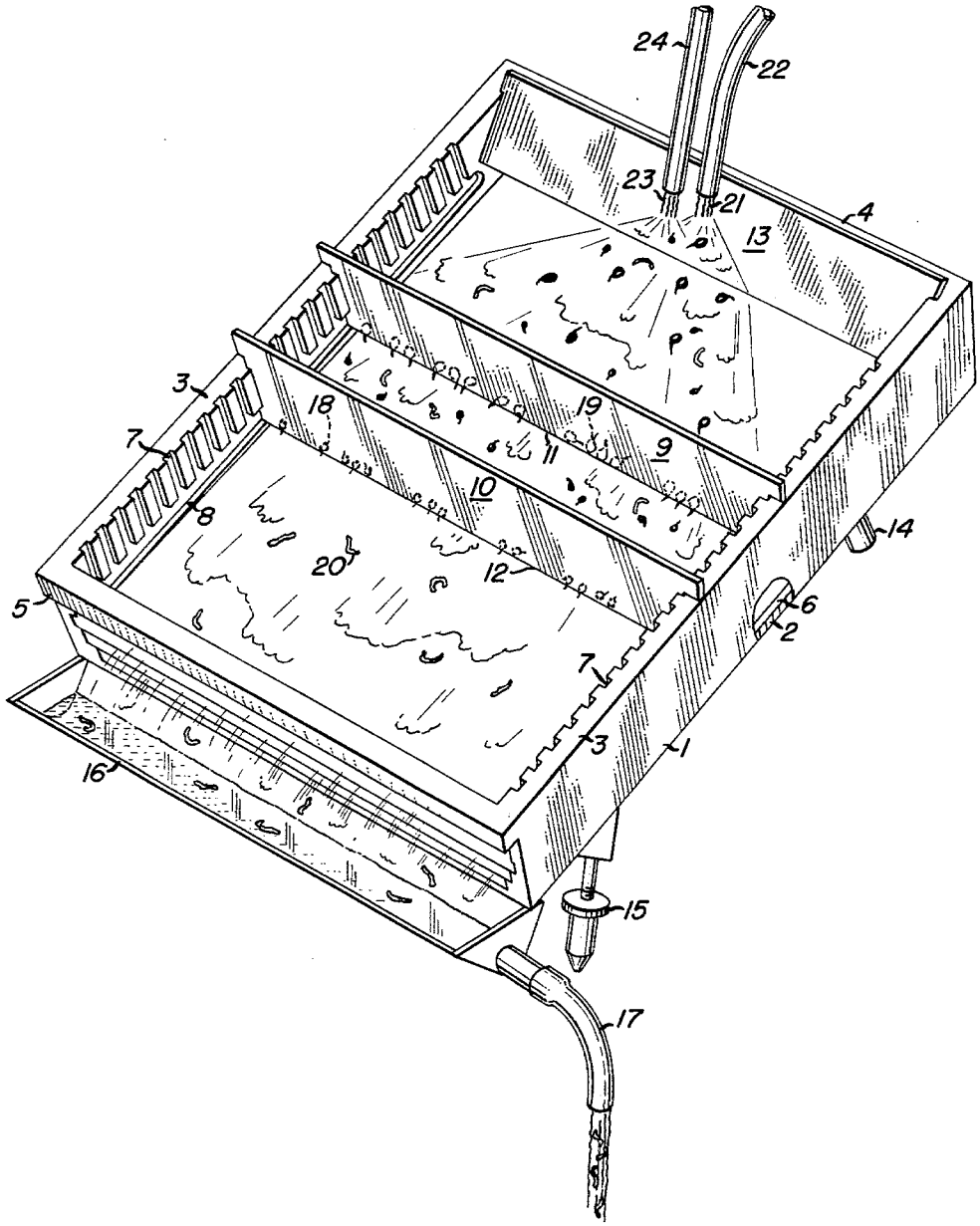
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SLOT TYPE SEPARATOR

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SLOT TYPE SEPARATOR

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The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment to us of any royalty thereon.

This invention relates to a device for separating and classifying small water-borne insects. More specifically, this device has been designed to separate and classify male mosquito pupae and female mosquito pupae from liquid containing male and female pupae, larvae, food and debris particles.

It is extremely desirable in carrying out insect pupae experimentation to know the number of females and males within a certain test group. Sometimes it becomes necessary not only to separate large numbers of male pupae from the female pupae and vice versa, but it is also necessary to recombine them in a definite proportion in order that certain experiments can be conducted. An example of such experimentation is the sterilization of male pupae. First, the males are separated from the females. Then they are subjected to a source of radioactivity, after which the males and females are recombined in order to determine the sterilization results.

Fortunately, female pupae are larger than the male pupae and the male pupae are larger than the larvae. While it may appear that a solid separation could easily be carried out, such is not the case. The reason is that the pupae and larvae are live, air breathing creatures which swim rapidly to and fro. Since these creatures are alive, it is necessary to separate them without killing them by drowning or crushing. We have devised an apparatus which will accomplish this separation with a high degree of accuracy and without appreciable mortality. The separation is accomplished by passing the liquid bearing pupae and larvae through two slotted orifices, the first being wider than the second. Wash water must be carefully regulated so that it will not crush the pupae against the slotted wall, but it must have sufficient force in order to prevent the pupae and larvae from swimming upstream thereby avoiding the separation. We attain this separation by the mechanism illustrated in the accompanying drawing which is an isometric view of the entire device.

The "Pupaerator" (see FIG. 1) consists of a box type frame **1**, having an underside flat bottom **2**, two side rails **3**, upper side **4** and an opened lower side **5**. Above the bottom **2** of the box is a smooth surface plate **6** made of ¼ inch thick safety glass fitted snugly into the box. Located in the right and left side rails **3**, at ½ inch intervals, are 23 grooves **7**, ⅛ inch wide by ⅛ inch deep. These grooves **7** extend perpendicularly from the top of the side rails **3** to longitudinal grooves **8** located at the surface of the plate **6** at the open end of the box frame and extending on a 0°7′ angle from the plate **6** toward the rear of the box. When baffles **9** and **10** are placed in the vertical grooves **7**, the bottom ends of the baffles **9** and **10** rest on the bottom of the longitudinal grooves **8** thus forming slots **11** and **12** between the bottoms of the baffles **9** and **10** and the plate **6**. Due to the ½ inch spacing of the vertical grooves **7** and the 0°7′ slope of longitudinal grooves **8** that the baffles **9** and **10** rest on, there is a .004 inch difference in adjacent slot sizes, the slot dimensions decreasing toward the open end of the frame. These dimensions have been selected for a particular type of insect. Other dimensions would be used for other sizes of insects. An adjustable device to take the place of longitudinal grooves **8** could easily be designed in order to vary this slope. For example, an adjustable metal strip could be substituted for the longitudinal grooves **8**. These longitudinal metal strips could be built in at the top portions of the side rails so that the baffles **9** and **10** would rest on them, or they could be built in on the side walls in exactly the same location of the present longitudinal groove **8**. Other ways of course can be devised to produce this adjustable slope which in turn can produce many more different slot sizes. A distribution plate **13**, ⅛ inch thick on an angle of approximately 30° from the plate **6** is fixed at the closed end of the frame. One rear leg **14** and two front legs **15** are pivoted for angle adjustment and leveling. A collection trough **16** is located across the open end of the frame and is fitted with a rubber tube **17** for distributing the male **18** and the female pupae **19** and larvae **20** into collection pans.

The pupaerator is set at an angle of approximately 20° from horizontal by adjusting the rear leg **14** and is leveled across the width by adjusting one of the two front legs **15**. The solution **21** containing the pupae **18** and **19**, larvae **20**, etc., is directed from the feed tube **22** onto the distribution plate **13** where it is spread out by impact with the distribution plate **13**. The solution **21** then flows down the inclined plate **6** carrying the pupae **18** and **19** and larvae **20** to the first slot **11** formed by baffle **9**.

The slot **11** is preadjusted in width so that the male pupae **18** and the larvae **20** pass through the slot **11** and on down the plate **6** to the second slot **12** while the female pupae **19** are retained at the first slot **11**. The second slot **12**, formed by a baffle **10**, is preadjusted in width to retain the male pupae **18** and allow the larvae **20** to pass through. The larvae **20** are then washed into a collection trough **16** mounted at the end of the box frame **1** and are then directed into suitable containers through the rubber tube **17**.

When a sufficient quantity of pupae are collected to nearly fill either the first slot **11** or the second slot **12**, the feed solution **21** flow is stopped and tempered tap water **23** from tube **24** is directed onto the distribution plate **13** in a similar manner to the feed solution **21** flow. This water **23** flushes down any pupae **18**, **19** and larvae **20** remaining on the distribution plate **13** or on the plate **6**.

After a few seconds it will be observed that the flow of larvae **20** through the second slot **12** has ceased. At this time separation is complete. With the flushing water **23** still flowing, the baffle **10** forming the second slot **12** is manually raised approximately .020 inch thus allowing the flushing water **23** to carry the trapped male pupae **18** through the then enlarged slot **12** to the collection trough. These pupae **18** are then directed to a suitable container through the rubber hose **17**. With the second slot enlarged, the procedure is repeated at the first slot **11** to collect the female pupae **19**. After this collection is made, the flow of water **23** is stopped and the two baffles **9** and **10** are lowered to the original operating position, ready to start another separation cycle.

The normal concentration of larvae and pupae in the feed solution is 1 per ml. The proper feed flow rate is approximately 4 liters per minute at a two-foot head pressure. This combination of conditions were used in a testing program in which more than 116,000 *Aedes aegypti* mosquitoes were separated. The test results show that 45% of the mosquitoes that lived to become adults were female, 55% were male. Our mechanism collected 36% of these adults on a slot size of .048 inch, 98% of which were female, 50% of the adults were collected on a slot size of .039 inch, 92% of which were male.

The pupaerator was designed to separate mosquito pupae, however, it is reasonable to assume that it will

separate other water-borne insects if there is a difference in the size of the male and female pupae.

The basic design as presented is adaptable to mechanization, automation, continuous operation and increased capacity. Moreover, this device can be used also as a classifier. By taking a representative sample of liquid bearing larvae and pupae, the ratio of female to male larvae can be statistically determined in a much larger volume liquid bearing pupae and larvae.

It is therefore easily seen that we have invented a dual-purpose device which separates live material accurately without causing appreciable mortality.

We claim:

1. A device for the separation of pupae of live water-borne insects comprising a container having an inclined bottom, side walls, an upper end wall and a lower end wall; said side walls each having a complementary first guide means positioned lengthwise along its interior; said first guide means being biased toward the container bottom from the upper to lower end along the entire length thereof; said side walls each having a plurality of complementary second guide means along its interior and positioned substantially normal to said first guide means and in manifold contact therewith; baffle means extending the width of the container and slidably positionable in any of the complementary pairs of second guide means and in abutting contact with said first guide means; whereby the distance between the bottom edge of the baffle means and the container bottom is varied as the baffle means is positioned in the different complementary pairs of second guide means; means for uniformly flowing pupae-containing water onto the bottom of the container above the baffle means, and collecting means attached to the bottom of the container at the lower end thereof.

2. A device in accordance with claim **1** comprising two baffle means spaced from each other and positioned in any of the complementary pairs of second guide means and in abutting contact with the first guide means.

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