

Sept. 6, 1960

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2,951,737

RECORDING TRAFFIC COUNTER

Filed Feb. 18, 1957

2 Sheets-Sheet 1

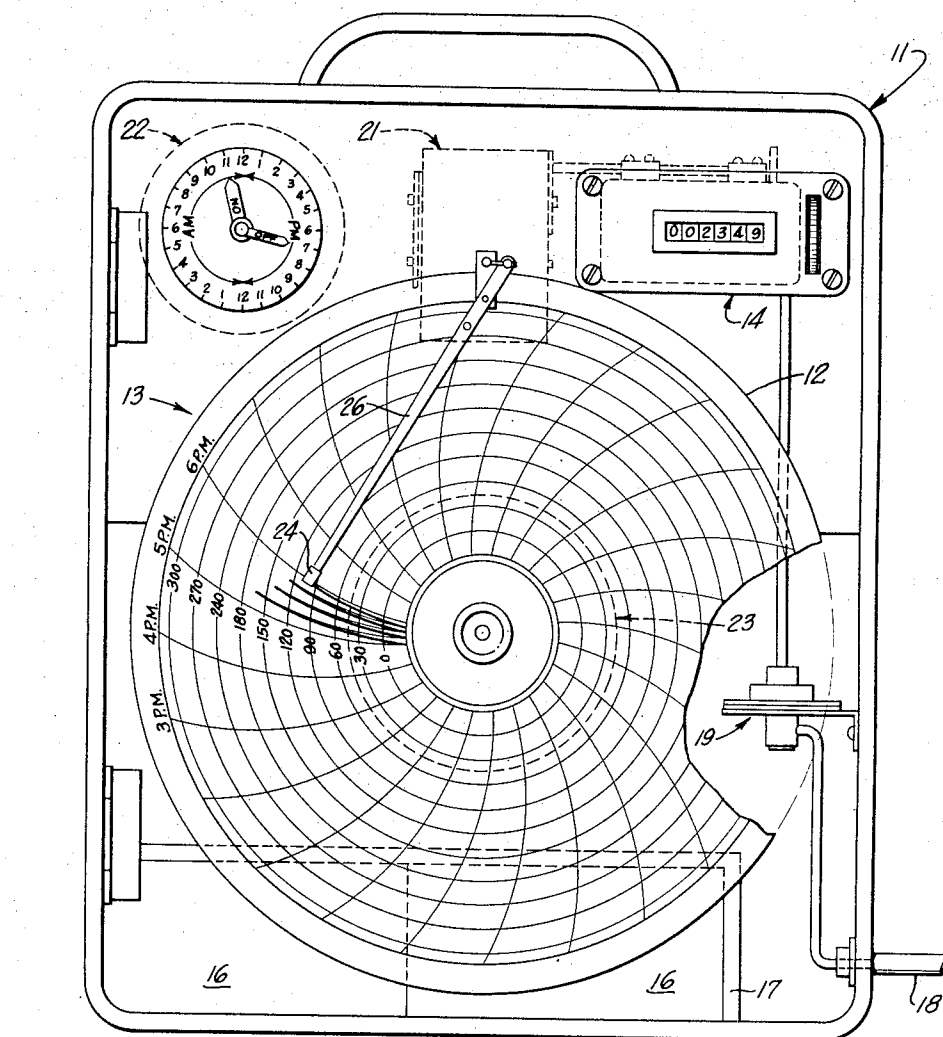


FIG. 1

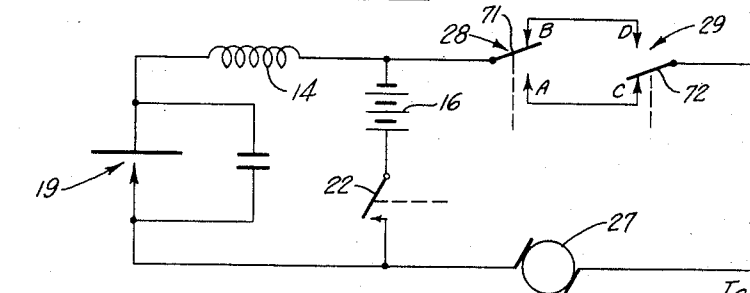


FIG. 6

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2 Sheets-Sheet 2

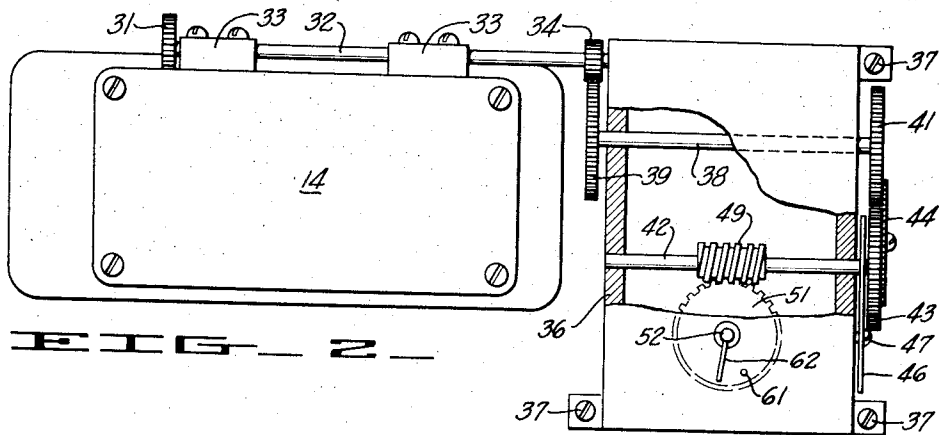


FIG. 2.

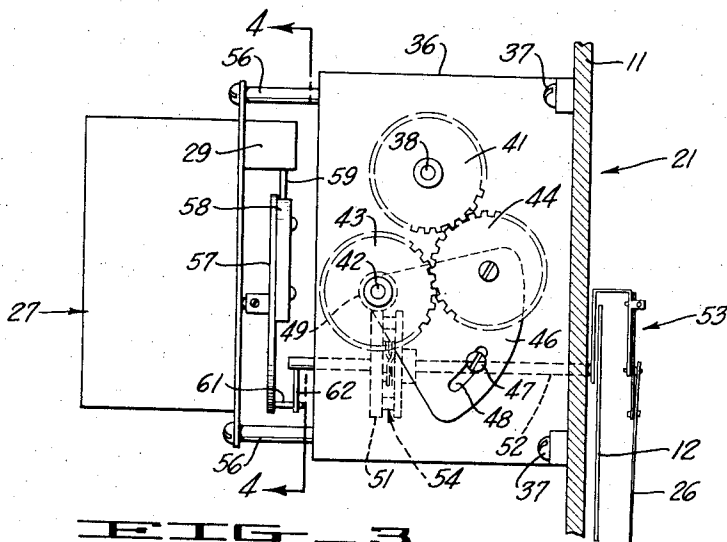


FIG-3-

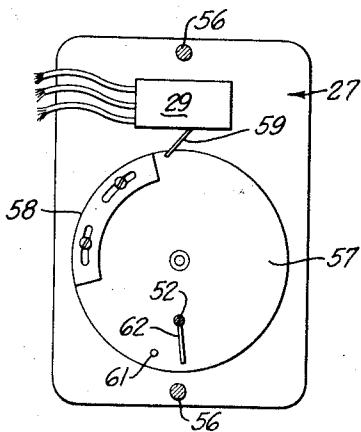


FIG. 4.

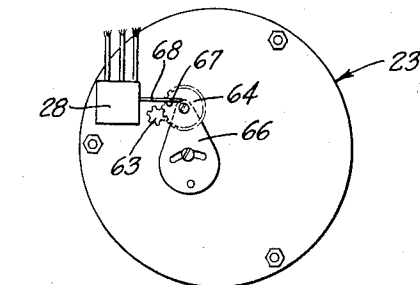


FIG-5

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2,951,737

RECORDING TRAFFIC COUNTER

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5 Claims. (Cl. 346—14)

The present invention relates to counting apparatus particularly adapted for vehicular traffic counting and providing an integrated graphical representation of counts received in time increments.

There are known and widely employed a variety of devices adapted to count and indicate the number of impulses received from some event and in the field of traffic survey a number of different traffic counters have been developed and are commercially available. Information obtained by such counters is invaluable in planning of streets and roads as well as in choice and operation of traffic control apparatus. Although stationary counters are sometimes employed the cost of traffic counters is such that more flexibility is desirable and portable counters are more commonly employed.

Conventional traffic counters include in addition to a power supply, such as batteries, a driven counter or register actuated from the power supply by a pressurized hose or the like operating a counter energizing switch. Such counters normally indicate a total number of vehicle passages over the hose in some predetermined time period during which the unit is disposed at a traffic check point. In order to properly evaluate the foregoing information there have been developed various formulae or relationships based upon generalities and attempting to break down the single overall count into time increments of significance to traffic engineers and the like. For example, a certain percentage of daily counts upon particular types of roadways are allocated to separate time intervals during the day. This breakdown of traffic figures is a necessity for proper traffic control; however, it will be appreciated that general relationships or ratios as noted above can only give an approximation of the desired information with the likelihood of serious errors in individual circumstances.

The present invention entirely obviates the previous approximations required for detailed traffic counting and provides exact information on traffic counts for very small time increments with a total count also provided. Not only are incremental readings produced by the present invention but further they are recorded in such a manner as to be immediately available and most easily handled and utilized. In addition, the present invention requires only relatively simple apparatus consistent with the universal requirement of low cost, reliability, and minimization and ease of maintenance and/or repair. Furthermore, the invention is entirely portable so as to be readily adapted to all traffic counting applications.

It is an object of the present invention to provide a counter for indicating the number of events in a predetermined time period and producing incremental time readings.

It is another object of the present invention to provide a traffic counter producing visual indicia of counts per each increment of time during a long time period.

It is yet another object of the present invention to provide a traffic counter producing a graph of counts versus time and divided into small time increments.

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It is still another object of the present invention to provide in a traffic counter means for recording total counts in a predetermined time period as well as counts per unit time therein.

It is a further object of the present invention to provide a traffic counter producing a circular graph of traffic counts in a predetermined time interval with the counts in each time increment of predetermined duration separately indicated.

Another object of the present invention is to provide in a traffic counter a circular chart recorder and means for resetting an indicator thereof at predetermined time increments during a period of counting for indicating the counts per time increment.

Other possible objects and advantages of the present invention may be found in the following description of a single preferred embodiment of the invention taken together with the accompanying drawings, wherein:

Figure 1 is an elevational view of the invention with the front removed and the actuating means cut off;

Figure 2 is an end view of the counter and drive means;

Figure 3 is a side view of the drive means;

Figure 4 is a sectional view taken at 4—4 of Figure 3;

Figure 5 is a back view of the chart recorder showing only one control feature; and

Figure 6 is a schematic circuit diagram of the invention.

The invention in brief comprises a counting mechanism electrically energized from a portable power source by means of such as a pressurized hose actuating a counter energizing switch upon hose compression as by a vehicle passing thereover. A circular chart recorder rotated at constant speed so that circumferential displacement represents time has the pin or other recording instrument thereof displaced radially of the chart by drive means from the counter and the chart pen is periodically reset by such means so that there is produced a circular chart of counts per increment of time between resets. In this manner only a quick glance at a single circular chart immediately shows the number of counts during any short period of time whereby maximum traffic information is readily available.

Considering now the structural details of the illustrated preferred embodiment of the invention and referring first to Figure 1 of the drawings there is shown a portable housing 11 preferably having a window in the front thereof for viewing the chart 12 of a circular chart recorder 13 and the face of a counter mechanism 14 mounted within the housing. Power is supplied by one or more batteries 16 securely fixed within the housing as in a battery compartment 17 thereof and input intelligence is received from a hose 18 extending from the housing and adapted for disposition upon the surface of a roadway at a traffic check point. The hose 18 has a closed outer end and is filled with air at substantially atmospheric pressure with a housing hose connection leading to a diaphragm switch 19 whereby hose compression as from a vehicle passing thereover actuates the diaphragm switch by pneumatic pressure.

All of the foregoing items are individually conventional units except for such modifications as are noted below; however, in addition thereto there herein is provided within the housing, drive means 21 connecting the chart recorder and counter mechanism as set out in some detail below. The counter mechanism 14 is electrically actuated and overall control thereof is provided by a conventional timing switch 22 including such as a clock with a pair of hands thereon that are marked "on" and "off" and which serve to close and open the switch at the times they are set to indicate on the clock face.

Before proceeding with a description of the drive means and electrical circuit of the invention attention is invited

to the chart recorder which includes a spring wound escapement 23 having a drive shaft removably carrying the chart 12 for rotating same at a constant speed. Of course a synchronous motor may be substituted for the spring drive in installations where external power is available to drive the motor. As a further portion of the chart recorder there is provided a pen 24 with reservoir mounted on a pen arm 26 that is in turn pivotally mounted upon the drive means with conventional arm adjustment for zeroing same. The pen is adapted to be moved radially outwardly of the chart while riding thereon to form an ink line on the chart representing pen arm displacement as dictated by the drive means. It will be appreciated that only a limited pen arm displacement radially of the chart 12 is possible before the pen moves off the chart and as it is desired to provide a large count scale on the chart the present invention operates to periodically return the pen to zero position adjacent the chart center. To this end the pen arm is reset at the end of each time increment of predetermined duration by means to be later described and including a reset or reversing motor 27 forming a part of the drive means. Also forming a part of the drive means for control of the reset or reversing motor 27 are a pair of switches 28 and 29 such as spring loaded microswitches described as to functional operation more fully in the later description of the electrical circuit.

Considering now the drive means 21, it is first noted that motivation therefor is derived from the counter 14. As may be seen from Figures 1 and 2, the counter, which may be a conventional unit producing one count for each two input signals, is modified by the addition of a gear 31 meshing with the counter drive gear, not shown, and extending outside the counter casing where it is mounted upon the end of a shaft 32. A number of bearings 33 are mounted on the case of the counter for carrying the shaft 32 in rotatable relation thereto and the shaft 32 extends to the drive means 21 with a gear 34 on the outer end thereof.

The structural details of the drive means 21, as shown in Figures 2-5, include a rigid frame 36 adapted for mounting within the housing 11 by bolts 37. A first shaft 38 extending transversely through the frame in rotatable relation thereto has a gear 39 at one end thereof meshing with the gear 34 on the countershaft 32 and a change gear 41 on the other shaft end. A second shaft 42 is rotatably mounted through the frame 36 parallel to the first shaft 38 and displaced therefrom. A driven gear 43 is fixed to one end of the second shaft 42 in the same plane as the change gear 41 on the first shaft 38 and an idler gear 44 meshes with both the latter mentioned gears to transmit rotational motion from the change gear 41 to the driven gear 43. The idler gear is mounted for rotation upon a plate 46 that is in turn mounted about the second shaft 42 for pivoting thereabout and the pivotal plate position is controlled by a bolt or screw 47 threaded into the frame 36 and extending through a curved slot 48 in the plate 46. It is contemplated that the ratio of rotation of the drive means shafts 38 and 42 may be varied by switching the change gear 41 for one of another diameter and meshing of the idler gear therewith is accomplished by pivoting the plate 46, with the idler gear at all times maintaining meshing relation with the driven gear 43 as the plate pivots about the shaft 42 thereof.

As previously noted the pen 24 of the chart recorder 13 is moved by the drive means 21 and this is accomplished through worm gearing including a worm 49 fixed on the second shaft 42 and meshing with a worm gear 51 mounted for rotation upon an output or pen shaft 52. This output shaft 52 is mounted for rotation in the frame 36 transversely of the first and second shafts and extending from the front of the drive means through a mounting plate upon which the drive means may be affixed. At the front end of the shaft 52 there is secured conventional pen mounting means 53 of the chart recorder. As previously noted the worm gear 51 is mounted to freely

rotate upon the output shaft 52 and power is applied to this shaft by means of a friction clutch 54 affixed thereto and bearing upon the worm gear so that the shaft is normally rotated by the worm gear through the clutch but no reverse drive of the gear from the shaft is possible as the clutch would then slip.

Upon the rear of the drive means housing is mounted the reversing motor 27 as by bolts 56 and the motor shaft has a cam disc 57 affixed thereto with a sector cam 58 adjustably positioned on one surface thereof. This cam 57 will be seen to rotate with the reversing motor and is provided to actuate the aforementioned switch 29 by means of the sector cam 58. The switch 29 is mounted radially outward of the cam 58 and is provided with an actuating arm 59 extending toward the cam so as to be struck by the cam 58 for moving the switch from one position to another and the switch is designed to return to the original position as by a spring when the arm thereof is no longer contacted by the cam. As a further portion of this cam 57 there is provided a pin 61 extending normally from the disc thereof toward the drive means frame and adapted to engage an arm 62 fixed to the rear end of the output shaft 52 and extending radially therefrom. The cam 58 is normally positioned as illustrated in Figure 4 with the pin 61 thereof spaced from the output shaft arm 62 so that energization of the reversing motor causing the cam to rotate counter-clockwise causes the cam pin 61 to strike the output shaft arm 62 and rotate the output shaft a distance determined by the arm length.

One further structural feature worthy of note before considering the electrical circuit and overall operation of the invention is the placement of the other switch 28, as shown in Figure 5, and same is therein seen to be mounted upon the back of the chart recorder escapement 23. A shaft extending from the escapement carries a gear 63 thereon which is driven by the escapement and a driven gear 64 meshes therewith. This driven gear 64 is preferably mounted upon a plate 66 pivoted at a distance from the gear and fixed in adjustable position by a screw through a curved slot therein and into the escapement. By this mounting it is possible to vary the diameter of drive gears employed to change the speed of rotation of the driven gear and this latter gear carries a pin 67 thereon adapted to strike a switch actuating arm 68 for switching contacts of the switch 28 from normal to actuated position. It will be appreciated that the gear 63 drives the gear 64 at a constant speed so that at like time intervals of adjustable duration the pin 67 strikes the switch arm 68 to momentarily move the switch contacts from normal to operated position following which the switch contacts immediately return to normal position as by spring tension and so remain for the same time interval previously mentioned.

Considering now the electrical circuit of the invention as shown in Figure 6, together with the overall operation of the invention, the pneumatic switch 19 will be seen to be connected in series with the coil of the counter 14 through the power supply 16 and on-off switch 22. Additionally the switches 28 and 29 are connected in series and as regards this connection note that both switches are single pole double throw with switch 28 having alternate stationary contacts A and B with a movable contact 71 and switch 29 having alternate stationary contacts C and D and a movable contact 72. Connection is made between switch contacts A and C and between switch contacts B and D with the movable contact 71 of switch 28 connected to one side of the power supply 16 and the movable contact 72 of switch 29 connected through the reversing motor 27 and the on-off switch 22 to the other side of the power supply so that the reversing motor is thus connected across the power supply under the control of the switches 28 and 29.

As previously mentioned, impulses received from the hose 18 at the switch 19 instantaneously close same to

energize the counter 14. The counter energization turns the gear 31 mounted thereon and the drive means is actuated to slightly turn the shaft 38 and thus the shaft 42 thereof through the gear train therebetween. As the shaft 42 rotates so does the worm 49 thereon and the worm gear 51 is likewise turned to incrementally rotate the shaft 52 through the clutch 54. As the pen 24 is affixed to the shaft 52 it is slightly moved radially outward upon the chart 12. Continued impulses at the hose 18 produce like pen movements and the chart 12 which is steadily rotated by the chart recorder 13 thus has a somewhat cycloidal line traced thereon by the pen moving radially outward thereon.

As the escapement mechanism 23 of the chart recorder 13 rotates the chart 12 it also turns the gear 63 on the back of the escapement so that the meshing gear 64 is rotated. This gear 64 thus moves the pin 67 thereon into contact with the actuating arm 68 of the switch 28 periodically, as for example at fifteen minute intervals. At expiration of each predetermined time interval the pin 67 strikes the switch arm 68 to momentarily swing the movable switch contact 71 from contact B to contact A and as soon as the pin 67 moves slightly further the switch arm 68 is released so that the switch 28 returns to normal position with contacts 71 and B touching. During the short interval that the contacts 71 and A of switch 28 are closed a circuit is completed through same and switch 29 to connect the reversing motor 27 across the power supply so that the motor is energized.

Operation of the switch 29 is controlled by the cam 58, as seen in Figure 4, and note that switch 29 has a normal or spring return position with contacts 72 and C closed. The rest cam position is shown in Figure 4 wherein the cam 58 is just past the switch arm 59 so that contacts 72 and C are closed, as shown in Figure 6. As soon as switch 28 is actuated, as previously described, the reversing motor circuit is completed through switch contacts A and C so that the motor turns the cam disc 57 whereupon the pin 61 thereon strikes the shaft arm 62 to rotate the pen shaft 52 back to a zero pen position. Note here that as the shaft 52 is rotated back the clutch 54 slips as no reverse drive through the worm gearing is possible.

Continued rotation of the cam disc 57 by the reversing or reset motor 27 also moves the cam surface 58 around to strike the switch actuating arm 59 so that the switch 29 is moved to actuated position with contacts 72 and D closed thereby momentarily stopping the reset motor 27 until the other switch 28 is released from actuated position by the pin 67 to return to normal position with 71 and B closed. These switch positions form a closed circuit through the reversing or reset motor so that further operation thereof results and the cam disc 57 is rotated substantially the remainder of one complete revolution until the cam surface 58 moves past the switch arm 59 to release this switch for spring return to normal position with contacts 72 and C closed so that the reversing motor circuit is interrupted. The circuit is then reset to the position of Figure 6 and is again ready for another operation as above noted following passage of the predetermined time interval.

The cam disc 57 has the adjustable cam portion 58 extending a finite circumferential distance thereabout in order to rotate the cam disc the remaining part of one complete revolution after the switch 28 returns to normal position so that the cam pin 61 is brought to rest at a point beyond which the arm 62 should not move. This latter mentioned positioning of pin 61 and shaft arm 62 is advantageous in that the shaft cannot then be rotated by the counter sufficiently to drive the chart pen off the chart. Improper preliminary evaluation of traffic with a consequent overly long time setting of the device could result in the pen being driven off the chart before resetting were it not for this feature.

It is noted as regards the operation of the chart recorder and particularly the reset thereof that other pen return means could be employed; however, it has been determined that overly rapid pen return is undesirable in that ink is spilled from the pen of conventional chart recorders. Thus while solenoid return, for example, is possible the present motor return is found most advantageous and a pen return time of the order of one-half second as employed has been found not to interfere with accurate traffic counting. Additionally the worm drive on the pen shaft as herein employed is of particular advantage for thereby backlash is entirely eliminated and undesirable pen excursions prevented.

While the salient features of this invention have been described in detail with respect to certain embodiments thereof, it will of course be apparent that certain modifications may be made within the spirit and scope of this invention, and it is not desired therefore to limit the inventions to the exact details shown except insofar as they may be defined in the following claims.

What is claimed is:

1. A recording traffic counter comprising a register, actuating means for said register responsive to the passage of traffic, a chart recorder including a circular chart rotated at a constant speed and a pen resting thereon, drive means comprising a gear train connected from said register through a friction clutch to a shaft carrying said pen whereby said pen is moved radially upon the chart in proportion to register actuation, and time controlled reset means including an electric motor, cam means driven by said motor for engaging an extension of said shaft carrying said chart pen to drive the shaft in reverse to return the pen to an initial position, and electrical switching means controlled by chart recorder position for energizing said motor at predetermined equal angular increments of rotation of said chart to periodically return said pen to said initial position after corresponding equal time increments.

2. A recording device comprising a counter, a power supply actuating said counter, control means interconnecting said counter and power supply for actuating the former in accordance with events to be counted, a chart recorder comprising means rotating a circular chart at a constant rate and a pen resting thereon, drive means connecting said counter through a unidirectional coupling to a shaft carrying said pen for moving the latter radially upon said chart in accordance with counter actuation from a central pen position outward of the chart, a reset motor having a cam mounted thereon for rotation and a pin on said cam for engaging an extension of said pen shaft and turning same to a predetermined position, and a pair of switches connecting said motor across said power supply with the first of said switches being actuated at equal time intervals by said chart recorder and the other of said switches being actuated by said motor cam whereby said pen shaft is periodically returned to central position.

3. A recording device comprising a counter, a power supply actuating said counter, control means interconnecting said counter and power supply for actuating the former in accordance with events to be counted, a chart recorder comprising means rotating a circular chart at a constant rate and a pen resting thereon, drive means connecting said counter through a unidirectional coupling to a shaft carrying said pen for moving the latter radially upon said chart in accordance with counter actuation from a central pen position outward of the chart, a reset motor connected across said power supply through first and second switches, each of said switches having first and second stationary contacts with a switch arm movable therebetween and actuating means, means connecting the first stationary contacts of said switches and connecting the second stationary contacts of said switches, means connecting the switch arm of one of said switches to said power supply and the switch arm of the other switch to

the reset motor, said first switch having a normal position with the switch arm and first stationary contact engaged and said second switch having a normal position with the switch arm and second stationary contact engaged, a first cam rotated by said chart recorder and disposed adjacent said first switch for periodically engaging the actuating means thereof to actuate said first switch and engage the switch arm and second contact thereof for a predetermined period of time, and a second cam mounted upon said reset motor for engaging said pen shaft to return the pen to control position and engaging said second switch actuating means for moving the switch arm to engage the first contact of said second switch whereby said reset motor is de-energized until said first switch is released to return the switch arm thereof to engagement with the first contact and the reset motor is again energized to return the second cam to original position releasing said second switch.

4. A recording traffic counter comprising a circular chart recorder rotating a circular chart thereon at constant speed and having a shaft mounted pen resting upon the chart for movement radially thereof upon pen shaft rotation, a counter, a power supply, a control switch connecting said counter and power supply, a traffic detector closing said control switch for each passage thereby of an element to be counted, a worm gear rotatably mounted on said pen shaft, a clutch engaging said worm gear and pen shaft to transmit rotation from the former to the latter, a worm engaging said worm gear and rotated by said counter, a reset motor, and means providing periodic limited engagement of pen shaft and reset motor for returning said pen shaft to an initial angular position at equal time intervals.

5. A recording traffic counter comprising a circular chart recorder rotating a circular chart thereon at constant speed and having a shaft mounted pen resting upon the chart for movement radially thereof upon pen shaft rotation, a counter, a power supply, a control switch connecting said counter and power supply, a traffic detector closing said control switch for each passage thereby of an element to be counted, drive means including worm gearing interconnecting said counter and chart pen for moving the latter in accordance with counter actuation, a reset motor, a switch periodically actuated by said chart recorder for momentarily energizing said reset motor, a cam upon said motor for rotation thereby and having a pin for engaging said pen shaft to return the pen to a central chart position, a second switch having a normal position completing an energizing circuit through said motor upon first switch actuation and an actuated position controlled by said cam for completing a like circuit with said first switch in a normal position whereby said cam is periodically motor rotated one complete revolution.

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