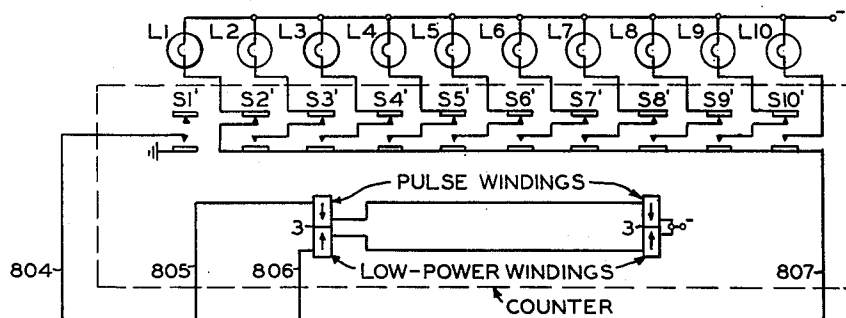
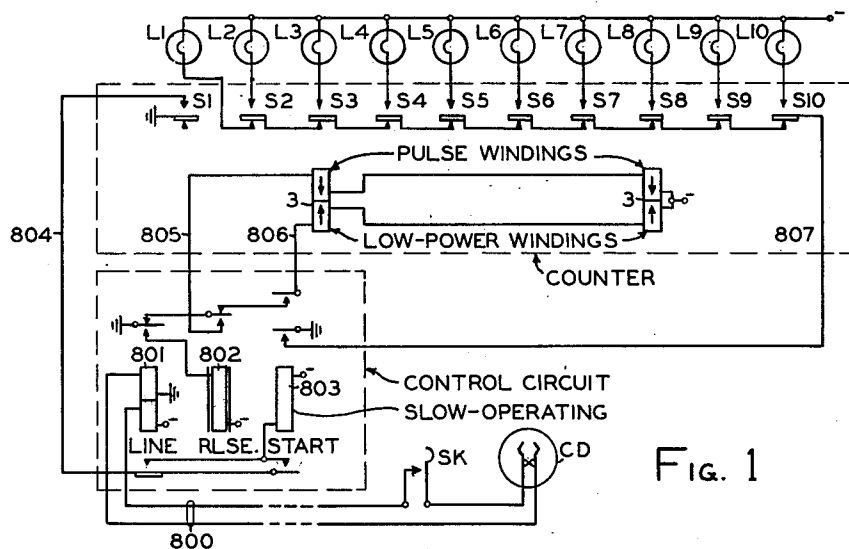


April 7, 1953

J. I. BELLAMY
CONTROL AND MARKING CIRCUITS FOR
ADDING-TYPE IMPULSE COUNTERS
Original Filed Feb. 15, 1946

2,634,403



INVENTOR:

John I. Bellamy

UNITED STATES PATENT OFFICE

2,634,403

CONTROL AND MARKING CIRCUITS FOR
ADDING-TYPE IMPULSE COUNTERS

John I. Bellamy, Wheaton, Ill., assignor, by mesne assignments, to Kellogg Switchboard and Supply Company, a corporation of Delaware

Original application February 15, 1946, Serial No. 647,896, now Patent No. 2,538,816, dated January 23, 1951. Divided and this application November 21, 1950, Serial No. 196,886

3 Claims. (Cl. 340-168)

1

This invention relates to control and marking circuits for an adding-type impulse counter.

This application is a division of my application for Impulse Counting Devices, Serial No. 647,896, filed February 15, 1946, now Patent No. 2,538,816.

The object of this invention is to provide an improved control and marking circuit arrangement for an electromagnetic counting device of the adding type as disclosed in my parent application above identified.

The counting device of the parent application is termed an adding type device, for the receipt and counting of each new impulse of a series results in a new set of contact members being added to the stackups already actuated, in that the nature of the counting device is such that all actuated contact sets are maintained actuated until the device is cleared out following the completion of the counting operation.

A specific object is to provide individual marking conductors corresponding respectively to the impulses of the maximum series to be counted, but to control these wires exclusively from the contact sets succeeding the first, which is thus left free to perform any desired pilot or off-normal control functions.

A further specific object is to limit as far as practicable the number of contact sets which exercise control over any individual marking conductor, to the end that a circuit fault at any contact set affects a minimum of individual marking conductors.

Referring now to the accompanying drawings, comprising Figures 1 and 2,

Figure 1 shows the counting device of Figs. 1 to 3 of the parent application employed in a simple signaling system to control the lighting of any desired one of a series of signal lamps; and

Figure 2 shows a similar signaling system employing a desirable modification of the contact sets of the counting device.

The system of Figure 1

In the system of Fig. 1, the electromagnetic counting device of parent application is shown in circuit diagram within the rectangle labeled "Counter." The contact sets S1 to S10 of the counter are indicated diagrammatically within this rectangle, along with the two electromagnets 3. A desirable feature of this system is that the first contact set S1 is freed for control duty as off-normal contacts by the illustrated circuit arrangement in which the second contact set S2 serves the first and second marking conductors, extending to the first and second lamps L1 and

2

L2 of a set of ten, the remaining marking wires and lamps being served respectively by contact sets S3 to S10. The ten contact sets of the counter thus selectively control ten separate marking wires or signal leads, in addition to providing a set of off-normal contacts for general control purposes. This has the advantage that the device does not need to be widened, or otherwise altered, to provide an additional set of contacts for off-normal purposes as in my Patent No. 2,441,001.

The impulse counter is controlled over line 800, through the medium of the control circuit comprising relays 801 to 803. The control is exercised from a control station having a telephone-type calling device CD and a switch key SK.

Calling device CD, as is well-known, can transmit a series containing from one to ten interruption impulses. The switch key SK corresponds to the hookswitch ordinarily used at a telephone substation.

In the control circuit, relay 801 corresponds to the line relay customarily used in automatic telephone systems; relay 802 corresponds to the slow-restoring release relay; and relay 803 is a slow-operating start relay which refrains from operating until a transmitted series of impulses has terminated.

Electromagnets 3 are each shown as having two differentially connected windings. The upper one is the winding which receives the impulses to be counted, while the lower one is a relatively low-powered winding employed to generate the reversed magnetism employed to clear out the counting device. In practice, it is usually preferable to employ concentric windings, of which the inside one is the relatively high-powered pulse winding, but for convenience the electromagnets are illustrated in the manner customarily employed for so-called tandem (end to end) windings.

Assuming now that a desired one of the lamps L1 to L10 is to be lighted as a signal indication, this operation is effected from the control station by first closing key SK, and then manipulating calling device CD to transmit a corresponding series of interruption impulses over line 800.

Line relay 801 operates responsive to the closure of key SK, followed by the operation of release relay 802. At its upper armature, release relay 802 prepares a circuit over conductor 805 for transmitting impulses to the counter. Being slow-restoring, release relay 802 is able to re-

3

main operated throughout the series of restorations of line relay 801 incident to the assumed operation of calling device CD.

Line relay 801 restores momentarily each time calling device CD interrupts the line circuit. Each time it does so, it momentarily closes a circuit through the back contact of the upper armature thereof, and through the front contact of the armature of the operated release relay 802, and over conductor 805, for the pulse windings of electromagnets 3 in series. These impulses cause the counting device to operate as described in the parent application. The concerned ones of the contact sets S1 to S10 are thereby actuated successively, each incidental to its corresponding impulse of the series, and each remains actuated until the device is subsequently cleared out.

Upon the operation of contact set S1, incidental to the receipt of the first impulse by the counter, a circuit is prepared for start relay 803 which becomes closed momentarily upon each reoperation of line relay 801 during the remainder of the impulse series. Being slow operating, start relay 803 does not respond to these momentary closures of its circuit, but waits until its circuit is closed relatively permanently following the termination of the impulse series, when line relay 801 again comes to rest in an operated condition.

Upon operating at the end of the transmitted impulse series, start relay 803 closes a self-locking circuit, at its lower contacts, independent of the lower contacts of line relay 801; prepares a clear-out circuit for the counter at its upper contacts; and at its inner upper contacts, it applies ground potential to the common marking or signal conductor 807, thereby completing a lighting circuit for the one of lamps L1 to L10 which corresponds to the last-operated one of the contact sets S1 to S10.

When the system of Fig. 1 is to be cleared out, key SK is reopened, permitting line and release relays 801 and 802 to restore successively. Incidentally, a further impulse is delivered over conductor 805 to the counter during the interval required for relay 802 to restore following restoration of relay 801, but this is ordinarily not objectionable. It may be avoided, if desired, by carrying conductor 805 through a pair of normally closed contacts (not shown) of start relay 803.

Start relay 803 remains operated, through the actuated contact set S1, subsequent to the restoration of line relay 801, since the lower contacts of the line relay are shunted by the lower contacts of the start relay.

With relays 801 and 802 restored, and with relay 803 maintained in operated condition, the impulse circuit over conductor 805 is open, and the restoring circuit over conductor 806 is closed. The low-powered differentially connected lower windings now magnetize the structure sufficiently in the reverse direction to overcome the residual magnetism of the magnetically "hard" work armatures (not shown) of the counter, whereupon the counter clears out in the manner described in the parent application. When it does so, the actuated first contact set S1 is restored, along with the remaining actuated contact sets thereof. Start relay 803 is thereby open-circuited and restored, returning the system of Fig. 1 to its illustrated normal condition.

The modified system of Figure 2

The modified signal system of Fig. 2 is similar to that of Fig. 1 except that the contact ar-

4

rangement of the stackups is altered to provide contact sets S1' to S10'.

In the modified arrangement of Fig. 1 each of the contact sets S1' to S10' comprises a lower pair of "make" contacts and an upper pair of "break" contacts. This arrangement employs four contact members for a contact set instead of the arrangement illustrated in Fig. 1, wherein three contact members suffice. The traveling contact members of the two contact pairs of any contact set S1' to S10' may be interlinked, in the manner common in telephone-relay construction, to cause them to move together upon actuation of the contact set. For example, when contact set S1' is actuated, the lower contact pair thereof closes, which operation is preferably preceded slightly by an opening of the upper contact pair thereof.

As in the system of Fig. 1, the operation of the first contact set S1' results merely in the grounding of off-normal conductor 804 in preparation for the operation of slow-operating start relay 803. Lamp L1, being normally connected to the common marking conductor 807, becomes lighted upon the operation of start relay 803, if only a single impulse is received. On the other hand, if the received series contains a second impulse, the operation of contact set S2' disconnects lamp L1 at its upper contacts and prepares a circuit for lamp L2 at its lower contacts. The operation of any subsequent one of the contact sets S3' to S10' results in disconnection of the mark wire and signal lamp corresponding to the preceding contact set, and in the preparation of a circuit for its own mark wire and signal lamp. The principal advantage of the arrangement of Fig. 2 is that no mark-wire, or lamp, circuit includes contacts in more than two of the contact sets S1' to S10', as distinct from the common chain arrangement of Fig. 1.

I claim:

1. In an impulse counting device, a series of contact sets, means for actuating the sets successively responsive respectively to the impulses of a received series, a normally open common signal conductor, a series of individual signal conductors corresponding respectively to the impulses in a received series, the common signal conductor being normally connected to the first individual signal conductor, actuation of the second contact set, incident to the receipt of the second impulse of a series, serving to transfer the common conductor from the first individual signal conductor to the second, actuation of any succeeding contact set serving to transfer the common signal conductor from the previously connected individual signal conductor to the next succeeding one, and means controlled through the first contact set for closing the common signal conductor responsive to the termination of the received impulse series.

2. In an impulse counting device, a series of contact sets, means for actuating the sets successively responsive respectively to the impulses of a series and for maintaining any such set actuated indefinitely thereafter, each contact set after the first including a make-contact pair closed by actuation of the set and a break-contact pair opened by actuation of the set, a common signal conductor, a series of individual signal conductors equal in number to said contact sets and corresponding respectively thereto, a connection between the common signal conductor and the first individual signal conductor directly through the break-contact pair of the second con-

5

tact set, a connection between the common signal conductor and any succeeding individual signal conductor through the make-contact pair of its corresponding contact set, any such connection preceding the last being in series with the break-contact pair of the next succeeding contact set.

3. In an impulse counting device, a series of contact sets, means for actuating the sets successively responsive respectively to the impulses of a series and for maintaining any such set actuated indefinitely thereafter, each contact set after the first including a make-contact pair closed by actuation of the set and a break-contact pair opened by actuation of the set, a normally open common signal conductor, a series of individual signal conductors equal in number to said contact sets and corresponding respectively thereto, a connection between the common signal conductor and the first individual signal conductor directly through the break-contact pair

6

of the second contact set, a connection between the common signal conductor and any succeeding individual signal conductor through the make-contact pair of its corresponding contact set, any such connection preceding the last being in series with the break-contact pair of the next succeeding contact set, and means controlled through the first contact set for closing the common signal conductor responsive to the termination of the series of impulses.

JOHN I. BELLAMY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,008,909	Hershey	July 23, 1935
2,241,156	Powell	May 6, 1941