

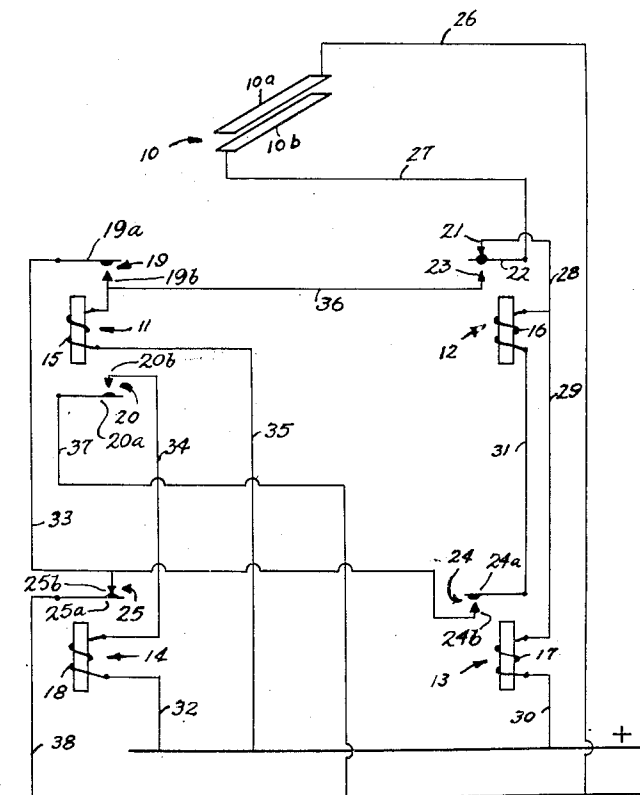
Aug. 25, 1942.

B. COOPER

2,293,932

RELAY SYSTEM

Filed March 31, 1939



INVENTOR.

Benjamin Cooper

UNITED STATES PATENT OFFICE

2,293,932

RELAY SYSTEM

Benjamin Cooper, Jersey City, N. J.

Application March 31, 1939, Serial No. 265,288

6 Claims. (Cl. 235—92)

This invention relates to counting circuits. It is particularly directed to traffic counting circuits where a treadle, disposed in the roadway and adapted to be actuated by vehicles, controls a counting mechanism which counts the number of vehicles that pass over the treadle. In prior systems of this nature, each vehicle axle as it moves over the treadle actuates the counting circuits and its associated counter, thereby giving a resultant count, not of vehicles themselves, but of vehicle axles.

It is an object of this invention, therefore, to provide a counting circuit of the character described so arranged as to permit only one actuation of the counter for every two actuations of the treadle. Since, for traffic counting purposes, the number of three-axle vehicles is usually negligible compared to the number of two-axle vehicles, the counter substantially indicates the vehicle count directly.

In vehicle counting circuits of the character described, the counters are subject to considerable use. It is, therefore, a further object of this invention to decrease the wear on the counters by energizing said counters only on every other actuation of the treadle.

It is a further object of this invention to provide a circuit of the character described, which shall be relatively inexpensive to manufacture, fast and positive in operation, and practical and efficient to a high degree in use.

Other objects of this invention will in part become obvious and will in part hereinafter be pointed out.

The invention accordingly consists in features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter described, and of which the scope of application will be indicated in the following claims.

In the accompanying drawing in which is shown one of the various possible embodiments of this invention, the single figure is a diagrammatic representation of a vehicle counting circuit embodying the invention in connection with a single switch treadle.

Referring now in detail to the drawing, 10 represents a treadle switch adapted to be transversely disposed in a roadway so that the pressure of a vehicle wheel rolling over said treadle will close the switch by bringing the two contacts, 10a and 10b, of said switch 10, together. The associated circuit comprises three relays, 11, 12, and 13, and an electromagnetically operated counter, 14.

Relay 12 has an actuating coil 16 and a contact arm 22 which normally rests against contact 21 but is adapted to move into engagement with contact 23 upon energization of said coil. Two normally open switches, 19 and 20, are controlled by relay 11, so that upon energization of coil 15 of said relay, said switches 19 and 20 are closed. Switch 19 comprises movable switch arm 19a and a fixed contact 19b. Switch 20 comprises a movable switch arm 20a and a fixed contact 20b. Similarly, normally open switch 24 is adapted to close upon excitation of relay 13 by energizing coil 17 thereof. Switch 24 comprises movable switch arm 24a and fixed contact 24b. The electromagnetic counter 14, having an actuating coil 18, has associated therewith a normally closed switch 25 which is adapted to be opened upon actuation of the counter. Switch 25 comprises movable switch arm 25a and a fixed contact 25b.

Contact 10a is connected by wire 26 to the negative power supply, and contact 10b is connected by wire 27 to contact arm 22. Contact 21 is connected by wire 28 to coil 16 and by wire 29 to coil 17. The other side of coil 16 is connected by wire 31 to the arm of switch 24. The other side of coil 17 is connected by wire 30 to the positive power supply. Contact 23 is connected by wire 36 to one side of coil 15, and, also to the contact of switch 19, the other side of coil 15 being connected by wire 35 to the positive power source. The arm of switch 19 is connected by wire 33 to the contact of switch 25, and also to the contact of switch 24. One side of coil 18 is connected by wire 32 to the positive power source, the other side of said coil being connected by wire 34 to the contact of switch 20. The arm of switch 20 is connected by wire 37 to the negative power supply. The arm of switch 25 is also connected to the negative power supply by wire 38.

The operation of the circuit, when a vehicle traverses the treadle, will now be explained. First the front wheels close treadle switch 10, energizing relay 11 through a circuit traceable from negative power supply, wire 26, switch 10, wire 27, arm 22, contact 21, wire 28, wire 29, coil 17, wire 30, to positive power supply. As relay 13 becomes energized, switch 24 is closed, thereby completing a circuit which connects one end of coil 16 to the negative power supply, said circuit including wire 31, the now closed switch 24, wire 33, switch 25, and wire 38. Since the other side of coil 16 is also connected to negative power supply through wire 28, contact 21, arm 22, wire 27, the now closed switch 10, and wire 26, coil

16 will not be energized. However, as the front wheels pass off the treadle, switch 10 is released and allows coil 16 to be energized in series with coil 17 through the following circuit; positive power source, wire 30, coil 17, wire 29, coil 16, wire 31, switch 24, wire 33, switch 25, wire 32, to negative power source. Coils 16 and 17 are adapted to be energized by half the power supply voltage so that they may actuate their respective relays through the aforementioned series circuit. Upon excitation of relay 12, contact arm 22 moves into engagement with contact 23.

When the rear wheels of the vehicle again close switch 10, a circuit can now be traced from negative power source, wire 26, treadle switch 10, wire 27, arm 22, contact 23, wire 36, coil 15, wire 35, to positive power source, thereby exciting relay 11 and closing switches 19 and 20. The closing of switch 20 completes a circuit for energizing the counter coil 18, said circuit being traceable from negative power source, wire 37, switch 20, wire 34, coil 18, wire 32, to positive power source. Energization of coil 18 actuates the counter for the registration of the passage of the vehicle.

Since the counter is a relatively slow acting mechanism due to mechanical inertia, the closing of switch 19 completes a holding circuit for relay 11, to maintain the excitation of said relay if the vehicle is moving so rapidly that the counter does not have sufficient time to operate before the treadle switch is released after being made by the rear wheels, said holding circuit being traceable from positive power source, wire 35, coil 15, switch 19, wire 33, switch 25, wire 32, to negative power source.

As the counter operates to provide the single registration of the passage of the wheels of two vehicle axles, switch 25 is opened breaking the series holding circuit of relays 12 and 13 and also opening the holding circuit for relay 11, causing switches 19 and 20 to open. The opening of switch 20 breaks the circuit for the counter 14 which becomes de-energized quickly and permits switch 25 to again close. Thus, the entire circuit becomes de-energized and restored to normal, ready to record the passage of another pair of axles.

If, as counter 14 becomes energized, treadle switch 10 is not yet released, for example, if the rear wheels roll on the treadle and remain thereon, relay 11 will remain excited through the circuit from negative power source, wire 26, switch 10, wire 27, contact arm 22, contact 23, wire 36, coil 15, wire 35, to positive power source. The counter 14 will consequently also remain energized. Relays 12 and 13 will similarly remain excited through a circuit from positive power supply, wire 30, coil 17, wire 29, coil 16, wire 31, switch 24, wire 33, switch 19, wire 36, contact 23, arm 22, wire 27, treadle switch 10, wire 26, to the negative power supply. Thus, the circuit remains energized until the rear wheels roll off the treadle to open switch 10 a second time. Relays 11, 12, and 13 are then released simultaneously and the consequent opening of switch 20 of relay 11 de-energizes the counter 14.

Hence, the circuit cannot become de-energized and reset until switch 10 has been released the second time and the counter has been actuated for registering the passage of two vehicle axles, thereby preventing false counts.

It will be noted that it does not matter how long the time interval between the first and second actuation of the switch 10, so that should

a vehicle with three axles pass over the treadle, subsequent two-axle vehicles will cause a count on the counter 14, resulting from the actuation of the treadle by the rear wheels of one vehicle and the front wheels of a subsequent vehicle.

While the switch 10 is described as a treadle switch embedded in the roadway to be contacted by the vehicle wheels, it will be understood that said switch may be of any type which will be actuated once for each axle of the vehicle.

Although the drawing shows the treadle 10 in the form of a switch comprising a single pair of contacts, it will be noted that a multiple switch treadle may be employed, such for example, as disclosed in a patent issued to me on July 11, 1939, Patent No. 2,166,090. In such event, the treadle circuit disclosed in said patent would be used in conjunction with the circuit disclosed in this application, the counter of said patent merely being replaced by a relay controlling an additional normally open switch, replacing the switch 10 of the circuit disclosed in this application.

The improved counting system disclosed herein may also be utilized to independently count vehicles passing in either direction on a common lane. In such event, the counting system disclosed in a patent issued to me on June 25, 1940, Patent No. 2,205,555, is utilized in conjunction with the system disclosed herein.

To provide a system in which vehicles or pairs of axles are counted, instead of counting axles, on a two way traffic lane, there is substituted for the forward counter of the system disclosed in said last mentioned patent, a relay provided with an additional normally open switch substituted for the treadle switch 10 of one counting circuit such as disclosed in this application; and there is substituted for the backward counter of the system disclosed in said patent, a relay controlling an additional normally open switch substituted for the treadle switch 10 of a second counting system, such as is disclosed herein. With such a composite system there are two counters 14, one to count the vehicles passing along the common highway in one direction, and another counter 14 to count the vehicles passing along said highway in an opposite direction.

It will thus be seen that there is provided a device in which the objects of this invention are achieved and which is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiment above set forth, it is to be understood that all matter herein described or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. In combination, a switch, an electromagnet, and three relays, means to energize the first of said relays upon actuation of said switch for the first time, means controlled by the energized first relay to energize the second of said relays upon restruction of said switch to initial condition, means controlled by the energized second relay to energize the third of said relays upon actuation of said switch for the second time, and means controlled by said energized third relay to energize said electromagnet.

2. In combination, a switch, an electromagnet, and three relays, means to energize the first of said relays upon actuation of said switch for the

first time, means controlled by the energized first relay to energize the second of said relays upon restoration of said switch to initial condition, means controlled by the energized second relay to energize the third of said relays upon actuation of said switch for the second time, means controlled by said energized third relay to energize said electromagnet, and means controlled by said energized electromagnet to deenergize the three relays upon final restoration of said switch to initial condition.

3. In combination, a switch, an electromagnet, and three relays, means to energize the first of said relays upon actuation of said switch for the first time, means controlled by the energized first relay to energize the second of said relays upon subsequent restoration of said switch to initial condition, means controlled by said electromagnet in conjunction with said means controlled by said first relay to maintain said first and second relays energized, means controlled by the energized second relay to energize said third relay upon a second actuation of said switch, and means controlled by said energized third relay to energize said electromagnet.

4. In combination, a switch, an electromagnet, and three relays, means to energize the first of said relays upon actuation of said switch for the first time, means controlled by the energized first relay to energize the second of said relays upon subsequent restoration of said switch to initial condition, means controlled by said electromagnet in conjunction with said means controlled by said first relay to maintain said first and second relays energized, means controlled by the energized second relay to energize said third relay upon a second actuation of said switch, means controlled by said energized third relay to energize said electromagnet, said means controlled by said electromagnet being adapted to open the holding circuit of said first and second relays upon energization of said electromagnet when said switch is restored to initial condition for a second time.

5. In combination, a switch comprising a pair or normally open contacts, conductor means to connect one of said contacts to a first lead of a power supply, a pair of relays, each having a coil, conductor means to connect one side of one coil with one side of the other coil, a movable switch element controlled by one of said pair of relays, conductor means to connect said switch element to the other contact of said first switch, a fixed contact normally in engagement with said switch element, a second fixed contact adapted to be engaged by said switch element when said relay is energized, said first fixed contact being connected by a conductor to said second mentioned conductor means, a second movable switch ele-

ment controlled by the other of said pair of relays, and connected by a conductor to the other side of the coil of the first relay of said pair of relays, a third fixed contact adapted to be engaged by said second switch element upon energizing the second of said pair of relays, the other side of the coil of said second relay of said pair of relays being connected to a second lead of the power supply, a third relay having a coil, one side of which is connected by a conductor to the second fixed contact, and the other side of which is connected by a conductor to the second lead of said power supply, a fourth fixed contact connected by a conductor to the first side of the coil of said third relay, a third movable switch element normally open but adapted to engage said fourth fixed contact upon energizing said third relay, conductor means to connect said third switch element to the third fixed contact, a fourth movable switch element controlled by said third relay, normally open, a fifth fixed contact adapted to be engaged by the fourth switch element upon energizing said third relay, conductor means to connect the fourth switch element to the first lead of said power supply, an electromagnet having a coil, one side of which is connected by a conductor to the fifth fixed contact, and the other side of which is connected by a conductor to the second lead of the power supply, a fifth movable switch element controlled by the last electromagnet, and connected by a conductor to the first lead of the power supply, a sixth fixed contact connected by a conductor to the conductor interconnecting the third switch element with the third fixed contact, and normally engaged by said fifth switch element, said fifth switch element being adapted to disengage from said sixth fixed contact upon energizing the last electromagnet.

6. In combination with a switch, a pair of relays, a third relay, an electromagnet, means to energize one of said pair of relays, upon actuating said switch a first time, means to energize the other of said pair of relays upon subsequent restoration of said switch to initial condition, means to energize said third relay, upon actuating said switch a second time, means controlled by the energized third relay to energize said electromagnet, and means controlled by the energized electromagnet to deenergize said pair of relays and third relay, upon second restoration of said switch to initial condition, the means to deenergize said pair of relays and third relay being inoperative to deenergize said pair of relays and third relay, as long as said switch remains in actuated condition, after being actuated a second time.

BENJAMIN COOPER.