *f*, *e*, *d*, and *c* of switch UTCO are respectively connected to conductors LU-1, LU-2, LU-3, LU-4, relays 702 to 705, inclusive, which are respectively connected to the wipers of banks *f*, *e*, *d*, and *c* of switch UTCO are selectively energized in position 2 in accordance with the energized condition of the indicating relays IR-1 to IR-4 inclusive associated with indicator I-A. For example, it will be assumed that the units digit of the total indicated by indicator I-A is 8 so that only relay IR-4 is energized. Therefore, in position 2 of switch UTCO, a circuit for relay 705 is completed through contacts *a* of relay P, contacts *a* of relay IR-4, conductors LU-4, wiper and con-

tact 2 of bank c of switch UTCO and winding of relay 705.

The contacts of relays 702 to 705, inclusive, are connected to the eleven contacts of bank a of switch UTTR in such a way that all of the contacts, except one, which depends upon the combination in which these relays are energized, are connected to a source of current when the contacts a of relay 710 are closed, for example, when all of the relays 702 to 705 are deenergized, thereby indicating that they are not associated with an units indicator which is displaying a digit, all the circuits, except the circuit through conductor 750 to contact 1 of bank a of switch UTTR, are closed. When the associated indicator is displaying the digit 0, relays 702 and 703 are energized, and the circuit through conductor 751 to contact 2 of bank a of switch UTTR is open. When the associated indicator is displaying the digit 1, relay 702 is energized and the circuit through conductor 752 to contact 3 of bank a is open. When the associated indicator is displaying the digit 2, relay 704 is energized and the circuit through conductor 753 to contact 4 of bank a is open. When the digit 3 is being displayed, relays 703 and 704 are energized and the circuit through conductor 754 to contact 5 of bank a is open. When the digit 4 is being displayed, relays 702 and 703 are energized and the circuit through conductor 755 to contact 6 of bank a is open. When the digit 5 is being displayed, relay 703 is energized and the circuit through conductor 756 to contact 7 of bank a is open. When the digit 6 is being displayed, relay 702 and 705 are energized and the circuit through conductor 757 to contact 8 of bank a is open. When the digit 7 is being displayed, relays 702 and 704 are energized and the circuit through conductor 758 to contact 9 of bank a is open. When the digit 8 is being displayed, relay 705 is energized and the circuit through conductor 759 to contact 10 of bank a is open. When the digit 9 is being displayed, relays 703 and 705 are energized and the circuit through conductor 760 to contact 11 of bank a is open.

Since under the conditions assumed, the relay 705 alone is energized and relay 710 is also energized when switch UTCO reaches position 2, a circuit is completed through contacts a of relay 710, conductor 761, wiper and normal contact of bank c of switch UTTR and winding of relay 813, and also a circuit through conductor 761, contacts g of relay 705, contact 1 and wiper of bank a of switch UTTR, and winding of relay 815. Since time relay 813 is designed so that it does not close its contacts a until after its winding has been energized for a sufficient length of time to allow relay 815 to open its contacts b, which are in series with the contacts a of relay 813, the circuit through these series connected contacts is not closed at this time. By closing its contacts a, relay 815 completes from the wiper of bank a of switch UTTR a circuit through contacts b of operating magnet OMSS and winding of relay 818, and another circuit through contacts b of operating magnet OMSS, resistance 850, contacts a of relay 808, contacts b and winding of operating magnet OMUG. Due to the resistance 850 in this last-mentioned circuit, sufficient current does not flow through operating magnet OMUG to effect the operation thereof. Relay 818 however is energized and by closing its contacts a, completes a circuit for operating magnet OMSS which in turn, by opening its contacts b, effects the deenergization of the relay 818

which in turn, by opening its contacts a, effects the deenergization of the operating magnet OMSS so that the switch UTTR is moved to its position 2.

In position 2 of switch UTTR, a circuit is completed for relay 815 through the wiper and contact 2 of bank a of switch UTTR, conductor 751, contacts d of relay 704, conductor 761 and contacts a of relay 710. Therefore, a circuit for relay 818 is completed through the contacts a of relay 815 so that it effects, in the manner above described, the energization and subsequent deenergization of operating magnet OMSS, thereby causing the switch UTTR to move to its position 3. The energization of the relay 818 while the switch UTTR is in position 2 also completes an energizing circuit for operating magnet OMUG through contacts b of relay 814, contact 2 and wiper of bank d of switch UTTR, contact c of relay 813, contact c of relay 808 and winding of operating magnet OMUG. Therefore, when relay 818 is substantially deenergized by the operation of magnet OMSS, operating magnet OMUG is deenergized to move totalizing machine UDG T one step.

In position 3 of switch UTTR, a circuit is completed through the wiper and contact 3 of bank a of switch UTTR, conductor 752, contacts b of relay 702, conductor 761 and contacts a of relay 710 so that relay 815 is energized and completes through its contacts a a circuit for relay 818 which controls the operation of magnets OMSS and OMUG in the manner heretofore described so that switch UTTR moves to its position 4 and totalizing machine UDG T is advanced another step. In a similar manner, relay 815 effects the movement of switch UTTR from position 4 to position 10 and totalizing machine UDG T is advanced seven more steps, or a total of eight steps. In position 4 of switch UTTR, the circuit for maintaining relay 815 energized is through the wiper and contact 4 of bank a of switch UTTR, conductor 753, contacts f of relay 704, conductor 761 and contacts a of relay 710. In position 5 of switch UTTR, the circuit for relay 815 is through wiper and contact 5 of bank a, conductor 754, contacts b of relay 703, conductor 761 and contacts a of relay 710. In position 6, the circuit for relay 815 is through the wiper and contacts 6 of bank a, conductor 755, contacts d of relay 702, conductor 761 and contacts a of relay 710. In position 7 of switch UTTR, the circuit for relay 815 is through wiper and contact 7 of bank a, conductor 756, contacts a of relay 705, conductor 761, and contacts a of relay 710. In position 8 of switch UTTR, the circuit for relay 815 is through the wiper and contact 8 of bank a, conductor 757, contacts f of relay 702, conductor 761 and contacts a of relay 710. In position 9 of switch UTTR, the circuit for relay 815 is through the wiper and contact 9 of bank a, conductor 758, contacts h of relay 702, conductor 761 and contacts a of relay 710.

When switch UTTR reaches position 10, the circuit for relay 815 is open so that it closes its contacts d and thereby completes a circuit for relay 814 through the wiper and tenth contact of bank c of switch UTTR. By closing its contacts c, relay 814 completes a locking circuit for itself around the contacts b of relay 815, and this locking circuit remains completed through the wiper and contacts of bank c of switch UTTR until this switch is restored to its normal position. By closing its contacts a, relay 814 completes through conductor 851 a circuit for oper-

ating magnet OMU, this circuit being a low resistance shunt circuit around the winding of relay 710. Therefore, the operating winding OMU is sufficiently energized to cause it to open its contacts *b* and the relay 710 is deenergized so that it opens its contacts *a*. By closing its contacts *e*, relay 814 completes a circuit through the wiper and tenth contact of bank *b* of switch UTTR, contacts *b* of operating magnet OMSS and winding of relay 818. Relay 818 then effects, in the manner heretofore described, the energization and deenergization of operating magnet OMSS so that switch UTTR moves to its position 11 and since relay 814 remains energized in this position, the relay 818 again operates to effect the movement of switch UTTR from position 11 to its normal position, in which position relay 814 is deenergized. While switch UTTR is in position 11, the circuit for relay 815 is not completed through the wiper and contact 11 of bank *a* of switch UTTR because this circuit is open at contacts *a* of relay 710.

By opening its contacts *a*, when switch UTTR reaches its normal position, relay 814 effects the deenergization of operating magnet OMU so that switch UTCO moves to its position 3. While effecting the movement of switch UTTR from its position 10 to its normal position, relay 818 does not effect the operation of totalizing machine UDG T in the manner above described, because the operating circuit of operating magnet OMUG through contacts *c* of relays 808 and 818 is now open at the contacts *b* of relay 814.

In position 3 of switch UTCO, relays 702 to 705 inclusive are selectively energized in accordance with the units digit being displayed by another of the feature indicators I—2 to I—12, and then switch UTTR and its associated relays are operated, in the manner above described, to effect the transmission to operating magnet OMUG of a series of impulses corresponding in number to the units digit being displayed, after which switch UTTR is restored to its normal position and switch UTCO is moved to its next position. This cycle of operation is repeated in each of the positions 4 to 13, inclusive, of switch UTCO so that the total number of impulses transmitted to operating magnet OMUG while the switch UTCO is in positions 2 to 13, inclusive, equals the sum of the units digits being displayed by the indicators I—1 to I—12, inclusive.

In case any one of the features in group W is locked out, none of the relays 702 to 705 inclusive is energized when switch UTCO connects these relays to the indicator of this locked-out feature. Therefore, since the circuit through conductor 750 is opened when all of the relays 702 to 705 inclusive are simultaneously deenergized, relay 815 does not become energized in position 1 of switch UTTR when switch UTCO reaches the position allotted to a locked-out feature. Time relay 813, however, is energized in the manner above described while switch UTTR is in position 1 and, by closing its contacts *a*, relay 813 completes a circuit through contacts *b* of relay 815, conductor 851 and winding of operating magnet OMU to effect in the manner above described the movement of switch UTCO to its next position. Therefore, when switch UTCO reaches a position allotted to a feature which is locked out, it is advanced to its next position without effecting the movement of switch UTTR through its various positions.

In order that totalizing machine TDGT may be advanced one step each time totalizing machine

UDGT receives ten impulses, a circuit for the operating magnet OMTG is completed each time the relay 818 is energized in position 10 of totalizing machine UDG T, this circuit being through contacts *b* of relay 717, conductor 801, wiper and contact 10 of bank *c* of totalizing machine UDG T, contacts *a* of relay 819, which is energized in position 10 of totalizing machine UDG T, contacts *a* of relay 822 which is energized whenever relay 814 is deenergized and switch UTTR is in any of its off-normal positions, contact *e* of relay 818, contacts *c* of relay 815, contacts *e* of relay 808 and winding of operating magnet OMTG. Therefore, when relay 818 becomes deenergized to move totalizing machine UDG T from its position 10 to its normal position, operating magnet OMTG is deenergized to advance totalizing machine TDGT one step.

When switch UTCO reaches position 14, the circuit through conductor 762 to the winding of relay 808 is opened and remains open through positions 14 to 25 of this switch. Relay 808, therefore, becomes deenergized and transfers the connections, which are completed through the contacts *c* of relay 818 when this relay is energized, so that this relay effects the energization and deenergization of operating magnet OMTG instead of the energization and deenergization of operating magnet OMUG.

In the arrangement shown in the drawings, contacts 14 of banks *f*, *e*, *d* and *c* of switch UTCO are respectively connected to conductors LT—1, LT—2, LT—3 and LT—4 so that the relays 702 to 705, inclusive, are selectively energized in position 14 of this switch in accordance with the digit that is being displayed by the tens digit indicator I—B of indicator I—1 for feature No. 1. For the purpose of this description, it will be assumed that the tens digit being displayed by indicator I—B is the digit 8 so that only relay 705 is energized when switch UTCO stops in position 14. The relay 705 effects, in the manner above-described, the operation of switch UTTR so that it moves through its various positions, and each energization of relay 818, while switch UTTR is in positions 2 to 9, inclusive, now completes a circuit for operating magnet OMTG through contacts *b* of relay 814, wiper and contact of bank *d* of switch UTTR, contacts *c* of relay 818, contacts *b* of relay 808 and winding of operating magnet OMTG. Consequently, operating magnet OMTG is energized and deenergized eight times to cause totalizing machine TDGT to advance eight steps while switch UTCO is in position 14.

When switch UTTR is restored to its normal position and relay 814 is again deenergized, the movement of switch UTCO to its position 15 is effected, in which position the relays 702 to 705, inclusive, are selectively energized in accordance with the tens digit then being displayed by another of the tens indicators 1B to 12B, inclusive. Switch UTTR and its associated relays are then operated in a manner similar to that above described to effect the transmission to operating magnet OMTG of a series of impulses corresponding in number to the tens digit. This cycle of operation is repeated in each of the positions 15 to 25, inclusive, so that the total number of impulses transmitted to operating magnet OMTG while switch UTCO is in position 14 to position 25, inclusive, equals the sum of the tens digits being displayed by the tens indicators 1B to 12B, inclusive.

In order that totalizing machine HDGT may be advanced one step each time totalizing machine

chine TDGT receives ten impulses, a circuit is arranged to be completed to accomplish this result each time operating magnet OMTG is operated to effect the movement of totalizing machine TDGT from its position 10 to its normal position. This circuit is through contacts *d* of relay 717, conductor 802, wiper and contact 10 of bank *c* of totalizing machine TDGT, contacts of relay 820, which is energized when the totalizing machine TDGT is in position 10, contacts *a* of operating magnet OMTG, conductor 854 and winding of relay 828. By closing its contacts *c*, relay 828 completes a circuit through contact *b* of operating magnet OMHG, conductor 803, contacts *c* of relay 828 and winding of relay 809. By closing its contacts *a*, relay 809 completes a locking circuit for itself through contacts *a* of relay 828. By closing its contacts *e*, relay 809 completes a circuit through conductor 804 for the winding of operating magnet OMHG. Therefore, when the operating magnet OMTG is deenergized to move totalizing machine TDGT from position 10 to its normal position, relays 828 and 809 and operating magnet OMTG are successively deenergized to cause totalizing machine TDGT to advance one step.

When either relay 828 or 809 is energized the contacts *k* thereof complete a circuit through the winding of time relay 821 conductor 831, contacts 780 of relay 724W, conductor 781 and winding of operating magnet OMSS, thereby insuring that switch UTTR is not advanced to its next position prior to the relays 828 and 809 effecting the proper operation of operating magnet OMHG. If for any reason either relay 829 or 809 should remain energized an abnormally long time, relay 821 closes its contacts *a* to complete a circuit for a suitable signal 840.

In a similar manner totalizing machine THGT is advanced one step each time totalizing machine HDGT is moved from its position 10 to its normal position and totalizing machines TTGT and HTGT are advanced one step each time totalizing machines THGT and TTGT respectively are moved from their positions 10 to their normal positions.

When switch UTCO returns to its normal position relay 724—W again is energized and when the similar switches associated with the other totalizing machines such as TOT—P and TOT—S in Fig. 1 are restored to their normal positions, similar relays 724—P and 724—S are energized. When these three relays 724—W, 724—P and 724—S are simultaneously energized, thereby indicating that all of the values registered on the various adding machines have been added to the totals of the respective totalizing machines, a circuit is completed through contact *b* of switch RST, conductor CH, contacts *a* of relay 724—S, contacts *a* of relay 724—P, contacts *a* of relay 724—W, conductor CH—1 and winding of time relay C, and also from conductor CH—1 through contacts *b* of relay C, wiper and contact 1 of bank *e* of switch S—1, contacts *b* and winding of operating magnet OMS. Operating magnet OMS then produces, in the manner heretofore described, another cycle of operation of the sequence control apparatus to cause the indicators associated with the various totalizing machines to indicate the final grand totals which are now registered thereon. Before switch S—1 completes its cycle of operation, time relay C opens its contacts *b* so that when the switch S—1 again reaches its normal position, and the operation of the magnet OMS is again effected to start another

cycle of operation of the sequence control apparatus.

Resetting operation

After the sale of tickets has been stopped and the final indications of the various totals have been displayed, the steward may reset the equipment by operating switch RST so that a circuit is completed through its contacts *a* and conductor *y* to the windings of the reset relays for all of the adding and totalizing machines. Also, by opening its contacts *b*, switch RST interrupts the heretofore described circuit for relay C.

In the arrangement shown in the drawings, the windings of relay 519, 612, 701, 717, 920 and 901 are connected to the conductor *y* so that they are energized when switch RST is in its displaced position.

By closing its contacts *a*, relay 519 completes a notching circuit through conductor 440, wiper and an off-normal contact of bank *a* of adding machine 2D—1, contacts *b* and winding of operating magnet OM2D so that adding machine 2D—1 is restored to its normal position. By closing its contacts *c*, relay 519 completes a notching circuit through conductor 441, wiper and an off-normal contact of bank *a* of adding machine 2D—2, contact *b* and winding of operating magnet OM2D' so that adding machine 2D—2 is restored to its normal position. By closing its contacts *e*, relay 519 completes a notching circuit through wiper and an off-normal contact of bank *a* of adding machine 5D, contact *b* and winding of operating magnet OM5D, so that adding machine 5D is restored to its normal position. By closing its contacts *g*, relay 519 completes a circuit through contacts *b* of operating magnet OM10D, wiper and an off-normal contact of bank *a* of adding machine 10D, contacts *g* of relay 519 and winding of operating magnet OM10D so that adding machine 10D is restored to its normal position.

By closing its contacts *a*, relay 612 completes a notching circuit through contacts *b* of operating magnet OMF, wiper and off-normal contact of bank *a* of adding machine 50D, contacts *a* of relay 612 and winding of operating magnet OMF so that adding machine 50D is restored to its normal position. By closing its contacts *c* and *g*, relay 612 completes a notching circuit through contacts *b* of operating magnet OMH, contacts *c* of relay 612, wiper and off-normal contacts of bank *a* of adding machine 100D, contacts *g* of relay 612 and winding of operating magnet OMH so that adding machine 100D is restored to its normal position.

By closing its contacts *a*, relay 701 completes a notching circuit through the wiper and off-normal contact of bank *a* of adding machine THD, contact *b* and winding of operating magnet OMT so that adding machine THD is restored to its normal position. By closing its contacts *c*, relay 701 completes a circuit through wiper and off-normal contacts of bank *a* of adding machine TDT, contacts *b* and winding of operating magnet OMTT so that adding machine TTD is restored to its normal position.

By closing its contacts *a*, relay 717 completes a circuit through the wiper and off-normal contacts of bank *a* of switch UTCO, contacts *b* and winding of OMU so that if the switch UTCO is not in its normal position it is restored thereto.

By closing its contacts *c*, relay 717 completes a notching circuit through conductor 770, wiper and off-normal contacts of bank *a* of totalizing machine UDGT, contacts *b* and winding of oper-

ating magnet OMUG so that totalizing machine UDG T is restored to its normal position. By closing its contacts *e*, relay 717 completes a notching circuit through conductor 711, wiper and off-normal contacts of bank *a* of totalizing machine TDGT, contacts *b* and winding of operating magnet OMTG so that the totalizing machine TDGT is restored to its normal position.

By closing its contacts *a* and *c*, relay 920 completes a notching circuit through contacts *b* of operating magnet OMHG, contacts *a* of relay 920, wiper and off-normal contacts of bank *a* of totalizing machine HDGT, contacts *c* of relay 920 and winding of operating magnet OMHG so that totalizing machine HDGT is restored to its normal position. By closing its contacts *e*, relay 920 completes a notching circuit through the wiper and off-normal contacts of bank *a* of totalizing machine THGT, contacts *b* and winding of operating magnet OMTHG so that totalizing machine THGT is restored to its normal position.

By closing its contacts *a*, relay 991 completes a notching circuit through the wiper and off-normal contacts of bank *a* of totalizing machine TTGT and contacts *b* and winding of operating magnet OMTTG so that totalizing machine TTGT is restored to its normal position.

By closing its contacts *c*, relay 991 completes a notching circuit through the wiper and off-normal contacts of bank *a* of totalizing machine HTGT, contacts *b* and winding of operating magnet OMHTG so that totalizing machine HTGT is restored to its normal position.

The operator maintains the key RST in its depressed position until all of the units and tens digit indicators for the various features which have not been locked out display the digit zero and no digits are displayed by the other indicators. When the operator releases the key RST, the closing of its contacts *b* again completes the circuit heretofore described for relay C and the operating magnet OMS for switch S—1 so that the sequence control apparatus goes through another cycle of operation in order to check that all of the adding and totalizing machines which have not been locked out have been properly reset.

While I have, in accordance with the patent statutes, shown and described my invention as applied to a particular system and as embodying various devices diagrammatically indicated, changes and modifications will be obvious to those skilled in the art, and I therefore aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a totalizing system, ticket issuing machines for issuing tickets of different denominations for each of a plurality of features, an electric impulse adding machine for each feature, means controlled by said ticket issuing machines for transmitting to the proper feature adding machine to effect the operation thereof an electric impulse representing the value of each ticket issued by said ticket issuing machines for the corresponding feature, control means for stopping all of said ticket issuing machines from issuing any more tickets, a totalizing machine, means for normally effecting the operation of said totalizing machine only when the total registered on any feature adding machine reaches a predetermined amount which is greater than the minimum value represented by said electric impulses or a multiple of said predetermined amount, and means for

causing said totalizing machine to add to its total after the issuance of tickets has been stopped the remaining portion of the total registered on each feature adding machine which previously had not been registered on the totalizing machine.

2. In a totalizing system, ticket issuing machines for issuing tickets of different denominations for each of a plurality of features, an electric impulse adding machine for each feature, means controlled by said ticket issuing machine for transmitting to the proper feature adding machine to effect the operation thereof an electric impulse representing the value of each ticket issued by said ticket issuing machines for the corresponding feature, control means for stopping all of said ticket issuing machines from issuing any more tickets, a totalizing machine normally totalizing only each hundred of the total registered on each feature adding machine, and means for causing said totalizing machine to add to its total the units and tens of the totals registered on each feature adding machine after the issuance of tickets has been stopped.

3. In combination, an adding machine, means for varying the total registered on said machine, indicating means including a group of electric lamps for each digit of the total registered on said machine, means for sequentially effecting the locking of said adding machine against operation by said first-mentioned means and then the selective lighting of said lamps in each group in accordance with the corresponding digit of the total then registered on said machine and then the releasing of said adding machine for operation by said first-mentioned means, means for effecting the operation of said sequence means at the expiration of predetermined definite time intervals, and means for maintaining the lamps in each group selectively lighted during each time interval in accordance with the corresponding digits of the total registered on said machine at the beginning of the time interval and irrespective of any change that occurs in the total during the time interval.

4. In combination, an adding machine, means for varying the total registered on said machine, indicating means for displaying the total registered on said machine, means for sequentially effecting the locking of said adding machine against operation by said first-mentioned means and then a change in the total displayed by said indicating means so that it corresponds to the total then registered on said machine and then the releasing of said adding machine for operation by said first-mentioned means, means for effecting the operation of said sequence means at the expiration of predetermined definite time intervals, and means for maintaining displayed during each time interval the total registered on said adding machine at the beginning of the time interval.

5. In combination, an adding machine, means for varying the total registered on said machine, indicating means including a source of current, a group of electric lamps for each digit of the total registered on said machine, and a group of relays associated with each group of lamps for selectively controlling the connections between the associated lamps said source, and means for sequentially effecting the locking of said adding machine against operation by said first mentioned means, the disconnection of said source from said lamps, the deenergization of all of said relays and the subsequent selective completion of energizing and holding circuits for the relays in each group

in accordance with the corresponding digit of the total registered on said machine while it is stopped, and then the release of said adding machine and the reconnection of said lamps to said source while maintaining the holding circuits completed, and means for effecting the operation of said sequence means at the expiration of predetermined definite time intervals.

6. In combination, a plurality of adding machines, means for effecting the operation of each adding machine to add a plurality of different values, a totalizing machine, means normally operative to effect the operation of said totalizing machine only when the total registered on any adding machine reaches a predetermined amount which is greater than the minimum of said values or a multiple of said predetermined amount, and means operative under a predetermined condition of said first mentioned means for effecting the operation of said totalizing machine to add to its total the totals below said predetermined amount which are then registered on said adding machines.

7. In combination, a plurality of electric impulse adding machines, means for transmitting to each adding machine to be added thereby electric impulses representing different predetermined values, an electric impulse totalizing machine, means normally operative to transmit to said totalizing machine an electric impulse in response to only each increase in the total registered on any adding machine of a predetermined amount which is greater than said predetermined values, and means for rendering said first mentioned transmitting means inoperative to transmit additional electric impulses to said adding machines and for transmitting to said totalizing machine electric impulses representing the totals below said predetermined amount which are then registered on said adding machines.

8. In combination, a plurality of electric impulse adding machines, each adding machine including means for counting electric impulses which respectively represent values of ten, values of less than ten and values of predetermined multiples of ten, means for transmitting to each adding machine electric impulses representing said values, a totalizing machine, means normally operative to effect the operation of said totalizing means in response to only each increase of a hundred in the total registered on each adding machine, and means for rendering said transmitting means inoperative to transmit additional impulses to said adding machines and for effecting the operation of said totalizing means to add to its total the totals of less than a hundred registered on said adding machines.

9. In combination, an adding machine including a plurality of counting devices for respectively counting different predetermined values and means for normally transferring to the total on one of said counting devices which counts values of a relative high value a predetermined amount from the total registered on all of the other counting devices which count values below said predetermined amount each time the total registered on all of said other counting devices equals said predetermined amount under certain conditions of said counting devices and each time the total registered on all of said other counting devices exceeds a predetermined amount which is greater than said first mentioned predetermined amount under other conditions of said counting devices, indicating means for displaying the total registered on said adding machine, and means

operative periodically to effect the operation of said indicating means in accordance with the exact total registered on all of said counting devices including means for effecting a premature transfer of said first mentioned amount to said one of said counting devices before effecting the operation of the indicating means of the total registered on all of said other counting devices equals said first predetermined amount but said other conditions of said counting devices exist so as to prevent a normal transfer.

10. In combination, an adding machine including a plurality of counting devices for respectively counting different predetermined values of less than a hundred and a counting device for counting values of a hundred and means for normally transferring to the total on said last mentioned counting device a value of a hundred from the total registered on said plurality of counting devices each time the total registered on said plurality of counting devices equals a value of a hundred under certain conditions of said plurality of counting devices and each time the total registered on said plurality of counting devices equals another predetermined value in excess of a hundred under other conditions of said plurality of counting devices, indicating means for displaying the units and tens digits of the total registered on said machine, other indicating means for displaying the hundreds digit of the total registered on said machine, and means operative periodically to effect the operation of said first mentioned indicating means in accordance with the total registered on all of said plurality of counting devices and the operation of said second mentioned indicating means in accordance with the number of hundreds registered on said hundred value counting device including means for effecting a premature transfer of a value of a hundred to said last mentioned counting device before the operations of said indicating means are effected if the total registered on said plurality of counting devices equals a hundred but the conditions thereof are such as to prevent a normal transfer.

11. In combination, a plurality of adding machines, each machine including a plurality of counting devices for respectively counting different predetermined values and means for normally transferring to the total on one of said counting devices which counts values of a relative high value a predetermined amount from the total registered on all of the other counting devices which count values below said predetermined amount each time the total registered on all of said other counting devices equals said predetermined amount under certain conditions of said counting devices and each time the total registered on all of said other counting devices exceeds a predetermined amount which is greater than said first mentioned predetermined amount under other conditions of said counting devices, a totalizing machine for totalizing the totals registered on all of said one of said counting devices, indicating means for respectively displaying the totals registered on each adding machine and said totalizing machine, and means operative periodically to effect the operation of said indicating means in accordance with the totals registered on each adding machine and said totalizing machine including means for effecting in each adding machine a premature transfer of said first mentioned amount to said one of said counting devices of the adding machine before effecting the operation of said indicating means if the total registered on all of said other counting devices of the

adding machine equals said first mentioned amount but said other conditions of the counting devices exist so as to prevent a normal transfer.

12. In combination, a plurality of adding machines, each machine including a plurality of counting devices for respectively counting values of two, five, ten and a hundred, means for normally transferring a value of a hundred to the total on the counting device which counts values of a hundred from the total registered on all of the other counting devices each time the total registered on all of said other counting devices of the adding machine equals a hundred if there is an even number of five values registered on the counting device which counts values of five and each time the total registered on all of the other counting devices of the adding machine equals a predetermined amount above a hundred if there is an odd number of five values registered on the counting device which counts values of five, a totalizing machine for totalizing the totals registered on all of said counting devices which count values of a hundred, indicating means for displaying the totals registered on each adding machine and said totalizing machine, and means operative periodically to effect the operation of said indicating means in accordance with the totals registered on each adding machine and said totalizing machine including means for effecting in each adding machine a premature transfer of a hundred to the counting device thereof which counts values of a hundred and the inclusion of this prematurely transferred amount in the total registered on the totalizing machine before the operation of said indicating means if the total registered on all of said other counting devices of the adding machines equals a hundred but the condition of said counting devices are such as to prevent a normal transfer.

13. In combination, an electric impulse counting device including a switch having a plurality of successive positions, a relay and means responsive to each deenergization of said relay for effecting the movement of said switch to its next position, means for transmitting electric impulses representing a predetermined value to said relay, a second electric impulse counting device including a second switch having a plurality of successive positions, a second relay and means responsive to each deenergization of said second relay for effecting the movement of said second switch to its next position, means for transmitting electric impulses representing a predetermined value to said second relay, a third electric impulse counting device, and means responsive to the energization of either of said relays by an impulse which when subsequently registered on its respective counting device will bring the sum of the totals registered on both of said first-mentioned counting devices to a predetermined value which is a multiple of the values represented by said impulses for transmitting to said third counting device an electric impulse through series connected contacts of both of said switches and of the energized relay.

14. In combination, an electric impulse counting device including a switch having a plurality of successive positions, a relay and means responsive to each deenergization of said relay for effecting the movement of said switch to its next position, means for transmitting electric impulses representing a predetermined value to said relay, a second electric impulse counting device including a second switch having a plurality of successive positions, a second relay and means re-

sponsive to each deenergization of said second relay for effecting the movement of said second switch to its next position, means for transmitting electric impulses representing a predetermined value to said second relay, a third electric impulse counting device, and means responsive to the simultaneous energization of both of said relays by impulses which when subsequently registered on their respective counting devices will bring the sum of the totals registered on both of said first-mentioned counting devices to a predetermined value which is a multiple of the values represented by said impulses for transmitting to said third counting device an electric impulse through series connected contacts of both of said switches and both of said relays.

15. In combination, an electric impulse counting device including a switch having a plurality of successive positions, a relay and means responsive to each deenergization of said relay for effecting the movement of said switch to its next position, means for transmitting electric impulses representing a predetermined value to said relay, a second electric impulse counting device including a second switch having a plurality of successive positions, a second relay and means responsive to each deenergization of said second relay for effecting the movement of said second switch to its next position, means for transmitting electric impulses representing a second predetermined value to said second relay, a third electric impulse counting device, and means responsive to the energization of either of said relays by an impulse which when subsequently registered on its respective counting device will bring the sum of the totals registered on both of said two first-mentioned counting devices to a predetermined value which is a multiple of said first two predetermined values for transmitting an impulse to said third counting device.

16. In combination, an electric impulse counting device including a switch having a plurality of successive positions, a relay and means responsive to each deenergization of said relay for effecting the movement of said switch to its next position, means for transmitting electric impulses representing a predetermined value to said relay, a second electric impulse counting device including a second switch having a plurality of successive positions, a second relay and means responsive to each deenergization of said second relay for effecting the movement of said second switch to its next position, means for transmitting electric impulses representing a second predetermined value to said second relay, a third electric impulse counting device, and means responsive to the simultaneous energization of both of said relays by impulses which when subsequently registered on their respective counting devices will bring the sum of the impulses registered on both of said two first-mentioned counting devices to a third predetermined value which is a multiple of said first two predetermined values for transmitting an impulse to said third counting device.

17. In combination, an electric impulse counting device including a switch having a plurality of successive positions, a relay and means responsive to each deenergization of said relay for effecting the movement of said switch to its next position, means for transmitting electric impulses representing a predetermined value to said relay, a second electric impulse counting device including a second switch having a plurality of successive positions, a second relay and means responsive to each deenergization of said second

relay for effecting the movement of said second switch to its next position, means for transmitting electric impulses representing said predetermined value to said second relay, a third electric impulse counting device, and means responsive to the energization of either of said relays while said two first-mentioned counting devices occupy positions due to a total of $N-1$ impulses of said predetermined value being registered thereon for transmitting an impulse representing a value of N times said predetermined value to said third electric impulse counting device.

18. In combination, an electric impulse counting device including a switch having a plurality of successive positions, a relay and means responsive to each deenergization of said relay for effecting the movement of said switch to its next position, means for transmitting electric impulses representing a predetermined value to said relay, a second electric impulse counting device including a second switch having a plurality of successive positions, a second relay and means responsive to each deenergization of said second relay for effecting the movement of said second switch to its next position, means for transmitting electric impulses representing said predetermined value to said second relay, a third electric impulse counting device, and means responsive to the simultaneous energization of both of said relays while said two first-mentioned counting devices occupy positions due to a total of $N-2$ impulses of said predetermined value being registered thereon for transmitting an impulse representing a value of N times said predetermined value to said third electric impulse.

19. In combination, two electric impulse counting devices, a group of electric impulse transmitting stations, each station of which is arranged to produce electric impulses representing a predetermined value, a second group of electric impulse transmitting stations, each station of which is arranged to produce electric impulses representing said predetermined value, multiple position switching means for simultaneously associating in predetermined successive positions thereof one of said counting devices with a different station in said first group and the other counting device with a different station in said second group whereby an electric impulse is transmitted to each counting device in each of said predetermined positions of said switching means if the associated station is in a predetermined condition, a third electric impulse counting device, and means operative to effect the transmission of an electric impulse representing a second predetermined value which is a multiple of said first mentioned predetermined value to said third counting device each time the sum of the totals registered on both of said two counting devices equals said second predetermined value while maintaining said switching means in whatever position it may be in when said sum equals said second predetermined value.

20. In combination, an electric impulse counting device, means for transmitting electric impulses to said device, each impulse representing a predetermined value, indicating means, means for operating said indicating means while maintaining said impulse transmitting means inoperative to transmit impulses to said device so that said indicating means indicates the amount then registered on said counting device, means for effecting the operation of said operating means at the expiration of predetermined definite time intervals, and means for causing said indicating

means to indicate during each time interval the amount registered on said counting device at the beginning of the time interval and irrespective of any change that occurs in the total registered on the counting device during the time interval.

21. In combination, a plurality of electric impulse counting devices, means for transmitting electric impulses to each device, indicating means, means for operating said indicating means while maintaining said impulse transmitting means inoperative to transmit impulses to said devices so that said indicating means indicates the sum of all of the amounts then registered on said counting devices, means for effecting the operation of said operating means at the expiration of predetermined definite time intervals, and means for causing said indicating means to indicate during each time interval the sum of all of the amounts registered on said counting devices at the beginning of the time interval and irrespective of any change that occurs in the sum during the time interval.

22. In combination, two electric impulse counting devices, means for transmitting to one of said counting devices electric impulses each of which represents a predetermined value and for transmitting to the other counting device electric impulses each of which represents another predetermined value greater than but not a multiple of said first mentioned predetermined value, a plurality of groups of electric lamps, and means controlled by said counting devices for selectively lighting said groups of lamps so as to form the digits of the sum of the totals registered on said counting devices.

23. In combination, two electric impulse counting devices, means for transmitting to one of said counting devices electric impulses each of which represents a predetermined value and for transmitting to the other counting device electric impulses each of which represents another predetermined value greater than but not a multiple of said first mentioned predetermined value, a plurality of groups of electric lamps, and means for periodically interconnecting electrically said groups of lamps and said counting devices so that said groups of lamps are selectively lighted to form the digits of the sum of the totals then registered on said counting devices.

24. In combination, a plurality of impulse counting devices, means for transmitting to each of said counting devices electric impulses each of which represents a predetermined value, another electric impulse counting device, means for transmitting to said last mentioned impulse counting device electric impulses each of which represents another predetermined value greater than but not a multiple of said first mentioned predetermined value, a plurality of groups of electric lamps, and means controlled by said counting devices for selectively lighting said groups of lamps so as to form the digits of the sum of the totals registered on said counting devices.

25. In combination, a plurality of feature adding machines, means for effecting the operation of each feature adding machine so as to increase the total registered thereon by different increments of less than 100, a totalizing machine, means normally operative sequentially to connect said totalizing machine to said feature adding machines so as to cause said totalizing machine to totalize each increase in the hundreds digit of the total registered on each feature adding machine, and means for effecting the sequential

connection of said totalizing machine to said feature adding machines so as to cause said totalizing mechanism to add to its total the sum of the units and tens digits of the amounts registered on all of the feature adding machines.

26. In combination, a plurality of feature adding machines, means for effecting the operation of each feature adding machine so as to increase the total registered thereon by different amounts, a totalizing machine, means normally operative sequentially to connect said totalizing machine to said feature adding machines so as to cause said totalizing machine to totalize the total in excess of a predetermined amount registered on each feature adding machine, said predetermined amount being greater than the minimum increase that can be made in the total registered on each feature adding machine, and means for effecting the connection of said totalizing machine to said feature adding machines so as to cause said totalizing machine to add to the total registered thereon that remaining portion of the total registered on each feature adding machine which has not been totalized by the totalizing machine.

27. In combination, a plurality of feature adding machines, means for increasing the total registered on each adding machine by different increments of less than a predetermined amount, a totalizing machine, means for sequentially connecting said totalizing machine to said adding machine so as to totalize only that portion of the total then registered on each adding machine in excess of said predetermined amount, and means for sequentially associating said totalizing machine with said adding machine so as to totalize the remainder of the total then registered on each adding machine and not included in the total registered on the totalizing machine.

28. In combination, a plurality of feature adding machines, each adding machine including means for transmitting electric impulses representing different predetermined values, electric impulse counting devices controlled by said impulses and impulse storing means controlled by said counting devices so that an electric impulse is stored therein in response to each increase of a predetermined amount in the total registered on the associate adding machine, said predetermined amount being greater than the value represented by some of said impulses, a totalizing machine, means for sequentially connecting said totalizing machine to said feature adding machines, and means controlled by said impulse storing means for causing said totalizing machine to increase its total said predetermined amount each time said totalizing machine is associated with a feature adding machine whose associate storing means has impulses stored therein representing amounts not totalized by the totalizing machine.

29. In combination, a plurality of feature adding machines, each adding machine including means for transmitting electric impulses representing different predetermined values, electric impulse counting devices controlled by said impulses, and impulse storing means controlled by said counting devices so that an electric impulse is stored therein in response to each increase of a predetermined amount in the total registered on the associate adding machine, said predetermined amount being greater than value represented by some of said impulses, a totalizing machine, means for sequentially connecting said totalizing machine to said feature adding machines, means controlled by said impulse stor-

ing means for causing said totalizing machine to increase its total said predetermined amount each time said totalizing machine is associated with a feature adding machine whose associate storing means has impulses stored therein representing amounts not totalized by the totalizing machine, and means for rendering said electric impulse transmitting means inoperative to transmit impulses to the counting devices of a feature adding machine when the number of impulses stored in the associate storing means represents a predetermined amount not totalized by the totalizing machine.

30. In combination, a plurality of feature adding machines, means for increasing the total registered on each adding machine by increments of less than a predetermined amount, indicating means respectively associated with said feature adding machine for displaying the exact totals registered on each machine, a totalizing machine, means for sequentially connecting said totalizing machine to said adding machines so as to totalize only that portion of the total then registered on each adding machine which is in excess of said predetermined amount, and indicating means associated with said totalizing machine for displaying the exact total registered thereon.

31. In combination, a plurality of indicating devices, each device including a group of electric lamps and a group of relays having their contacts so interconnected with said lamps that they may be lighted to display any one of a predetermined number of digits by selectively operating said relays, means for selectively energizing each group of relays to cause the associated group of lamps to display a predetermined digit, a totalizing machine including an electric impulse counting device, means for sequentially connecting said totalizing machine to each group of relays, and means selectively controlled by each group of relays when connected to said totalizing machine for effecting the transmission to said counting device of a number of impulses dependent upon the digit being displayed by the associate group of lamps.

32. In combination, a plurality of feature adding machines, means for varying the total registered on each adding machine, indicating means respectively associated with said feature adding machines for displaying the totals registered thereon, each indicating means including a group of lamps for displaying the units digit of the total registered on the respective adding machine, another group of lamps for displaying the tens digit of the total registered on the respective adding machine, a group of relays for selectively controlling the lighting of said first mentioned group of lamps, a second group of relays for selectively controlling the lighting of said second mentioned group of lamps, means for selectively operating said first mentioned group of relays in accordance with the units digit of the total registered on the respective adding machine, and means for selectively operating said second mentioned group of relays in accordance with the tens digit of the total registered on the respective adding machine, a totalizing machine including two electric impulse counting devices, means for sequentially connecting said totalizing machine to said groups of relays, and means selectively controlled by each of said first mentioned group of relays when connected to said totalizing means for effecting the transmission to one of said counting devices of a number of impulses

corresponding to the digit then being displayed by the associate group of lamps and controlled by each of said second mentioned group of relays when connected to said totalizing means for effecting the transmission to the other counting device of a number of impulses corresponding to the digit then being displayed by the associate group of lamps.

33. In combination, an electric impulse counting device, a movable control device, means for periodically associating said counting device with said control device, a ticket issuing machine including normally idle motor driven mechanism for issuing tickets, means responsive to the movement of said control device to a predetermined position for transmitting an electric impulse to said counting device the next time said counting device is associated with said control device after said control device has been moved to said predetermined position and also for immediately starting said motor driven mechanism into operation independently of the transmission of said impulse, and means controlled by said electric impulse for preventing said mechanism from issuing a second ticket until after said electric impulse has been transmitted.

34. In combination, an electric impulse counting device, a plurality of ticket issuing machines each machine including normally idle motor driven mechanism for issuing tickets, a movable control device, automatic switching means for successively associating said counting device with a different control device, means responsive to the movement of a control device to a predetermined position for transmitting a single electric impulse to said counting device the next time said counting device is associated with the operated control device by said automatic switching means after the control device has been moved to said predetermined position and also for immediately starting the motor driven mechanism of the associated ticket issuing machine into operation independently of the transmission of said impulse to the counting device, and means controlled by said current impulse for preventing said mechanism from issuing a second ticket until after the electric impulse representing the previous ticket issued thereby has been transmitted.

35. In combination, an electric impulse counting device, a plurality of ticket issuing machines each machine including normally idle motor driven mechanism for issuing tickets, a movable control device associated with each machine, automatic switching means for successively associating said counting device with a different control device, means responsive to the movement of a control device to a predetermined position for transmitting a single electric impulse to said counting device the next time the operated control device is associated with said counting device by said automatic switching means and also for immediately starting the motor driven mechanism of the associated ticket issuing machine into operation independently of the transmission of said impulse to the counting device, means for preventing a ticket issuing machine from issuing more than one ticket in response to each movement of the associated control device to said predetermined position, and means controlled by each impulse for rendering the ticket issuing ma-

chine with which the counting device is then associated operative to issue another ticket.

36. In combination, an electric impulse counting device including a relay, a ticket issuing machine including normally idle motor driven mechanism for issuing tickets, a multiple-position control device associated with each machine, a marginal relay associated with each control device, means for periodically associating said counting device with said control device, means responsive to the movement of said control device to a predetermined position for completing a high resistance series circuit through windings of both of said relays the next time said counting device is associated with said control device to effect the operation of said counting device relay only and also for immediately starting said motor driven mechanism into operation independently of the completion of said circuit, means for locking said control device in said predetermined position, means responsive to the operation of said counting device relay for initiating the operation of said counting device, means controlled by the operation of said counting device for increasing the current through said marginal relay to effect the operation thereof, and means responsive to the operation of said marginal relay for interrupting said circuits and for unlocking said control device.

37. In combination, an electric impulse counting device including a relay, a plurality of ticket issuing machines each machine including normally idle motor driven mechanism for issuing tickets, a manually controlled multiple-position control device associated with each machine, a marginal relay associated with each control device, automatic switching means for successively associating said counting device with a different control device, means operative when said counting device is associated with a control device which is in a predetermined position for stopping the operation of said switching means so as to maintain said counting device associated with the operated control device, means for completing a relatively high impedance series circuit through a winding of said counting device relay and a winding of the marginal relay of a control device in said predetermined position when it is associated with said counting device to effect the operation of said counting device relay only, means responsive to the movement of a control device to said predetermined position for immediately starting the motor driven mechanism of the associated ticket issuing machine into operation independently of the completion of said circuit, means for locking each control device in said predetermined position, means responsive to the operation of said counting device relay for initiating the operation of said counting device, means controlled by the operation of said counting device for increasing the current through the winding of said marginal relay to effect the operation thereof, and means responsive to the operation of said marginal relay for effecting the interruption of said circuits and the restarting of said switching means into operation and the release of the control device with which the operated marginal relay is associated so that the control device can be reoperated to issue another ticket.

ARTHUR J. JOHNSTON.