On the Path of the Firefly While Periodically Flashing

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A good deal has been written on the life history of the firefly, and many, including physicists and chemists, have speculated on the efficient light that these small insects can turn on and off at will. It is not the writer's intention to say anything regarding the former, for he is not a zoologist, or anything regarding the chemical and physical aspects in the production of the light, but he does wish to call attention to one of the firefly's instinctive qualities, namely, to its path in flight while periodically flashing. A fairly complete search through the literature for discussions on this point has been made without much success.

The writer was reared on a farm in the "Big Woods" of northwestern Ohio at a time when nature there was still in its unspoiled state, for three-fourths of the area was forest. He remembers as a boy a field of about ten acres, recently cleared, lying alongside of the road and adjacent to his

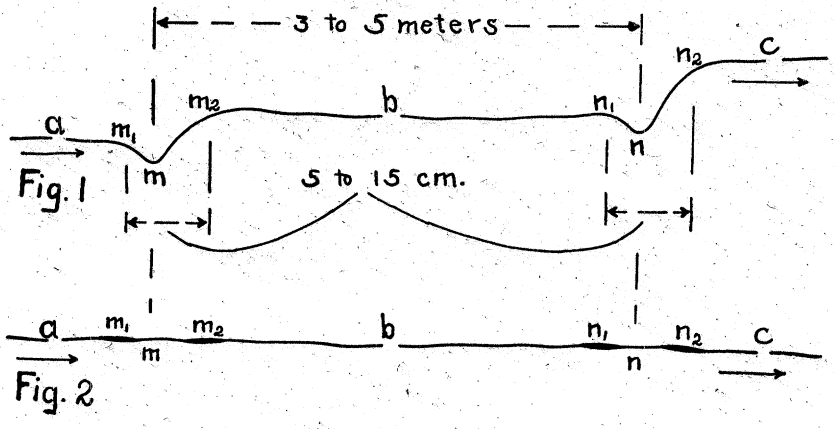

Fig. 1

Fig. 2

father's place. We often drove along this road at dusk and with wonderment observed the myriads of fireflies moving about over this newly cleared, but not yet broken, field. The soil conditions, the humidity, the decaying stumps and new undergrowth must have been favorable for their existence and propagation. It was in this field that the writer first observed the actual path that the firefly traces in flight while flashing periodically. He has observed this same characteristic path down through the years, and only last summer checked it again. It should be stated that numerous persons have been interviewed, including zoologists, chemists, physicists, physiologists and psychologists and the first has yet to be found who definitely stated having noticed the recurrent irregularities in the flight of the firefly at the time of flashing.

A brief description and discussion follow: The firefly on its twilight excursions flies for the most part in a horizontal direction. Take a windstill evening. A trace of its path viewed horizontally and from the side is shown in Fig. 1.

The portions *a*, *b* and *c* represent the more or less undulating stretches of flight of the fly, while m_1, m, m_2 the path during a "flash", and n_1 n, n_2 the path during the next following flash. As viewed from the side the fly on approaching m_1 slows down appreciably (seeming to waver slightly as if in an effort to stop) but maintains its flying level. The light then goes on and simultaneously the firefly drops visibly from its horizontal flight, but acceleration at once ensues, the downward duck is quickly arrested followed by an upward spurt as shown by the trace m m_2 in the figure. On reaching m_2, at a distance of from 5 to 15 cm from the beginning of the flash, the light is suppressed and simultaneously the flight is again slowed down. The firefly seems to waver, as in an effort to regain its equilibrium, before continuing its more or less undulatory flight along *b*, reaching n_1, when the luminous path cycle is repeated.

Looking down from above, (Fig. 2) the path discloses no outstanding characteristics. The direction of flight is pretty much straight ahead, but on close observation there may be seen at times signs of wavering at points m_1 and m_2 and also at n_1 and n_2, referred to above and shown in Fig. 2 by the thickened portions of the line. Observations from above reveal the accelerations in flight, both positive and negative, over the flash period. These observations are not, however, easy to make, as one can well imagine.

Speculating on the evidence revealed by the foregoing, it seems that the system (the firefly) may be thought of as containing stored energy under control of the insect for both maintaining flight and producing flashes of light. The fly now contemplates a flash as it approaches, say, m_1. On turning on the light (drawing energy from the common source) the attendant "overload" causes the mechanism necessary for sustained flight to slow down and the fly drops slightly. Simultaneously extra stores of energy are tapped, the flight mechanism responds, the illumination brightens and the insect speeds upward, in its endeavor to overcome the falling tendency, and reaches the point m_2, having thus described the smooth path m_1 m m_2. At m_2 the energy for the production of the light is shut off, and with it doubtless some that was needed in maintaining flight. The flight mechanism again slows down, the fly may waver as though to regain its balance (Fig. 2), and then starts off at reduced speed over the routine flight between flashes, while energy for the next flash is generated (chemically or otherwise) enroute. That considerable energy is expended in the production of the flash, and must be renewed (between flashes) is evidenced by the fact that if the fly is caused to emit light continuously its brightness dims perceptibly with time.

The above are the writer's observations, extending over a long period. Figure 1 depicts the path quite accurately. Have other observers noticed similar persistent irregularities?