

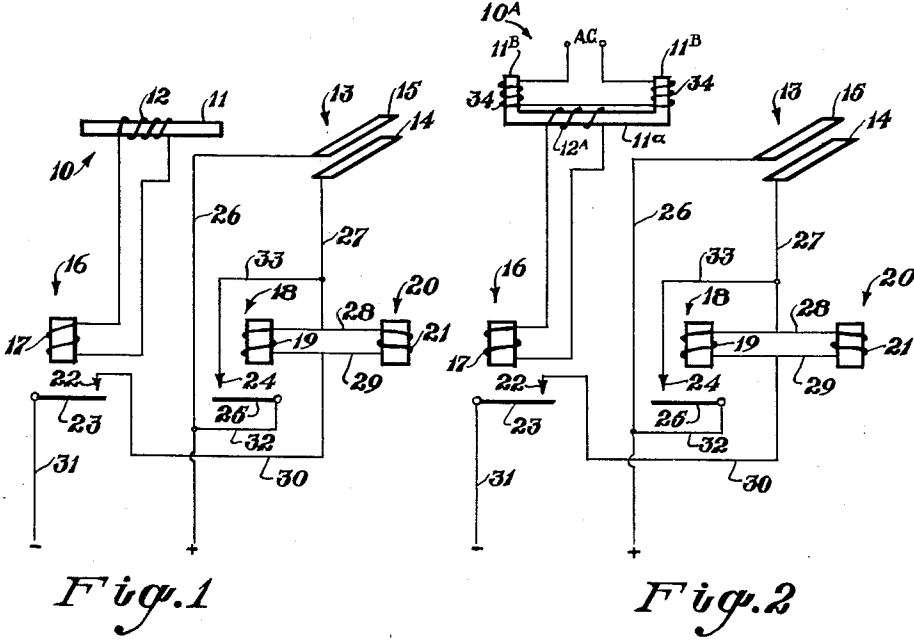
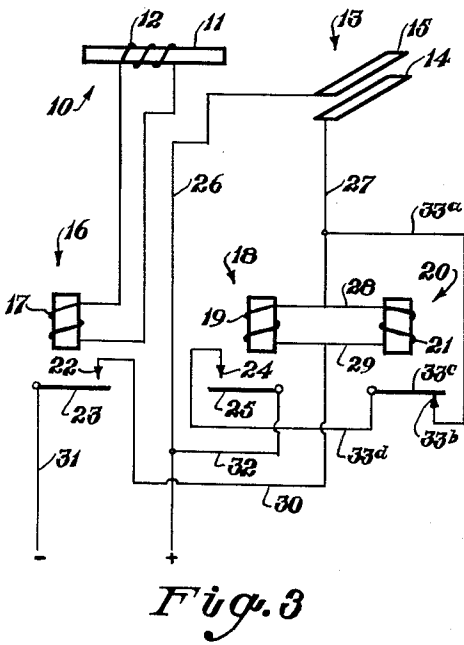
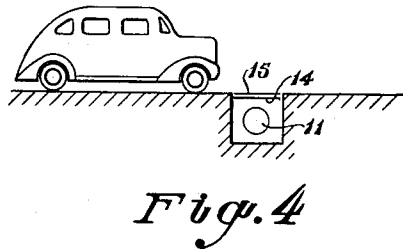
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VEHICLE COUNTING CIRCUITS

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VEHICLE COUNTING CIRCUIT

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This invention relates to vehicle counting circuits. It is particularly directed to the means, influenced by the passage of vehicles, which control the counting circuit for registering and counting said vehicles.

It has been found that in vehicle counting systems controlled by switch treadles on the roadway, adapted to be actuated by the wheels of vehicles, wrong counts are obtained because the switches can be actuated by pedestrians or weights. In vehicle counting systems utilizing electromagnetic detectors, adapted to be influenced by the iron in a vehicle as the vehicle moves past said detector, to operate a counter, wrong counts have often resulted because large vehicles influence not only the electromagnetic detectors in the lane of the vehicle but also the detector in adjacent lanes. It is, therefore, an object of this invention to provide a vehicle counting system which will respond only to the passage of a vehicle in a lane, and in which a count cannot be made by pedestrians, or by the passage of a vehicle in an adjacent lane.

It is a further object of this invention to provide an improved simple vehicle counting system which shall comprise a combination of the magnetic treadle and contact treadle, and require the simultaneous passage of both an iron mass and the pressure of vehicle wheels, to operate the counting circuit.

A further object of this invention is to provide a vehicle counting circuit of the character described adapted to count vehicles directly, irrespective of the number of axles thereon, and yet depends on the pressure of vehicles wheels to operate the counter.

Yet another object of this invention is to provide a vehicle counting circuit of the character described so constructed that only a single count will be produced even if the vehicle stops after the front wheels have passed over the contacts and actuated the same, and after pausing, the vehicle continues moving so that the rear wheels thereof again actuate the contacts.

In some automatic traffic supervisory systems, such as are used for controlling vehicular traffic at street intersections, the traffic signals are operated by switch treadles, imbedded in the roadway and actuated by the vehicles approaching and leaving the intersection. It has been found that, in installations of this nature, the traffic signals may be operated by casual or mischievous actuations of the vehicle treadles by pedestrians. It is therefore a still further object of this invention to provide a simple means for detecting

the passage of vehicles for controlling traffic supervisory apparatus, which is responsive only to the passage of a vehicle and cannot be actuated by pedestrians.

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

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

The invention accordingly consists in the features of construction, combinations 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,

20 Fig. 1 is a wiring diagram of a counting circuit embodying the invention and adapted to count vehicles;

25 Fig. 2 is a wiring diagram of a counting circuit embodying the invention, and illustrating a modified form of the invention, in which the counting means will produce a single count even if the vehicle stops while over the treadle, and then continues moving;

30 Fig. 3 is a wiring diagram of a counting circuit embodying the invention and adapted to count vehicle axles; and

Fig. 4 is a cross-sectional view of a highway showing a magnetic treadle and a treadle switch disposed thereon.

Referring to detail to Fig. 1, there is represented a vehicle counting circuit comprising a magnetic detector 10 and a single switch treadle 13.

40 The magnetic detector 10 may be of any well known suitable type comprising a permanent bar magnet 11 and a pickup coil 12 surrounding said magnet. The detector 10 is disposed in a lane of a highway, preferably imbedded beneath the road surface, so that it is influenced by the iron in a vehicle as it passes over the magnet.

45 The single switch treadle 13 may also be of any suitable type comprising a pair of top and bottom contacts, 14 and 15, which are disposed in a lane of a roadway and actuated by the pressure of wheels of a vehicle. The contacts of said treadle may be long metallic strips disposed transversely of the lane, perpendicular to the normal direction of vehicular travel, so that a vehicle wheel passing over said treadle will press the two contacts together and close the switch.

55 The magnetic detector 10 may be disposed di-

rectly beneath the switch 13. Thus, the magnetic treadle is so arranged with respect to the treadle switch that a vehicle approaching in either direction will enter within range of and influence said magnetic detector before the front wheels actuate the treadle switch, and said detector remains influenced until all of the wheels have passed over the treadle switch and the vehicle is beyond said detector.

Means is provided to produce a single count on an electromagnetic counter 20 when a vehicle passes along the lane influencing the magnetic detector and closing the treadle switch. To this end, the pickup coil 12 of magnetic detector 10 is connected in series to the coil 17 of a relay 16 adapted to move a normally open switch arm 23 into engagement with a fixed contact 22. Said switch arm 23 is connected by wire 31 to a negative power source.

Connected to the counter coil 21 in parallel circuit by wires 28 and 29 is the coil 19 of a relay 18. Said relay, when energized, is adapted to move a normally open switch arm 25 into engagement with the fixed contact 24. One side of the coils 19 and 21 is connected by wire 30 to the fixed contact 22, the other side of said coils 19 and 21 is connected by wire 27 to the treadle contact 14 and by wire 33 to the fixed contact 24. The other treadle contact 15 is connected by wire 26 to the positive power supply and switch arm 25 is also connected to the positive power supply by wire 32.

The operation of the counting system will now be described as a vehicle approaches within the range of the magnetic detector 10. The magnetic field surrounding the permanent magnet 11 is distorted, changing the magnetic flux in member 11 and changing the flux linkages in the coil 12, inducing therein a current of sufficient voltage to energize coil 17 of relay 16. This voltage will continue to exist as long as a vehicle is moving in the range of said permanent magnet. Upon excitation of relay 16, arm 23 is brought into engagement with contact 22.

As the front wheels of the vehicle close treadle switch 13, a circuit through coils 19 and 21 of relay 18 and counter 20, respectively, is completed. Said circuit is traceable from the positive power source, wire 26, treadle switch 13, wire 27, coils 19 and 21, wire 30, contact 22, and switch arm 23, to the negative power supply. As relay 18 is excited, arm 25 closes and completes a holding circuit for both coil 19 and coil 21, traceable from the negative power source, arm 23, contact 22, wire 30, coils 19 and 21, wire 27, wire 33, contact 24, arm 25, and wire 32, to the positive power source. As the front wheels pass over and release treadle switch 13, relay 18 and counter 20 remain energized under the influence of said holding circuit.

As the vehicle continues along the roadway, the wheels of the second axle again actuate treadle switch 13. However, since both relay 18 and the counter 20 are held energized by their holding circuit, and relay 16 also remains energized, due to the continued influence of the moving vehicle on the magnetic detector, the second actuation of treadle switch 13 produces no effect on the circuit. The same is true for a third axle if the vehicle has three axles.

As the vehicle progresses, it passes outside the range of the magnetic detector. The induced voltage in coil 12 disappears and relay 16 is released, opening switch arm 23 and break-

ing the holding circuit for coils 19 and 21. Thus, both the counter 20 and relay 18 are released and the circuit is restored to normal for reactivation by another vehicle.

It will be noted that the counter coil 21 cannot be energized by the closing of treadle switch 13 unless switch arm 23 is also closed. Therefore, in order to operate the counter for registering the passage of a vehicle, the magnetic detector 10 must be actuated concurrently with the treadle switch 13 and that the actuation of either of said instrumentalities alone will not actuate the counter. It will also be seen that the counter is energized only once for each vehicle which passes over the treadle, irrespective of the number of axles thereon.

It will be noted that the operation of the circuit shown in Fig. 1 depends upon continued movement of the vehicle from before the actuation of the switch 13 by the front wheels of the vehicle until after the rear wheels of the vehicle have actuated said switch. Should the vehicle stop after the front wheels have closed switch 13, relay 17 will be de-energized to open switch arm 23, and if the wheel thereafter continues moving again, the switch arm 23 closes, and when the next wheels of the vehicle closes switch 13 another count is produced.

In Fig. 2, however, there is shown a counting system which will produce a single count for each vehicle even if the vehicle stops over the magnetic detector. To this end, there is provided a magnetic detector 10A comprising an iron core 11A, preferably having upwardly extending pole portions 11B, each provided with magnetizing coils 34 connected in series to an alternating current power supply. On the central portion of the core 11A is a pickup coil 12A, connected to the coil 17 of relay 16. The remainder of the circuit is similar to the circuit shown in Fig. 1.

As the vehicle approaches the detector 10A, the presence of iron in the vehicle decreases the magnetic reluctance of the iron core 11A, thereby increasing the magnetic flux in said core, and inducing a voltage in coil 12A sufficient to energize coil 17 of relay 16. This voltage does not depend upon movement of the vehicle, and hence, the relay 16 will remain energized until the vehicle passes beyond the magnetic detector, even should the vehicle stop while over the detector. In this circuit, therefore, only a single count will be produced on the counter 20, even if the vehicle stops between actuations of the switch 13 by the wheels of different axles of the vehicle.

Fig. 3 illustrates a system for counting the axles of vehicles passing along a lane, instead of counting vehicles directly as in Figs. 1 and 2. The circuit comprises a magnetic detector 10 and a treadle switch 13 similar to those shown in Fig. 1.

The detector 10 likewise comprises a permanent magnet 11 carrying a pickup coil 12, connected in series to the coil 17 of a relay 16. The relay 16, when energized, is also adapted to move a normally open switch arm 23, connected to a minus power supply by wire 31, into engagement with a fixed contact 22.

In the circuit of Fig. 3 there is also provided a counter 20 comprising a coil 21 connected in parallel to the coil 19 of relay 18. The coils 19 and 21 are likewise connected on one side by wire 30 to a fixed contact 22, and on the other side by wire 27 to the switch contact 14. The relay 18, when excited, is likewise adapted to move

a normally open switch arm 25, connected by wire 32 to the positive power supply, into engagement with a fixed contact 24. The treadle contact 15 is likewise connected by wire 26 to the plus power supply.

Counter 20, when energized, is adapted to open a switch arm 33c, normally engaging a fixed contact 33b. Switch arm 33c is connected by wire 33d to the fixed contact 24. The fixed contact 33b is connected by wire 33a to the wire 27, and hence, to one side of the coils 19 and 21.

The operation of the axle counting circuit of Fig. 3 will now be described. As a vehicle enters the range of the magnetic detector 10, the induced voltage of coil 12 energizes coil 17 of relay 16. As the vehicle continues along the highway the front wheels close treadle switch 13, completing a circuit which energizes relay 18 and counter 20, as heretofore described.

The closing of relay 18 closes switch arm 25 and completes a holding circuit for both coils 19 and 21, said circuit being traceable from positive power source, wire 32, arm 25, contact 24, wire 33d, arm 33c, contact 33b, wire 33a, coils 19 and 21 in parallel, wire 30, contact 22, arm 23, to negative power supply. Since counters are usually relatively slow acting mechanisms due to their mechanical inertia, the purpose of the above mentioned holding circuit is to insure the operation of the counter if the vehicle is moving so rapidly that the counter does not have sufficient time to become completely energized before the treadle switch 13 is released, after having been closed. As soon as counter 20 is energized, contact arm 33c is opened, thereby breaking the holding circuit and releasing relay 18 and counter 20.

If the counter becomes completely energized before the front wheels release treadle switch 13, the counter will not be de-energized until said treadle switch is opened, thereby preventing the registration of more than one count for the passage of one axle.

As the vehicle continues along the highway, the wheels on the second axle again close switch 13. Since relay 16 is maintained energized, due to the continued influence of the moving vehicle on the magnetic detector, switch arm 23 is still closed. Therefore, the second closure of treadle switch will again energize relay 18 and counter 20 in a manner identical with the passage of the first axle, and the counter will again register a count and be released. Similarly, if the vehicle has three axles, the third axle will register a third count.

After the last axle has passed over the treadle switch, the vehicle continues along the highway and moves out of the range of the magnetic detector, releasing relay 16, and restoring the circuit to normal for reactivation by another vehicle.

It will be understood that, although the magnetic detector 10 and 10A of Figs. 1, 2, 3, and 4 are illustrated as comprising a bar magnet 11, 11A, and a pickup coil 12, 12A, any type of detector may be utilized which is influenced by the proximity of an iron mass, and which will actuate a switch, such as 22, 23 of Figs. 1, 2, and 3 when so influenced.

It will thus be seen that there is provided a device in which several 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 set forth 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. A system for counting vehicles in a lane, comprising, a magnetic detector adapted to be influenced by magnetic mass in vehicles in said lane, a treadle switch in said lane adapted to be actuated by the wheels of said vehicles, a pair of electro-magnets, an operating electro-magnet, means to energize one of said pair of electro-magnets when said magnetic detector is influenced by a vehicle in said lane, means, controlled by the first of said pair of electro-magnets, to energize the other of said pair of electro-magnets, when said treadle switch is thereafter actuated by the wheels of said vehicle, said last means being inoperative to energize said other of said pair of electro-magnets unless said detector is influenced, and means to energize said operating electro-magnet when both of said pair of electro-magnets are energized.

2. A system for counting vehicles in a lane, comprising, a magnetic detector adapted to be influenced by magnetic mass in vehicles in said lane, a treadle switch in said lane adapted to be actuated by the wheels of said vehicles, a pair of electro-magnets, an operating electro-magnet, means to energize one of said pair of electro-magnets when said magnetic detector is influenced by a vehicle in said lane, means, controlled by the first of said pair of electro-magnets, to energize the other of said pair of electro-magnets, when said treadle switch is thereafter actuated by the wheels of said vehicle, said last means being inoperative to energize said other of said pair of electro-magnets unless said detector is influenced, and means to energize said operating electro-magnet when both of said pair of electro-magnets are energized, and including means to retain said operating electro-magnet energized as long as said first of said pair of electro-magnets remains energized.

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