

disease in a community are to be demonstrated. With a good quantitative procedure, the effect of suppressive drugs for schistosomiasis in highly endemic places, where frequent exposure to reinfection usually occurs, could also be determined. For this purpose, as far as the stool technique for egg-counting is concerned, the examination of 3 sediments per gram of stool sample instead of just

one in the TIFC technique will lead to more reliable results. However, in order to eliminate the tedious process of preparing the 3 sediments, Alevaire or preferably its tyloxapol component can be used with one sedimentation only. It has been shown above that concentrations of as low as 0.1% tyloxapol in the TF stock solution may be used effectively in this manner.

Modified Apparatus for Parasite Filtration*

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Since the studies of Rowan & Gram^a and of Bell^b filtration methods have been increasingly used as alternatives to sedimentation or flotation for separating helminths and their eggs from suspending media. Filtration has been employed in the enumeration of schistosome cercariae,^c eggs,^{b, d} and other stages.^e It has also been used for *Ascaris* and *Trichuris* eggs, for plant nematode larvae,^f and recently for microfilariae in blood.^g There is little doubt that, by extension of the use of micropore cellulose esters in cytology, filtration methods will find wide application in protozoology.

For some years various forms of home-made apparatus resembling that devised by Bell^b have been used for filtration procedures in this laboratory. These forms of apparatus had three draw-

backs: (1) errors could be introduced by the operator when aliquots of suspension were drawn up into the pipette; (2) replacement parts had to be found or made on an *ad hoc* basis; and (3) a specification for the apparatus could not readily be provided for other interested persons.

An automatic pipetting machine has now been incorporated into the design, thus eliminating the main source of technician error and facilitating handling of large batches of specimens from surveys. In addition a series of commercially available components has now been combined to give a flexible yet reliable apparatus for filtration of routine material and for more specialized experimental and cytological studies.^h

The complete apparatus is shown in Fig. 1, with more detailed illustrations of the various parts in Fig. 2 and 3. If the equipment is to be used for a single purpose only, such as egg counts from a particular helminth, some of the apparatus may be omitted and the filter-holder fitted directly into a side-arm flask with omission of the manifold. In the account which follows the numbers in parentheses refer both to the illustrations and to the

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^a Rowan, W. B. & Gram, A. L. (1959) *J. Parasit.*, **45**, 615-621.

^b Bell, D. R. (1963) *Bull. Wld Hlth Org.*, **29**, 525-530.

^c Rowan, W. B. (1957) *J. Parasit.*, **43**, 696-697.

^d Bradley, D. J. (1965) *Bull. Wld Hlth Org.*, **33**, 503-508.

^e Bradley, D. J. (1967) *The measurement of schistosome populations*. In: Mostofi, F. K., ed., *Symposium on bilharziasis*, Berlin, Springer, pp. 301-327.

^f Storm, L. W., Storm, N. S. & Dahlgren, E. A. (1960) *Plant Dis. Reporter*, **44**, 450.

^g Bell, D. R. (1967) *Ann. trop. Med. Parasit.*, **61**, 220-223.

^h A limited number of mimeographed lists of the commercial components used in this equipment, with catalogue numbers and prices, is available for persons officially or professionally interested in this field of study, on request to Parasitic Diseases, World Health Organization, 1211 Geneva, Switzerland.

COMPONENTS OF FILTRATION APPARATUS

Item No.	Component	Item No.	Component
Items obtainable from commercial laboratory-equipment suppliers ^a		Items obtainable locally	
1	Griffin Diluspence type 220	15	Wooden stand for pipetting device, 30 cm high, 28 cm deep and 15 cm wide, fixed to flat wood base for stability
2	Small vacuum-pressure pump 200-250 V or 2A pump, 100-110 V	16	Rubber or plastic pressure tubing, 6 mm internal diameter (1.5 m)
3	3 spare delivery jets	17	Strong glass or rigid plastic tubing, 6 mm external diameter (1 m)
4	Spare 2-ml syringe	18	2 jars or carboys of glass or rigid plastic
5	Spare 5-ml syringe	19	Stoppers for item 18, each with 2 holes to take item 17
6	Porcelain 3-piece Hartley Büchner funnel, 60 mm diameter	20	Electrical plugs (2), and sockets with flex if needed
7	3-place polyvinyl chloride filter manifold	21	Perspex or Lucite disc, 9 cm diameter and 6 mm thick, with very numerous holes of 2 mm diameter bored over the central part, to a radius of 3 cm from the centre
8	Vacuum pump 220 V, 50 Hz or 8A pump 115 V, 60 Hz or 8B pump 110 V, 50 Hz	22	Glass, plastic, or steel cylinder of 7 cm external diameter, 5 mm thick, and 8 cm high with edges ground flat (optional item)
9	Spare glass oil-cup for pump	23	Small sieve about 4 cm diameter and with wire or nylon mesh and holes at least 0.25 cm across (optional item)
10	Oil for pump	24	Filters as required, depending on size of parasite: Cellulose ester filters (pores 10 μ or less) Whatman glass-fibre papers Whatman filter-papers (7 cm diameter of type 541 recommended for schistosome eggs in stool)
11	Ground-glass filter set with rectangular metal top and clamp		
12	Metal-screened filter set with round glass top and clamp		
13	Neoprene stopper (No. 8)		
14	Stainless-steel forceps for delicate filters		

^a Item 1-6 were obtained from Griffin & George Limited, Ealing Road, Alperton, Wembley, Middlesex, England, and items 7-14 from the Millipore Corporation, Bedford, Mass. 01730, USA. However, similar equipment from other manufacturers would no doubt prove equally satisfactory.

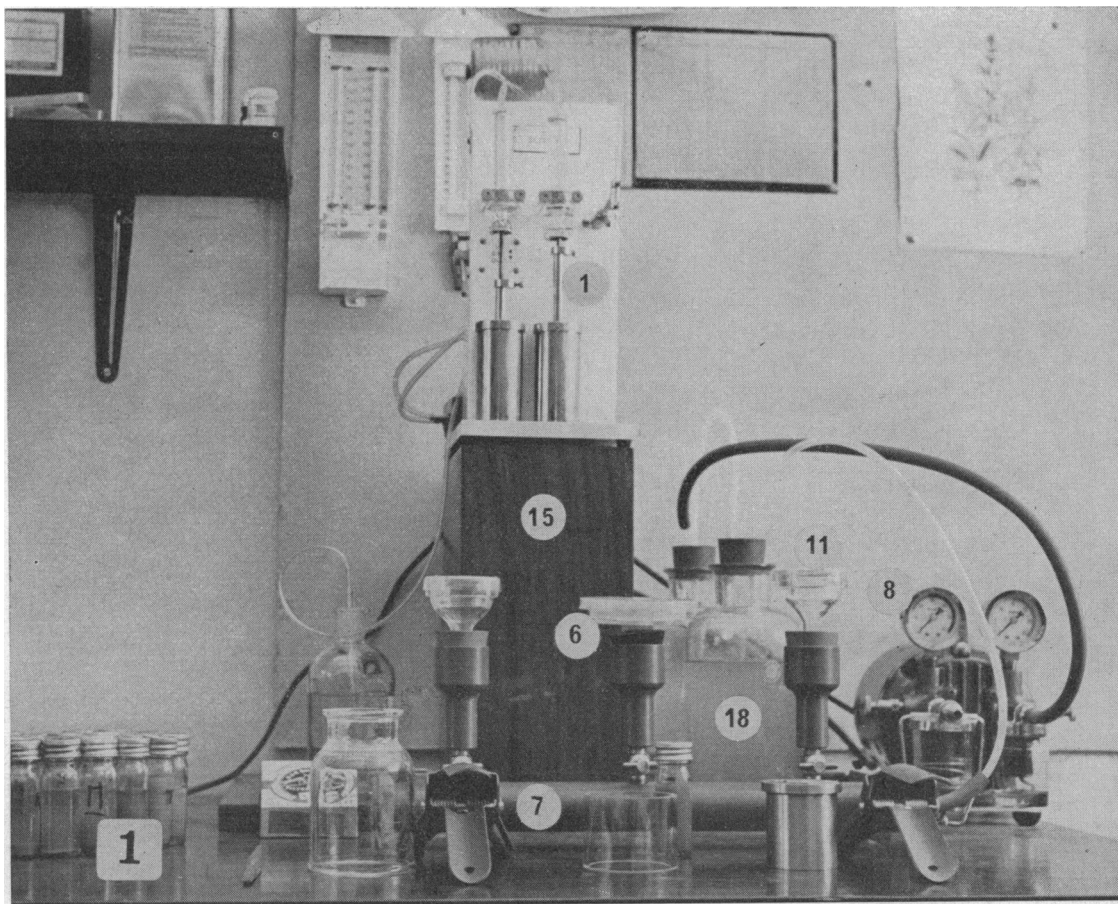
item numbers in the accompanying table.^b Parts of the equipment are referred to by letters which also appear on the illustrations.

The automatic pipetting device (1) is driven by a small pressure-vacuum pump (2), both of which stand on a wooden platform (15). The back of this is conveniently open to accommodate electrical wiring and switches. The pipette system can be preset by means of a piston nut (A) to sample any volume under 10 ml, though if the sample is usually below 2 ml the syringe on the machine may be usefully replaced by a smaller one (4). A second syringe system (B) controls the volume of diluent from the bottle (C) which is used to wash the sample out of the pipette. Up to 10 ml of diluent can be used for each sample. In use, the sample

is suitably agitated and then put under the pipette as in Fig. 2. The control lever is set to IN and after preset volumes of sample and diluent have been taken up, the pipette is wiped to remove excess material. A suitable filter system is placed beneath the pipette and the lever set to OUT when the sample will be washed on to the filter by the diluent.

Three types of filter system with independent taps are mounted on the manifold (7). Suction is provided by a pump (8) provided with a vacuum gauge and variable air leak. This is connected to the manifold through 2 jars (18) by plastic or rubber pressure tubing. One jar collects the filtrate and the other acts as a fluid trap to prevent water reaching the pump. The filter mounts suggested

FIG. 1
FRONT VIEW OF ENTIRE FILTRATION APPARATUS

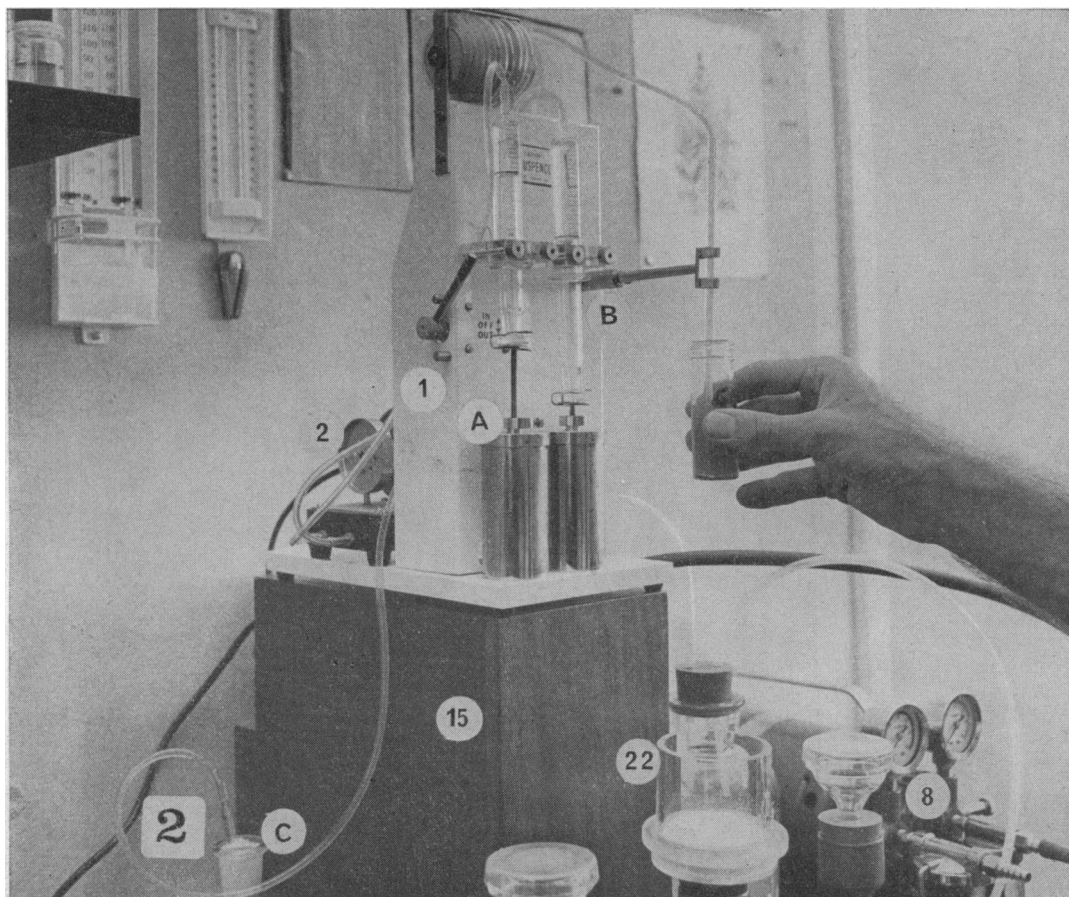


provide filtration areas of 9.6 cm², 27 cm² and 6 cm² respectively. Larger Büchner funnels can be added if needed. The glass funnels of 9.6 cm² filter area take 47-mm diameter paper or cellulose ester filters. The latter are standard, but filter-papers of 42.5 mm diameter can also be used. The metal clips (D) prevent leakage around the filter membrane. The second filter stand is that used for *Schistosoma mansoni* eggs counts. In many ways the most satisfactory base is one made in acrylic resin (Perspex) after Bell^b or Bradley.^e Alternatively, a porcelain tripartite Büchner funnel (6) may be used; however, its

sieve plate has far too few perforations and is replaced by a perforated 9-cm acrylic disc (21) with as many holes as possible in the central 6 cm. The porcelain cylinder may be used on the top but more satisfactory is one of glass or metal (22). If made of stainless steel, this should be polished very smoothly and have a narrow (1 mm) basal edge. If of glass, it should be 5 mm thick with ground ends. Faecal egg counts in schistosomiasis are carried out using 7-cm diameter Whatman 541 filter-papers on this stand. The third filter system has a similar base to the first, but the funnel is of stainless steel having a rectangular hole allowing a

FIG. 2

SIDE VIEW OF AUTOMATIC PIPETTING DEVICE HAVING JUST TAKEN UP 5 ml OF THE SPECIMEN AND 10 ml OF DILUENT



filtration area of 6 cm² through cellulose ester membranes, glass fibre, or rather thick filter-papers. The resulting filtered specimen fits conveniently on to a standard 7.5 cm × 2.5 cm glass slide. It is used especially for small faecal samples, urines containing *S. haematobium* eggs, and cytological studies.

These three sizes of filter cover most routine and research needs with the exception of the cercariometry of natural waters, for which the much larger field apparatus of Rowan[†] is more suit-

able. Processing of papers and membranes after filtration follows known methods.[‡] Where faeces are filtered and contain much coarse debris a sieve (23) may be used to prevent this reaching the paper.^b

The apparatus described has given trouble-free operation, provided that neither electric pump is allowed to stand idle for long periods, and has given reliable results without requiring skilled technical help for routine work.

[†] Rowan, W. B. (1965) *Bull. Wld Hlth Org.*, 33, 63-71.

[‡] Bradley, D. J., Sturrock, R. F. & Williams, P. N. (1967) *E. Afr. med. J.*, 44, 193-204.

FIG. 3

OBLIQUE VIEW OF FILTER HOLDERS, WITH THE 9.6 cm² ROUND FILTER IN FOREGROUND, ONE FOR FAECAL EGG COUNTS IN SCHISTOSOMIASIS IN THE CENTRE AND METAL RECTANGULAR FILTER BEING CLAMPED ON RIGHT

