

Feb. 16, 1937.

C. E. STEWART ET AL

2,071,184

INDICATING SYSTEM

Filed Jan. 26, 1929

3 Sheets-Sheet 1

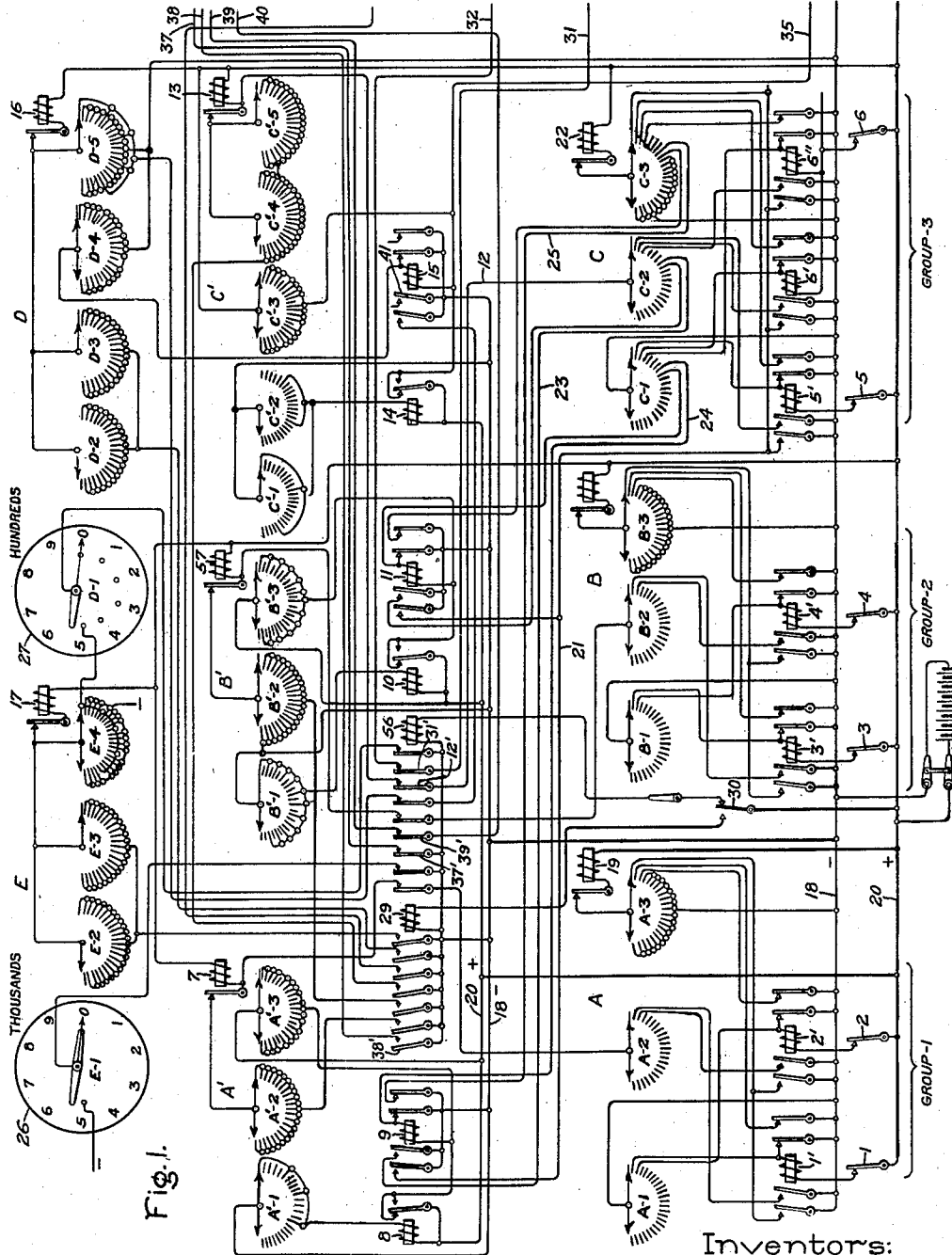


Fig. 1.

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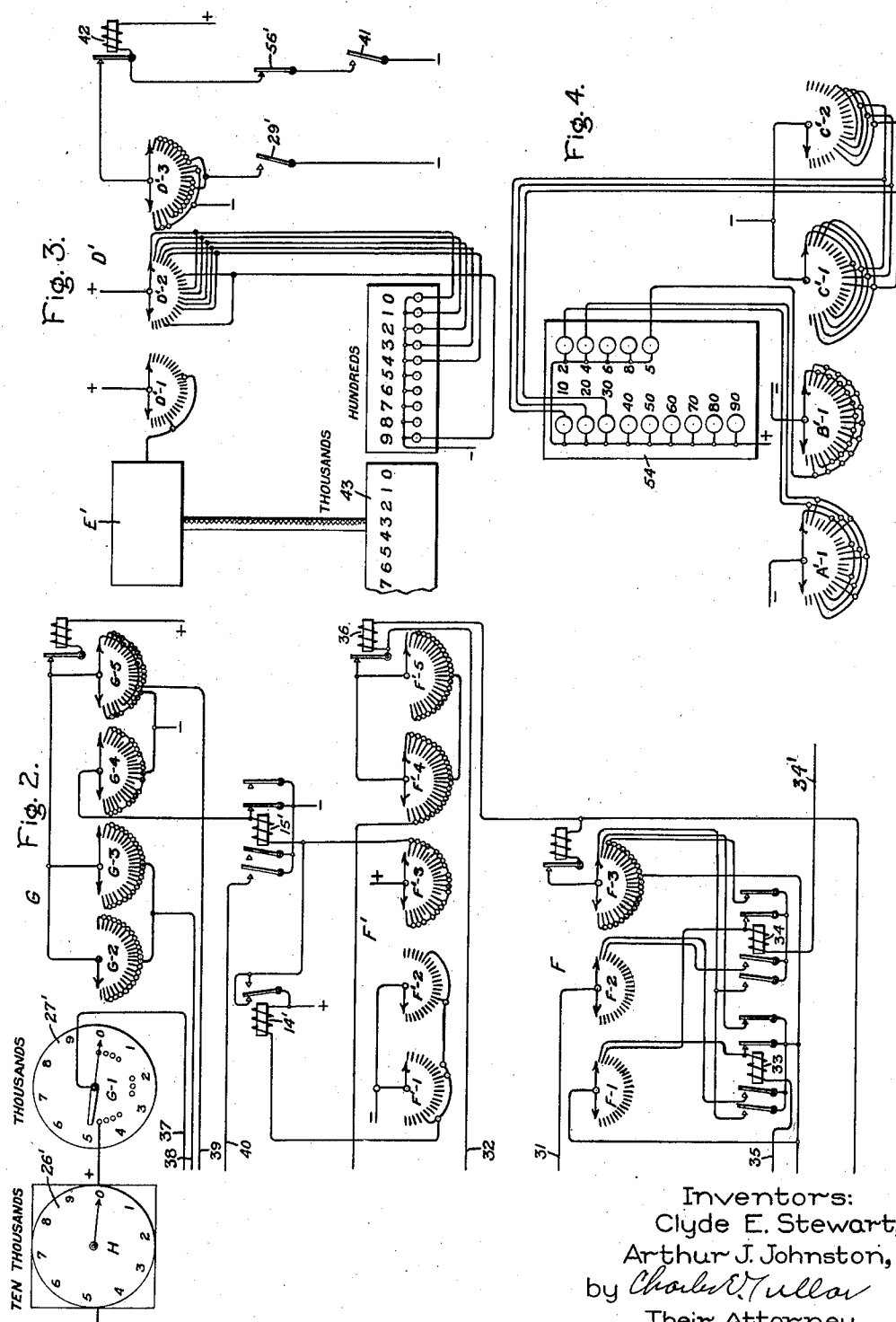
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3 Sheets-Sheet 3

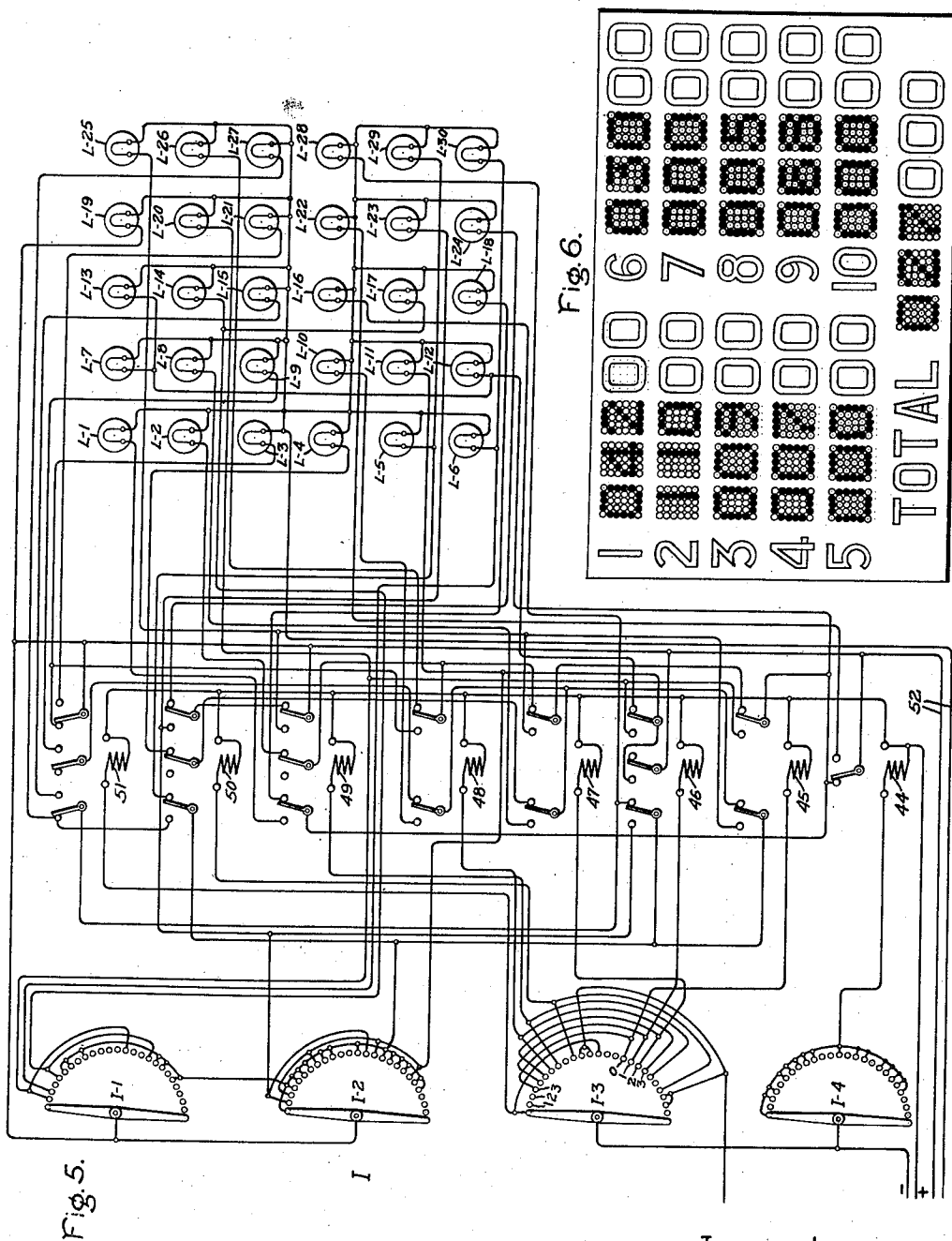
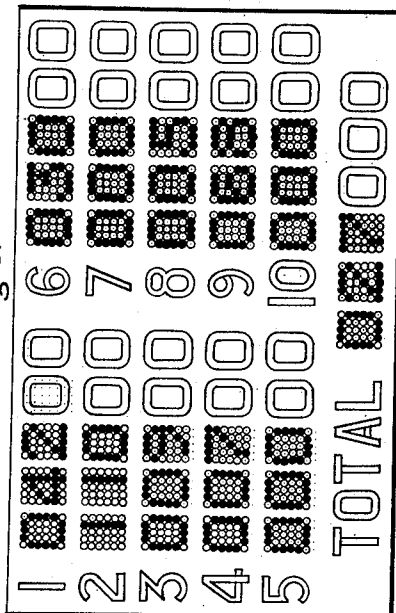


Fig. 6.



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UNITED STATES PATENT OFFICE

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INDICATING SYSTEM

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Application January 26, 1929, Serial No. 335,348

20 Claims. (Cl. 235—92)

Our invention relates to indicating systems and more particularly to indicating systems peculiarly adapted for use at public gathering places, public stadia, large department stores and the like for indicating the total of values corresponding to sale of tickets or commodities, admissions, etc., which have been made at the different selling points.

It frequently occurs, for example, at public gathering places that tickets, an indication of the total of values of which is desired, are sold during simultaneous periods, with respect to the different features of the exhibition and at a large number of widely distributed points and, further, that these tickets with respect to each feature are sold in a number of different values. Further the sales are frequently made by means of rapidly operating ticket vending machines at rates determined largely by the capacity of the machine itself.

One of the objects of our invention is to provide an electric system whereby the total value represented by all tickets sold and the total value represented by tickets sold with respect to each of the different features may be continuously indicated during the period in which sales are made. A further purpose of the invention is to provide such a system which is capable of operating with sufficient rapidity to indicate the above mentioned totals substantially simultaneously with the sales, that is, such that the totals which are indicated follow the progress of the sales with substantial accuracy, or with the degree of accuracy that is required, as by rendering the indication in even hundreds or thousands. A further object of our invention is to provide a system capable of accomplishing the above result notwithstanding the rapid operation of the ticket vending machines.

Another purpose of the invention is to provide means whereby the desired totals may be indicated by any suitable means as by means of dials with cooperating pointers, or by means of a lamp, or by means of groups of lamps which are respectively controlled so that they are lighted so as to form the digits of the quantity to be indicated.

In the operation of the system to be described, as briefly stated, an electric impulse is produced in response to each operation of the different ticket vending machines. Each impulse therefore represents a definite value which is to be included in the total. Means are provided whereby all of the impulses from each group of stations which transmit impulses representing equal

value are collected, without confusion of impulses, upon a single conductor and caused to actuate means included in the totalizing equipment whereby all impulses produced by all of the ticket vending machines are reduced to impulses of equal value. These impulses of equal value are then automatically added to produce an indication of the desired total in even hundreds, thousands, etc. as is desired.

It will thus be apparent that, while we particularly mention the use of our invention in connection with the totalizing of the value of tickets sold at public places, exhibitions, theaters and the like, it is by no means limited thereto and may be employed wherever an electric impulse may be produced in response to each unit of value which is to be included in the total to be indicated. For example, our invention has utility in connection with the totalizing of the readings of integrating power meters. Each of the meters, the reading of which is to be included in the total, may be provided with means whereby an impulse is produced in response to each unit of power integrated by the respective meters. The impulse transmitted in response to operation of different meters may represent different units of power as desired and the meters may be variously located. All of these impulses will then be caused to actuate the totalizing equipment to be described whereby the total power integrated by all of the meters may be indicated.

Thus many other applications of our invention will readily suggest themselves to one skilled in the art and all of such applications are contemplated as within the scope of the present invention.

The novel features which we believe to be characteristic of our invention are set forth with particularity in the appended claims. Our invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings in which Fig. 1 represents a totalizing system constructed in accordance with our invention; Fig. 2 represents an extension of the system shown in Fig. 1 whereby an indication of the total indicated by a plurality of systems such as that shown in Fig. 1 may be produced; Figs. 3 and 4 represent means which may be employed in connection with the system shown in Fig. 1 for indicating the total by means of lamps; Fig. 5 represents means whereby any number representing a digit of the total to be indicated

may be outlined by a group of lamps, and Fig. 6 indicates the nature of the indicating board when the means shown in Fig. 5 are employed.

Referring to Fig. 1 of the drawings 1, 2, 3, 4, 5, and 6 represent electric impulse transmitting stations, which in order to simplify the disclosure are shown as pairs of contacts, which may be controlled manually or by means of a device the operation of which represents the values which are to be included in the total to be indicated. According to the arrangement shown these contacts are momentarily interrupted in response to each operation of the ticket vending machine, for example, or they may be momentarily interrupted at a rate determined by the rate of operation of a power integrating meter, or by any other suitable device not shown. Thus momentary interruption of any pair of contacts represents a certain value which is to be included in the total. These contacts are arranged in groups in accordance with the values represented by the operation thereof. Thus, for example, assuming that the operation of contacts 1 or 2 represents a value of 2. These contacts and all other contacts, the operation of which represents this value, will then be included in a single group designated on the drawings as group 1. Similarly assuming that the operation of each of contacts 3 or 4 represents a value of 5 then these contacts and all contacts, the operation of which represents this value, will be included in another group designated on the drawings as group 2. Similarly the operation of contact 5 may be assumed to represent a value of 10, and the operation of contact 6 a value of 50. For reasons which will later be indicated we have included these contacts in a single group designated on the drawings as group 3.

It will be apparent as the description proceeds that operation of the different contacts may represent any desired value, the circuit adjustments necessary in any case being obvious to one skilled in the art. For the purpose of illustrating the operation of the system without unnecessary complication of the drawings, and not in any way to limit the protection herein claimed, the above values are assumed, but three groups are indicated, and further, only two contacts in each group are illustrated.

It will be noted that each contact 1, 2, 3, etc. has associated therewith a relay 1', 2', 3', etc. respectively and that associated with each group of contacts, is a rotary selector switch, or collecting device, A, B, the operation of each of which is controlled by any of the relays associated with contacts in its respective group. Also associated with each group is an additional selector switch A', B' which functions as a counting or adding device. Each of these selector switches consists of a plurality of semi-circular banks of contacts each of which has a cooperating wiper associated therewith. These wipers are connected to a common shaft and are adapted to be moved in a step by step manner over the contacts in their respective banks in response to the energization and deenergization of a suitable driving motor magnet which is associated therewith. While the number of contacts in each bank may be any desired number, usually they are constructed in practice with 25 contacts in each bank. Switches of this type are well known in the art and one construction which may be employed is fully disclosed in Letters Patent 1,472,465 to O. F. Forsberg, granted October 30, 1923. While we have shown selectors of the well known rotary

type, it will be obvious to those skilled in the art that any other well known type of selectors may be used. The arrangement shown in the drawings is such that upon operation of any contact or combination of contacts in any group causing the operation of the associated relay 1', 2', 3', 4' the respective collecting switch A, B rotates over its entire bank of contacts and transmits an impulse to the adding switch A', B', of the respective groups corresponding to each of the contacts 1, 2, 3, 4 which have been operated. Thus, for example, if all of the contacts in group 1 were operated simultaneously collecting switch A would rotate over its contacts and transmit an impulse to the motor magnet 7 of adding switch A', for each of the operated contacts in group 1, thus causing this adding switch to step forward a corresponding number of steps. In the particular arrangement shown each of the switches A, A', B and B' has three banks of 25 contacts. The normal and each successive fifth contact of the bank A—1 of the adding switch A' are connected together and in circuit with a relay 8 which is actuated whenever the wiper engages one of these contacts. The contacts of this relay are arranged to control an additional relay 9 in a manner similar to that in which the contacts 1, 2, 3, 4 control the associated relays 1', 2', 3', 4'. Similarly the normal and every other contact of the bank B—1 of adding switch B' are connected together and in circuit with a relay 10, the contacts of which control an additional relay 11. Relays 9 and 11 are connected to a collecting switch C in the same manner in which the contacts 1, 2, 3, 4 are associated with their respective collecting switches A, B and, accordingly upon each operation thereof cause the collecting switch C which is similar in construction to switches A and B to operate over its entire bank of contacts thereby to supply impulses through a conductor 12 to the motor magnet 13 of an adding switch C'.

It will be apparent that relay 9 is operated in response to every five impulses received by the motor magnet 7 from the collecting switch A and serves to transmit an impulse through the collecting switch C to the motor magnet 13 of adding switch C'. Thus, since each of the impulses transmitted through the collecting switch A represents a value of 2, it will be apparent that the impulse transmitted by relay 9 through collecting switch C represents a value of 10. In the same way since relay 11 is operated in response to every other operation of adding switch B', it will be apparent that impulses transmitted by this relay through the collecting switch C represent values of 10. Thus all of the impulses transmitted through the collecting switch C to the motor magnet 13 of adding switch C', represent equal values.

Switches C', D and E, each of which is similar in construction to switches A, B and C except that C' and D have five banks of contacts and E has four banks of contacts, are connected in cascade relation in the order mentioned; that is, these selector switches are so connected that upon a predetermined number of operations of each of these switches an impulse is transmitted to the motor magnet of the next switch in the cascade connection thereby causing an operation or a predetermined number of operations of that switch. Thus, upon each 10 operations of switch C' an impulse is transmitted to the motor magnet 16 of the switch D causing a predetermined operation of that switch, and upon each 10 such

predetermined operations of the switch D an impulse is transmitted to the motor magnet 17 causing a similar operation of switch E. As many additional switches may of course be included in the cascade connection as is desired. Thus it will be apparent that the switches C', D and E constitute a totalizing device for the received impulses. Since each actuation of motor magnet 13 of adding switch C' represents a value of 10, each actuation of switch D will represent a value of 100 and each actuation of switch E will represent a value of 1000. Accordingly the total of values represented by operation of the keys 1, 2, 3, 4 may be indicated in any desired number of digits by means of dials having cooperating pointers carried by the shafts of each of these switches.

Since operation of contacts 5 represents a value of 10 the associated relay 5' is connected to the collecting switch C in the same manner in which the relays 1', 2', 3', 4' are connected to their respective collecting switches. Since operation of contact 6 represents a value of 50, this contact is arranged to control five relays of which, to simplify the drawings, only two, 6' and 6'' are shown. Each of these relays is arranged to control the collecting switch C in the same manner in which the relays 5', 9 and 11 control the collecting switch C. Thus, upon each operation of contact 6, the collecting switch C will transmit five impulses to the motor magnet 13 of adding switch C'. Since contacts 5 and 6 may be caused to transmit impulses of equal value from their associated relays we have designated these contacts as included in a single group. Similarly other contacts, the operation of which represents different multiples of 10, may be included in group 3, to a number determined by the magnitude of the multiples and the capacity of collecting switch C.

It will thus be apparent that the function of the collecting switches A and B is to collect the impulses from the stations in groups 1 and 2 respectively. The function of adding switches A' and B' is to add the impulses collected by the collecting switches A and B respectively and to transmit an impulse representing a predetermined multiple of the values represented by the impulses collected thereby each time the value of the total number of impulses received by the respective adding switch equals the predetermined multiple. Similarly the function of the collecting switch C is to collect all of these impulses representing this predetermined multiple and to supply them to the totalizing device comprising the switches C', D and E. Since in the arrangement disclosed impulses which have a value less than 10 are not added to the total until a sufficient number of such impulses have been collected so that the value represented thereby is equal to 10, these impulses which represent values less than 10 may be called impulses of minor value and the impulses which represent the value 10 may be called impulses of major value.

Having now generally indicated the character of the system a better understanding thereof may be had by reference to its more detailed circuit arrangement and operation.

Referring to Fig. 1 of the drawings, with all of the equipment in the position illustrated, it will be seen that relays 1', 2', 3', 4', 5', 6', and 6'' are all normally energized through a holding circuit including their inner right-hand contacts and the contacts of the respective con-

tacts 1, 2, 3, 4, 5, 6. Let us assume that the contacts 1 have been momentarily separated. Relay 1' will then be deenergized and will thereby open both of its right-hand contacts and close both of its left-hand contacts. By means of its outer left-hand contacts a circuit is completed from the negative bus 18 through the normal contact and wiper of the bank A—3 and motor magnet 19 of the collecting switch A back to the positive bus 20. Motor magnet 19 will then be energized thereby actuating its armature and deenergizing itself, at the same time, stepping the wipers of each of the respective banks one step. Since the outer right-hand contacts of relay 1' are now separated the motor magnet 19 will not immediately be energized when the collecting switch A is in the first off normal position. However, when the wiper of the bank A—1 engages its first off normal contact, relay 1' is again energized through an obvious circuit thereby closing its right-hand contacts and energizing the motor magnet 19 which in turn steps the collecting switch to its second off normal contact. The second off normal contact of bank A—3 is connected through the outer right-hand contacts of relay 2', which are now closed to the negative bus. Accordingly motor magnet 19 is again energized and steps the wiper of the bank A—3 to the next contact which, to illustrate the operation of the equipment, is shown permanently connected to the negative bus 18. Thus the motor magnet 19 will actuate collecting switch A over its entire bank of contacts and return to its initial position where it will be deenergized by the outer left-hand contacts of relay 1'.

When the wiper of the bank A—2 engages its first off normal contact a circuit is momentarily completed which extends from the negative bus 18 through the inner left-hand contacts of relay 1' which are closed at this instant, first off normal contact of bank A—2, contacts of relay 56, motor magnet 7 of adding switch A' back to the positive bus 20. Thus motor magnet 7 receives one impulse.

The manner in which impulses are transmitted to the motor magnet 57 of adding switch B' in response to operation of the contacts in group 2 is the same as that which has been described in connection with the operation of switches A' and A, and therefore will not be further related.

Since selector switches of the type employed in the system are ordinarily constructed with contacts in each bank, it will now be apparent that there may be as many as 24 stations included in either group 1 or group 2. It will be apparent that if all of the switches in any group are operated simultaneously, the corresponding collecting device, or selector switch A, B, will rotate through a complete cycle transmitting impulses in succession over the single conductor which connects the wiper of bank A—2 to the motor magnet 7, and at the same time restoring the corresponding relays to the normal position where they are in readiness for the next operation. Similarly the same will occur independently of the order in which the contacts of any group are operated. All of the relays in any group are interlocked by means of their outer right-hand contacts to prevent any loss of impulses. Thus, for example, assuming that collecting switch A is on its second off-normal contact due to operation of relay 2', when relay 1' is operated, it will first energize relay 2' and

transmit the corresponding impulse to the motor magnet 7 after which it will return to the normal position. Since the circuit of the normal contact is completed by relay 1' it will again rotate over its bank of contacts and restore relay 1' to the normal position and send its impulse to the motor magnet 7.

The normal contact and each successive fifth contact of the bank A'—1 of adding switch A' are connected together and in circuit with relay 8 across the negative and positive busses 18 and 20. The armature of this relay 8, in either position thereof, engages one of two contacts which are connected together and which are included in the holding circuit of relay 9. Thus upon the first actuation of adding switch A' relay 8 is deenergized and its armature momentarily interrupts the above described circuit for relay 9. However, simultaneously therewith a circuit is completed for relay 9 which extends from the positive bus 20 through the wiper and first off-normal contact of the bank A'—3 of adding switch A', relay 9 and the inner right-hand contacts thereof to the negative bus. Thus no operation of relay 9 occurs. This circuit is also completed through the second, third and fourth off normal contacts of the bank A'—3. When the adding switch A' engages its fifth off-normal contact, however, relay 8 is again energized and momentarily interrupts the holding circuit of relay 9, and relay 9 is then deenergized for the reason that the above described circuit through the wiper and contacts of bank A'—3 is not completed when the wiper is in this position. Accordingly relay 9 will close its left-hand contacts and interrupt its right-hand contacts. A circuit will then be completed which extends from the negative bus through the outer left-hand contacts of relay 9, conductor 21, normal contact and wiper of the bank C—3 of collecting switch C and motor magnet 22 of collecting switch C to the positive bus. When the wiper of the bank C—2 engages its contact which is connected to conductor 23 an impulse will be transmitted through the inner left-hand contacts of relay 9, conductor 23, wiper of the bank C—2, conductor 12, contacts 12' on relay 56, and motor magnet 13 of adding switch C' to the positive bus.

Simultaneously therewith a circuit is completed through conductor 24 and wiper of the bank C—1 of the collecting switch C, which in turn restores relay 9 to its initial position thereby applying negative potential through its outer right-hand contact and conductor 25 to the corresponding contact of the bank C—3 and causing the collecting switch C to complete its rotation. Thus it will be seen that one impulse representing a value of 10 is supplied to the motor magnet 13. When the adding switch A' steps an additional step relay 8 is again deenergized and will remain deenergized for four successive steps of the adding switch A' but relay 9 will not be operated for the reason that its circuit is completed through the succeeding four contacts of the bank A'—3.

Since relays 10 and 11 are wired to the switches B' and C in the same manner in which the relays 8 and 9 are wired to the switch A' and C their operation will not be further described. However, since each operation of the adding switch B' represents a value of 5, every second off normal contact on bank B'—1 is connected with relay 10 rather than every fifth off normal contact as in the case of the bank A'—1. Thus relay 11 is operated once for every other opera-

tion of switch B', and therefore serves to supply impulses representing a value of 10 through the bank C—2 and conductor 12 to the motor magnet 13 of adding switch C'. Since relays 5', 6' and 6'' are wired to the collecting switch C in the same manner as has been described in connection with the other relays 1', 2', 3', 4', 9 and 11 no additional description thereof is necessary, it being pointed out that there are five relays 6', 6'', etc. which are controlled by the contacts 6 such that upon each operation of contact 6 all of these relays are deenergized causing the operation of collecting switch C which in turn rotates restoring these relays to their initial position, and transmitting an impulse having a value of 10 from each of these relays to the motor magnet 13 of adding switch C'.

In connection with the adding switch C' it is to be noted that this switch has five banks of contacts instead of three as is the case with adding switches A' and B'. The reason for this is that it is desired to transmit an impulse from this switch C' to the next switch D in the cascade arrangement in response to each 10 actuations thereof. As has been stated each bank includes 25 contacts. Thus, if the switch C' were connected in the manner in which switches A' and B' are connected on receipt of twenty-five impulses the wipers of the switch C' would be operated through one-half of a revolution. By arranging the wipers of banks C'—1 and C'—2, and C'—4 and C'—5 to extend in diametrically opposite directions and by connecting these wipers together these banks may be made to perform the function of a single circular bank having 50 contacts. Thus upon receipt of 50 impulses the wipers are actuated through a complete revolution and returned to the initial position. The normal contact on C'—1 and each successive tenth contact on banks C'—1 and C'—2 may then be connected together and in circuit with relay 14 for the purpose of transmitting impulses, one impulse being transmitted for every 10 received impulses or five impulses for each revolution of the switch.

When relay 15 is deenergized in response to the energization of relay 14 a circuit is completed which extends from the negative bus 18 through the outer left-hand contact of relay 15, contacts on relay 56 to the normal contact and each successive fifth contact on the bank D—5 of switch D, and thence through the wiper and motor magnet 16 of the switch D to the positive bus. The intermediate contacts on bank D—5 being connected directly to the negative bus, switch D will then be actuated to its fifth off-normal position where it will again await deenergization of relay 15, this relay having been energized through the intermediate contacts on bank D—4 and having completed its holding circuit through the contacts of relay 14. Upon the next step of adding switch C' relay 14 will be deenergized but relay 15 will not operate for the reason that its holding circuit is maintained through bank C'—3. Thus relay 15 responds only when relay 14 becomes energized. After another ten steps of adding switch C' relay 15 is again deenergized and switch D is stepped through another five operations.

Since the motor magnet 16 advances the wipers of the switch D five steps in response to each received impulse, it will be seen that in response to 10 received impulses the wipers will rotate one complete revolution. Accordingly the wiper of bank D—1 of switch D is arranged once in each revolution to supply an impulse to the next selector switch E in the cascade arrangement. For

this purpose the twenty-fourth off-normal contact of bank D—1, upon which the wiper rests only momentarily, is connected to the first and each succeeding fifth contact of bank E—4. This selector switch likewise advances five steps for each received impulse, and its bank E—1 is arranged once in each revolution to supply an impulse to the motor magnet of the next selector switch not shown.

Indicating dials 26, 27 having cooperating pointers mounted upon the shafts of the selector switches E and D may be provided, each dial corresponding to one digit of the total which is to be indicated, that is, the dial 27 may represent the hundreds digit, since each impulse received by the switch D represents a value of 100, and the dial 26 may represent the thousands digit since each impulse received by the switch E represents a value of 1000.

Thus it will be apparent that the total of values represented by operation of contacts 1, 2, 3, 4, 5, 6, etc. will be indicated in even hundreds and thousands respectively by means of the dials 27, 26 and their cooperating pointers.

In order to restore switches A', B', C', D and E to their normal positions, as for example, at the end of totalization, relays 29 and 56 are provided, the relay 56 being normally energized and relay 29 normally deenergized. These relays are controlled by means of a key 30, which is normally in its right-hand position, thereby completing the circuit of relay 56. When this key 30 is operated to its left-hand position relay 56 is deenergized thereby interrupting all of the circuits controlled thereby, and relay 29 is energized thereby closing all of its contacts. All of the contacts of the bank A'—2 of adding switch A' with the exception of the normal contact are connected together and through one pair of contacts on relay 29 to the negative side of the battery. The wiper of this bank of contacts is connected to the stationary contact which cooperates with the armature of the motor magnet 7, and thence through the motor magnet to the positive side of the battery. Thus it will be seen that when the contacts on relay 29 are closed a buzzer circuit including this bank of contacts and the motor magnet of relay 7 is completed, by means of which, the switch is operated to its normal position in which position the motor magnet is deenergized.

Similarly the adding switch B' is provided with a bank of contacts B'—2 which operates in the same manner. Adding switch C' is similarly provided with banks of contacts C'—4 and C'—5. All of the contacts of these banks with the exception of the normal contact of bank C'—5 are connected together and operate in the same manner to restore the switch to its normal position. As has already been stated the wipers on these banks extend in opposite directions. For the same purpose banks D—2 and D—3 and E—2 and E—3 are provided upon the switches D and E respectively. At the same time the impulse transmitting circuits extending through the motor magnets of the different switches, except those of the collecting devices A, B and C, are interrupted by relay 56 permitting these motor magnets to be energized only through the associated resetting banks which are provided for the purpose.

Let us assume that in a particular installation there are employed a plurality of systems such as that shown in Fig. 1 each of which totalizes the values represented by the sales of tickets, for example, with respect to a particular feature of an

exhibition or the total power indicated by the different meters of a power distribution system, and that it is desired to indicate the total of values indicated by all of these systems. This may be accomplished by means of the additional equipment shown in Fig. 2. In this equipment the collecting switch F which is similar to switch C operates as a collecting device for collecting impulses from all of the different systems and for supplying impulses through conductor 31, contacts 31' on relay 56, and conductor 32 to the motor magnet 36 of adding switch F' which is similar to switch C'. This collecting device F is controlled by means of relays 33, 34 each of which is controlled from one of the systems corresponding to the system shown in Fig. 1. For example, relay 33 is connected through conductor 35 to the contacts on relay 14 such that this relay is deenergized simultaneously with relay 15, and relay 34 is connected through conductor 34' to a similar point on another system. A corresponding relay will be provided for each system. Deenergization of relay 33 causes collecting device F to rotate through a complete revolution and to transmit an impulse through the inner left-hand contacts of relay 33, first off-normal contact and wiper of the bank F—2, conductor 31, contacts 31' on relay 56, conductor 32 and motor magnet 36 of the adding switch F'. Thus impulses received by the motor magnet 36 of the adding switch F' represent values of 100. Switch F' is connected in the same manner in which switch C' is connected and controls relays 14' and 15' which in turn supply impulses representing values of 1000 to the switch G in the same manner in which relays 14 and 15 supply impulses representing values of 100 to switch D. Switch G which is similar to switch D is connected in the same manner in which switch D is connected; that is, the wiper of the bank G—1 is connected through conductor 37 and contacts 37' on relay 56 to the positive battery; the contacts of banks G—2 and G—3, with the exception of normal contact on G—3 are connected through conductor 38 and contacts 38' on relay 29 to the negative battery, these banks comprising the resetting banks of the selector switch; the normal contact and each successive fifth contact on the bank G—5 is connected through conductor 39 and contacts 39' on relay 56 and conductor 40 to the outer-left-hand contacts on relay 15'. While the intermediate contacts on G—5 and the corresponding contacts on G—4 are connected directly to negative battery, thus it will be seen that the impulses which are supplied to the switch G represent values of 1000, and that in response to each of these impulses this switch is actuated through five steps and in response to 10 such impulses the switch completes a revolution and supplies an impulse through the wiper of bank G—1 to the next switch H in the cascade connection. These switches, and as many others as may be desired, are similarly provided with dials 27' and 26' having pointers for indicating in even thousands the total indicated by each of the different systems.

In case it is desired to produce the indication of total indicated by the system in Fig. 1 at a plurality of different points, this may be accomplished by providing relay 15 with one or more additional left-hand contacts 41 and causing each of these contacts to control additional cascade connected switches corresponding to switches C', D and E.

The indication may be provided at these different points by means of lamps, as shown in Fig. 3. In connection with switches D, E and G it will be noticed that each of these switches operate through five steps in response to each received impulse. It will be seen that in this way sufficient mechanical displacement is provided to permit easy reading of the dials. Where the total is to be indicated electrically as by means of lamps, for example, this is not necessary, and the first indicating selector switch may be wired as shown at D' in Fig. 3 and controlled by relay 15 of Fig. 1. That is the motor magnet 42 is connected in a circuit which extends from positive battery through the motor magnet 42, normally closed contacts on relay 56 (which are represented at 56' in Fig. 3), contacts on relay 15 (which are represented at 41 in Figs. 1 and 3) to the negative side of the battery. Thus upon each deenergization of relay 15 the motor magnet 42 of the switch D' is energized through this circuit. When relay 15 is again energized by bank D—4 of switch D, motor magnet 42 of switch D' is deenergized and switch D' is advanced one contact position. Thus switch D' is advanced one step for each received impulse. Since the bank D'—3 has 25 contacts five of these contacts are connected directly to the negative bus. The wiper of this bank is connected to the stationary contact cooperating with the armature of the motor magnet so that the switch is actuated over these five contacts by buzzer action and is returned to the initial position in response to twenty received impulses. Preferably these contacts are so chosen, as indicated in Fig. 3, as to separate the remaining contacts into two groups of ten contacts each. These contacts are connected through contacts on resetting relay 29 (which are indicated at 29' in Fig. 3) to the negative battery. Thus this bank is utilized as the resetting bank for the switch D'.

The bank D'—2 controls the indicating lamps corresponding to the hundreds digits of the total. Thus when the switch is in its initial position the lamp corresponding to zero is lighted. When it is in position 1 the lamp corresponding to 10 is lighted, and so on, for the position of the other integers. Bank D'—1 serves to supply an impulse to the next selector switch in the cascade connection in response to each 10 received impulses, which switch, in turn, controls the lamps indicated by the rectangle 43 for indicating the thousands digit. Since the switch passes over five of the contacts in bank D'—3 by buzzer action contacts in bank D'—1 corresponding to certain to these contacts are employed for actuating the next selector switch. Thus only one impulse is supplied to the next switch since the switch never rests indefinitely upon these contacts.

It may be desirable in particular cases to have means whereby the accurate total may be indicated rather than the total as represented by even hundreds or thousands. This may be effected by wiring the unused contacts on banks A'—1, B'—1 and C'—1, and C'—2 in the manner shown in Fig. 4. The wiper of each of these banks is connected to negative potential and each of these contacts is connected through a lamp on the indicating panel 54 to positive potential, the lamps serving to indicate the number of impulses which has caused the wiper to be actuated from the last impulse transmitting contact to the instant position. Thus it will be seen that contacts on the banks C'—1 and C'—2 control

the lamps indicating values 10, 20, 30-90, contacts on bank A'—1 control lamps indicating values of 2, 4, 6, and 8 and alternate contacts on the bank B' being connected to a single lamp indicating the value 5. Thus the total value indicated by these lamps corresponds to the value represented by impulses which are stored in the equipment at any particular time, and which is not included in the total as indicated by the selectors D and E. The same result of course may be had by means of dials mounted upon these switches. Similarly the accurate grand total may also be had by also wiring the banks F'—1, F'—2 to indicating lamps in the manner shown in connection with banks C'—1 and C'—2.

For out of door purposes or for purposes of large gathering places, it may be desirable to indicate each of the digits by means of a group of lamps, as is shown in Fig. 6, for example, where each of the numbers represented in rows 1, 2, 3 to 10 correspond to the total indicated by a system such as that shown in Fig. 1, and the total which is indicated at the bottom of the figure corresponds to the grand total which is indicated by the equipment shown in Fig. 2. It will be seen that each digit of each of these quantities is indicated by a plurality of lamps. For the purpose of controlling the lamps comprising any particular digit the means represented in Fig. 5 may be employed. This means comprises a selector switch I having banks I—1, I—2, I—3 and I—4 plus one additional bank not shown, which may be wired in the manner indicated in connection with bank D'—3 of Fig. 3, for example, such that upon each impulse of the first nine impulses received, the switch advances one step. Upon receipt of the tenth impulse the switch advances over two contacts and stops upon the next contact which corresponds to the zero position. Upon receiving each of the next nine impulses it advances one step and upon receiving the tenth impulse advances three steps to the position shown in the drawings.

Associated with this switch are a plurality of relays 44, 45, 46, 47, 48, 49, 50 and 51. The relay 44 is controlled by the wiper of the bank I—4 and the remaining relays are controlled by the wiper of the bank I—3 through obvious circuits which may be readily traced from the drawings. When these relays are energized their armatures are actuated to the left, and when they are deenergized their armatures are actuated to the right. The position of the selector switch in which the respective relays are energized is indicated by the following table:

Integer indicated and switch position	Relay	Energized
0.....	44	51
1.....	None	
2.....	44	
3.....	44	45
4.....		46
5.....	44	47
6.....	44	48
7.....	44	49
8.....	44	
9.....	44	50

The lamps L comprising each digit are arranged in five columns of six each and are controlled through relays 44 to 51 and the banks I—1 and I—2 of the selector switch. One terminal of all the lamps is connected permanently to the lower conductor of the lighting circuit 52, and the other terminal of each of the lamps is connected through contacts of the respective controlling de-

vices, either one or more of relays 44 to 51 or one of the wipers of the banks I-1 and I-2 to the opposite side of the lighting circuit.

Bearing in mind which of the relays are energized and the position of the selector switch, the circuit of each of the lamps which are lighted when any particular integer is to be indicated may be very readily traced. Thus, for example, if zero is to be indicated the switch will be in the zero position which is that shown in the drawings and relays 44 and 51 will be energized. The lamps which should be lighted may be determined from Fig. 6. A circuit is completed for lamps L-7, L-13 and L-12 through the left-hand contact and armature of relay 44. Lamp L-19 is lighted in all digits and therefore is permanently connected across the circuit 52. L-26 is lighted through the right-hand armatures of each of relays 48, 47 and 45 in their right-hand position, and armature of relay 44 in its left-hand position. Lamp L-27 is lighted through the left-hand contact of relay 51 in its left-hand position, left-hand contact of relay 46 in its right-hand position and normal contact and wiper of the bank I-2. Lamp L-28 is lighted through the left-hand contact of relay 46 in its right-hand position and normal contact and wiper of the bank I-2. Lamp L-29 is lighted through left-hand armature of relay 50 in its right-hand position and normal contact and wiper of bank I-2. Lamp L-24 is lighted through right-hand armature of relays 50 and 49 in their right-hand position. Lamp L-18 is lighted through left-hand armature of relay 49 in its right-hand position and armature of relay 44 in its left-hand position. Lamp L-5 is lighted through the armature of relay 50 in its right-hand position and normal contact and wiper of bank I-2. Lamp L-4 is lighted through the middle contact of relay 50 in its right-hand position, left-hand armature of relay 47 in its right-hand position, left-hand armature of relay 45 in its right-hand position and normal contact and wiper of bank I-2. Lamp L-3 is lighted through the right-hand armature of relay 51 in its left-hand position, and lamp L-2 is lighted through the middle armature of relay 49 in its right-hand position, right-hand armatures of relay 47 in its right-hand position and the right-hand armature of relay 45 in its right-hand position and armature of relay 44 in its left hand position.

When the switch is advanced to its first off normal position relays 44 and 51 are deenergized and all of the lamps, with the exception of lamp L-19 which is permanently lighted, and L-24, are extinguished. In this position none of the relays is energized. Lamp L-20 is lighted through the wiper of the bank I-1. Lamp L-21 is lighted through the right-hand contact of relay 51. Lamp L-22 is lighted through the right-hand contact of relay 44. Lamp L-23 is lighted through the wiper of bank I-2 and L-24 is lighted through the relays 50 and 49. Similarly the circuits for all of the lamps for each of the digits may be readily traced, the reader determining from Fig. 6 the lamps which are lighted and bearing in mind the position of the relays and that of the switch. While the system shown in Fig. 5 has been described as controlled by relay 15 it will, of course, be understood that this will depend upon the lowest digit to be indicated by the system. If the hundreds digit is to be indicated the system will be connected to receive impulses representing a value of one hundred and similarly for the other digits.

While we have shown a particular embodiment of our invention it will be understood by those skilled in the art that many changes and modifications, both in the circuit arrangement and in the instrumentalities employed, may be made without departing from our invention and we therefore aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of our invention.

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

1. In combination, a plurality of impulse transmitting stations, all of said stations transmitting impulses representing a certain value, normally idle collecting means, adding means and means responsive to operation of any station for effecting the operation of said collecting means to collect impulses from all of said stations having impulses awaiting collection and to supply said impulses to said adding means whereby the total of values represented by impulses transmitted from all of said stations may be determined.

2. In combination, a plurality of impulse transmitting stations, each station having an output circuit, a rotary collecting switch having a normally idle wiper and a bank of contacts each of said output circuits including one of said contacts, adding means connected with said wiper, and means responsive to operation of any of said stations for causing said wiper to engage each of its contacts in succession whereby said adding means is successively connected in circuit with said stations.

3. In combination, a plurality of devices, each operation of each of said devices corresponding to a definite value, a normally inactive collecting device, an adding device, a plurality of means, each means being responsive to operation of one of said plurality of devices to render said collecting device operative and to supply an impulse thereto, the impulses supplied by all of said means representing equal values, and means included in said collecting device when operative for collecting impulses from all of said means having impulses awaiting collection and for transmitting impulses of equal value corresponding to said received impulses to said adding means whereby the total of values represented by said impulses may be determined.

4. The combination, in a totalizing system, of a plurality of relays, means for operating each of said relays, a collecting switch having a plurality of banks of contacts and wipers arranged for simultaneous engagement with corresponding contacts in each bank, a circuit controlled by each of said relays, each circuit including a contact in one of said banks, a circuit for controlling each relay including a corresponding contact in a different bank, adding means associated with said wipers, and means for actuating said wipers over said banks of contacts thereby to connect each of said first mentioned circuits in succession to said adding means and to complete said relay controlling circuits.

5. In combination, a plurality of impulse transmitting stations, said stations being arranged in groups according to values represented by impulses transmitted from each station, means respectively associated with said groups for receiving impulses from all of the stations in the associated group having impulses awaiting collection and for transmitting impulses, a rotary collecting switch having contacts connected with the output of each of said last means and a normally idle wiper, adding means associated with said

wiper, and means responsive to an impulse transmitted from any of said first means for actuating said wiper over all of said contacts thereby to supply impulses from any of said first means to said adding means.

6. In combination, a plurality of impulse transmitting stations, said stations being arranged in groups according to values represented by impulses transmitted from the respective stations, a relay associated with each group, means associated with each group for receiving impulses from all of the stations therein and for actuating said relay associated with said group in response to a predetermined number of received impulses, circuits respectively controlled by said relays, an adding device, and means responsive to operation of each relay for connecting said adding device in each of said circuits.

7. In combination, a plurality of impulse transmitting stations, said stations being arranged in groups according to values represented by impulses transmitted from the respective stations, a relay associated with each group, means associated with each group for receiving impulses from all of the stations therein and for actuating said relay associated with said group in response to a predetermined number of received impulses, circuits respectively controlled by said relays, an adding device, means responsive to operation of each relay for connecting said adding device in each of said circuits, and means for restoring each relay which has been operated to its initial position when said adding device has been connected in the circuit controlled by said relay.

8. In combination, a plurality of impulse transmitting stations, said stations being arranged in groups according to values represented by impulses transmitted from each station, means associated with each group for receiving impulses from all of the stations in said group and for transmitting an impulse when the total number of impulses received thereby represents a value equal to a predetermined multiple of the values represented by the impulses transmitted from all of said stations, an additional impulse transmitting station, the impulses transmitted from said additional station representing values equal to values transmitted from each of said means, an impulse adding device, and means for connecting each of said means and said additional station in circuit with said adding device.

9. In combination, a plurality of groups of impulse transmitting stations, each station in the same group being arranged to transmit an electric impulse representing the same predetermined value which differs from the value represented by each impulse transmitted from each station in any other group, adding devices respectively associated with said groups of stations, normally idle collecting switches respectively associated with said adding devices for successively connecting the stations in each group to the associated adding devices, means for effecting the actuation of a collecting switch when any station in the associated group has an impulse awaiting collection, impulse transmitting means respectively associated with said adding devices for transmitting an electric impulse representing a value which is a multiple of the values represented by the impulses transmitted by said stations each time the associated adding device receives a predetermined number of impulses, additional adding devices arranged in cascade relation, and means for actuating the first of said cascade connected adding devices in response to each impulse

transmitted from said last-mentioned impulse transmitting means.

10. In combination, a collecting switch having a plurality of positions, means for operating said switch, an impulse transmitting station, an electric impulse adding machine means controlled by said station and said switch for transmitting an electric impulse representing a predetermined value to said adding machine when said switch is in a predetermined position, a second impulse transmitting station for transmitting electric impulses each of which represents a second predetermined value, said first predetermined value being a multiple of said second predetermined value, means for adding under predetermined conditions said impulses representing said second predetermined value at the same time said adding machine is receiving impulses and for adding under other predetermined conditions said impulses representing said second predetermined value at a time when said adding machine is not receiving impulses, and means controlled by said adding means and said switch for transmitting to said adding machine an impulse representing said first mentioned value when said switch is in another predetermined position and the value of the total number of impulses received by said adding means equals said first mentioned value.

11. In combination, a collecting switch having a plurality of positions, means for operating said switch, an impulse transmitting station for producing electric impulses each of which represents a predetermined value, a second impulse transmitting station for producing electric impulses each of which represents a second predetermined value, means for adding said impulses representing said first-mentioned value, means controlled by said adding means and said switch for producing an electric impulse representing a third predetermined value which is a multiple of said first and second mentioned values when the number of impulses received by said adding means represents a value equal to said third predetermined value and said switch is in a predetermined position, other means for adding under certain conditions said impulses representing said second-mentioned value at the same time said impulses representing said first-mentioned value are being added and for adding under other conditions said impulses representing said second mentioned value at a time when said impulses representing said first mentioned value are not being added, means controlled by said other adding means and said switch for producing an electric impulse representing said third value when the number of impulses received by said other adding means represents a value equal to said third predetermined value and said switch is in another predetermined position, and means for adding said impulses representing said third value.

12. In combination, a collecting switch having a plurality of positions, means for operating said switch, a group of impulse transmitting stations respectively allotted to certain predetermined positions of said switch, an electric impulse adding machine means controlled by said stations and said switch for transmitting to said adding machine an electric impulse representing a predetermined value when said switch is in a position allotted to a station, a group of other impulse transmitting stations, each of said other transmitting stations producing impulses representing a second predetermined value, said first predetermined value being a multiple of said

second predetermined value, means for adding under predetermined conditions said impulses representing said second predetermined value at the same time said adding machine is receiving impulses and for adding under other predetermined conditions said impulses representing said second predetermined value at a time when said adding machine is not receiving impulses, and means controlled by said adding means and said switch for transmitting an impulse to said adding machine representing said first mentioned value when said switch is in another predetermined position and the value of the total number of impulses received by said adding means equals said first mentioned value.

13. In combination, a collecting switch having a plurality of positions, means for operating said switch, a group of impulse transmitting stations each of which produces electric impulses representing a predetermined value, a second group of impulse transmitting stations, each of which produces electric impulses representing a second predetermined value, means for adding said impulses representing said first-mentioned predetermined value, means controlled by said adding means and said switch for producing an electric impulse representing a third value which is a multiple of said first and second predetermined values when the number of impulses received by said adding means represents a value equal to said third value and said switch is in a predetermined position, other means for adding under certain conditions said impulses representing said second predetermined value at the same time said impulses representing said first-mentioned value are being added and for adding under other predetermined conditions said impulses representing said second mentioned value at a time when said impulses representing said first mentioned value are not being added, means controlled by said other adding means and said switch for producing an electric impulse representing said third value when the number of impulses received by said other adding means represents a value equal to said third value and said switch is in another predetermined position, and means for adding said impulses representing said third value.

14. In combination, two electric impulse adding machines, means including groups of electric impulse transmitting stations respectively associated with said machines for effecting some of the time the transmission of an electric impulse from a station in one group to its associated adding machine while an electric impulse is being transmitted from a station in the other group to its associated adding machine and at other times the transmission of impulses to said adding machines nonsimultaneously, each impulse transmitted from each station in one group representing a predetermined value which is a multiple of the predetermined value represented by each impulse transmitted by each station in the other group, and means controlled by the adding machine adding the impulses representing the lower value for transmitting to the other adding machine when it is not receiving an impulse from any station in its associated group an impulse each time the value of the total number of impulses received by the adding machine which adds the impulses having the lower value equals the value represented by each impulse transmitted to said other adding machine.

15. In combination, two electric impulse adding machines, means including groups of electric im-

pulse transmitting stations respectively associated with said machines for effecting some of the time the transmission of an electric impulse from a station in one group to its associated adding machine while an electric impulse is being transmitted from a station in the other group to its associated adding machine and at other times the transmission of impulses to said adding machines nonsimultaneously, means controlled by each adding machine for effecting the transmission of an electric impulse representing a predetermined value each time the value of the total number of impulses respectively received by each adding machine equals said predetermined value which is a multiple of the values respectively represented by each impulse transmitted from said stations including means for insuring the transmission of two separate impulses whenever the values of the total number of impulses respectively received by said adding machines simultaneously equal said predetermined value, and means for adding said impulses representing said predetermined value.

16. In combination, two electric impulse adding machines, means including electric impulse transmitting stations respectively associated with said machines for effecting the transmission of electric impulses from said stations to said adding machines simultaneously under certain conditions, each impulse transmitted to one of said machines representing a value which is a multiple of the value represented by each impulse transmitted to the other adding machine, and means controlled by the adding machine adding the impulses representing the lower value for transmitting to the other adding machine when it is not receiving an impulse from its associated impulse transmitting station an impulse each time the value of the total number of impulses received by the adding machine which adds the impulses having the lower value equals the value represented by each impulse transmitted to said other adding machine.

17. In combination, two electric impulse adding machines, means including electric impulse transmitting stations respectively associated with said machines for effecting the transmission of electric impulses from said stations to said adding machines simultaneously under certain conditions, means controlled by each adding machine for effecting the transmission of an electric impulse representing a predetermined value each time the value of the total number of impulses respectively received by either adding machine equals said predetermined value which is a multiple of the values respectively represented by each impulse transmitted from said stations including means for insuring the transmission of two separate impulses representing said predetermined value when the values of the total number of impulses respectively received by said adding machines simultaneously equal said predetermined value or multiples thereof, and means for adding said impulses representing said predetermined value.

18. In a totalizer including ticket issuing machines and a registering device and apparatus for setting said registering device into operation, an electromagnetic switch, consisting in a wiper arm, normally at rest, and a plurality of contacts over which said arm can be moved, a plurality of conductors each connecting a different ticket machine to a contact of said switch, control means associated with each conductor and other means associated with each conductor whereby when the control means of a conductor is actuated

the said wiper arm of the switch is moved to that conductor and extends it to a single conductor leading from the switch to the apparatus for setting the registering device into operation.

- 5 19. In a totalizing system, a plurality of ticket issuing machines, storage devices, each machine having means controlled by the operation of a key thereof for sending a signal to its storage device, each device having means for storing a
10 predetermined number of said signals, a register, a switch for the register, means controlled by each device for marking the switch each time the predetermined number of signals have been stored, and means controlled by said switch re-

sponsive to such marking for operating the register to register multiples of the signals.

20. In a totalizing system, a register, a switch therefor, a bank of contacts for said switch, ticket
5 issuing machines having key controlled means for transmitting indications to a remote point, storage devices for receiving and storing said indications, means in each storage device responsive to a plurality of indications to mark the contacts
10 in said switch, and means in the switch responsive to the markings to operate said switch and enter said markings in the register.

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