

## A Multi-outlet Pump used in the Taiwan Malaria Control Programme

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The following pages describe the construction and performance of a Japanese-made, multi-outlet pump, which was used in the 1954 and 1955 spraying operations of the Taiwan malaria control programme.

The pump has two reciprocating cylinders, mounted horizontally, each with a bore of  $1\frac{5}{8}$  inches  $\times$  3 inches (4 cm  $\times$  7.5 cm.). The two ends of a hollow, bronze rod, which measures  $1\frac{1}{2}$  inches  $\times$  9 inches (3.8 cm  $\times$  22.8 cm) serve as single-acting pistons. A pin runs through the centre of the rod, connecting it, to the arms of the rocking lever. With this arrangement, intake and discharge action is effected through valves in the two cylinder blocks. A pressure tank of about 2 litres' capacity is mounted on the discharge block. The whole pump is supported on a frame of aluminium alloy, mounted on a board 8 inches wide, 36 inches long and 1 inch thick (about 20 cm  $\times$  90 cm  $\times$  2.5 cm). The intake and discharge outlets measure  $\frac{3}{4}$  inch (about 2 cm) in diameter. Four outlets are incorporated in the discharge system, three for the insecticide and one for a gauge. Three different views of the pump are shown in the figure below.

The knapsack and compression sprayers which were used in previous campaigns are capable of satisfactory performance for short periods only, and are inadequate for long-term spraying operations. To ensure that the new equipment would be more effective, it was subjected to a series of tests before use in the field.

The requirements were as follows : (a) uniformity of discharge; (b) satisfactory operation at low pressures, and (c) ease and practicability of handling.

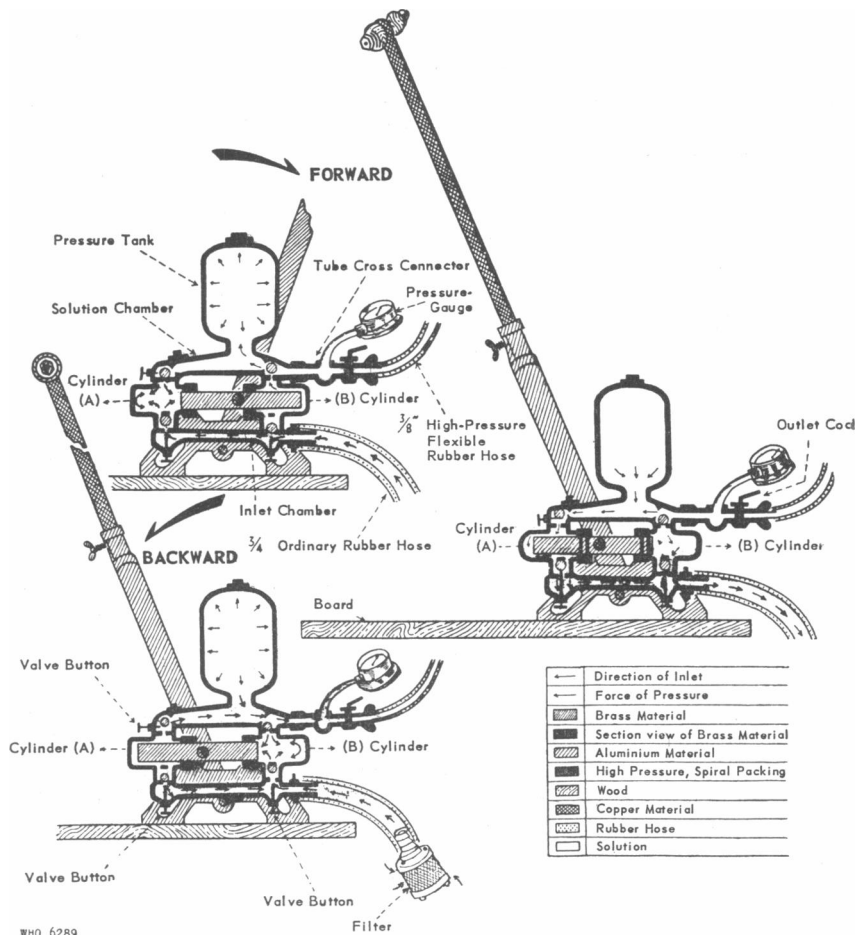
A 15-metre (50-foot) discharge hose (reinforced),  $\frac{5}{8}$  inch (1.5 cm) in diameter, and a standard  $\frac{1}{4}$ -inch (0.5 cm) lance were connected to each outlet. 8002 "Teejet" nozzles were fitted. The pressure was maintained at 50 p.s.i. (3.5 kg/cm<sup>2</sup>). It was found that the number of strokes required when one, two and three outlets were used was twelve, twenty and thirty respectively.

Tests were designed to determine the uniformity of discharge. The test pressure was 50 p.s.i., as this was the maximum that would be used in the field. The following data summarize the results of the tests:

	<i>Average discharge per outlet</i>	<i>Number of trials</i>
Only one of the three outlets opened . . .	915.8	12
Two of the three outlets opened . . . . .	927.4	24
All three outlets opened . . . . .	920.4	12

This indicates that there is no significant difference in the rate of discharge under the three conditions enumerated.

THE LP (LIFT AND PRESSURE) SPRAYER



The following advantages were noted when the equipment was used to spray a house: (a) the operator was not obliged to carry a 10-kg load on his back during the spraying; (b) it was easier to spray under beds, furniture, and other spots difficult of access; (c) there was very little effort on the part of the pump operator, although he had to watch the oscillations of the gauge. It was not, however, difficult to maintain a steady pressure; (d) the uniform output assured an even spray pattern; (e) the operator at the pump could tell from the gauge when any of the three operators were not spraying; (f) the recharging of the tanks was no longer a problem.

The disadvantages were the long hoses and the inconvenience of moving the entire unit—pump, hoses and mixing tanks—in order to reach some small out-houses.

On the basis of the results described above, 300 multi-outlet reciprocating pumps, known locally as the "LP" (lift and pressure) sprayer, were ordered for the 1954 programme.

Although hand-sprayers were also used during this campaign, it was noted that with the introduction of the "LP" sprayer the number of metres covered per man-hour was 10% greater than that of the preceding year. Under better supervision, in Lan-Yu, this rate was increased by some 75%. As further evidence of the efficiency of the new sprayer, it might be mentioned that, during the 1955 programme in Central Taiwan, 50% of the operations had been completed at the end of the fourth week, whereas in the preceding year, when hand-sprayers alone were used in that area, only 46% of the work had been done in the same period.

From the experience acquired during the 1954 campaign, it was concluded that certain conditions had to exist if optimum use was to be made of the "LP" sprayer: (a) the number of buildings in the area should be sufficient to keep the squad occupied for half a day, i.e. there should be about 8 structures, the average area per structure being calculated at 350 m<sup>2</sup>; (b) the houses or structures should be in groups of at least 5 in flat areas and 10 to 15 in hilly country, so that operators would not have to walk for more than about 5 minutes from one house to the next.

Two further comments might usefully be made on the advantages of the "LP" sprayer:

1. The effects of erosion on nozzles, even if these are made of stainless steel, are considerable. While the nozzles of hand-sprayers had to be changed in the middle of the campaign, those of the "LP" sprayers lasted throughout the entire spraying period.

2. To pump a compression sprayer from 20 to 50 p.s.i. (1.4-3.5 kg/cm<sup>2</sup>) would need a force of 48 to 120 lb. (about 20-55 kg). Many operator applicants were, in fact, rejected on grounds of inability to pump to 50 p.s.i. With the "LP" sprayer, however, it takes a force of only 6 lb. (2.7 kg) to pump at 16-20 strokes per minute.

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## ***Anopheles claviger* in the Middle East**

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What account should be taken of *Anopheles claviger* in the Middle East when one is planning a malaria eradication campaign? *A. claviger* is widely distributed in all the Middle Eastern countries, but its role as a vector of malaria in rural communities is not entirely clear. It has been definitely associated with hyperendemic malaria (Jerusalem), with hypoendemic malaria (Lebanon, Cyprus), and with anophelism without malaria (Lebanon, Greece, Italy).