

Feb. 17, 1959

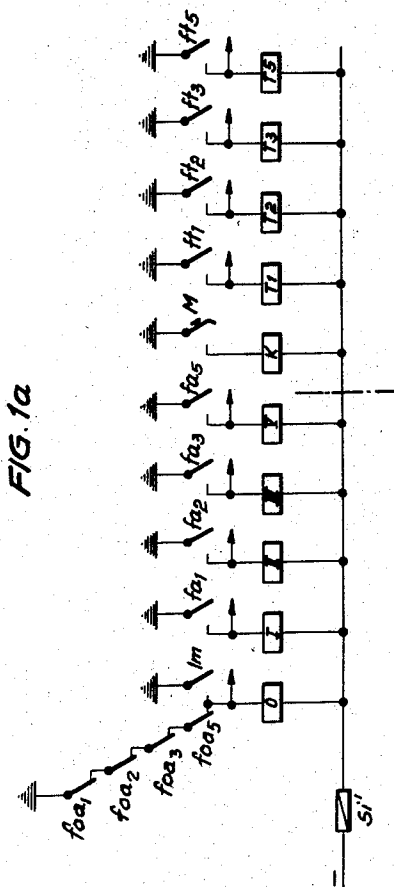
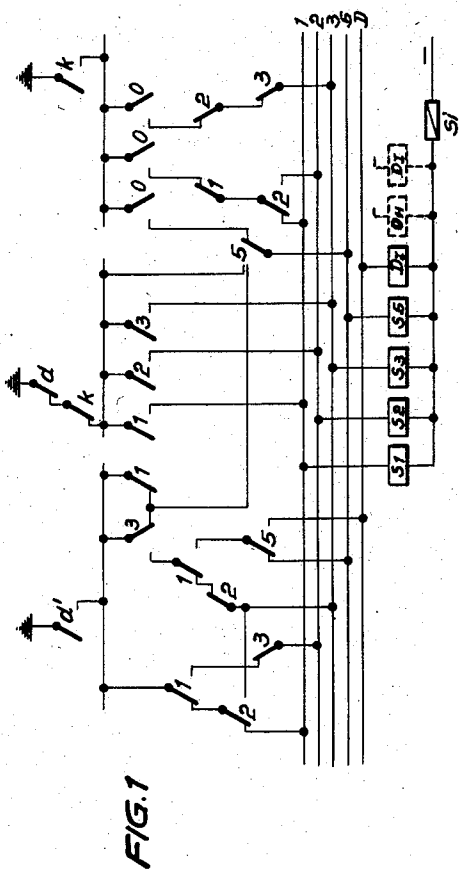
M. HEBEL

2,873,914

ELECTRICAL SUMMING DEVICE

Filed Aug. 2, 1955

2 Sheets-Sheet 1



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M. HEBEL

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2 Sheets-Sheet 2

FIG. 2

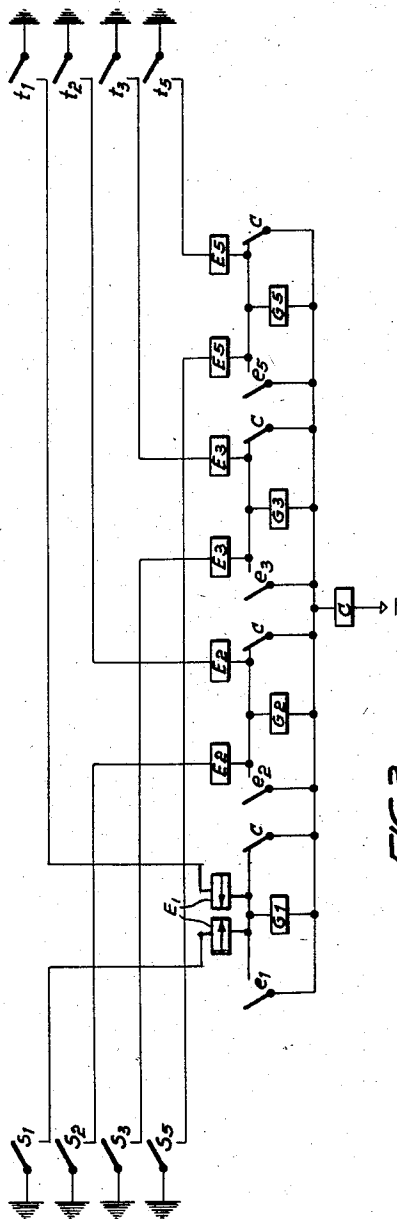
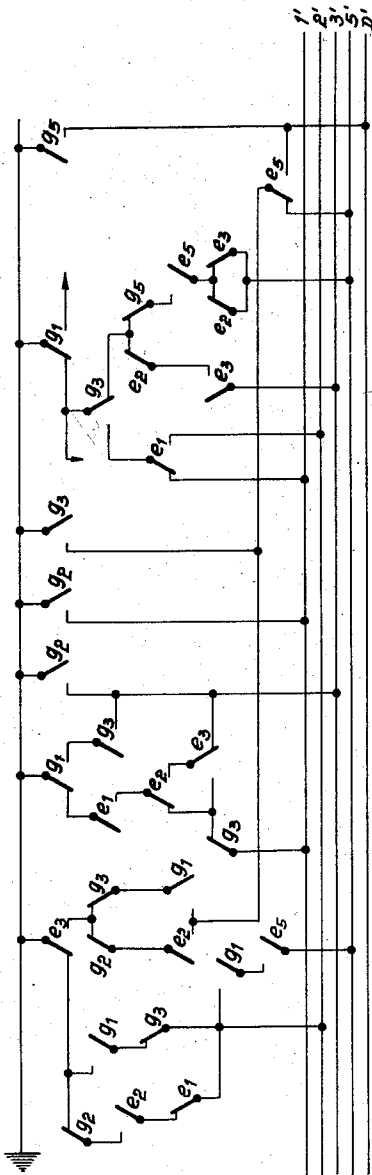


FIG. 3



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2,873,914

ELECTRICAL SUMMING DEVICE

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8 Claims. (Cl. 235—168)

The present invention relates to electrical summing devices and more particularly to an electrical summing device including relays and relay operated switches.

It is known to use electrical summing devices in computers by which additions and subtractions are carried out by the operation of relays and switches. The values of the two summands of an addition are introduced into the summing device from storing devices and from contact-forming keyboards, while the terminals of the summing device may be connected to storing means for storing the results, such storing means again comprising groups of relays.

It is the purpose of the summing device to close a circuit representing the sum of an addition when the summands are introduced into the device by closing contacts or switches. For instance, if the summands 3 and 5 are introduced, circuits corresponding to 3 and 5 are grounded and a current flows through the same which energizes suitable relays and operates suitable switch means so that the result circuit is closed corresponding to the sum 8.

The addition of the digits from 0 to 9 contains 100 possible combinations, namely the additions $0+0$, $0+1$, and so forth up to $9+9$. Assuming that the summands are written on the side lines of a checkerboard having 100 squares, the ten diagonal squares will contain the same summands, while the other squares contain pairs of additions having the same result and interchangeable summands.

It is one object of the present invention to simplify a summing device of the above-described type and to provide a summing device in which a minimum of circuits is used to express the result of all possible additions.

It is another object of the present invention to provide in a summing device of the above-described type a tens transfer device and a complement-transforming device for reducing the numbers of circuits required for expressing the results.

It is a further object of the present invention to provide a signal-combining device through which the input signals pass before reaching the summing device proper, the signal combining device actuating the same circuits in the summing device proper regardless of the order in which the two summands are introduced, as long as the result of the two summands is the same.

It is a further object of the present invention to reduce the number of circuits required for expressing the result so that conventional relays having no more than six relay contacts can be used in the summing device of the present invention.

It is also an object of the present invention to introduce digits into the summing device in coded form.

Each digit can be expressed by digit elements, and according to a preferred embodiment of the present

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invention, the digit elements 1, 2, 3 and 5 are used. For instance, the digit 4 is expressed by the digit elements 3 and 1, the digit 6 by the elements 5 and 1, and the digit 9 is expressed by the elements 5, 3 and 1. By introducing coded digits, the number of circuits required in the summing device is further reduced.

With these objects in view, the present invention mainly consists in an electrical summing device which comprises a set of first electrical input means and a set of second electrical input means for representing, respectively, the summands of a sum, the input means of each of the sets of input means being, respectively, associated with the same series of digits or digit elements so that pairs of first and second input means are associated with the same digit or digit elements, each of the input means being operable between an operative condition and an inoperative condition; a source of potential; a set of output terminals respectively associated with the series of digits or digit elements for representing the sum of the summands when the source of potential is connected to selected output terminals; a plurality of circuit means, each of the circuit means including circuit completing means, at least one of the circuit means connecting each of the output terminals to the source of potential when the respective circuit completing means are actuated; and a set of electrical actuating means, each of the actuating means being respectively associated with predetermined circuit completing means for connecting the source of potential to at least one selected output terminal, each of the actuating means being connected to one pair of the pair of first and second input means and controlled by the first and second input means of the respective pair in such manner that the circuit completing means associated with the respective actuating means complete the circuit means associated therewith when either input means of the respective pair of first and second input means is in the operative condition.

The electrical actuating means comprise relays and switches operated by the relays. The arrangement is such that when the same digit or digit element is introduced by the first and second electrical input means, a pair of oppositely wound relay windings are energized which compensate each other so that a switch associated therewith is not operated. When, however, only one of the relay windings is energized, the switch is operated and affects by relays and switches the completion of certain circuits for representing the result.

The first and second input means are respectively controlled by input control means which are operated, for instance, by the relays of a storing device and by a keyboard, respectively. Between the input control means and one of the input means, a tens transfer device and a complement-transforming device is preferably provided. Consequently, the tens transfer operation and the complement transforming operation are carried out before the signals reach the summing device proper so that the circuits of the same are simplified.

In the arrangement of the present invention, the circuits in the summing device are completed in the same manner regardless of whether for instance the addition $M+N$, or $N+M$ is carried out. In other words, regardless of whether a summand is taken from a storing device or is newly introduced, for instance, by a keyboard, as long as the same summands constitute an addition, the summing device operates in the same manner. Consequently, only one circuit has to be provided for the additions $3+5$ and $5+3$.

The novel features which are considered as character-

istic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1a is a diagram illustrating input control means;

Fig. 1 is a diagram illustrating a combined tens transfer and complement transforming device;

Fig. 2 is a diagram illustrating a signal combining device; and

Fig. 3 is a diagram illustrating a summing device.

The arrangement illustrated in the drawing is directed to an arrangement according to which the summands and the result are expressed in a code using the digit elements 1, 2, 3, 5. Another code system using the digit elements 1, 2, 4 and 8 or a quinary system could be used as well, and the code is selected in accordance with the particular purpose of the machine.

In order to clarify the application of the code according to which all digits are expressed by the digit elements 1, 2, 3, 5, the transformations and combinations of the code are shown in the following table.

Digit	Coded digit	Tens transfer	Complement
1-----	1	2	5+3
2-----	2	3	5+2
3-----	3	3+1	5+1
4-----	3+1	5	5
5-----	5	5+1	3+1
6-----	5+1	5+2	3
7-----	5+2	5+3	2
8-----	5+3	5+3+1	1
9-----	5+3+1	Tens transfer	0
0-----	0	1	5+3+1

The digit elements 1, 2, 3, 5 are represented by completed circuits, and the tens transfer is indicated in the same manner. Zero is indicated when no circuit is completed.

Referring now to the drawings, and more particularly to Fig. 1a, a first set of input control relays I, II, III and V is connected in series with a first set of input control switches fa_1 , fa_2 , fa_3 and fa_5 , which are respectively associated with the digit components one, two, three and five. A second set of input control relays T_1 , T_2 , T_3 and T_5 are respectively connected in series with a second set of input control switches ft_1 , ft_2 , ft_3 and ft_5 which are also respectively associated with digit components one, two, three and five. The input control switches are connected to the positive terminal of a source of potential, such as a battery, while the relays are connected to the negative terminal of the source of potential. The positive terminal is grounded in the arrangement illustrated in Fig. 1a. A fuse Si' is provided in the conductor leading to the negative terminal. The switches fa may be operated from a storing device, while the switches ft may be operated from the keyboard or from analyzer means sensing punch cards. In any event, the switches fa and the relays I-V are provided for representing a stored summand, while the switches ft and the relays T_1 - T_5 are provided for representing a summand which is to be added to the first summand. A set of switches foa_1 - foa_5 is connected in series with a zero relay 0 and is also operated from the storing device. A relay K is provided for complementary values and energized by means of a switch M which is operated by a minus key when a subtraction is to be carried out by complementary addition. A control switch $1m$ is connected in series with the relay 0 and is actuated by suitable electromagnet means, not shown.

Fig. 2 illustrates a first set of input switch means s_1 , s_2 , s_3 , s_5 and a second set of input switch means t_1 , t_2 , t_3 ,

t_5 . The switches t are operated by the input relays T_1 , T_2 , T_3 and T_5 illustrated in Fig. 1a. The switches s are operated by the input relays S_1 , S_2 , S_3 and S_5 illustrated in Fig. 1. Fig. 1 also shows switches 1, 2, 3, 5 and 0, operated, respectively, by the relays I, II, III, V and 0 illustrated in Fig. 1a. Fig. 1 further shows a switch k operated by the relay K shown in Fig. 1a, and two control switches d , d' operated by the relay D. Relay D has three windings D_I , D_{II} and D_H , the holding winding D_H being energized when one of the other windings D_I or D_{II} operates the holding contact d_H shown in Fig. 3. The control switch d is normally in closed position and the control switch d' is normally in open position. The switches d , d' and k are connected to the grounded positive terminal of the source of potential, and the relays S_1 to S_5 and D are connected to the negative terminal of the source of potential. A fuse Si is provided in the conductor leading to the negative terminal of the source of potential. The circuits shown in Fig. 1 connected to the complement switch k constitute a complement transforming device, while the circuits connected by the switches d , d' constitute a tens transfer device.

Fig. 2 shows the input switches s and t connected to ground potential and a relay C connected to the negative terminal of the source of potential. The switches s and t associated with the same digit element or digit, for instance the switches s_1 and t_1 are connected to two oppositely wound relay coils E_1 . The relays E_1 to E_5 operate switches e_1 to e_5 shown in Figs. 2 and 3. Relay coils G_1 to G_5 are connected in series with each pair of oppositely wound relay coils E_1 to E_5 , and operate, respectively, the switches g_1 to g_5 shown in Fig. 3. Switches c are arranged in parallel with the relay coils G_1 to G_5 for bridging the same and are operated by the relay winding C.

Fig. 3 is the summing device proper, and includes output terminals $1'$, $2'$, $3'$, $5'$ which are connected to the negative terminal of a source of potential whose positive terminal is grounded. D' is a tens transfer output terminal, also connected to the negative terminal of the source of potential. When any one of the circuit means which include the circuit completing switch means g_1 to g_5 and e_1 to e_5 is completed by closing switches normally in open position, the respective output terminal is connected to ground potential and a current flows therethrough which may be used for indicating the result of the addition. Windings D_{II} and D_H which form part of the circuit of the serial adder are shown in solid lines in Fig. 3, and in broken lines in Fig. 1. Relay winding D_I which is connected into the circuit of the tens-transfer device, is shown in broken lines in Fig. 3.

The present invention is concerned with the arrangement illustrated in Figs. 1, 1a, 2 and 3, which constitute a summing device. It is immaterial, and not an object of the present invention, in which manner the impulses are created by which the summands are introduced into the summing device of the present invention, and similarly it is not an object of the present invention in which manner the impulses in the output terminals are used to represent the result of the addition.

It is known to provide storing devices for each decimal order which are capable of storing coded digits. Storing relays which when energized represent the digit elements 1, 2, 3 and 5 can be provided in each decimal order, and consecutively connected to the input of the apparatus according to the present invention for actuating the switches fa_1 to fa_5 .

If a punched card system is used, the analyzer means which sense the punched cards column by column and decimal order by decimal order correspond to the switches fa_1 to fa_5 . In the event that the sensed value is to be added to a stored value, the analyzer means would be represented by the switches ft_1 to ft_5 . Similarly, the switches ft_1 to ft_5 can be operated by the keyboard of a calculating machine. If for instance the key

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9 is operated, the three contacts ft_1 , ft_3 and ft_5 are closed which represent the digit elements 1, 3, 5 whose combination corresponds to the digit 9 in accordance with the code applied in the illustrated arrangement.

For computing complementary values it is necessary to indicate in the empty decimal places the absence of a digit different from zero by operation of the relay 0. These cases are indicated by the switch 1m which is operated by relay means, not shown, when the numbers introduced on the left side of Fig. 1a include a zero or empty position. For instance, the relays 0 can be energized during the respective computing step when none of the switches foa_1 to foa_5 indicates the presence of a summand. The switches foa_1 to foa_5 which are shown in the left side of Fig. 1a to be connected in series are normally in a closed position and actuate the relay 0. When, however, one of the switches fa_1 to fa_5 associated with the relays I to V is moved from its normal open position to a closed position, the corresponding switches foa_1 to foa_5 which is connected in series with the relay 0 is opened so that the relay 0 is not energized. A similar operation takes place when punched cards are analyzed, or when the keyboard is operated for introducing the number.

In any event, during a summing operation it is necessary to add to a stored summand, another summand which is introduced, for instance, by operation of a keyboard. In the signal combining device shown in Fig. 2, the input switch means s_1 to s_5 represent the stored summand, and the input switch means t_1 to t_5 represent the introduced summand which may be introduced by the operation of a keyboard. Since in the calculating machine in which the summing device of the present invention is applied, the addition is carried out by consecutively adding the digits of each decimal order, the input means need only represent a single digit, which is expressed by digit elements as explained above. It would be possible to operate the input switches s_1 to s_5 directly by the relays I to V similar to the operation of the input switches t_1 to t_5 which are operated by the relays T₁ to T₅. However, in the illustrated arrangements a tens transfer and complement transforming device, shown in Fig. 1, is arranged between the relays I to V and the input switch means s_1 to s_5 . The relays I to V operate the switches 1 to 5 in Fig. 1 and move, when energized, the switches, which are normally in closed position as shown in Fig. 1, to an open position, and the switches, which are normally in open position as shown in Fig. 1, to a closed position. The control switch d in the center of Fig. 1 is normally closed, and when no tens transfer is necessary, the relays S_1 to S_5 actuate the input switch means s_1 to s_5 in the same manner as if they were directly operated by the relays I to V. If, however, a tens transfer is necessary, the tens transfer control switch d' on the left side of Fig. 1 is closed which is normally in open position, while the control switch d in the center of Fig. 1 is opened. The switches 1 to 5 which are connected in series with the tens transfer control switch d' open such paths for the impulses energizing the relays S_1 to S_5 that a digit augmented by a unit is introduced by closing the respective input switches s_1 to s_5 . It will be noted that the tens transfer is carried out by adding the transfer unit to the stored summand.

When it is necessary to carry out a subtraction by adding the complement value, the key M, see Fig. 1a, is operated, whereby the relay K is energized, closes the switch k and opens switch k' shown in Fig. 1. The arrangement of the switches 0 to 5 which are connected in series to the switch k is such that the complement value is expressed by energized relays S_1 to S_5 and by the input switches s_1 to s_5 actuated by the same when the switch k is closed and the circuit controlled by switch d is disconnected by the opened switch k' . If a tens-transfer is necessary, the winding D_{II} is energized (Fig. 3) and effects shifting of switches d and d' . A fugitive

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one exceeding the storing capacity is added in a known manner in the lowest order. In this respect the complemental addition is in no way different from any other addition, since the circuit closed by the switch k in Fig. 1 serves to actuate the input switch means s_1 to s_5 by energizing the relays S_1 to S_5 when the switches s_1 to s_5 have to correspond to the complements of the digits to be subtracted. Otherwise the switches s_1 to s_5 are actuated by the relay windings S_1 to S_5 in their regular order when the switch d remains closed and connects the relay windings S_1 to S_5 through the closed contact k' which is connected in series with the switch d . When the relay winding K is energized not only the switch k is closed, but also the switch k' is opened thereby disconnecting the circuit normally used for addition. In the illustrated arrangement the input switches s_1 to s_5 which are associated with the stored summand are transformed into complement values by operation of the key M, but it is also possible to provide a complement transforming device as shown on the right side of Fig. 1 and which cooperates with the input switches t_1 to t_5 .

The device illustrated in Fig. 1 includes a tens transfer device and a complement transforming device. If a tens transfer and a complement transformation are required simultaneously on the same input side, complements to the 10 can be formed which include the tens transfer unit. The device shown in Fig. 1 carries out any required tens transfer or complement transformation before the summands are introduced into the summing device proper. It will be understood that the tens transfer and complemental circuit of Fig. 1 is arranged before the device shown in Fig. 2 since not matter how the relay windings S_1 to S_5 are energized in response to transformer input value, always the switches s_1 to s_5 will be operated.

As explained above, different digit elements are introduced into the device shown in Fig. 2 by the switches s_1 to s_5 when no tens transfer is necessary (switch d closed); when a tens transfer is necessary (switch d' closed), and for example s_2 is operated instead of s_1 ; and finally when a complemental addition is necessary in which event the digit 8 is introduced by means of switches s_3 and s_5 instead of the the digit element 1.

The signal combining device as shown in Fig. 2 serves the purpose of rearranging the input signals so that the summing device shown in Fig. 3 has to perform the same operation for two summands m and n regardless of whether summand m is introduced by the input switches s_1 to s_5 and summand n is introduced by the input switches t_1 to t_5 , or summand n is introduced by the input switches s_1 to s_5 and summand m by the input switches t_1 to t_5 .

The arrangement will be best understood with reference to a practical example, assuming that the input switches s_1 , s_3 and s_5 are closed to represent the digit 9, and the input switches t_1 and t_5 are closed to represent the digit 6. Since the switches s_1 and t_1 are closed, the terminals of the source of potential are connected through relay C, switch c , which is normally in closed position, and the oppositely wound relay coils E_1 . Since the two coils E_1 are wound in opposite directions, the switch e_1 is not actuated and remains open. The relay winding C rapidly operates and opens the switch c whereby the relay G_1 is energized and operates the circuit completing switches g_1 in Fig. 3 whereby predetermined circuits are closed for connecting an output terminal to ground potential. Since the relay G_1 is energized when two summand components corresponding to the digit element 1 are present, a circuit is completed in the summing device of Fig. 3 which connects the output terminal 2' to ground potential corresponding to the sum of 1+1.

The same operations take place with respect to the summand component 5, which is common to both summands. The relay G_5 is energized when the relay C opens the contact c and operates the associated circuit

completing switch means g_5 in Fig. 3 whereby a circuit is completed which corresponds to the sum of two digit elements 5.

The digit element 3 of the summand 9 has no counterpart in the other summand. Consequently, the closed input switch s_3 energizes only one of the two oppositely wound relay coils E_3 . Since the effect of the energized coil E_3 is not compensated by the other coil E_3 , the switch e_3 is closed and shortcircuits the relay G_3 . Immediately thereafter the relay C opens the switch c , but this has no effect since the relay G_3 is already bridged by the switch e_3 . The current flows through relay C, switch e_3 and one of the relay coils E_3 , and input switch s_3 to ground potential.

The energized relays G_1 , G_5 and E_3 operate the circuit completing switches g_1 , g_5 and e_3 in the circuit means of Fig. 3. The circuit completing switches e and g in Fig. 3 are shown in normal position, and it will be understood that some of the circuit completing switches are normally closed and others are normally open so that their operation by the associated relays E and G will move normally open circuit completing switches to closed position and normally closed circuit completing switches to open position.

From the above description of the apparatus, it will be understood that the relay windings E_1 , G_1 to E_5 , G_5 , the switches e_1 to e_5 and c , and the relay winding C shown in Fig. 2 constitute electrical actuating means for the circuit-completing switch means e_1 to e_5 and g_1 to g_5 shown in Fig. 3.

The result of the addition is 15, and consequently in accordance with the code applied in the arrangement, the digit 5 must be represented by sending an impulse through the output terminal 5', while at the same time a tens transfer to the next higher decimal order must be prepared. In the example this is carried out in the following manner. In the fourth circuit means from the left in Fig. 3 the switches e_3 and g_1 are closed, the switches g_3 and g_5 remain closed so that a circuit between the output terminal 5' and ground potential is completed. An impulse flows from the terminal of the source of potential to the output terminal 5' which is used to express the result digit 5 in a suitable manner which is not an object of the present invention.

At the same time the switch g_5 at the extreme right end of Fig. 3 closes and connects the minus terminal of the source of potential through the tens transfer output terminal D' to ground potential. As pointed out above, the energizing of the relay G_5 which operates the switch g_5 , takes place when both summands contain the digit element 5 so that the result must be at least 10. The tens transfer relay D, see Figs. 3 and 1, is energized by current flowing through winding D_H , opens the control switch d at the center of Fig. 1 and closes the tens transfer control switch d' on the left side of Fig. 1 and the holding contact d_H . Current flows through the holding winding D_H of the relay D so that the switches d and d' are held in shifted positions. As previously described, this results in the addition of a unit to the digit introduced during the next following operation in the next higher decimal order. For instance, if the digit element 1 is introduced in the next higher decimal order by closing the input control switch fa_1 , while switch d' is closed and switch d is open, the switches 1 in Fig. 1 are operated, and instead of the relay S_1 , the relay S_2 is energized so that the input switch s_2 is closed although the input control switch fa_1 was operated. When the relay C is energized in the next order, the contact c' (see Fig. 3) opens and relay D is de-energized. If a tens-transfer to the next following order is necessary, the winding D_T is energized and operates switches d , d' and d_H . The tens transfer operation will now be further explained with reference to a few numerical examples. The switches 1 to 5 which are normally closed as shown in Fig. 1 will be referred to as switches 1_c to 5_c , and

the switches which are normally open as shown in Fig. 1 will be referred to as switches 1_o to 5_o .

Assuming that the relay D is energized so that the control switches d and d' are shifted whereby the tens transfer circuits on the extreme left of Fig. 1 are made effective, the following transformations take place.

Introduced digit	Operated switches	Computed digit
0	$1_o, 2_o$	1
1	$1_o, 3_o$	2
2	$1_o, 2_o$	3
3	$1_o, 2_o$	1 4
4 (3, 1)	$3_o, 1_o, 2_o$	3 5

The tens transfer transformation for the digits 5 to 9 are carried out in a corresponding manner.

The complement transformation is effected when the relay K is energized and moves the contact k to closed position. The switches 0 open during each step since the relay 0 in Fig. 1a is energized by operation of the switch $1m$.

Introduced digit	Operated switches	Computed digit
0	$1_o, 2_o (1)$ $2_o, 3_o (3)$ $3_o (5)$	1+3+5=9
1	$2_o, 3_o (3)$ $3_o (5)$	3+5=8
2	$1_o, 2_o (2)$ $3_o (5)$	2+5=7
3	$1_o, 2_o (1)$ $3_o (5)$	1+5=6
3+1=4	$3_o (5)$	5
5	$1_o, 2_o (1)$ $2_o, 3_o (3)$	1+3=4

The complementary values of the digits 6 to 9 are found in a corresponding manner. The following is an example of a complementary addition as carried out by the apparatus:

Subtraction: 58	Complemental Addition: 58
-34	+65
24	123
	+ 1
	124

From the above description of the arrangement according to the present invention, it will be apparent that the summing device proper, which is illustrated in Fig. 3, is considerably simplified by the rearrangement of the signals by the signal combining device shown in Fig. 2 and by the tens transfer device and the complement transforming device shown in Fig. 1. Due to the fact that the summands of an addition are rearranged in the signal combining device so that they are added in the summing device by the same circuits regardless of whether they were introduced through the control switches fa or through the control switches ft , the summing device is considerably simplified.

The relay constructions which are generally used for telephone and telecommunication circuits are constructed for a limited number of contacts such as five or six switch contacts. Circuits requiring a greater number of switches to be operated by relay means necessitate the provision of twice as many relays which would render an electrical summing device employing relays uneconomical and impractical as compared with mechanical constructions. Consequently, the distribution

of the relay operations to the tens transfer device, the complement transforming device, and the signal combining device reduces the number of relay switches required in the summing device proper so that conventional relays can be used. Without a signal rearranging device, approximately twice as many circuit completing switches would be necessary in the summing device shown in Fig. 3 as compared with the arrangement of the present invention.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of summing devices differing from the types described above.

While the invention has been illustrated and described as embodied in a summing device including a signal combining device, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In an electrical summing device, in combination, a set of first electrical input switch means and a set of second electrical input switch means for representing, respectively, the summands of a sum, the input switch means of each of said sets of input switch means being, respectively, associated with the same series of digits or digit elements, each of said input switch means being operable between an operative closed condition and an inoperative open condition; a source of potential; a set of output terminals respectively associated with said series of digits or digit elements for representing the sum of said summands when said source of potential is connected to selected output terminals; a plurality of circuit means, each of said circuit means including circuit completing switch means, at least one of said circuit means connecting each of said output terminals to said source of potential when the respective circuit completing switch means are actuated; and a set of actuating relay means, each of said actuating relay means being respectively associated with predetermined circuit completing switch means, each of said actuating relay means including a pair of oppositely wound coils respectively connected in series with the input switch means of one pair of said pairs of first and second input switch means, a relay coil connected in series with said pair of oppositely wound coils, a bridging switch connected in parallel to said relay coil and being normally in open position and being closed when only one of said oppositely wound coils is energized, and another bridging switch connected in parallel with said relay coil and being normally in closed position; and a relay winding connected at one end thereof through all said actuating relay means and said first and second input switch means to one terminal of said source of potential and being connected at the other end thereof to the other terminal of said source of potential, said relay means operating said other bridging switch so that the circuit completing switch means associated with the respective actuating relay means complete the circuit means associated therewith when either input switch means of the respective pair of first and second input switch means is in said operative closed condition, and complete other circuit means of said circuit means associated therewith when both first and second input switch means of the respective pair of first and second input switch means are in said operative closed condition, said

other circuit means connecting said source of potential to selected output terminals representing the sum of the digit or digit elements represented by said first input switch means of the respective pair of first and second input switch means.

2. An electrical summing device as claimed in claim 1 and including a first set of input control relay means; a second set of input control relay means for operating said second input switch means between said closed and open conditions; a tens transfer output terminal connected to said circuit means; a tens transfer device arranged intermediate said first set of input control relay means and said first input switch means and including a set of relay means and switch means connected in series with the same and operated by said first set of input control relay means and operating said first set of input switch means, said tens transfer device including control switch means for switching said tens transfer device between a normal position and tens transfer position, said control switch means being connected to said tens transfer output terminal for placing said tens transfer device in said tens transfer position when said tens transfer output terminal is connected to said source of potential.

3. An electrical summing device as claimed in claim 2 and including a complement transforming circuit including switch means operated by said first set of input control relay means and being connected to said set of relay means of said tens transfer device, said complement transforming device being operable between a normal inoperative position and an operative position for transforming digits or digit elements into complementary values.

4. An electrical summing device as claimed in claim 3 wherein said circuit completing switch means include switches operated by either coil of each pair of said pairs of oppositely wound coils and other switches operated by said relay coils of said actuating relay means.

5. An electrical adding device as claimed in claim 1 wherein said circuit completing switch means include switches operated by either coil of each pair of said pairs of oppositely wound coils and other switches operated by said relay coils of said actuating relay means.

6. In a device of the type described, in combination, a set of first electrical input means and a set of second electrical input means for representing respectively the summands of a sum, the input means of each of said sets of input means being respectively associated with the same series of digits or digit elements; a serial adder for adding two digits or digit elements represented by electrical signals; a signal combining device connecting said first and second input means with said serial adder device, said signal combining device including a set of relay means respectively associated with said digit or digit elements, each of said relay means including a pair of oppositely wound coils respectively connected to associated first and second input means, a relay coil connected in series with said pair of oppositely wound coils, a bridging switch connected in parallel to said relay coil and being normally in open position and being closed when only one of said oppositely wound coils is energized, and the other bridging switch connected in parallel with said relay coil and being normally in closed position; a relay winding connected at one end thereof through all said relay means to said first and second input means, said relay winding controlling said other bridging switch; and a source of potential having one terminal connected to the other end of said relay winding and the other terminal connected to said first and second input means so that a first signal is introduced into said serial adder by each relay means when both coils of the same are energized, and a second signal is introduced into said serial adder when only one coil of the respective relay means is energized.

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7. A device as set forth in claim 6 and wherein said first input means include a tens transfer device and a complement transforming device; and means for selectively rendering said tens transfer device and said complement transforming device effective.

8. A device as set forth in claim 6 wherein said input means are switches respectively movable between a circuit opening position and a circuit closing position.

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