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2,636,932

RELAY COUNTING CHAIR USING DOUBLE-COIL RELAYS

Filed Aug. 4, 1947

3 Sheets-Sheet 1

FIG. 1.

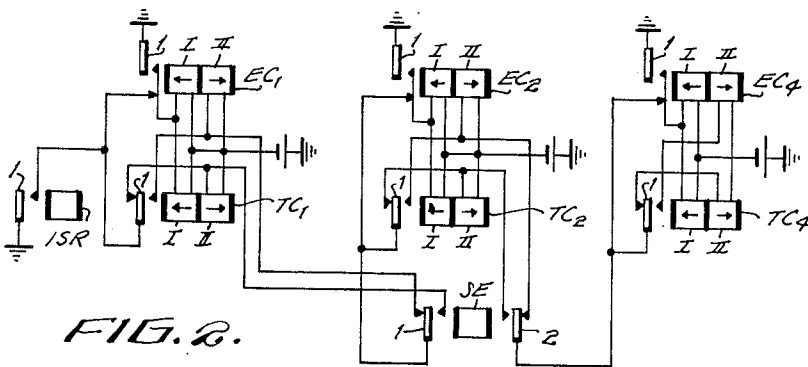
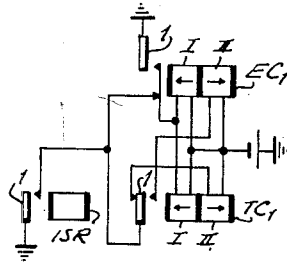


FIG. 2.

	0	1	2	3	4	5	6	7
EC ₁								
TC ₁								
EC ₂								
TC ₂								
EC ₄								
TC ₄								

FIG. 3.

	0	1	2	3	4	5	6	7
EC ₁								
TC ₁								
EC ₂								
TC ₂								
EC ₄								
TC ₄								

FIG. 4.

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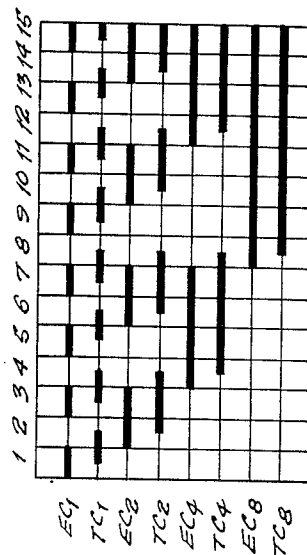
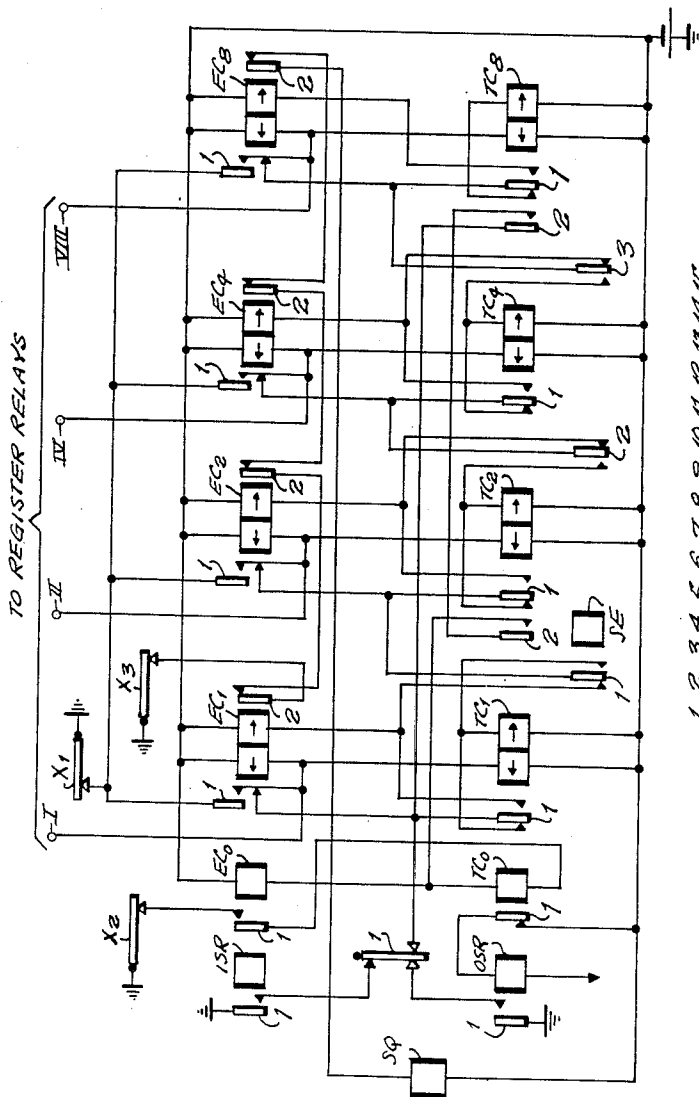
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RELAY COUNTING CHAIR USING DOUBLE-COIL RELAYS

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FIG. 7.

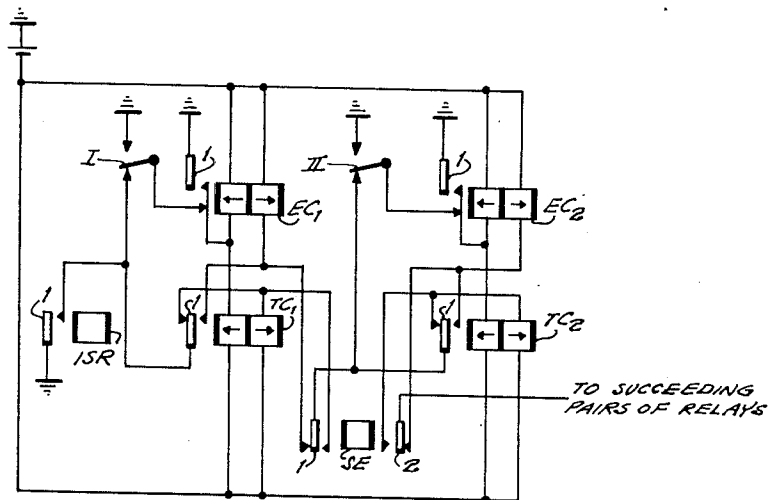
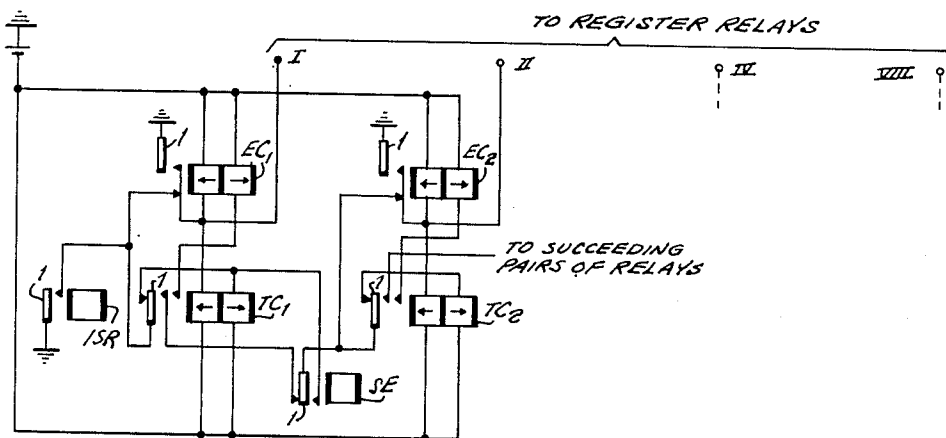


FIG. 8.

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UNITED STATES PATENT OFFICE

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RELAY COUNTING CHAIN USING
DOUBLE-COIL RELAYSRoelof M. M. Oberman and Antonie Snijders,
The Hague, NetherlandsApplication August 4, 1947, Serial No. 768,028
In the Netherlands September 14, 1945

3 Claims. (Cl. 175-320)

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The invention relates to a relay register, equipped by means of a principle resembling that of Fig. 2 of the Dutch Patent 52,592, in so far as this older circuit arrangement makes use of 4 pair of relays, each pair consisting in a counting relay and an auxiliary relay, which 4 pair can be energized in all the combinations, whereby till 15 impulses can be counted with that arrangement. The application in question is, however, not restricted to any particular number relay groups or impulses to be counted. It is nevertheless a fact that just like the older arrangement it makes use of the principle that a counting relay is energized when the impulse contact makes and the appropriate auxiliary is energized when the contact breaks; this impulse contact may be a contact for registering into the register the impulses that have been sent into the register or it may be a contact of a so called out-stepping relay when the register must be used in a Bell system, in which case, as known, after the register has received a figure, when pulsing out the registered figure it must receive re-issue impulses from the automatic exchange till the total impulses amount to 11.

Instead of by impulses of the impulse contact the register according to the invention can be positioned by single contact closures, effected by keys or equivalent elements, which contact closures immediately result in the energization of the counting arrangement relays in a particular combination corresponding with the figure to be registered. These contact closures preferably take place according to the 1-2-4-8 system, i. e. that 4 conductors are connected to the counting arrangement, when the counting arrangement comprises 4 counting relays, in which case by right combination of the energizations effected via these conductors till 15 impulses can be transferred to the counting arrangement and the figure registered in it every time is equal to the sum of the digits of the four mentioned conductors, in so far as these conductors have been used for the single energization of counting relays. It will be evident that the four mentioned conductors can also be used in the reverse direction, i. e. for the registering at register-relays or condensers of a figure received by the counting arrangement under the control of an impulse contact.

The counting arrangement has with regard to the register relays a receiving function, while it fulfills a pulsing out function when in a later stadium of the building up of the connection the registered figure is retransmitted from the reg-

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ister relay to the selector, during which function the register relays relative to the counting arrangement fulfill a function, which has been attributed above to keys or suchlike.

It has already been described above in what manner a counting arrangement according to the invention will operate for pulsing out a received figure to a Bell selector; if the counting arrangement is to co-operate with an automatic exchange according to another system, e. g. a Siemens automatic exchange, it will be necessary for the counting arrangement to effect a stopping circuit for the impulse transmitter as soon as over the impulse contact a number of impulses has arrived on the counting arrangement, which number is equal to the received figure. The counting arrangement according to the invention provides in a simple manner for the required different function for these different systems, as it is equipped of switch-over contacts, which in position make the counting arrangement work normally for adding arriving impulses, on the whole in the same manner as before mentioned older application and which bring about in the other position, that each following arriving impulse diminishes the figure that has been received in the counting arrangement, by one; thus the counting arrangement is enabled to give a criterion to the relevant selector when it has been reduced again to zero.

For the last mentioned purpose each counting relay and each auxiliary relay has been equipped with two counteracting coils, which when being energized simultaneously make the relay release or prevent it from attracting, while the relay attracts when one of the windings is energized alone.

The impulse circuit has been connected over a normal contact to one of the windings of a counting relay, that, when being energized breaks this normal contact, but as it is a make-before-break contact to earth, supplies a holding circuit for the mentioned winding. At the end of the impulse the appropriate auxiliary relay operates; parallel to the mentioned winding one of the windings of the auxiliary relays is namely energized; as simultaneously the counteracting winding is energized over the impulse contact, the relay cannot operate before the impulse contact is broken. So in this last mentioned function the arrangement according to the invention differs already from the one according to the above mentioned older application, where the auxiliary relay attracted in series with the counting relay when the impulse contact breaks. At

its being energized the auxiliary relay switches over the impulse circuit from its second winding to the second, counteracting winding of the counting relay and in parallel with it to the first winding of the following counting relay of the series, in such a manner that at the second impulse the first counting relay releases and the second attracts and at the end of the second impulse the first auxiliary relay releases and the second attracts.

The before indicated through-switching of the impulse circuit to the second counting relay takes place via a changeover contact that can be moved over with the before mentioned object of changing the arrangement for another automatic system; if this takes place, the through-switching of the circuit to the following counting relays is no longer dependent on the being energized of the preceding auxiliary relay but on the being released of that relay. In consequence of the switching over now each following impulse only causes the release of a counting relay at the beginning of the impulse and the release of the additional relay at the end of the impulse, while at the beginning not a following counting relay is energized and again, like before, at the end of the impulse the impulse circuit is through-switched to a following counting relay.

Hereafter the invention will be explained nearer by means of the annexed drawing, which by way of example represents some embodiments and shows:

Fig. 1 the principle of the co-operation of counting- and auxiliary relays each with two windings;

Fig. 2 a simple arrangement for counting impulses which makes use of three sets of counting and auxiliary relays, each with two windings, which sets can be energized in all possible combinations;

Fig. 3 the succession in which the relays of the arrangement of Fig. 2 function, when impulses arrive at it;

Fig. 4 the succession in which the relays of the arrangement of Fig. 2 operate, when the contacts *se* from the drawn position have been moved over and owing to that the arrangement from adding has become subtracting;

Fig. 5 a relay register for a decade system, which can be used for a Bell automatic exchange as well as for an automatic exchange according to another system, e. g. Siemens;

Fig. 6 the functioning schematic belonging to Fig. 5, in case this arrangement has an adding function;

Fig. 7 a modification of the arrangement according to Fig. 5;

Fig. 8 a second modification of the arrangement according to Fig. 5.

Fig. 1 is a diagram of a relay arrangement for counting rhythmical impulses which comprises a normally open impulse contact shown in Fig. 1 as a contact *1* of a relay *ISR* which is energized by the impulses sent from a dial as explained more fully in connection with Fig. 5. The impulse contact *1* of the relay *ISR* is connected on the one hand to the make-before-break contact *1* of a counting relay *EC₁* which has a first winding *I* and a second winding *II* which are wound in opposition to each other so as to counteract each other. On the other hand the impulse contact *1* of the relay *ISR* is connected to a change-over device *1* which is under control of an auxiliary relay *TC₁* having a first winding *I* and a second winding *II* being wound in

opposition to each other so as to counteract each other. One end of the first winding *I* of the counting relay *EC₁* is connected to one end of the first winding *I* of the auxiliary relay *TC₁*, and the make-before-break contact device *1* of the counting relay *EC₁* being under control of the counting relay *EC₁* is connected to the junction of the first windings *I* of the counting relay *EC₁* and the auxiliary relay *TC₁* and has contacts connected, respectively, to ground and to the impulse contact *1* of the relay *ISR*, the make-before-break contact device in the normal position thereof engaging the contacts connected to the impulse contact. The change-over contact device has an armature being under control of the auxiliary relay *TC₁* and is connected to the contact of the make-before-break contact device connected to the impulse contact, the change-over contact device having contacts being connected, respectively, to one end of the second windings *II* of the counting relay *EC₁* and the auxiliary relay *TC₁*, the change-over contact device in the normal position thereof engaging the contact thereof connected to the second winding *II* of the auxiliary relay *TC₁*. Furthermore, means such as a battery are provided for supplying a current to the other ends of the windings *I* and *II* of both the counting relay *EC₁* and the auxiliary relay *TC₁*.

The operation of this device is as follows:

When the impulse contact *1* actuated by the relay *ISR* is closed the first time, the winding *I* of the counting relay *EC₁* is energized in the circuit ground, impulse contact *1* of relay *ISR*, make-before-break contact *1* of the counting relay *EC₁*, first winding *I* of the counting relay *EC₁*, battery to ground. The counting relay *EC₁* attracts therefore the armature of the make-before-break contact *1* and closes thereby a holding circuit for itself to ground. It should be noted that the winding *II* of the counting relay *EC₁* does not carry any current during this stage of the operation since the circuit thereof is interrupted at the change-over contact device *1* of the auxiliary relay *TC₁*.

At the same time the first winding *I* and the second winding *II* of the auxiliary relay *TC₁* are energized. The current in the first winding of the auxiliary relay *TC₁* flows in the circuit from ground over impulse contact *1* of relay *ISR*, make-before-break contact device *1* of the counting relay *EC₁*, first winding *I* of auxiliary relay *TC₁*, battery to ground. The ground of this circuit is replaced by the ground connected to the make-before-break contact *1* of the counting relay *EC₁* as soon as the latter is energized. The current of the second winding *II* of the auxiliary relay *TC₁* flows from ground over impulse contact *1* of relay *ISR*, change-over contact device *1* of the auxiliary relay *EC₁*, winding *II* of the auxiliary relay *EC₁*, battery to ground. Thus it will be understood that the two windings of the auxiliary relay *TC₁* opposing each other prevent the auxiliary relay *TC₁* from operating as long as the impulse contact *1* of the relay *ISR* remains in the closed position thereof.

However, when the impulse contact *1* of the relay *ISR* is released the auxiliary relay *TC₁* attracts the armature thereof. This happens approximately at the time when half of the first impulse has passed. The counting relay *EC₁* remains energized until the second impulse is given, and the impulse contact *1* of the relay *ISR* closes a second time. At this moment the auxiliary relay *TC₁* is energized and attracts the

armature thereof and in consequence thereof the second winding II of the counting relay EC₁ is energized together with the first winding I thereof so that the counting relay EC₁ remains unenergized during the second impulse. When approximately half of the second impulse has passed, the impulse contact 1 of the relay ISR returns to the open position and then all the windings of the counting relay and the auxiliary relay are in open circuits so that arrangement returns to the initial position thereof.

This principle has been used in the arrangement according to Fig. 2 showing three counting relays EC₁, EC₂, EC₃ and three auxiliary relays TC₁, TC₂, TC₃, each relay having two windings acting in opposition to each other. One side of the second winding of the counting relay EC₁ is connected over the impulse circuit to the next counting and auxiliary relays EC₂ and TC₂ by means of a contact *se 1* in the shown position. Owing to this following impulses according to the diagram of Fig. 3 are now registered as energizations of the relays EC₁—TC₃ while the result of a second impulse is not only that the relays EC₁ and TC₁ release, but also that relays EC₂ and TC₂ operate.

Whenever a contact *se* is moved over to its off-normal position, the impulse circuit for the relays of the next stage is connected to the second winding of the auxiliary relay of the preceding stage. The beginning of the first impulse releases the first counting relay EC₁ and the end of the first impulse the first auxiliary relay TC₁, while the beginning of the following impulse releases the second counting relay EC₂, etc. Furthermore, at the second impulse the first counting relay EC₁ is energized again. Consequently it is to be understood that while during an adding process the energization of EC₂ is accompanied by the release of EC₁, as shown in Fig. 3, during a subtracting process the release of EC₂ is accompanied by the energization of EC₁ as shown in Fig. 4. Let it now be assumed that all the counting and auxiliary relays are energized and the contacts *se 1* and *se 2* are in the off-normal position. The operation of the arrangements is as follows and illustrated by the diagram shown in Fig. 4. When the impulse contact *isr* is now closed on the first incoming impulse the second winding of the first counting relay EC₁ will carry a current in a circuit from ground over the impulse contact *isr*, front contact *tc 1*, second winding of relay EC₁, battery to ground and counteracts the first winding of counting relay EC₁ which is operated in a circuit from ground over contact *ec 1*, first winding of counting relay EC₁, battery to ground so that the first counting relay EC₁ is released and the make-before-break contact *ec 1* is switched over from the holding ground to the ground supplied by the impulse contact *isr*. The first winding of the first auxiliary relay TC₁ stays operated as long as the contact *ec 1* supplies ground. When ground is removed by the impulse contact *isr* the first auxiliary relay TC₁ releases the armature thereof.

At the beginning of the second impulse ground is supplied over the impulse contact *isr* to the first winding of the first counting relay EC₁ and both windings of the first auxiliary relay TC₁, and also to the second winding of the second counting relay EC₂ in a circuit from ground over the impulse contact *isr*, back contact *tc 1*, off-normal contact *se 1*, front contact *tc 2*, second winding of the second counting relay EC₂, battery to ground. As the second winding of the

relay EC₂ counteracts the first winding of relay EC₂, relay EC₂ releases its armature *ec 2*. Owing to the make-before-break contact *ec 2* switching over from the holding ground to the ground at the impulse contact *isr* the first windings of relays EC₂ and TC₂ carry a current which is interrupted only at the end of the impulse. At the third impulse the first counting and auxiliary relays EC₁ and TC₁ are de-energized again as described hereinabove for the first impulse.

At the beginning of the fourth impulse the first and second counting relays EC₁ and EC₂ are energized again while the third counting relay EC₃ releases the armature thereof.

The first counting relay EC₁ is once more energized in the circuit described with reference to Fig. 1, whereas the second counting relay EC₂ is operated over the first winding thereof in a circuit from ground over the impulse contact *isr*, back contact *tc 1*, off-normal contact *se 1*, contact *ec 1*, first winding of second counting relay EC₂, battery to ground, while both winding of the first and second auxiliary relays TC₁ and TC₂ carry current. The second counting relay EC₂ switches over its make-before-break contact *ec 2* to the holding ground. The second counteracting winding of the third counting relay EC₃ carries current in a circuit from ground over the impulse contact *isr*, back contact *tc 1*, off-normal contact *se 1*, back contact *tc 2*, off-normal contact *se 2*, front contact *tc 3*, second winding of relay EC₃, battery, to ground. Contact *ec 3* makes before breaking the holding ground, the contact supplying ground over the impulse contact *isr*. The third auxiliary relay TC₃ stays in energized condition as long as the impulse lasts. At the end of the fourth impulse the third counting relay EC₃ and the third auxiliary relay TC₃ are restored to normal, while the first and second auxiliary relays TC₁ and TC₂ are operated. At the fifth impulse the first counting relay EC₁ is again de-energized as described hereinafter for the first impulse. At the sixth impulse the second counting relay EC₂ is restored to normal as described hereinabove for the second impulse while the first counting relay EC₁ is operated again. At the seventh impulse the first counting relay EC₁ is restored to normal and so is the first auxiliary relay TC₁ at the end of the seventh impulse.

Whenever the contacts *se 1* and *se 2* are in the shown normal position the operation is as follows (Fig. 3):

The first impulse is recorded as described with reference to Fig. 1. The second impulse is transferred to the second counting relay EC₂ over front contact *tc 1* in a circuit from ground over impulse contact *isr*, front contact *tc 1*, normal contact *se 1*, contact *ec 2*, first winding of relay EC₂, battery, to ground. Both the windings of the second auxiliary relay TC₂ are energized, the first winding parallel to the first winding of relay EC₂ over contacts *ec 2*, the second winding of relay TC₂ over the back contact *tc 2*. The first counting relay EC₁ is de-energized on the second impulse as stated with reference to Fig. 1. At the end of the second impulse the first auxiliary relay TC₁ is restored to normal whereas the second auxiliary relay TC₂ is operated over the first winding thereof parallel to the first winding of the second counting relay EC₂ over the contact *ec 2* thereof to the holding ground. On the third impulse the first counting relay EC₁ is operated again, and at the end of the impulse also the first auxiliary relay TC₁. On the fourth impulse

the third counting relay EC_3 is operated over the first winding thereof in a circuit from ground over impulse contact isr , front contact tc_1^1 , normal contacts tc_2^1 , normal contact $se\ 2$, contact ec_4^1 , first winding of relay EC_4 , battery, to ground. The first and second counting relays EC_1 and EC_2 , however, release the armatures thereof owing to currents in their second winding, respectively, from ground, impulse contact isr , front contact tc_1^1 , second winding of relay EC_1 , battery, to ground, and over front contact tc_1^1 , normal contact $se\ 1$, front contact tc_2^1 so that the make-before-break contacts ec_1^1 , and ec_2^1 thereof, respectively, are switched over to the impulse circuit which supplies ground as long as the impulse lasts. At the end of the fourth impulse the third counting relay EC_3 and the third auxiliary relay TC_3 are operated in circuits, respectively, from ground over contact ec_4^1 , first winding of relay EC_4 , battery to ground, and over ec_4^1 , first winding of relay TC_3 , battery, to ground. The first and second auxiliary relays TC_1 and TC_2 are restored to normal at the end of the fourth impulse, the ground being removed by the impulse contact isr from the first windings thereof.

On the fifth impulse the first counting relay EC_1 is once more energized as described hereinabove, whereas at the end of the fifth impulse the first auxiliary relay TC_1 is operated. On the sixth impulse the second counting relay EC_2 is energized as described hereinabove for the second impulse, the first winding relay EC_1 being de-energized. At the end of the sixth impulse the second auxiliary relay TC_2 is energized and the first auxiliary relay TC_1 de-energized as described hereinabove for the second impulse. On the seventh impulse the first counting relay EC_1 is again energized and at the end of the seventh impulse also the first auxiliary relay TC_1 .

It will be clear that the last counting performance is an arithmetical progression which is transformed by the counting relays to a logarithmical progression of 2, the first counting relay EC_1 standing for 2^0 , the second counting relay EC_2 for 2^1 , the third counting relay EC_3 for 2^2 and if the system is extended, a fourth counting relay EC_4 stands for 2^3 , a fifth counting relay for 2^4 etc. Furthermore this last counting performance is based on adding the impulses such that the total amount of the received impulses is indicated by the operated counting relays, e. g. when 6 impulses are received the second and fourth relays EC_2 and EC_4 are energized standing for a total of $2^1 + 2^3 = 6$ impulses.

When the contacts $se\ 1$ and $se\ 2$ are in their off-normal position the received impulses form a negative arithmetical progression, so that this counting process may be called a subtraction.

This inverse operation in the two difference positions of se is used in the register shown in the essential parts thereof in Fig. 5.

In the shown normal position of the contacts $se\ 1$ — $se\ 3$ the operation of the counting arrangement under the influence of closures of the impulse contact isr or of the contact osr of an outstepping relay OSR is as indicated in the diagram shown in Fig. 6, whereby the arrangement is so designed that on the 11th impulse the relays EC_0 , TC_0 are energized, owing to which the contact tc_0^1 stops the relevant selector.

In the off-normal position of the contacts $se\ 1$ — $se\ 3$ the arrangement is subtracting and receives impulses from the contact isr until the relevant digit which has been recorded by the arrangement is reduced to zero, by the steps

made by the relevant selector, after which a relay SQ stops the selector.

The cams x_1 , x_2 , x_3 and I of a sequence switch control the operation of the successive stages of the operation of the arrangement; the ground for the holding circuits is supplied over cam x_1 , so that removal of ground by cam x_1 results in the releases of the eight relays of the counting arrangement when they are energized; the cam x_2 supplies ground potential to the relays EC_0 and TC_0 which are de-energized by the removal of the ground by said cam, whereas cam x_3 is connected in the circuit of the selector stopping relay; the set EC_0 — TC_0 and for X_3 relative to SQ .

The four conductors I, II, IV and VIII serve for the transmission of a digit from the counting arrangement to register relays or—registering condensers (not shown) or for energizing the relays of the counting arrangement from register relays or keys according to a particular digit, when the counting arrangement has to operate as pulsing out arrangement positioning the selectors. The operation of the arrangement shown in Fig. 5 has been described hereinabove for seven impulses with reference to Fig. 2 with the contacts $se\ 1$ — $se\ 3$ in normal position. On the eighth impulse the fourth counting relay EC_3 is energized over the first winding thereof in a circuit from ground over impulse contact isr , cam I of the sequence switch, front contact tc_1^1 , normal contact $se\ 1$, front contact tc_2^1 , normal contact $se\ 2$, front contact tc_3^1 , normal contact $se\ 3$, contact ec_4^1 , first winding of relay EC_4 , battery, to ground. In this circuit both windings of the fourth auxiliary relay TC_3 carry current, the first winding parallel to the first winding of relay EC_3 , and the second winding over the back contact tc_3^1 of the relay TC_3 , battery to ground.

Armature eca^1 is switched over owing to the energization of the first winding of relay EC_3 , and completes a holding circuit from ground over cam x_1 of the sequence switch before breaking the ground supplied over the impulse circuit.

In the meantime the relays EC_1 , EC_2 and EC_4 have released their armatures ec_1^1 , ec_2^1 and ec_4^1 , respectively, owing to the energization of the second winding over the impulse circuit. At the end of the eighth impulse the fourth auxiliary relay TC_3 is operated over the first winding thereof in a circuit ground, cam x_1 of the sequence switch, front contact ec_4^1 , first winding of relay TC_3 , battery, to ground. The relays TC_1 , TC_2 and TC_4 are de-energized by the removal of ground at the impulse contact isr .

On the ninth impulse the first counting relay TC_1 is again operated and the first auxiliary relay TC_1 is operated at the end of the ninth impulse. On the tenth impulse the second counting relay EC_2 is operated again and the first counting relay EC_1 is de-energized, while at the end of the tenth impulse relay TC_2 is operated and relay TC_1 de-energized as stated hereinabove. On the eleventh impulse relay EC_1 and relay EC_0 are operated, the latter in the circuit from ground, impulse contact isr , cam I of the sequence switch, front contact tc_3^1 , front contact tc_2^1 , relay EC_0 , battery, to ground. Relay EC_0 closes a holding circuit in which relay TC_0 is operated from ground over cam x_2 of the sequence switch, front contact ec_3^1 , relay TC_0 , relay EC_0 , battery, to ground. Relay TC_0 interrupts by means of contact tc_0^1 the stepping circuit of the relevant selector. In the Bell system a digit-number is recorded as a total

equal to the digit-number, so that e. g. the digit-

number 6 is recorded as the energization of relays EC₁ and EC₂ ($2^1 2^2 = 6$), the selector is positioned by five steps being the complement of 11 so that on the eleventh impulse contact tc_0^1 interrupts the stepping circuit of the selector.

When cooperating with a Siemens exchange the contacts $se\ 1-se\ 3$ are in the off-normal position thereof. If e. g. the digit-number 8 is recorded relays EC₁ and EC₂ are energized when the relevant selector has to be positioned. On the first impulse from the selector relay EC₁ releases the armature thereof owing to the energization of the second winding thereof in the circuit ground over impulse contact isr , cam I of the sequence switch, back contact tc_1^1 . The operation of the following impulses has been described with reference to Fig. 2.

At the third impulse of the series, which has been taken as an example, all the counting relays EC₁—EC₈ are restored to normal so that the stopping relay SQ is now energized in the circuit from ground, cam z_3 , back contacts ec_1^2 , ec_2^2 , ec_4^2 and ec_8^2 , relay SQ, battery, to ground. Consequently the selector is now stopped.

The arrangement shown in Fig. 7 is for the greater part thereof in accordance with the one shown in Fig. 5; the main difference is the manner in which the front contact of each auxiliary relay connects the impulse circuit to the second winding of the next counting relay or to the prolonged impulse circuit.

Thus when the tc contact is released there is no connection between the prolonged impulse circuit and the windings of the counting relays, which prevents the undesired energization of counting relays if there would be ground at one of the conductors I, II, IV, VIII for the positioning of the counting arrangement, which might occur in the arrangement shown in Fig. 5.

In Fig. 5 the input of a digit over the conductors I, II, IV and VIII results in the energization of two windings when the digit is applied in a corresponding energization of register relays. The arrangement according to Fig. 8 corresponding also for the greater part with the one shown in Fig. 5; the difference consists in the manner in which the digit is positioned in the arrangement by keys, register relays or the like. Change-over contacts I, II of keys or relays are provided and energize the counting relays in corresponding combinations, so that cross connections of different counting relays may occur.

While we have illustrated and described what we regard to be the preferred embodiment of our invention, nevertheless it will be understood that such is merely exemplary and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention, we claim:

1. In a relay arrangement for counting electrical impulses, in combination, a normally open impulse contact connected to ground; means for control of said electrical impulses for closing said impulse contact; a counting relay and an auxiliary relay each having a first winding and a second winding being wound in opposition to each other so as to counteract each other, one end of said first winding of said counting relay being connected to one end of said first winding of said auxiliary relay; a make-before-break contact device under control of said counting relay and connected to the junction of said first windings, said make-before-break contact device having contacts being, respectively, grounded and connected to said impulse contact, said make-before-

break contact device in the normal position thereof engaging said contact connected to said impulse contact; a change-over contact device having a first stationary contact, a second stationary contact, and an armature cooperating alternately with said stationary contacts, said armature being under control of said auxiliary relay and connected to said contact of said make-before-break contact device connected to said impulse contact, said stationary contacts of said change-over contact device being connected, respectively, to one end of said second windings of said counting relay and said auxiliary relay, said armature of said change-over contact device in the normal position thereof engaging said stationary contact connected to said second winding of said auxiliary relay; and means for supplying a current to the other ends of said windings, whereby when said impulse contact is closed a first time the impulse energizes said counting relay, said auxiliary relay remaining unenergized because said two opposing windings thereof carry current, whereas at the following opening of said impulse contact only one of said windings of said auxiliary relay is energized, thus energizing said auxiliary relay, while at the beginning of the next impulse said counting relay is released and at the end of the next impulse said auxiliary relay is released as well thereby returning the relay arrangement to the initial position thereof.

2. In a binary relay arrangement for counting electrical impulses, in combination, a normally open impulse contact connected to ground; means for control of said electrical impulses for closing said impulse contact; a plurality of cooperating with one another in a binary relation and stages each including a counting relay and an auxiliary relay each having a first winding and a second winding being wound in opposition to each other so as to counteract each other, one end of said first winding of said counting relay in each stage being connected to one end of said first winding of said auxiliary relay in said stage; a make-before-break contact device in each stage under control of said counting relay in said stage and connected to the junction of said first windings in said stage; a first contact and a second contact for each of said make-before-break contact devices, said first contact in each stage being grounded and said second contact being connected in the first of said stages to said impulse contact and in the other stages, respectively, to the preceding stage; said make-before-break contact device in the normal position thereof engaging, respectively, in said first of said stages said contacts connected to said impulse contact and in said other stages said contacts connected to the preceding stage; a change-over contact device in each of said stages having a first stationary contact, a second stationary contact, and an armature cooperating alternately with said stationary contacts, said armature being under control of said auxiliary relay in said stage and connected to said second contact of said make-before-break contact device in said stage, said stationary contacts of each of said change-over contact devices being connected, respectively, to one end of said second windings of said counting relay and said auxiliary relay in said stage, said armature of said change-over contact devices in the normal position thereof engaging, respectively, said stationary contacts connected to said second windings of said auxiliary relays; and means for supplying a current to the other ends of said windings whereby said counting relay of

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said first stage is energized during every odd impulse, said counting relay of said second stage is energized during every consecutive two impulses starting with the second, sixth, tenth, etc., impulses, said relay (if any) of said third stage is energized during four consecutive impulses starting at the fourth and twelfth impulses, etc., and said auxiliary relays of each of said stages are energized, respectively, approximately a half impulse after said counting relays associated therewith.

3. In a binary relay arrangement for counting electrical impulses in a communication system, in combination, a normally open impulse contact connected to ground; means for control of said electrical impulses for closing said impulse contact; four stages cooperating with one another in a binary relation and each including a counting relay and an auxiliary relay each having a first winding and a second winding being wound in opposition to each other so as to counteract each other, one end of said first winding of said counting relay in each stage being connected to one end of said first winding of said auxiliary relay in said stage; a make-before-break contact device in each stage under control of said counting relay in said stage and connected to the junction of said first windings in said stage; a first contact and a second contact for each of said make-before-break contact devices, said first contact in each stage being grounded and said second contact being connected in the first of said stages to said impulse contact and in the other stages, respectively, to said second winding of said counting relay of the preceding stage, said make-before-break contact devices in normal position engaging, respectively, in said first stage said contact connected to said impulse contact and in said other stages said contacts connected to said second winding of said counting relay of the preceding stage; a change-over contact de-

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vice in each of said four stages, said change-over contact device having a first stationary contact, a second stationary contact, and an armature cooperating alternately with said stationary contacts, said armature being under the control, of said auxiliary relay in said stage and connected to said second contact of said make-before-break contact device in said stage, said stationary contacts of each of said change-over contact devices being connected, respectively, to one end of said second winding of said counting relay and said auxiliary relay in said stage, said armatures of said change-over contact devices in normal position engaging, respectively, said stationary contacts connected to said second winding of said auxiliary relays; and means for supplying a current to the other ends of said windings whereby said counting relay of said first stage is energized during every odd impulse, said counting relay of said second stage is energized during every consecutive two impulses starting at the second, sixth, tenth, and fourteenth impulses, said counting relay of said third stage is energized during every four consecutive impulses starting at the fourth and twelfth impulses, and said counting relay of said fourth stage is energized during eight consecutive impulses starting at the eighth impulse, said auxiliary relays of each of said stages being energized, respectively, approximately a half impulse after said counting relays associated therewith.

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