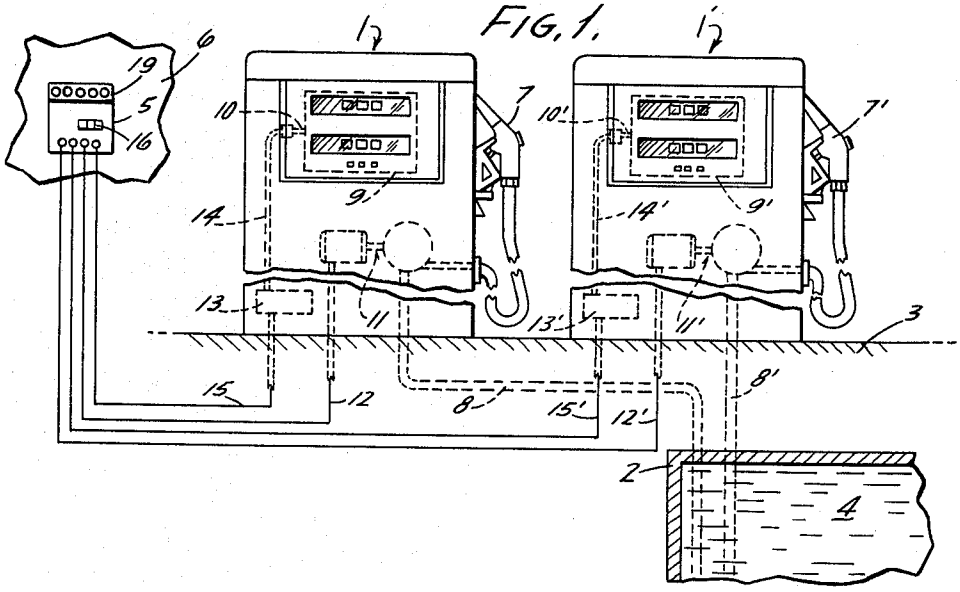
March 29, 1966 W. L. PROBERT 3,243,800

PULSE SEPARATING AND TRANSMITTING CIRCUIT

Filed March 29, 1963

FIG. 1.



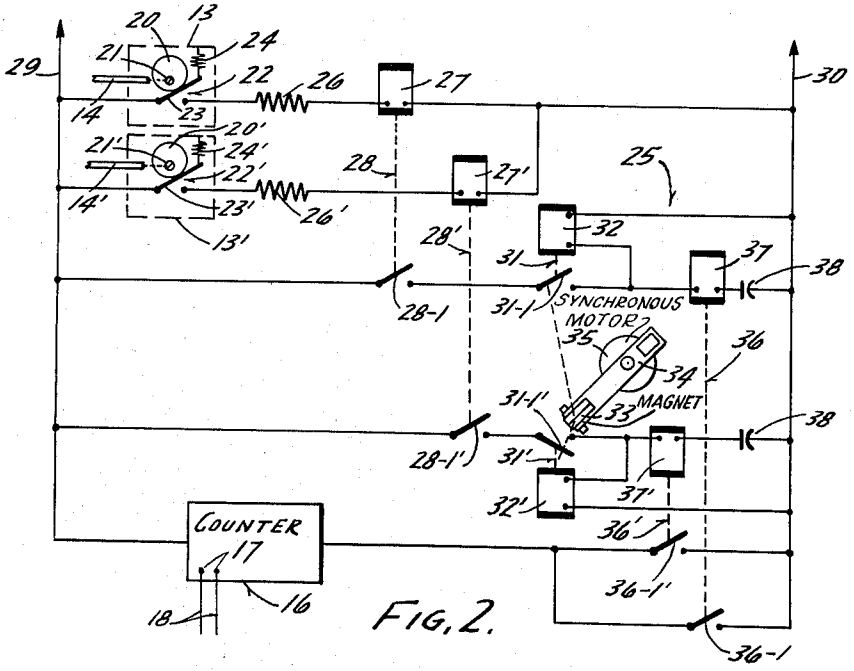


FIG. 2.

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PULSE SEPARATING AND TRANSMITTING CIRCUIT

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This invention relates to a pulse separating and transmitting circuit and in particular to a circuit for transmitting periodically generated pulse trains from a plurality of sources to a common output with means for preventing simultaneous transmission of pulses in different trains of pulses to the common output.

Simultaneous and parallel running of similar apparatus or processes may at times require summation of the individual functions. For example, the metering of flow through a number of individual flow or dispensing lines may be summated to operate a disconnect unit in a remote inventory control of gasoline and the like for allowing a supplier to maintain a bulk supply of gasoline in storage tanks at service stations while releasing only selected quantities of the stored gasoline to the service station operator.

In such totalizing units and the like, a common totalizer is provided to accept pulses from two or more of the signal generating units. Generally storage and separating means are provided for accepting simultaneously generated pulses from the various dispensing units and sequentially transmitting them to the common output; for example applicant's copending application entitled Pulse Transmission Apparatus which was filed January 29, 1962, with Serial No. 169,416 and which is assigned to a common assignee herewith, discloses rapid electronic counters and the like.

Although providing highly satisfactory results, electronic circuitry has certain disadvantages from considerations of expense and reliability. Prior art mechanical interlocks and pulse separating units are complicated and cumbersome.

The present invention is particularly directed to a very simple and economical circuit for separating and sequentially transmitting two or more simultaneously generated pulses or signals. The present invention employs very reliable, inexpensive components having a long life and it is therefore very well adapted to commercial use.

In accordance with the present invention, a plurality of sensing switches or other circuit altering means is periodically actuated by the loads to be measured to control the circuit of a corresponding electroresponsive switch. The electroresponsive switch is connected in series with the operating portion and the switching portion of a second electroresponsive switch means. A magnetic scanner or other suitable device is sequentially coupled to each of the switching portions of the second electroresponsive switch means which are independently and separately actuated in sequence. Once the scanner actuates the associated switch means, the second electroresponsive switch means is operated to hold it in the actuated position, assuming the first switch means has been actuated. A pulsing circuit is connected in parallel with the holding relay and preferably takes the form of a pulsing relay in series with a capacitor. The pulsing relay actuates a set of contacts connected in series with the output means. In operation when the circuit through the holding relay is closed, current will flow through the capacitor to charge it up and produce a momentary actuation of the pulsing relay and the associated switch means. In the preferred construction, the combined resistance of the holding relay and the pulsing relay is such that the discharge current of

the capacitor is insufficient to cause pulsing of the counter.

The present invention employs relays or the like which can be readily obtained and interconnected in a simple and long life operating circuit.

The drawings furnished herewith illustrate the best mode presently contemplated for carrying out the invention.

In the drawings:

FIG. 1 is a diagrammatic illustration of a multiple pump service station; and

FIG. 2 is a schematic circuit diagram of a portion of the counting mechanism adapted to be incorporated in the multiple pump service station shown in FIG. 1 to actuate a common totalizing or disconnect mechanism in accordance with the present invention.

Referring to the drawings and particularly to FIG. 1, a service station is diagrammatically shown as including a pair of gasoline pumps or dispensing units **1** and **1'** individually connected to a central storage tank **2** which is buried in the ground **3** in spaced relation to the pumps **1**. Gasoline **4** is stored within the tank **2** for selective discharge and delivery through the pumps **1** to the customers. A code operated release mechanism **5** is shown mounted in a fragmentary portion of the wall **6** of a service building, not otherwise shown. The release mechanism **5** is coupled to the pumps **1** and includes presettable means for recording the total discharge of gasoline through the several pumps **1** and for controlling the operation of pumps **1**. In this manner, selected quantities of gasoline can be released for discharge through the pumps **1** and a relatively close control on the gasoline **4** maintained.

Each of the pumps **1** and **1'** may be of any conventional construction. Pump **1** is described and the corresponding elements of the other pump **1'** are similarly numbered with a superscript prime added for simplicity and clarity of explanation. Pump **1** is shown including a dispensing nozzle **7** connected to an individual suction line **8** from the central storage tank **2**. A computer **9** is provided for recording the gallonage and cost of the gasoline which is dispensed at each operation of the corresponding pump **1**. The computer **9** establishes a mechanical movement in accordance with the quantity flow through the suction line **8** to the nozzle **7** which is translated into a visual gallonage reading and also into a cost figure in accordance with known construction. A stub shaft **10** projects outwardly from the computer **9** within each pump **1** and is suitably coupled within the computer **9** to rotate in accordance with the flow of gasoline.

A motor-pump unit **11** is connected in the suction line **8** and also to suitable power lines **12** for selective dispensing of gasoline from the corresponding pump **1**. The dispensing nozzle **7** normally includes a motor-pump unit switch, not shown, for selective energizing of the motor-pump unit **11**.

A small signal transmitter **13** is coupled to the stub shaft **10** by a flexible shaft or cable **14**. As more fully described hereinafter, the transmitter **13** establishes a pulse signal for each preselected unit of flow and is connected by suitable transmitting lines **15** for actuating the release mechanism **5**. As shown, the transmitting line **15** is buried in the ground between the release control **5** and the pumps **1** to eliminate unauthorized tampering therewith.

The release mechanism **5** is connected in circuit to the motor-pump unit **11** and controls the connection of the power lines **12** to an incoming power source. Release mechanism **5** is constructed to allow release and withdrawal of selected amounts of gasoline from the central storage tank **2**. The released gasoline is then dispensed from the pumps **1** until the total released quantity has

been dispensed after which the release mechanism 5 must be again preset for further dispensing of gasoline.

Referring particularly to FIG. 2, a preferred electrical circuit is schematically shown illustrating the operation of the release mechanism 5 as applied to multiple self-contained pumps shown in FIG. 1.

Generally, the release mechanism 5 includes a counter 16 having a main control switch 17 associated and operated thereby. The switch 17 is connected to control the completion of the circuit from incoming power lines 18 to the motor-pump power supply lines 12 and 12' of pumps 1 and 1'. In the illustrated embodiment of the invention, it is assumed that the switch 17 is opened and disconnects lines 12 from lines 18 when the counter 16 is at a zero reading and is closed at all other readings.

A push button input unit 19, shown in FIG. 1, is interconnected to preset the counter 16 from a zero reading position in any desired increments; for example, 500 or 1,000 gallons. In the previously identified copending application of James H. McGaughey, a push button input unit is provided for actuating a presetting cyclic motor which, in response to a correct input, presets the counter 16 from the zero position. As more fully disclosed therein, a code card, not shown, is provided within the release mechanism 5 for successively establishing a new code input in response to each release actuation of the mechanism 5. The input control for presetting of the counter 16 does not form any part of the present invention and consequently no further description thereof is deemed nessary or given.

Referring particularly to FIG. 2, the illustrated transmitter 13 includes a cam 20 rotatably mounted on a shaft 21 which is coupled to be driven by the flexible cable 14. A switch 22 includes a switch arm 23 held in engagement with the periphery of cam 20 in any suitable manner diagrammatically shown as a separate spring 24. The cam 20 is shaped to cyclically move arm 23 to open and close the switch 22 once for each gallon of gasoline discharged. The switch 22 is held closed for a short period of each cam revolution.

Switch 22 is connected to a pulse discriminating or separating circuit 25 for establishing a composite pulse train for operating counter 16 as follows.

In FIG. 2, the corresponding elements for pumps 1 and 1' are similarly numbered with superscript primes added to the element numbers for pump 1' for simplicity and clarity of explanation.

Switch 22 is connected in a series circuit with a current limiting resistor 26 and an operating trigger relay coil 27 of a trigger relay 28 between power lines 29 and 30. The relay 28 includes a set of normally open contacts 28–1 which are connected in circuit to control energization of a magnetically actuated holding relay 31 of the discriminating circuit 25.

The magnetically responsive holding relay 31 includes a relay coil 32 and a set of associated normally open relay contacts 31–1 which are connected in a series circuit with the contacts 28–1 between power lines 29 and 30. Relays 31 and 31' for the pumps 1 and 1' are equicircumferentially distributed to dispose the associated contacts beneath the path of a rotating magnet 33 which is secured within the end of a rotating arm 34. A synchronous drive motor 35 is coupled to the arm 34 and rotates it at a constant speed to sequentially align the magnet 33 with the relay contacts 31–1 and 31–1'. When magnet 33 is aligned with the contacts 31–1, the contacts close momentarily. If simultaneously, the contacts 28–1 are closed a circuit through relay coil 32 is completed. Energization of coil 32 holds contacts 31–1 closed independently of the scanner magnet 33.

Motor 35 may be of the usual synchronous variety to produce a very constant speed. The speed of motor 35 is faster than the period for closing and opening of switch 22 by flexible cable 14. Magnet 33 is aligned with each set of relay contacts 31–1 and 31–1' at spaced timed periods equal to closing and opening of the switches 22 and 22'. This insures operation of relay 31 for each closing of the corresponding switch 22.

A pulsing relay 36 is provided including a relay coil 37 connected in a branch circuit in series with a capacitor 38. The branch circuit of coil 37 and capacitor 38 is connected at one end between the relay coil 32 and the contact 31–1 and at the opposite end to the power line 30, common to relay coil 32, and thus in parallel or across the holding relay coil 32.

The pulsing relay 36 includes a set of normally open contacts 36–1 connected in series with the counter 16 and in parallel with the other corresponding contacts 36–1' for pump 1'. When contacts 28–1 and 31–1 are closed, current flows through coil 37 and capacitor 38 until the capacitor is fully charged. When either contacts open, the circuit is broken and relay 36 drops out. Closing and opening of either contacts 35–1 or 35–1' actuates the counter 16 and reduces the setting thereof by a predetermined count. For example, where a pulse is generated for each gallon of gasoline delivered, the counter 16 would be reduced by a corresponding reading of one gallon.

In summary, the illustrated embodiment of the invention operates as follows.

The cam 20 is driven by the associated flexible cable 14 of pump 1 whenever gasoline is withdrawn from the storage tank 2 therethrough. Switch 22 closes and the corresponding triggering relay coil 27 is energized. The associated contacts 28–1 close and when the scanning magnet 33 is moved into alignment with the relay contacts 31–1 of holding relay 31, the circuit through the holding relay coil 32 is completed. The energization of relay coil 32 maintains the contacts 31–1 closed independently of rotating magnet 33 so long as the corresponding triggering relay contacts 28–1 remain closed. At the instant the circuit is completed through the holding relay 31, current is also supplied through the series circuit including the relay coil 37 of pulsing relay 36 and capacitor 38. The current flows until the capacitor 38 is completely charged up. The timed current flow causes the associated contacts 36 to close momentarily and effectively transmits a pulse to the counter 16. The counter 16 is thereby actuated to reduce the setting in accordance with the gasoline flowage.

When the switch 22 is opened, as a result of the continued rotation of cam 20, the circuit to the triggering relay coil 27 is opened. As a result, the associated triggering contacts 28–1 open and break the circuit to the holding relay coil 32. The relay 31 thus drops out and opens the circuit to the holding contacts 31–1 and the circuit is reset for the next closure of the cam operated switch 22. The opening of contacts 28–1 as a result of the opening of switch 22 disconnects the power from the series circuit of relay coil 37 and capacitor 38 and the capacitor 38 discharges through the series circuit formed by the relay coils 37 and 32. The relay coils 37 and 32 are selected with a combined resistance of a sufficient magnitude, or suitable resistance may be added in the circuit, which reduces the discharge current below the operating level of the pulsing relay 36. This prevents pulsing or closing of the associated relay contacts 36–1 on discharge and a consequent erroneous actuation of the counter 16.

If for any reason this particular arrangement is considered undesirable, other suitable means might be provided such as employing a counter requiring a pair of pulses to actuate the counter or the like.

The holding relay 31 prevents erroneous operation as a result of two alignments of rotating magnet 33 with a set of contacts 31–1 per single closing of switch 22. Relay 31, when energized, remains so until the contacts 28–1, which also constitute a load responsive switch means, open. Therefore, the magnet 33 is operative in relation to contacts 31–1 and relay coil 32 only when

contacts **28–1** have opened and again closed after the immediately preceding alignment therebetween.

The cam operated switches **22** are driven in synchronism with the flow of gasoline through the corresponding pump **1**. The signals are transmitted to the common output or counter **16** in accordance with the sequential movement of the scanning magnet **33**. Thus, if pulses are simultaneously generated by pumps **1** and **1'**, each of the triggering relays **28** and **28'** are simultaneously energized and hold the latter and the associated contacts in the actuated or energized position for a period which allows the rotating magnet **33** to actuate the corresponding holding relays **31** in timed sequence. As a result, the pulsing relays **36** are sequentially energized to actuate the associated contacts **36–1** accordingly. The counter **16** will therefore be sequentially energized once for each of the pulses from the pair of pumps **1**.

The present invention thus provides a simple and inexpensive transmitting totalizing mechanism employing readily available components which have proven practical in other applications. The simplicity and use of known components also permits servicing and maintenance with a minimum of skill and experience.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. A signal transmitting circuit for transmission of signals from a plurality of sources to a load,

(a) a plurality of intermittently operated circuit altering means, one for each of said sources,

(b) a plurality of electroresponsive means connected in separate operating circuits with corresponding first circuit altering means and having circuit altering means,

(c) pulsing circuits including the circuit altering means of said electroresponsive means and a second circuit altering means connected to actuate a pulse means, and

(d) a timing device sequentially coupled to each of said second circuit altering means to operably enable said pulsing circuit for generation of a pulse.

2. A signal transmitting circuit,

(a) a switch,

(b) a pulsing circuit including a pulse means adapated to be connected to a load,

(c) a relay having a coil connected in series with said switch and having contacts forming a part of said pulsing circuit and enabling said pulsing circuit, and

(d) scanner means including a switch connected to actuate said pulsing circuit for generating a pulse and a continuously operable switch actuator momentarily and periodically coupled to said switch to actuate the pulsing circuit.

3. A signal transmitting circuit for operation of a load in accordance with the operation of a plurality of drive means, comprising,

(a) a plurality of individual transmission circuits, each comprising,

(1) a pulsing circuit adapted to transmit a pulse signal to said load,

(2) a first switch means adapted to be coupled to one of said drive means and intermittently actuated in accordance with the operation thereof,

(3) a second switch means,

(4) circuit means interconnecting said first and second switch means to conjointly control said pulsing circuit and including means whereby the pulsing circuit is conditioned for transmission of a pulse signal only with the first switch means in an actuated position and said second switch delivers the pulse signal and said first switch means resets the pulsing circuit in returning to a non-actuated position for transmission of a succeeding pulse signal, and,

(b) means cyclically and sequentially actuating the second switch means of the transmission circuits at a rate exceeding the maximum rate of the first switch means.

4. A signal transmitting circuit for transmitting random generated signals from a plurality of sources, comprising

(a) load circuit altering means adapted to be coupled to a source and intermittently operated in accordance therewith,

(b) first electroresponsive means connected in a series operating circuit with said load-responsive circuit altering means and having circuit altering means actuated in response to actuation of the load responsive circuit altering means,

(c) second electroresponsive means having circuit altering means, said second electroresponsive means being connected in an operating circuit with the circuit altering means of said first named electroresponsive means and with its own circuit altering means,

(d) scanning means to independently and periodically actuate said circuit altering means of said second electroresponsive means, the period of the scanning means being less than the maximum repetition rate of the intermittently operated circuit altering means, and

(e) a pulsing circuit actuated by said second electroresponsive means.

5. The signal transmitting circuit of claim **4** wherein

(a) said pulsing circuit is connected in parallel with said second electroresponsive means and is conjointly controlled by the circuit altering means of said first and second electroresponsive means.

6. A signal transmitting circuit for transmitting random generated signals from a plurality of sources, comprising

(a) intermittently operated switch means, one for each source,

(b) a first relay means, one for each source connected in a series operating circuit with the corresponding switch means and having contact means actuated thereby in response to actuation of the corresponding switch means,

(c) a second relay means for each source and having contact means actuated thereby, said second relay means being connected in an operating circuit with the corresponding switch means of said first named relay means and with its own switch means,

(d) scanning means to independently and periodically actuate said contact means of all said second relay means, the period of the scanning means being less than the maximum repetition rate of the intermittently operated switch means, and

(e) a plurality of pulsing circuits, one for each source and conjointly actuated by the corresponding first and second relay means.

7. The signal transmitting circuit of claim **6**, wherein

(a) each of said pulsing circuits include a relay and a capacitor connected in parallel with said second relay means.

8. The signal transmitting circuit of claim **7** wherein

(a) said pulsing circuit is connected in series with both of said contact means.

9. A signal transmitting circuit for transmitting random generated signals in accordance with the functions of a plurality of sources, comprising

(a) a plurality of switches adapted to be coupled one to each source and intermittently operated in accordance with the functioning of the corresponding source,

(b) a plurality of first relay means each having a winding connected in a series operating circuit with

a corresponding switch and having normally open contacts closed in response to energization of the associated winding,

(c) a plurality of second relay means each having a winding and normally open contacts closed in response to energization of the associated winding, said last named winding and contacts being connected in series with each other and with the contacts of the first relay means,

(d) a rotating magnet independently and sequentially aligned with the contacts of said second relay means, the period of the rotating magnet being less than the maximum repetition rate of the operation of the switches, and

(e) a pulsing circuit connected in parallel with the winding of said second relay means and in series with the contact means of said first and second relay means.

10. A signal transmitting circuit for generating and transmitting signals from a plurality of sources to a common output means, which comprises,

(a) a plurality of load responsive switches, one for each of said sources and adapted to be actuated thereby in accordance with a predetermined characteristic thereof,

(b) a plurality of holding relays one for each of said load responsive switches and each having a coil and a set of contacts, the corresponding load responsive switches and coils and contacts being connected in a series operating circuit,

(c) a scanner sequentially and separately operatively aligned with and coupled to the contacts of said relays and closing the aligned contacts for a predetermined time period, and

(d) a plurality of pulsing relays, one for each of said holding relays and having a coil and a set of pulsing contacts, all of said pulsing contacts being connected in parallel and adapted to be connected in series to said output means.

11. The signal transmitting circuit of claim **10** having,

(a) a plurality of capacitors, one being connected in series with each of the pulsing relays and the series connection being in parallel with the corresponding relay coil of the holding relay.

12. A signal transmitting circuit for generating and transmitting signals from a plurality of sources to a common output means, which comprises

(a) a plurality of signal generating switches one for each of said sources and adapted to be actuated thereby in accordance with a predetermined characteristic thereof,

(b) a plurality of trigger relays one for each of said signal generating switches and each having a coil and a set of contacts coupled to be actuated by the corresponding coil, each of said signal generating switches and the corresponding coil and contacts of the trigger relay being connected in a series operating circuit,

(c) a plurality of holding relays mounted in a circular array and each having a series connected relay coil and contacts connected to a corresponding set of contacts of said trigger relay,

(d) a magnetic scanner rotatably mounted to sequentially move past said holding relays and close the corresponding relay contacts for the period of alignment with the corresponding relay,

(e) a plurality of pulsing relays, one for each of said holding relays and each having a coil and a set of contacts actuated thereby, all of said contacts of said pulsing relays being connected in parallel and adapted to be connected in series to said output means, and

(f) a plurality of capacitors, one for each of said pulsing relays, said capacitors being connected in series with the corresponding relay coil and said series connection being in parallel with the corresponding relay coil of said holding relay, the combined resistance of each paired relay coils of the holding relay and the pulsing relay being of an amplitude maintaining discharge current below the operating magnitude of the pulsing relay.

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