FLASHLIGHT BATTERIES AS A POWER SOURCE FOR CDC MINIATURE LIGHT TRAPS

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The lead-acid type of battery (6-volt and modified 4-volt) has proven to be an efficient and reliable power source for the CDC miniature light trap (Sudia and Chamberlain, 1962). In permanent study sites with easy access by road, these batteries may still be the preferred source of power, in spite of weight and acid-corrosion problems.

Until now, attempts to develop alternate power sources (Nelson and Chamberlain, 1956 and Smith and Downs, 1969) have had varying degrees of success; usually these power sources have been unreliable for general use because the combined electrical requirements for a night's operation of the light-trap motor and lamp was higher than the amp/hr capacity of the battery employed.

This paper describes two additional battery systems which use either standard "D" size carbon-zinc flashlight batteries or the heavier-duty alkaline flashlight batteries. The existing CDC light traps can be easily and inexpensively modified for operation on the new power systems (Fig. 1).

LEAD-ACID BATTERIES. Figure 2 shows the wiring diagram of the 6-volt battery system and of the two newer systems. For use of the conventional 6-volt battery a 7.5 ohm resistor is needed in the line to drop the voltage to the 4 volts required for the Aristo-Rev #1 motor and the GE #1490 lamps.[1] Current drain is 215–225 milliamps (60–70 for the motor and 155 for the #1490 lamp); with a 30–35 amp/hr battery, 5 to 6 nights operation are obtained (Table 1).

[1] In this report, trade names are used as a means of identifying the product, and their use does not constitute endorsement by the Public Health Service or by the U. S. Department of Health, Education, and Welfare.

We have used a modified 4-volt lead acid battery (Fig. 2) which is made by using only two cells of a 12-volt automobile battery. This 4-volt battery eliminates the need for the 7.5 ohm resistor required with the 6-volt battery. The electrical characteristics are otherwise essentially the same as the 6-volt system (Table 1).

4.5 VOLT STANDARD FLASHLIGHT BATTERIES, SIZE D. The Aristo-Rev #1 motor and a GE #49 lamp are powered by four standard D size flashlight batteries (Fig. 2). The GE #49 bulb uses only 65–70 milliamps per hour rather than 155 as does the #1490 bulb, and the entire unit draws only 130–140 milliamps per hour. This bulb is rated at 2 volts, but in this configuration the trap is operated at 3 volts (Fig. 2). The excess voltage causes the lamp to burn somewhat brighter, and tests show that the life of the bulb is shortened slightly, but in field operation of 18 traps for a total of more than 850 trap nights, bulb-related failure was less than 2 percent.

Figure 3 shows the detailed wiring diagram for the conversion of the CDC light trap to the system using the four "D" size carbon-zinc flashlight batteries. The motor is operated on 4.5 volts, thereby increasing the airflow to approximately 700 ft. per minute (Table 1). Including the batteries the entire trap weights 2.7 lbs. The standard carbon-zinc batteries must be replaced after each night's use; however, if 4 alkaline type "D" batteries are used instead, 2 to 3 nights of operation may be obtained (Table 1, footnote). A list of materials required for the conversion of the CDC Trap to this system is appended.

3-VOLT, ALKALINE BATTERY, SIZE D.

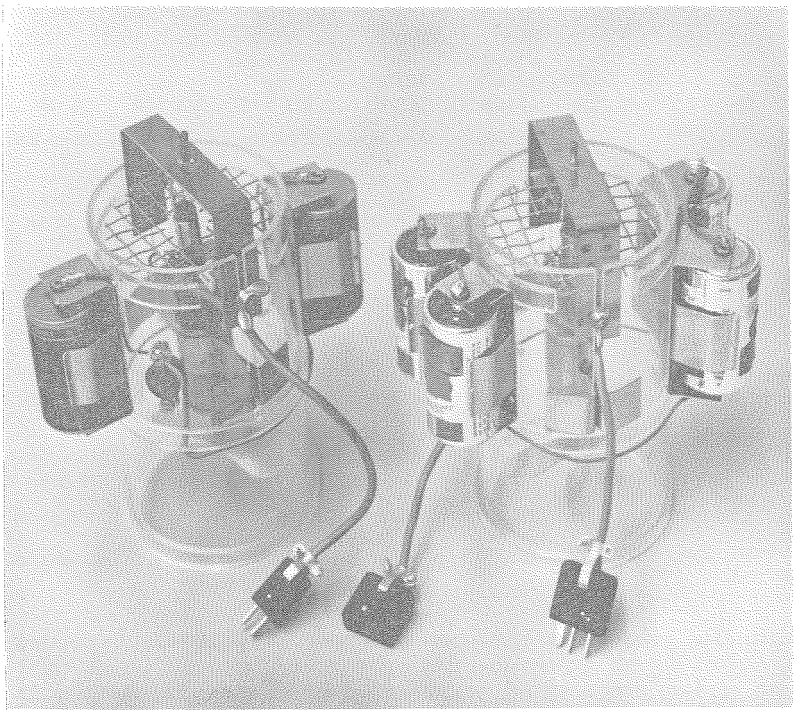


Fig. 1.—CDC light trap modified for the new power system.

Figure 3 shows the detailed wiring diagram for the conversion of the CDC light trap to the system using two alkaline flashlight batteries, and Figure 1 depicts the attachment of the batteries to the light trap. The electrical requirements are similar to those of the system using 4.5-volt batteries, but the motor is operated on 3 volts, which results in a lower fan speed (Table 1). Little difference was noted in the average number of mosquitoes caught per trap night in spite of the reduced airflow. Unfortunately, two standard carbon-zinc flashlight batteries do not have the capacity to operate this trap for a full night; therefore heavy-duty alkaline batteries such as "Duracel" or "Golden Energizers" must be used. A pair of these heavy-duty batteries will operate the trap for 4 nights, after which they may be recharged for repeated use.

A list of materials for conversion to this system is appended.

FIELD TRIALS. A comparison of the 3-volt and 4.5-volt flashlight battery systems was made during the epidemic of Venezuelan encephalitis (VE) in south Texas during the summer of 1971. In a special study, CDC miniature light traps modified to each system above and supplemented by dry ice (Newhouse *et al.* 1966) were used to collect 15,386 mosquitoes in 193 trap nights. An overall average of 80 mosquitoes per trap night was obtained. The 4.5-volt battery system was operated for 88 trap nights with a total catch of 7,175 mosquitoes (47 percent of the total for both systems) and an average catch of 82 mosquitoes per trap

TABLE 1.—CDC miniature light trap battery systems.

	Battery type				
	3-cell lead-acid 6 volts*	2-cell lead-acid 4 volts	4 "D" carbon zinc 4.5 volts	4 "D" carbon zinc 4.5 volts	2 "D" alkaline 3 volts
Motor	Aristo-Rev #1	Aristo-Rev #1	Aristo-Rev #1	Barber-Coleman (BYQM 2184)	Aristo-Rev #1
Operating voltage	4	4	4.5	4.5	3.0
Milliamps operating/hr.	60–70	60–70	65–75	100	35–40
Airflow, F.P.M.	650	650	700	500	450
Lamp used, G.E.	#1490	#1490	#49	#49	#49
Max. rated volts	3.4	3.4	2.0	2.0	2.0
Operating voltage	4.0	4.0	3.0	3.0	3.0
Milliamps operating/hr.	155	155	65–70	65–70	65–70
Motor & lamp, totals					
Milliamps/hr. required	215–225	215–225	130–140	170	100–115
Number batteries required	1	1	4	4	2
Effective nights operation	5–6	5–6	1**	1	4
Weight (lbs.) trap & battery	13.7	10.4	2.7	2.7	2.6

*A 7.5 ohm resistor is required to drop the 6.0 volts to the 4.0 volts required for the motor and lamp.

**Two nights if Eveready alkaline batteries are used; three nights if Mallory alkaline batteries are used.

night. The 3-volt battery system was operated for 105 trap nights with a total catch of 8,229 mosquitoes (53 percent of the total for both systems) and an average catch of 78 mosquitoes per trap night.

Since June 1971, the 4.5-volt system (four standard flashlight batteries) has been used by the Arbovirus Ecology Laboratory in south Texas and in northern and central Mexico for more than 1,100 trap nights. Over 400,000 mosquitoes were collected. In addition, U. S. Army personnel employing our 4.5-volt modification in VE studies in Louisiana, Arkansas, Oklahoma, and Texas collected approximately 500,000 mosquitoes. They preferred the modified trap to the lead-acid battery system for their surveillance studies (Lt. Col. Bruce Eldridge, personal communication).

The new system greatly simplifies the maintenance and operation of the traps in the field. Since the flashlight batteries

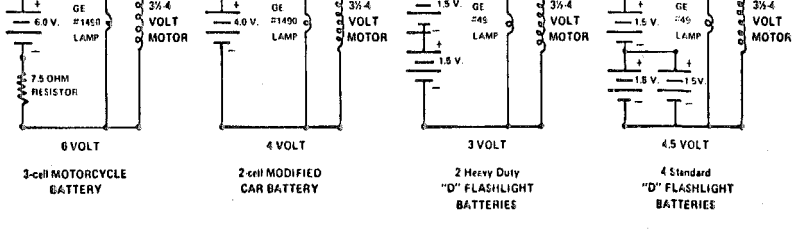
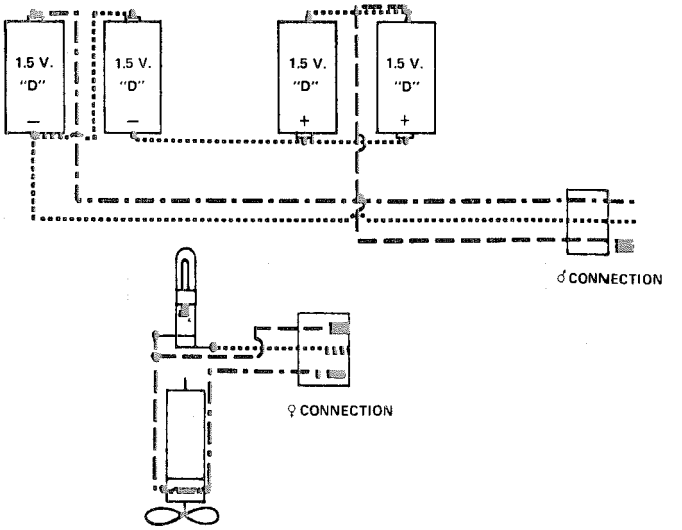


Fig. 2.—Wiring diagram alternatives for CDC miniature light traps.

WIRING DIAGRAM OF CDC MINIATURE LIGHT TRAP
Using 4 Standard duty "D" Flashlight Batteries



WIRING DIAGRAM OF CDC MINIATURE LIGHT TRAP
Using 2 Heavy duty "D" Flashlight Batteries

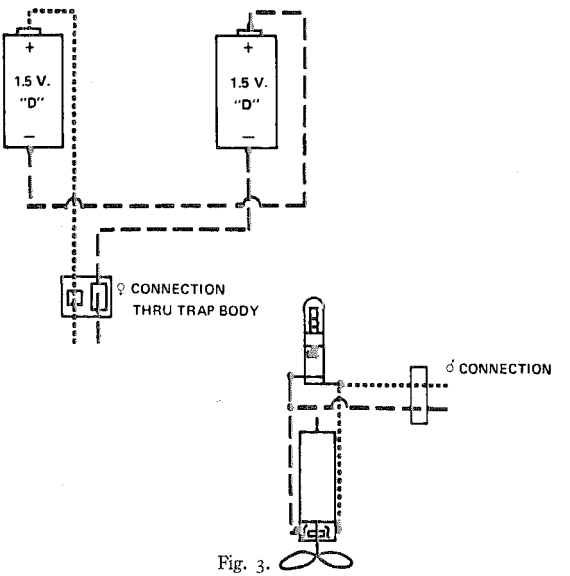


Fig. 3.

Parts list for adapting the CDC light trap for D cell operation; parts available from radio supply houses

No.	Item	Approx. cost
	4.5 volt battery system	
2	Keystone Battery Holder, 2 cell, D size, #176, or equal	.52
1	Cinch-Jones plug, line mount, 3 contact (P303CCT)	.60
1	Cinch-Jones socket, line mount 3 contact (S303CCT)	.60
1	GE #49 lamp	.15
18"	Belden wire, size 22, 3 conductor	.03′
	Approximate Total	$3.00
	3.0 volt battery system	
2	Keystone Battery Holder, 1 cell, D size, #175, or equal	.30
1	Cinch-Jones plug, line mount 2 contact (P302CCT)	.60
1	Cinch-Jones Socket, chassis mount, 2 contact (S302AB)	.60
1	GE #49 lamp	.15
18"	Belden wire, size 22, 2 conductor	.02′
	Approximate Total	$2.00
Motor—BYQM 2184 Barber-Coleman Co. Rockford, Ill.		$10.60 in lots of 25 or more

are mounted on the plastic body of the trap (Fig. 1), the conventional 6-foot cord which connects an acid battery to the light trap is unnecessary. As a result traps are less likely to be torn down by passing livestock, and the problem of ants reaching the collecting bags via the connecting cord is eliminated. The potential for snake bite and contact with poison ivy is reduced because the operator does not have to place or pick up a battery from the ground. Futhermore, the entire job of mosquito trapping is speeded up because more traps can be carried by the operator during placement or removal.

ADDENDUM. Since the conclusion of the field tests of these new battery systems, the importers have advised us of the possibility that they will no longer import the Aristo-Rev #1 motor.

We have, however, found a satisfactory substitute in the Barber-Coleman Company's motor, BYQM 2184. In 30 trap nights, tests have shown that the performance of this motor is well within the electrical requirement range for efficient operation on flashlight batteries (Table 1), and in 35 trap nights of field operation it has equaled the Aristo-Rev in all phases of performance.

Tests with the BYQM 2184 motor were made with the 4.5-volt standard flashlight battery system only because the voltage of the 2 alkaline battery system is too low for efficient operation of this motor.

Literature Cited

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Newhouse, V. F., Chamberlain, R. W., Johnston, J. G., Jr. and Sudia, W. D. 1966. Use of dry ice to increase mosquito catches of the CDC miniature light trap. Mosq. News 26:30–35.

Smith, T. A. and Downs, M. A. 1969. An alternative power source for the CDC miniature light trap. Calif. Vector News 17(1):3.

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