

Tetzel, H.D. and B.Backhaus. Institute of Biology II (Zoology), RWTH Aachen, FR Germany. An improved electronic counting device for determining large quantities of fruit flies (*D.melanogaster*).

For counting large numbers of fruit flies (*D. melanogaster*) we built an electronic counter according to Cuperus et al. (1969,1970). We encountered great difficulties in getting reliable results and hereby want to present some improvements we think to be useful.

A complete circuit diagram of power supply and counting device is given in Fig. 1 and 2, respectively. As to the apparatus originally described by Cuperus et al. (1969,1970), our device differs in the following details:

In the counting head (Fig. 3), 2 light barriers are arranged crosswise in order to increase the accuracy of counting. 2 IR-diodes (3 mWatt) with a maximum energy at 940 nm are used as light sources. The impulses caused by the flies which are sucked through the channel are given to 2 IR-receivers. Their signals are combined in the comparator which works as a summing amplifier (Fig. 2).

Since our device does not have to be shielded from natural sources of light, all 3 channels--the 2 counting channels and the suction pipe--could be fitted in plexiglass. Thus the counting head can be examined from outside which facilitates any repairs or alterations (e.g., cleaning or changing of a scratched glass pipe).

Integrating circuits are used which allow faster counting compared with discrete-component circuits. The threshold frequency in our device is 100,000/s which was tested with a sine wave generator. The minimum distance, d_{min} , between 2 impulses that still guarantees reliable counting can be calculated from the threshold frequency, f , and the air speed,

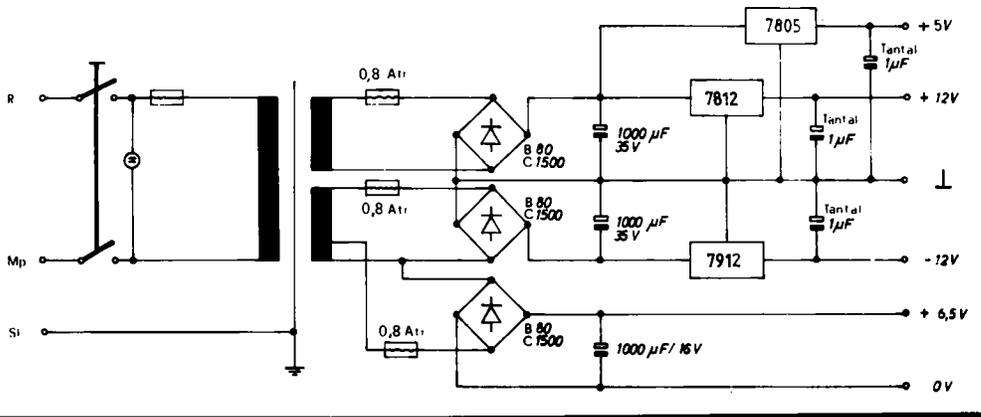


Fig. 1. Power Supply R, Mp, Si - main connections (220V).

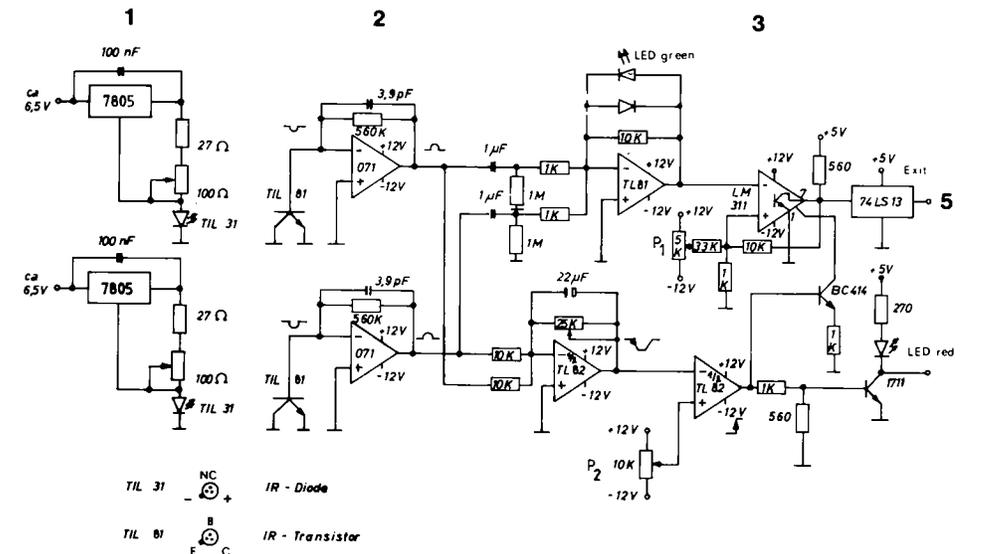


Fig. 2. Complete circuit diagram: (1) constant current supply and light transmitters (IR-diodes). (2) high speed receivers (IR-transistors) and amplifiers. (3) impulse forming device (AC coupled): comparator (working as a summing amplifier) and Schmitt-trigger. (4) transmission control (DC coupled): very low frequency pass combined with an integrator, comparator, and visual indicator. (5) electronic counter. P1,P2 - sensibility for counting of flies and dirt in the suction tube, respectively.

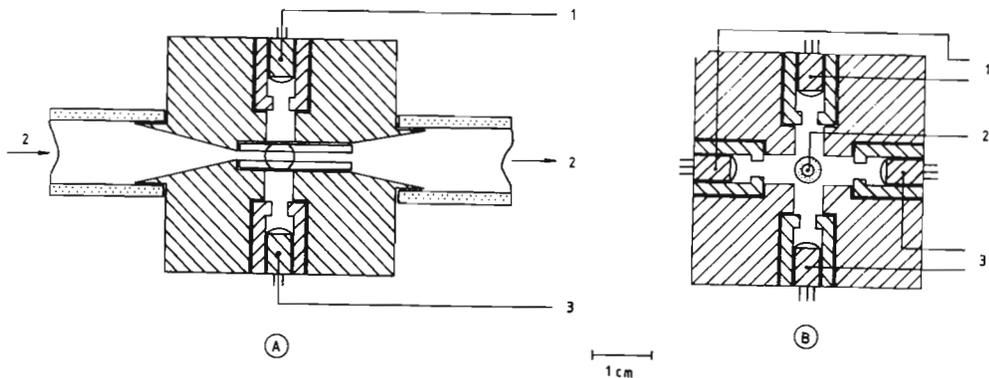


Fig. 3. Counting head:

- A Cross-sectional view.
 B Longitudinal view.
 (1) transmitter.
 (2) air flow through suction pipe.
 (3) receiver.

v_{air} , according to: $d_{min} = v_{air} \times t_{int}$; with t_{int} = duration of the interval between 2 impulses. (for $f = 100,000/s$ and $\pi = 10 \mu s$ we have $t_{int} = 5 \mu s$ per interval).

The maximum number of flies which theoretically can be counted within a given time, n_{max} , may be determined according to the following equation:

$$n_{max} = \frac{v_{air}}{l_{fl} + d_{min}} ; \text{ where } v_{air} \text{ represents the air speed at the sensor, } l_{fl} \text{ the mean}$$

fly length and d_{min} the minimum distance between 2 flies being sucked through the channel.

With a suction power of 500l/h and the diameter of the suction tube being 2 mm the mean air speed at the sensor is about 45 m/s. Taking a fly length of 2.5 mm and a minimum distance of $45,000 \text{ mm/s} \times 5 \mu s = 0.225 \text{ mm}$, theoretically about 15,000 flies may be reliably counted.

With flies as well as with poppy seeds (diameter: <1mm), we found counting deviations of less than 0.5%. Even very small flies--which are found especially in population experiments--were counted with the same accuracy.

Losses of flies being killed during the counting procedure are less than 0.5%.

When the apparatus is used daily, problems with counting accuracy may arise from the dirt being deposited in the suction tube. Therefore, we established a signal that shows optically when the transmission through the suction pipe drops below a critical value. At the same time the counting process is interrupted. This is effected by DC-coupling the impulses caused by the flies and leading them to an extreme low-frequency pass combined with an integrator (Fig. 2).

More detailed information can be obtained on request from the first-named author.

By varying the diameter of the suction tube and if necessary the suction power this counting device may be applied to other biological objects.

References: Cuperus et al. 1969, DIS 44:134-135; Cuperus et al. 1970, DIS 45:176.

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 A modular mating chamber for *Drosophila*.

Although density has been one of many variables studied by those interested in the mating behaviors of *Drosophila*, it appears that no one has designed a mating chamber in which the density of flies can be altered by incremental changes in the size of the chamber as well as by altering the number of flies in a chamber of constant size. The chamber described here is of modular construction; its size can be varied by combining two, three, or even more of the basic units. The single unit has been used successfully in studying the kinetics of the mating behavior of a sepia strain of *D.melanogaster* for densities ranging from 5 males plus 10 females to 320 flies of each sex over a half-hour period. Because the results of replicated tests were highly consistent, this mating chamber seems suitable for studying a number of aspects of mating behavior.

The basic unit of the mating chamber is a 12" length of rigid clear plastic tubing $4\frac{1}{2}$ " O.D. ($4\frac{1}{4}$ " I.D.; i.e., $1/8$ " wall). Attached to one end is a $1\frac{1}{2}$ " sleeve of the same type of