DIGITAL SPRAY MILEAGE RECORDER

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The Desplaines Valley Mosquito Abatement District situated in the western suburbs of Chicago, IL, utilizes truck-mounted spray equipment in both larval and adult mosquito control operations. The ability to determine the actual insecticide application rate/acre by truck-mounted equipment is correlated to the accuracy of recording distances traveled while spraying. Under typical start/stop situations, the vehicle odometer is not sufficient. A tractor speedometer kit modified by our District (MacBain, et al. 1968) utilized a small wheel to travel along the outer circumference of the vehicle's tire as a means of recording elapsed distance. Due to the physical nature of this system, numerous disadvantages which included frequent maintenance, a high failure rate when used on off-road vehicles, and the necessity of the driver to physically engage/disengage the recording system limited its practical application. An alternate system utilizing electronic technology was developed, and is described.

An electronic proximity switch is utilized to monitor the revolutions of the vehicle's driveshaft. A revolution count is maintained by a 4-digit presettable divider/counter which in turn provides input to a 6-digit LED electronic totalizing counter with 0.1 display capability. The recording system is wired in series with the equipment's spray on/off control switch and is activated only during the period of actual spraying. This feature eliminates the need for the operator to physically start/stop the system with spraying operations. The system is powered by the vehicle's 12 VDC battery and is adjustable to any tire circumference/axle ratio combination. The system has the capability of recording any measure of length in the English or metric system.

The proximity switch utilized has an operating range of 10 mm with an inductive scanning principle (Normally Open switching function). The proximity switch is securely located adjacent to the vehicle's transmission output shaft (Fig. 1). A 1″ wide sheet metal indicator tab is attached to the vehicle's driveshaft slip yoke by hose clamp and is positioned to come within a distance of 10 mm of the proximity switch for activation during each revolution. The indicator tab must be long enough to ensure activation

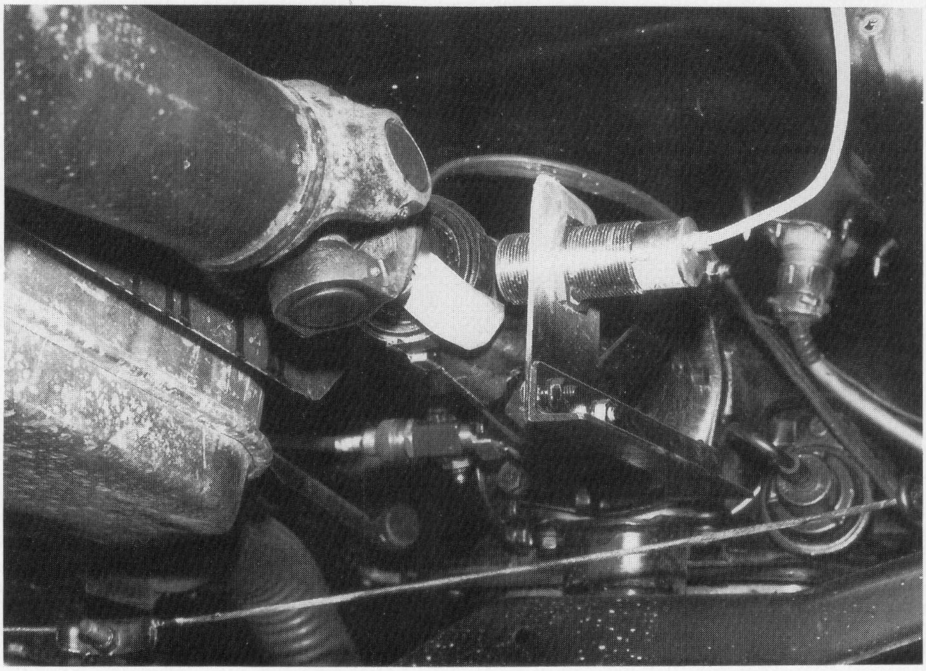

Fig. 1. Location of proximity switch adjacent to vehicle driveshaft slip yoke.

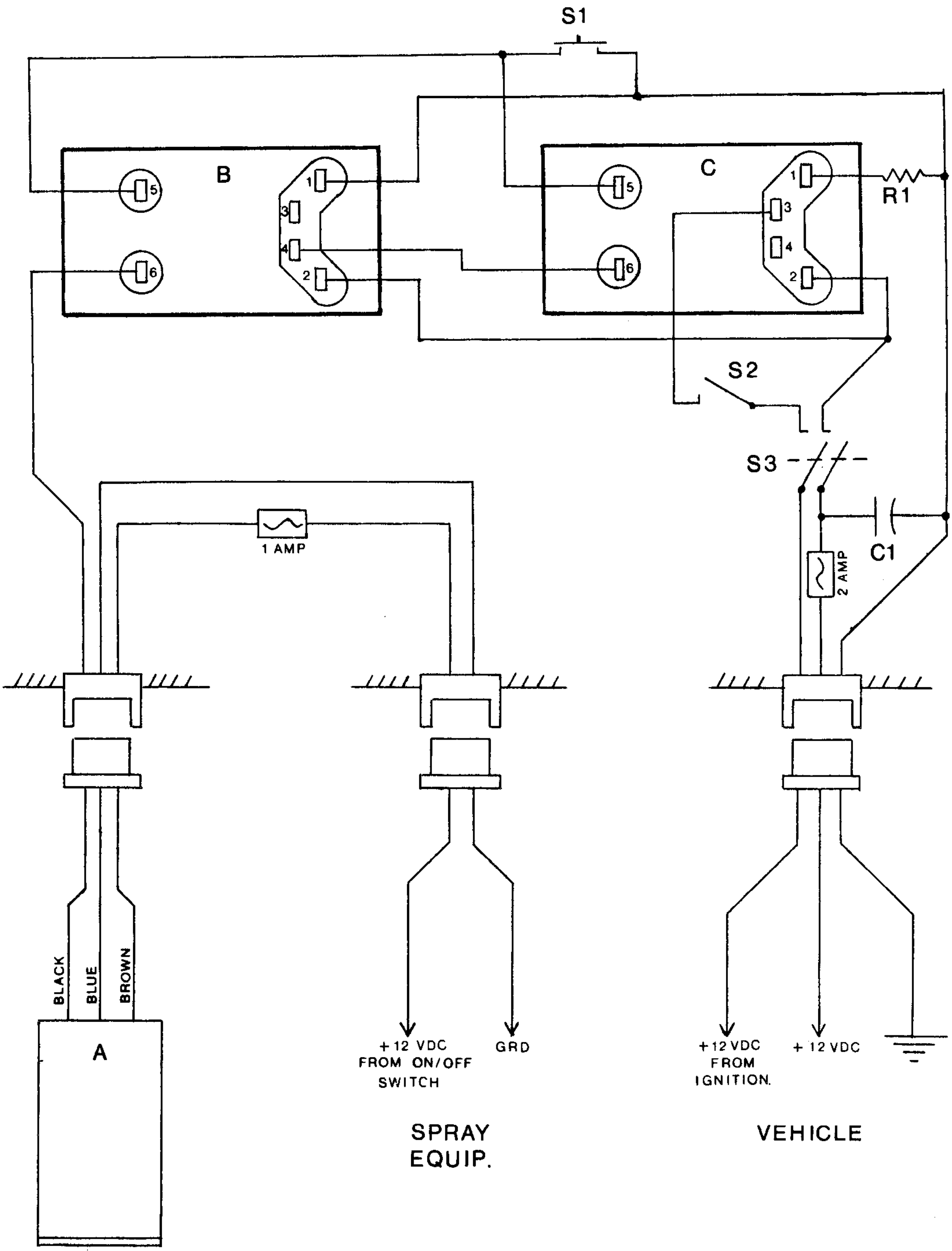

Fig. 2. Schematic wiring diagram; A. proximity switch: IVO Industries #DNO-30-Mb-3A, B. presettable divider/counter: IVO Industries #E011.020C-12VDC/100Hz, C. totalizing counter: IVO Industries #KN626.020Y007-12VDC/3, S1. SPST monetary push button for counter reset, S2. SPST toggle switch to control LED display output, S3. DPST toggle switch to control main power source. C1. 100uF 0-25VDC electrolytic capacitor, R1. 22 ohm 1 watt resistor.

Fig. 3. Location of recorder in vehicle cab adjacent to tachograph and spray equipment control.

over the full range of lateral travel of the driveshaft's slip yoke. Also, care must be exercised not to locate the proximity switch near the vehicle's exhaust system or catalytic converter.

The proximity switch is wired to the remaining components as indicated in Fig. 2. All components are housed in a plastic enclosure box and are situated in the vehicle's cab (Fig. 3). All wiring connections into the enclosure box are made through removable connectors for convenience. A panel mounted toggle switch (Fig. 2, S3) is included to eliminate component standby power drain during periods of extensive storage. In addition, a separate toggle switch (Fig. 2, S2) is included to control the totalizing counter's LED display output for operator's convenience, and a push button switch (Fig. 2, S1) is utilized to reset all counters to zero.

Calibration of the recording system to a particular vehicle requires several steps. First, one rear wheel is raised and supported by a jack stand to allow free rotation with vehicle transmission in neutral. The tire circumference is measured and recorded. Second, a determination of the differential axle ratio is made. Many newer vehicles have the axle ratio imprinted on a steel tag attached to one of the differential's cover bolts. If the identification tag is not present, the axle ratio can be determined by the following procedure. A chalk line is drawn on the raised wheel in a radial direction near the outer circumference. A second chalk line is drawn in a axial direction on the driveshaft adjacent to the differential. The raised wheel is rotated one full revolution and a corresponding count is made of the number of driveshaft revolutions. This number will rarely be a whole number, hence care must be exercised to approximate any fractions of a revolution as accurately as possible. The number obtained represents the differential axle ratio. The third step of calibration involves a calculation to determine the theoretical number of revolutions the vehicle's driveshaft will make for the desired unit of distance, i.e., linear mile, kilometer. The following formula can be applied:

$$\frac{\text{Desired unit of distance}}{\text{Wheel circumference}} \times \text{Axle ratio}$$
$$= \text{Driveshaft rev./unit distance.}$$

The wheel circumference must be expressed in the desired unit of distance. The number determined above is set on the 4-digit presettable divider/counter. The fourth and last step of calibration is a physical verification of the above determined number. A known distance of the unit of length selected must be traveled by the vehicle with recording system activated. Adjustments to the setting of the presettable divider/counter must be made to coordinate counter to actual data. Adjustments are usually required for vehicles equipped with radial tires due to greater variations in "rolling" versus measured tire circumferences.

The described recording system has been utilized by the District since 1982 with no failures to date. In addition, no maintenance has been required to date. All components necessary for recording system construction were available through respective manufacturers or local electronic supply houses for approximately $250.00. The system provides an accurate record of elapsed spray distances with flexibility to meet a variety of applications and specific program needs.

REFERENCES CITED

MacBain, A. G., R. Suhrbier and E. L. Holub. 1968. A slow speed speedometer. Mosq. News 28:110–111.