KING EDWARD'S

HOSPITAL FUND FOR LONDON

HOSPITAL CATERING ADVISORY SERVICE

THE HOSPITAL CENTRE

CROCKERY WASHING

(Incorporating Detergent Dispensers)

SEPTEMBER 1963

No copies

KING EDWARD'S HOSPITAL FUND FOR LONDON

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The Fund was founded in 1897 *by His Majesty King Edward VII (when Prince of Wales) for the "support, benefit or extension of the hospitals of London."*

It was incorporated by Act of Parliament in 1907, *and is not directly affected by the provisions of the National Health Service Act of* 1946.

Offices:
34, King Street,
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Telephone: MONarch 2394

The Fund's thanks are due to the following for their willing co-operation and help.

Barnet General Hospital
St. Bartholomew's Hospital
Paddington General Hospital
St. Charles Hospital
National Hospital for Nervous Diseases
Whittington Hospital
The Food Hygiene Department of the Public Health Laboratory Service who carried out the bacteriological tests
The Manufacturers mentioned in Appendix VII.

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INTRODUCTION

For many years now hospitals have been using machines for crockery washing with greater or less efficiency depending on many factors. It is well-known in the catering trade that it is difficult to operate these machines to give good results both bacteriologically and apparently without the use of detergents.

From visits to a large number of hospitals it was observed that almost invariably, irrespective of the type of machine, crockery was always dried by hand towelling. Further, the machines used were rarely operated correctly or in accordance with the instructions of the manufacturers of the equipment or detergent. It was for this reason the King's Fund decided to investigate crockery washing more fully. The Catering Advisory Service made studies in six hospitals using spray type machines as these seemed the ones most frequently installed. Five were the cabinet type in which the operator had to push the trays in and pull them out, and one was the rack conveyor type.

The study was carried out in four stages of one month for each stage in each hospital, observations being made at frequent intervals during the whole experiment. The investigation was completed in twelve months as some of the studies ran concurrently. This report is thus presented in four parts terminating with conclusions, a summary of recommendations, and some general observations. The first part is a summary of the observations made in the hospitals in the first stage of the investigation and mentions the shortcomings of the present crockery washing operations. The second part deals with the second stage when the Hospitals' detergents were replaced by three particular brands of detergent. In the third stage detergent dispensers and rinse injectors of the automatic hydraulic type were introduced. These in turn were replaced by electronic dispensers in the fourth stage.

In the report on each of these stages, references are made to the appendices which show the quantities and cost of detergents used and the results of the bacteria tests, Appendices VIII to XIII. Appendices I to VI are explanatory notes with diagrammatic drawings illustrating the operation of the various types of equipment. Appendices XIV to XVII are suggestions for layouts of crockery washing areas and instructions which might be given to staff operating the machines.

STAGE I

The first stage observations were made on the normal procedure for washing crockery in each hospital. The points to which particular attention was paid were:

1. The method of crockery washing starting with the return of "dirties" from the dining room to storage after washing.
2. The operation of the machine.
3. The temperatures of wash and rinse waters.
4. The type of detergent used.
5. The total quantity and cost of detergent used in each of four weeks.

6. The number of pieces of crockery and cutlery washed daily.

7. The cleanliness of the plates, both apparently and bacteriologically.

It was observed that in some hospitals there was no system of washing because the staff had been given no instruction or were unwilling to carry out the instructions or failed to understand them. Crockery returning from the dining room was rarely sorted and in some instances heaped on a side table or benching of inadequate length for the operator to sort as well as possible.

Plates were usually rough scraped into a bowl before racking but much of the debris or plate waste went into the machine, making the water dirty in a short space of time. In all instances except two the same wash water was used throughout the washing period, the rinse water being relied upon to effect the replacement of wash water. This is considered satisfactory providing the rinse is used for every rack of dishes and all crockery is pre-rinsed before washing.

On the semi-automatic machines the operator after inserting the rack switched on the wash water which continued to re-circulate until the operator switched it off or changed to rinse. All the machines had gauges which showed the temperature of the wash water. In one or two instances the water used was not up to the correct washing temperature, i.e., 140° F. - 150° F. However, in no instance did the operator check the thermometer to see the water was the right temperature. The generally accepted time for washing plates is 45 seconds. In every instance, with one operator the crockery was washed for not less than this time as he was usually preparing the next rack. Where there were two operators, on occasion, the crockery was not washed for the full 45 seconds.

For rinsing the plates on a semi-automatic machine it is necessary to hold the lever, which is spring loaded, in position for a period of 10 to 15 seconds with the rinse water at a temperature of 180° F. - 190° F. On some occasions no rinse was used and on others only 3 - 5 seconds. Some operators knew there should be a 10 - 15 seconds rinse but were very bad judges of time and believed the 3 seconds given was 10 seconds. Others felt they were too busy to " waste time rinsing ".

It was not possible on the semi-automatic machine for the operator to check the temperature of the rinse water. However, using special thermometers, tests were made with the result that in only two instances was the water shown to be above 180° F. Most were as low as 160°, including a new machine.

As regards the use of detergent, it appeared that all operators had received instructions on the quantity to be used. It took the form of:

(a) two tablets (or two cupsful) at the beginning of washing and one tablet (or one cupful) in one hour's time, etc.; or

(b) a handful to start and a handful every half-hour.

In one or two instances these instructions were carried out but usually the operators forgot to add more at the prescribed times or put in the full amount for the whole period at the start of the washing

operation. With the exception of Hospital A the results were poor or indifferent—this is reflected in the type and quantity of the detergent used.

The type, quantity and cost of detergent used in the six hospitals are shown in Appendix I together with the number of pieces of crockery washed daily. From this it will be seen that the cost for 10,000 pieces varied from 2/0.06d. to 8/11d., but these costs bore no relation to the results achieved. The two cheapest, B and E, were using a foaming detergent which was entirely unsuitable for spray type dishwashers.

In no instance did the crockery dry automatically and hand towelling was required. This was due to:

(a) the crockery not having been raised to a high enough temperature;

(b) globules of water collecting on the surface of the crockery.

An examination of the crockery before hand-towelling revealed, with few exceptions, stains and chalky streaks on the surfaces. This was due to:

(a) unsuitable or insufficient detergent;

(b) insufficient rinse water being used (sometimes because of blocked jets;

(c) the temperatures of the wash and rinse waters being too low.

Tests for bacteria were also carried out on tea towels in use in various kitchens. These tests showed that after use fairly high counts of bacteria accumulated on these tea towels.*

*Tests have previously been made by the Public Health Laboratory Service, Higgins and Hobbs (1950) *Mon. Bull. Minist. Hlth. Lab. Ser. 50*, 38. White, A., *Mon. Bull. Minist. Hlth. Lab. Ser.* (1963).

STAGE II

For the second stage the hospitals' detergents were replaced by one of three brands being tested. These were used in the same way as in stage one, i.e., hand feeding. Attention was also paid to the same points. The main difference was that all operators were given instruction in the amount of detergent to use at the beginning, and the frequency with which further detergent should be added. Whilst the best method of hand feeding is to add detergent after a fixed number of racks have been through the machine, in practice it was found that it was too difficult for the staff to remember the number of racks which had passed through. Therefore a fixed time of 20 minutes was given. It is realised, of course, that it is possible to use more detergent than is necessary if the scheduled number of racks of crockery have not been washed in the period.

In general the only improvements in apparent cleanliness shown in this stage were where the detergent introduced was more suitable than the one previously used.

From Appendix IX it will be seen that Hospital A used less than previously and the cost per 10,000 pieces was almost halved.

Hospital B costs almost doubled but the apparent results were a great improvement on the first test primarily due to using a more suitable detergent. Similar remarks apply to E although the cost was increased by approximately 35%. There was also an improvement in C due to the detergent being more suitable for the hard water but the cost was quite high. The results in Hospital F were better but the cost was more than trebled.

It was noticed that generally the measures used for adding the detergents became caked with detergent, consequently the amount was more often less than required, although in some cases the operator added an extra measure " just to make sure ". On other occasions the operator added all the detergent required for the full meal's crockery washing at the beginning of the wash period. This, of course, produced an over-concentration of detergent for the first racks of crockery going through the machine and therefore there were traces of detergent still on the plates afterwards. The racks going through the machine at the end of the service were not clean and in all instances showed chalky deposits, even in the middle of the washing period as the water had become so diluted by the addition of rinse water that there was little detergent left.

The plates did not dry automatically, not even when the correct water temperature prevailed, and in all cases, hand towelling was resorted to.

Bacteriologically the results were the same as in Stage I.

STAGE III

Detergent dispensers and rinse injectors from three separate firms were used in Stage III, and were of the automatic hydraulic type. Although the dispensers add detergent automatically it is essential to add detergent by hand when the machine is first filled with water. The degree of concentration to be maintained is decided in advance in consultation with the manufacturer of the detergent, who then adjusts the dispenser accordingly.

A wetting agent is dispensed by means of the rinse injector and works on the same principle as the detergent dispenser but is connected to the rinse water supply. The action of the wetting agent is to split up the large globules of water by reducing surface tension and so facilitate crockery drying. If the rinse is not used, as sometimes happens on the semi-automatic machines, the crockery has no chance of drying automatically.

As will be seen from Appendix XI, the amount of detergent used with the exception of Hospitals D and F is more than in Stage II when it was hand-fed. The cost is higher but this might be due to the valve adjustment made by the manufacturer who probably recommended a higher concentration of detergent than his competitor.

The crockery was generally much cleaner and no longer were there any chalky deposits and stains and there were few rejections. This was particularly noticeable towards the end of the washing period compared with Stages I and II where almost invariably the crockery was not clean.

However, there were a number of occasions when this improvement did not take place. Although the staff noticed the crockery washed was not as clean as it should be, it never occurred to them that the hopper containing the detergent might be empty, as indeed it frequently was. This could account for the lower consumption in Hospitals D and F.

On the smaller machines or where there were not so many pieces of crockery going through the machine, if the hopper was filled for the first wash of the day, it was sufficient to last the whole day. On the larger machines and those hospitals with a larger number of pieces to be washed it was essential to check the hopper before each service.

In setting the concentration of detergent, consideration must be given to the hardness of water, the number of pieces to be washed, and whether there is a prewash sink. If the water used is up to 8° of hardness a soft water detergent can be used. If acceptable results are to be obtained with water above 8° hardness a special hard water detergent should be used, but the cost in some instances is nearly double. However, even better results will always be obtained with soft water because the final rinse with hard water frequently leaves a light film on the surface of the crockery. A prewash sink unit, if operated correctly, will save a good deal of detergent as food soil on crockery will be reduced to comparatively small proportions in the wash water in the machine.

When the crockery did not dry automatically and a towel used, it was found to be due to:

(a) the bottle of wetting agent being empty;

or (b) the operator on a semi-automatic machine not holding the rinse lever for the prescribed time;

or (c) the water not being hot enough;

or (d) badly scaled-up rinse jets.

If the crockery is not brought up to the correct temperature the drying time is prolonged from 30 to 60 or more seconds, in which case staff are inclined to hand dry it.

STAGE IV

In Stage IV the hydraulic detergent dispensers were replaced by electronic dispensers, but the same rinse injector retained. With electronic dispensers two probes in the wash water determine the strength of the solution and can be set by the manufacturer for any agreed concentration. As the concentration of detergent drops the probes come into action and more detergent is fed to the water. In conjunction with the probes are signal lights. One is on all the time to indicate the equipment is working. A second one flashes intermittently when the detergent solution is being fed to the wash water but glows continuously when the dispenser has no detergent left.

On many occasions it was noticed that the light continued to glow and staff paid little heed to it and therefore, because of lack of detergent, some crockery came out of the machine rather streaky. However, where staff were not being frequently changed and could be trained on the

machine, they checked the hopper before each service and the apparatus functioned correctly with good results.

In three hospitals the consumption of detergent increased after the fitting of electronic dispensers. As will be seen from Appendix XII, the consumption rose in Hospital A from 7.5 lbs. per 10,000 to 18.75 lbs. An adjustment was made to the probe by the manufacturers to reduce the consumption and it was found that although less detergent was being used there were no adverse effects on the standard of crockery washed. With the exception of Hospital E, the apparent results were good on all crockery. However, in Hospital E the machine had become so scaled up and in need of maintenance that the washing action was very much retarded and it was not possible to assess the dispensers' efficiency.

In addition to the normal bacteriological tests a further series of tests were made on the efficiency of detergents in keeping down the level of bacteria in the wash water and on washed crockery. To make the assessment, two different kinds of detergents were used, one inorganic non-bactericidal and the other, it was claimed, had bactericidal properties. Each of these detergents were used in a dishwashing machine working at normal temperatures and then again in the same machine working at greatly reduced temperatures. The results of these tests can be seen in Appendix XIII a, b, c. The use of a bactericidal detergent which was hand-fed to the machines showed no improvement over a non-bactericidal detergent, nor were better results obtained when the detergent was added by automatic dispensers.

CONCLUSIONS

1. Detergents contribute to the apparent cleanliness of crockery but only if they are of the correct type for the water. They do not make any appreciable contribution to a reduction in bacteria count nor do the special bactericidal detergents.
2. The correct temperatures of the wash and rinse waters, and length of time of the wash and rinse operations make the greatest contribution to a low bacteria count but this can be defeated if the plates have to be hand towelled.
3. Rinse additives, when used correctly, make a worthy contribution as they ensure the drying of crockery in 30 to 50 seconds if a reasonable temperature has been reached.
4. Softened water (3° hardness) gives better results than hard water irrespective of the detergent used. The cost of detergent is also considerably less and machines require less maintenance.
5. If a single wash tank machine is fully automatic for wash and rinse a hydraulically operated detergent dispenser is suitable and cheaper to install. If the machine is of the multiwash tank type an electronic dispenser is better.
6. All three designs of rinsing agent dispensers worked equally well, two being mechanical and working on the rate of rinse water flow and the third having an electrically operated micro-pump.

7. A prewash sink conserves the cleanliness of the wash water, indirectly saves detergent and provides the initial heating of crockery.
8. When there is an efficient washing operation resulting in crockery automatically drying clean there is an indirect saving in the cost of tea towels, in man hours and there is a greater standard of hygiene.

RECOMMENDATIONS

The following recommendations are made in regard to detergents and dispensers.

1. Detergent to suit the local water should always be obtained.
2. Detergent dispensers and rinse injectors should be fitted to spray type machines.
3. The dispensers should always have a hopper large enough to last the full day's washing operation.
4. The supervisor should check the hopper (and rinse injector) every morning to ensure both are full.
5. Single tank machines should be automatic and have a fully timed wash and rinse control mechanism.
6. The hydraulic type dispenser for the single tank machine is suitable but is obtainable only on loan from the manufacturer of the detergent. Electronic dispensers can be purchased outright. The price is approximately £60 (1963).
7. For multi-wash tank machines the electronic dispensers are more suitable because of the great difficulty in maintaining the correct concentration of detergent.
8. Softened water should always be used.

OBSERVATIONS

Whilst the main object of the experiment was the investigation into the use of detergents, detergent dispensers, rinse additives and injectors, much valuable information was gained on the whole of the crockery washing operation and the following observations are made:

1. Dispensing equipment is an aid to clean crockery washing but in itself will not produce clean crockery without a machine in good working order and a correct working procedure and an adequate lay-out.
2. Machines should be well maintained, kept free of scale deposit and be working at the correct water temperatures and pressures. Therefore the machine should be inspected monthly and maintenance carried out. If this cannot be done by the hospital personnel there should be a contract with a firm to do the work. The major manufacturers of dishwashing equipment offer a service contract. In some instances suppliers of detergent will carry out a monthly inspection and submit a report free of charge.

3. Staff should be given instruction on the operation of the machine and training in correct dishwashing procedure from the sorting of crockery to the final storage. Instructions in the operation of the machine should also be displayed in a position all staff can see. An example for one particular make of machine is shown in Appendix XVII.
4. Examples of layouts are shown in Appendices XIV and XV. For single tank machines there should always be included a prewash sink as this gets rid of the bulk of soil and provides a first washing to the plate. The rinse spray can be suspended above the sink or be a flexible hose.
5. The soiled crockery benching should have a slight slope for draining water which should go into the prewash sink. It should not drain into the machine tank. Another drainage point can be interposed immediately before the tank.
6. The prewash sink should be one rack's distance from the machine.
7. There should be dirties' benching for not less than five racks including prewash sink. Clean benching should also hold five racks so that the crockery has a chance to air dry.
8. Further aids to crockery washing are illustrated in Appendix XIV and the sorting area includes an angled overshelf, which is essential when crockery is being brought to a wash unsorted.
9. There should be a soak tank for cutlery and a further soak tank if possible for any pieces of crockery which have come through the machine and still not properly clean.
10. In the dirties' benching a waste disposal unit or waste shoot with an easily removable bin should be interposed.
11. Roller conveyors are helpful in the movement of racks for drying and the return to the dirties' benching (see Appendix XIV).
12. With large machines, i.e., fully automatic with conveyor belts, the sorting and dirties' benching requirements are the same as for the small machines. The same length of drying benching and soak tanks are also required. However, with these larger machines there may be a need for roller benching only in regard to returns, but no prewash sinks.
13. All machines require good steam extraction except for some of the Flight type, which may have a condenser unit incorporated.
14. Acoustic treatment of the crockery washing area should also be considered, as apart from other considerations, it lessens operators' fatigue.

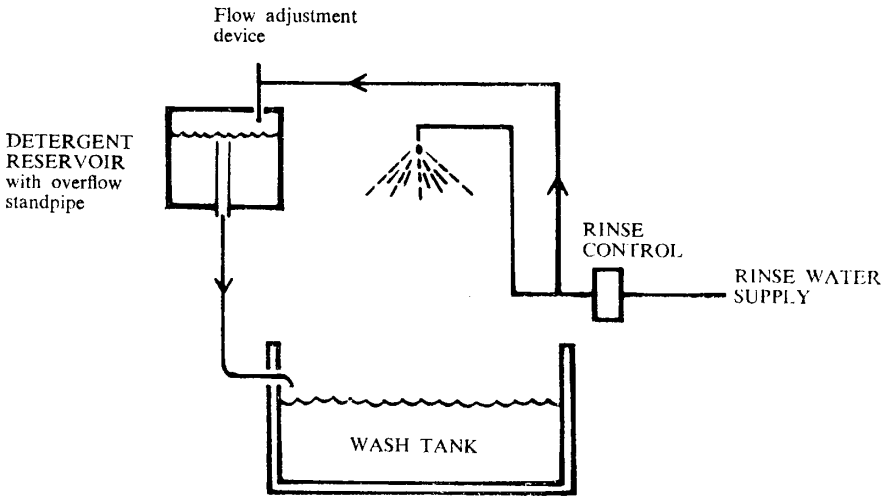
G. J. STORMONT, F.H.C.I.,

Catering Adviser to the King's Fund

APPENDIX I

HYDRAULIC TYPE OF DETERGENT DISPENSER

This consists of a stainless steel or polythene bowl sited above the machine. The bowl is connected by copper or polythene tubing to the dishwasher with the open end of the tube entering the machine in a convenient position to feed the wash tank with detergent solution. The other end is connected to a stand pipe in the centre of the dispenser bowl into which detergent powder (usually a predetermined amount) is placed. Hot water, which is fed to the bowl from the rinse water line of the machine, every time the rinse comes into action, dissolves the powder and causes the solution to overflow into the wash tank.



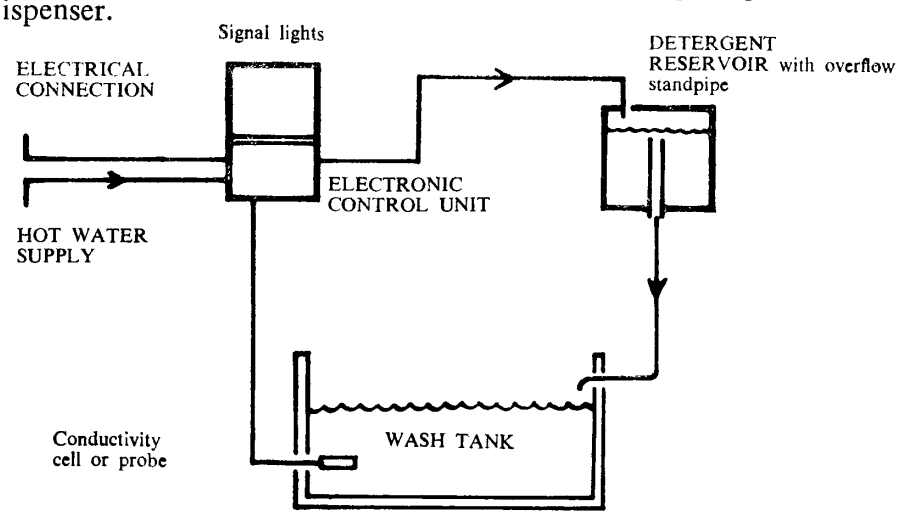
APPENDIX II

ELECTRONICALLY CONTROLLED TYPE OF DISPENSER

The dispenser with electronic controls has the same stainless steel or polythene container with a suitable outlet pipe connected to the dishwasher to feed the wash tank with detergent solution and a hot water feed pipe.

The control of the dispenser is activated by two probes or a conductivity cell, which are fitted into the side of the wash tank below the water level. The two probes measure the strength of the detergent solution by passing a signal between them. When the solution drops below a predetermined strength a switch is operated which allows hot fresh water to flow into the detergent dispenser. This overflows the detergent reservoir and the concentrated solution flows into the machine wash tank until the strength of detergent is brought back to the required level. (When the dispenser is switched on a green or amber light shows continuously as a signal that it is in working order.) When the detergent dispenser feeds, a red light signal flashes (on one model a buzzer sounds as well).

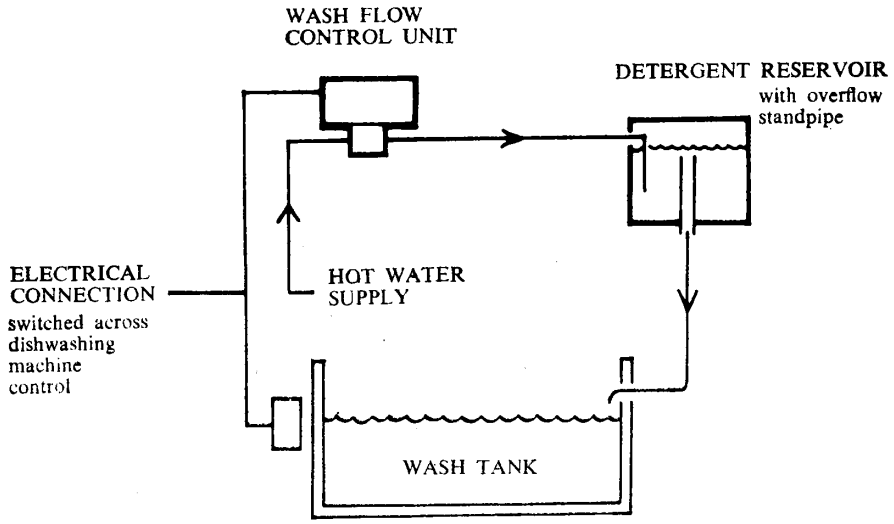
When the dispenser is empty the red light signal shows continuously to warn operators that they must add more detergent powder to the dispenser.



APPENDIX III

AUTOMATIC TYPE DETERGENT FEEDER

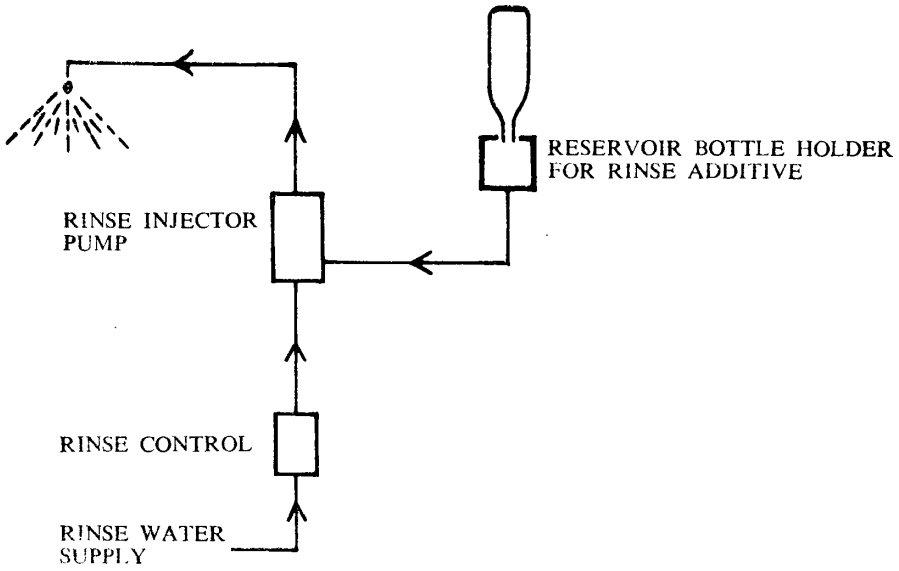
The automatic detergent feeder has the same stainless steel container and connections to the machine wash tank and to the hot water supply as previously described. The control of the feeder is electrically operated and is switched across the dishwashing machine control. It is designed to add a solution of detergent to the wash tank at regular timed intervals. The intervals and the amount of solution can be controlled and are set according to the rinse water consumption of the machine to maintain a constant detergent strength. No light signals or switches are necessary and it only requires the operator to add detergent powder to the container.



APPENDIX IV

MECHANICAL TYPE RINSE LINE INJECTOR

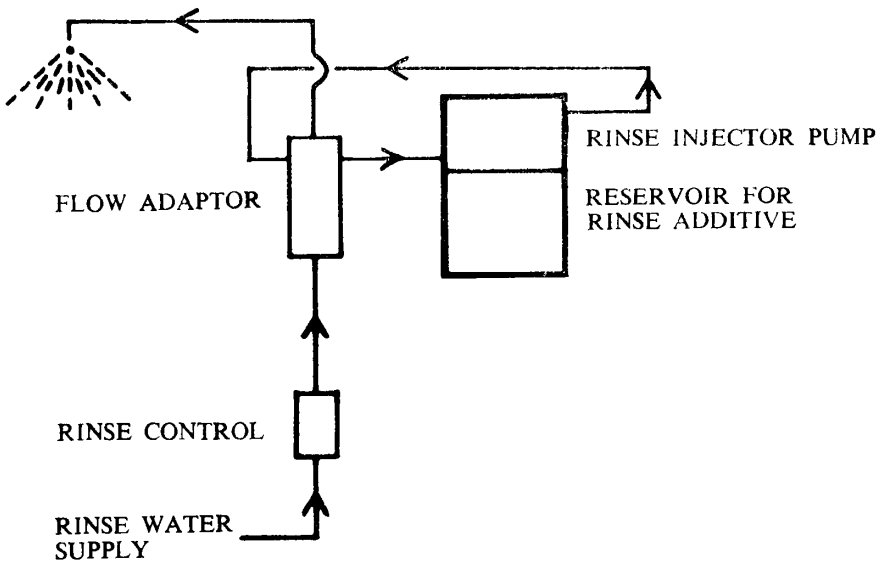
This injector consists of a reservoir bottle holder which contains an 8-oz. bottle of rinse additive fluid with a polythene tube connecting it to a rinse injector micro pump. This rinse injector pump is operated by the flow of water in the rinse water line. An adjustment to regulate the amount of rinse additive is incorporated. The injector is entirely mechanical and no electrical connections are required.



APPENDIX V

HYDRAULIC TYPE RINSE LINE INJECTORS

The operation of this type is again dependent on the flow of water through the rinse water line but will work on extremely low pressures as well as high water pressures. A special injector fitted is bolted into the rinse water line and connected by two copper pipes to a container which holds the rinse additive. To inject a correct amount of rinse additive or wetting agent, the pressure of water is measured which automatically allows a predetermined amount of fluid to pass into the rinse water. The injector fitted contains no moving parts and requires no electrical connections, its action being based on the " Venturi " and " Pilot Tube " principles.

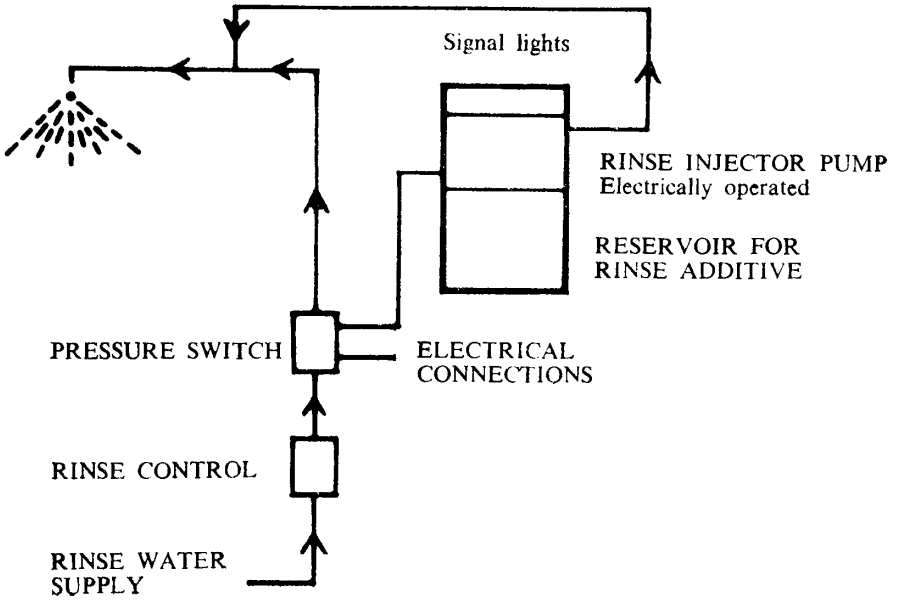


APPENDIX VI

ELECTRIC TYPE RINSE LINE INJECTOR

This type is electrically operated, having two signal lights. It has a micro injector pump and the electric power for its operation is controlled by a pressure switch which is fitted into the rinse water line. This switch is activated by the pressure of water each time the machine or operator rinses the dishes.

When working a continuous white signal light operates and when empty a second red light flashes.



APPENDIX VII

SUPPLIERS OF DETERGENT DISPENSERS, RINSE INJECTORS, DETERGENTS AND DISHWASHING MACHINES CONCERNED IN THE KING'S FUND EXPERIMENT

	Type of Equipment
British Hydrological Corp.,	Automatic Detergent Feeder
Colloidal Works,	Electrically Operated Rinse Injector
Deer Park Road,	
London, S.W.19	
Diversey Deosan Ltd.,	Hydraulic Type Detergent Dispenser
42/46 Weymouth Street.	Electronic Controlled Detergent Dispenser
London, W.1	Rinse Injector
	Automatic Detergent Dispenser for Liquid Detergent for Spray Type Machines (Not tested in our experiment)
Soilax (Eclab) Ltd.,	Hydraulic Type Detergent Dispenser
North House,	Electronic Controlled Detergent Dispenser
31 North Street,	Rinse Injector
Carshalton, Surrey.	
Hobarts Ltd.,	L.E. 3CT Automatic Timed Dishwasher,
Hobart Corner,	1962
New Southgate,	L.E. Semi-Automatic Dishwasher, 1948
London, N.11	
Dawson Bros. Ltd.,	A.A. Model, 1956
406 Roding Lane,	C.A. Automatic, 1956
South Woodford Green,	A. Model, 1954
Essex	A. Model, 1952.

APPENDIX VIII

TABLE OF COSTS AND DETERGENT CONSUMPTION

STAGE ONE

HAND-FEEDING OF DETERGENT CURRENTLY IN USE

Hospital	A	B	C	D	E	F
Detergent	IS.L. Bryta	Byprox and Domestos	Chinabrite Tablets	Ampolite	Teepol	M.O.W. Dish-washing Powder
Quantity used in four weeks	28 lbs.	8 gals. Byprox 2 gals. Domestos	112 Tablets	100 lbs.	28 Pints	200 lbs.
Quantity used for 10,000 pieces	2.09 lbs.	4.9 pints	6.6 Tablets	5.9 lbs.	3.3 Pints	10 lbs.
Cost per 10,000 pieces	4/11.8d.	2/10.3d.	8/11d.	5/8d.	2/0.06d.	4/2d.
Average Cost per Person per meal	0.0342d.	0.222d.	0.0473d.	0.0645d.	0.0024d.	0.025d.
Pieces Crockery per week	24,000	40,700	42,000	42,380	21,700	50,120
Meals per week	4,207	6,300	9,450	7,770	3,850	10,150

APPENDIX IX

TABLE OF COSTS AND DETERGENT CONSUMPTION

STAGE TWO

HAND-FEEDING OF DETERGENT

Hospital	A	B	C	D	E	F
Detergent	Soilax S.W.	Soilax Acclaim	Diversey Ampolite	Diversey Ampolite	B.H.C. China-brite 3346	B.H.C. China-brite 3322
Quantity used in 4 weeks	20 lbs. 8 ozs.	56 lbs.	127 lbs.	100 lbs.	49 lbs.	208 lbs.
Quantity used for 10,000 pieces	2 lbs. 2 ozs.	3 lbs. 13.1 ozs.	7 lbs. 9 ozs.	5.9 lbs.	1.8 lbs.	10.4 lbs.
Cost per 10,000 pieces	2/3.5d.	5/0.4d.	5/0.4d.	5/8d.	2/9.1d.	13/6d.
Cost per meal served per week	0.0133d.	0.0478d.	0.0427d.	0.0645d.	0.0334d.	0.079d.

APPENDIX X

Results of Bacteriological Examination of Wash and Rinse Waters and Swabs from Utensils and Crockery, taken from various Hospitals

Description of Sample	Hospital A *Temp.*	*Count/ml.*	Hospital B *Temp.*	*Count/ml.*	Hospital C *Temp.*	*Count/ml.*	Hospital D *Temp.*	*Count/ml.*	Hospital E *Temp.*	*Count/ml.*	Hospital F *Temp.*	*Count/ml.*
Wash (1)	60°C.	930	63°C.	470	66°C.	45	70°C.	122	69°C.	3	74°C.	20
Water (2)	60°C.	24	61°C.	20	60°C.	1,415	70°C.	173	70°C.	Not found	84°C.	14
Rinse water temp.	65°C.	—	77°C.	—	77°C.	—	80°C.	—	71°C.	—	84°C.	—
						Count/Article at 37°C.						
Dinner (1)	1		3		Not found		8		Not found		1	
Plates (2)	Not found		2		8		86		Not found		3	
Pudding (1)	Not found		Not found		5		Not found		Not found		2	
Plates (2)	Not found		1		Not found		1		4		2	
Forks (1)	1		90		4		5		17		24	
(2)	Not found		1.370		2		104		58		350	
Spoons (1)	1		708		1		19		29		138	
(2)	Not found		6		4		259		4		76	
Cups (1)	Not found		2		5		4		4		1	
(2)	3		1		1		1		3		14	
Glasses (1)	—		1		—		—		—		4	
(2)	—		1		—		—		—		7	

NOTE: — =No test was carried out.

APPENDIX XI

DETERGENT DISPENSING WITH HYDRAULIC DISPENSER AND RINSE INJECTOR

STAGE THREE

Hospital	A	B	C	D	E	F
Detergent	Soilax S.W.	Soilax Acclaim	Diversey Ampolite	Diversey Ampolite	Chinabrite 3346	Chinabrite 3322
Wetting Agent for Rinsing	Soilax Rinse Drv.	Soilax Rinse Drv.	Diversey Zero Spot	Diversey Zero Spot	/	/
Quantities used in 4 weeks	D. 72 lbs. W.A. 2 pts. 8 ozs.	114 lbs. 8 ozs. 1 pint 16 ozs.	210 lbs. 6 pints	38 lbs. 1 pint 14 ozs.	158 lbs.	172 lbs.
Quantities used for 10,000 pieces	D. 7.5 lbs. W.A. 5 ozs.	6 lbs. 13 ozs. 2.028 ozs.	7.1428 lbs. 0.2976 pints	2 lbs. 3.8962 ozs. 2.04 ozs.	18 lbs. 3.2446 ozs.	8.6 lbs. 11/1d.
Cost per 10,000 pieces	D. 4/9d. W.A. 5/0d.	12/2.4285d. 2/0.2857d.	13/2.33d. 13/2.619d.	3/9.1283d. 1/3.33d.	27/10.5622d.	
Cost per meal served	0.0668d.	0.0970 lb.	0.0629d.	0.0327d.	0.1886d.	0.0666d.

APPENDIX XII

DETERGENT DISPENSING WITH ELECTRONIC DISPENSERS AND RINSE INJECTOR

STAGE FOUR

Hospital	A	B	C	D	E	F
Detergent	Soilax Acclaim	Soilax Acclaim	Diversey Divoklor	Diversey Ampolite		Chinabrite 3322
Wetting Agent	Soilax Rinse Dry	Soilax Rinse Dry	Diversey Zero Spot	Diversey Zero Spot		B.H.C. Blu-Raid
Quantity used in 4 weeks	D. 182 lbs. W.A. 2 pints	98 lbs. 2 pints 8 ozs.	140 lbs. 5 3/5th pints	90 lbs. 1 pint		172 lbs. 5 2/5th pints
Quantity per 10,000 pieces	D. 18.75 lbs. W.A. 4.85 ozs.	6.2 lbs. 2.9 ozs.	8.33 lbs. 6.6 ozs.	5.12 lbs. 0.1136 ozs.		8.6 lbs. 6.4 ozs.
Cost per 10,000 pieces	D. 33/4d. W.A. 4/2.3d.	10/9.23d. 2/11.38d.	16/8.5d. 8/1.85d.	8/6.27d. 1/2.93d.		11/1d. 1/8.2d.
Average cost per person per week	0.2615d.	0.064d.	0.1313d.	0.0671d.		0.0759d.

APPENDIX XIIIa

Results of Bacteriological Examination of Wash and Rinse Waters and Swabs from Utensils and Crockery taken at Hospital A using detergent dispenser

Description of Sample	Non-Bactericidal Detergent (7 ozs. to 12 gallons)			Bactericidal Detergent (5 ozs. to 12 gallons)		
	First Sampling 1.10 p.m.	Second Sampling 1.15 p.m.	Third Sampling 1.45 p.m.	First Sampling 1.10 p,m.	Second Sampling 1.15 p,m.	Third Sampling 1.45 p.m.
Temperature of wash water	64° C.	46° C.	40° C.	65° C.	46° C.	36° C.
Temperature of rinse water	66° C.	48° C.	38° C.	71° C.	47° C.	38° C
Wash water count /ml.	2	15	1,550	8	134	2,340
	Count per article at 37° C.			Count per article at 37° C.		
Dinner plates	4	—	3	1	0	54
Pudding plates	3	95	21	1	0	74
Spoons	no organisms found	2	1	1	2	32
Forks	1	2	19	0	2	1
Cups	2	44	1	0	7	38

APPENDIX XIIIb

Results of Bacteriological Examination of Wash and Rinse Waters and Swabs from Utensils and Crockery taken at Hospital C adding detergent by measure at half-hourly intervals

Description of Sample	Non-Bactericidal Detergent (7 ozs. to 12 gallons)			Bactericidal Detergent (5 ozs. to 12 gallons)		
	First Sampling 12.50 p.m.	Second Sampling 1.10 p.m.	Third Sampling 1.45 p.m.	First Sampling 12.50 p.m.	Second Sampling 1.10 p.m.	Third Sampling 1.45 p.m.
Temperature of wash water	65° C.	35° C.	39° C.	64° C.	35° C.	37° C.
Temperature of rinse water	80° C.	40° C.	60° C.	80° C.	39° C.	39° C.
Wash water count per ml.	750	25,400	51,500	550	198,000	103,000
	Count per article at 37° C.			Count per article at 37° C.		
Dinner plates	6	46	43	Not found	153	356
Pudding plates	13	14	14	121	302	24
Spoons	14	64	32	6	344	222
Forks	71	46	233	316	40	181

APPENDIX XIIIc

Results of Bacteriological Examination of Wash and Rinse Waters and Swabs from Utensils and Crockery taken from Hospital D adding detergent by measure at half-hourly intervals

Description of Sample	Non-Bactericidal Detergent (7 ozs. to 12 gallons)			Bactericidal Detergent (5 ozs. to 12 gallons)		
	First Sampling 1.15 p.m.	Second Sampling 1.20 p.m.	Third Sampling 1.50 p.m.	First Sampling 1.15 p.m.	Second Sampling 1.20 p.m.	Third Sampling 1.50 p.m.
Temperature of wash water	53° C.	27° C.	37° C.	55° C.	44° C.	43° C.
Temperature of rinse water	59° C.	39° C.	37° C.	59° C.	47° C.	44° C.
Wash water count m/l.	1,650	5,600	16,200	2,640	4,240	12,100
	Count per article at 37° C.			Count per article at 37° C.		
Dinner plates	550	—	388	93	—	872
Pudding plates	372	—	408	54	—	424
Spoons	128	—	440	15	—	46
Forks	28	—	408	37	—	25
Cups	31	—	—	20	—	137

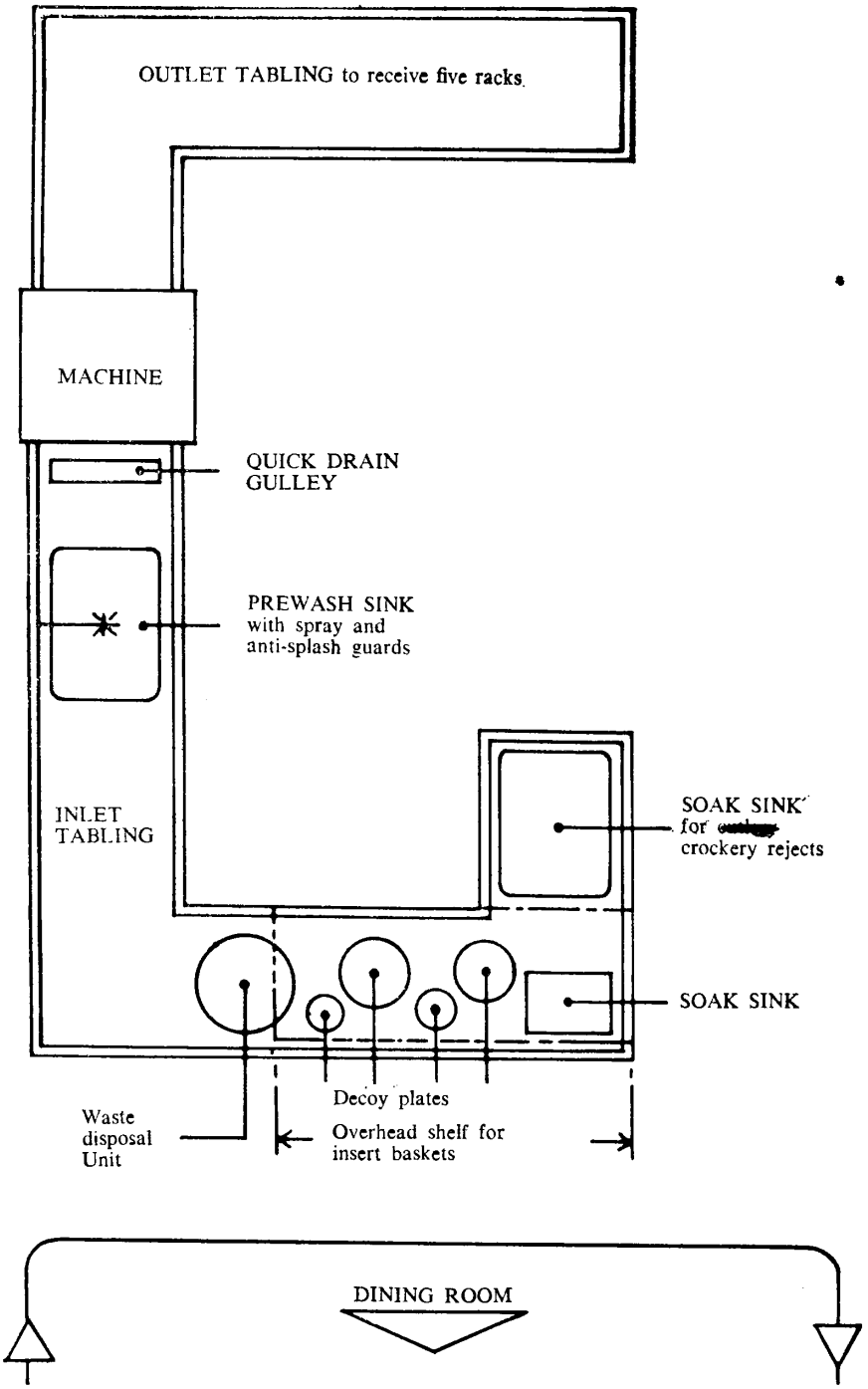
APPENDIX XIIId

Results of Bacteriological Examination of Wash and Rinse Waters and Swabs from Utensils and Crockery taken at Hospital B adding detergent by measure at half-hourly intervals

Description of Sample	Non-Bactericidal Detergent (7 ozs. to 12 gallons)			Bactericidal Detergent (5 ozs. to 12 gallons)		
	First Sampling 1.10 p.m.	Second Sampling 1.15 p.m.	Third Sampling 1.45 p.m.	First Sampling 1.10 p.m.	Second Sampling 1.15 p.m.	Third Sampling 1.45 p.m.
Temperature of wash water	65° C.	52° C.	41° C.	65° C.	56° C.	45° C.
Temperature of rinse water	70° C.	54° C.	47° C.	68° C.	58° C.	46° C.
Wash water count m/1.	1	16	285	8	11	735
	Count per article at 37° C.			Count per article at 37° C.		
Dinner plates	2	2	1	0	3	11
Pudding plates	1	2	11	2	1	12
Spoons	2	1	9	3	1	13
Forks	0	4	26	0	8	10
Cups	131	5	22	0	0	478

APPENDIX XIV

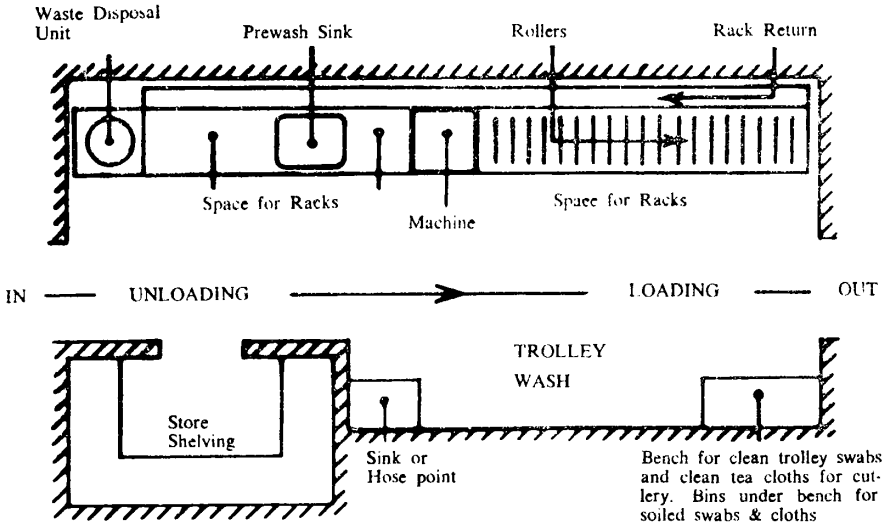
DIAGRAMMATIC LAYOUT OF CROCKERY WASHING AREA NEAR DINING ROOM

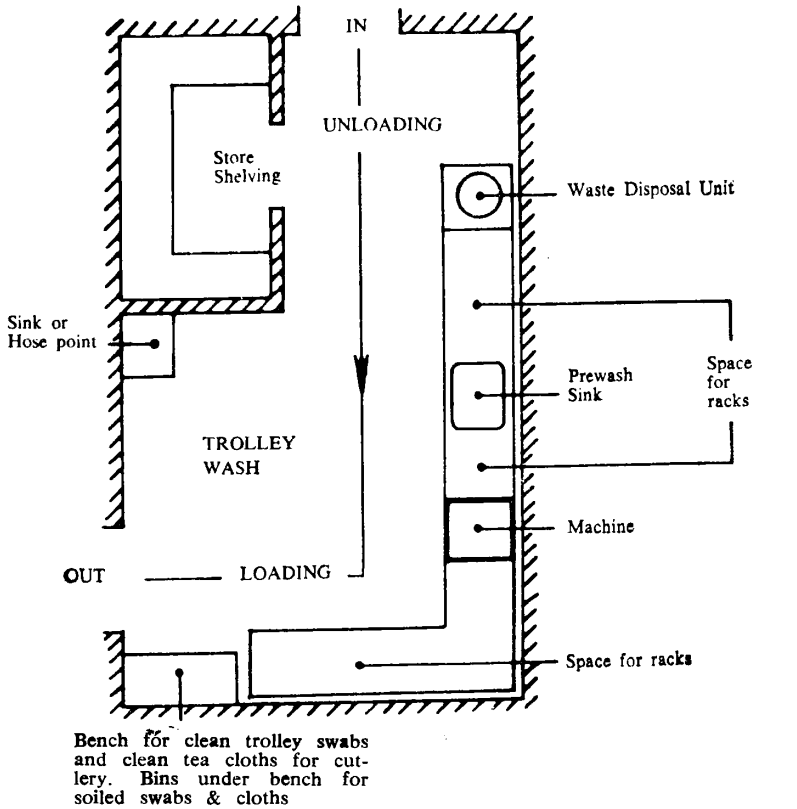


MACHINE	Fully automatic, complete with Detergent Dispenser and Rinse Line Injector.
RACK STORAGE	Shelving provided under tabling for Racks and Insert Baskets.

APPENDIX XV

DIAGRAMMATIC LAYOUTS SUITABLE FOR CENTRAL CROCKERY WASH





APPENDIX XVI

ORGANISATION OF WORK FOR DISHWASHING

The organisation of a dishwashing unit begins in the dining room where dirty dishes are first collected by a waitress or dining room maid. Assuming that the most efficient layout has been installed, chaos can still reign if maids are queueing up to unload their trays or trolleys in the dishwashing room.

Firstly, the personnel must be trained to collect dirty dishes and begin sorting at the same time, by stacking plates of the same kind together, separating cups from saucers, keeping glass-ware separately; further, where possible, different kinds of cutlery should be separated. If a trolley is used for clearing, sections for cutlery baskets, cup baskets and glasses, plus a scrap bin can be arranged.

At dirties table in the dish room a series of decoys should be placed in position as shown in Appendix VII so that the staff unloading their trays or trolleys will place the soiled crockery in the correct places. The machine operator will now be able to rack up dirty dishes of all the same kind/size into the appropriate rack without delay. By so doing the dishes when clean can be stacked and put away immediately as no sorting is required.

By using such methods the number of machine operators can be kept down to two persons in most cases, except where large numbers are being fed.

Not only does this system increase efficiency but it also decreases breakages and chipping of crockery considerably. To extend the method still further insert baskets should be used for cups and glasses (Appendix VII) which are shown on the over shelf. These baskets fit inside a standard dishwashing rack and can be used for storage after washing without removal of the contents.

APPENDIX XVII

EXAMPLE OF INSTRUCTIONS FOR STAFF OPERATING DISHWASHING MACHINES

The following instructions have been prepared as a sequence of operations to assist you in understanding and operating the dishwasher.

PREPARING DISHWASHER FOR OPERATION

1. Close drain by turning handle to "SHUT" position.
2. Place the overflow cover and the two strainer pans into position.

3. Detergent. Scatter initial charge of detergent (3 ozs.) on the strainer pans.

4. Turn on FILL valve (BLUE COLOURED HANDLE) and fill tank to overflow level.

5. Turn on HEATING control (RED COLOURED HANDLE).

6. THERMOMETERS. Check that correct temperatures have been reached before commencing to wash up.

   WASH THERMOMETER 140° F. to 160° F.
   RINSE THERMOMETER 180° F. to 190° F.

   (These temperatures are necessary for good dishwashing).

7. Check that detergent feeder has been charged with detergent powder and that the rinse injector is charged with wetting agent.

PACKING AND SORTING CROCKERY

All crockery must be sorted into small stacks of each kind, i.e., dinner plates, soup plates, side plates, etc., must all be in separate stacks.

DO'S	DON'TS
1. Place all crockery to be washed in correct rack.	Do not stack dishes on top of one another. Water must have free access to both sides of every dish. DO NOT OVERLAP PLATES, SAUCERS AND FLAT DISHES.
2. Stand all plates and flat dishes on edge in the racks.	
3. Put glasses and cups into flat open racks " bottoms up " and place retaining grid on top of crockery before washing.	Do not mix glasses and cups in the same rack, or plate metal articles in same rack as china or glass.
4. Cutlery is to be washed in the special baskets provided, spoons and forks with handles uppermost.	Do not pack cutlery too tightly in the compartments of the baskets, or they will not be washed clean.
5. Pre-rinse all racks of crockery before washing.	Do not push food scraps, dirty water, etc., into the dishwasher. Always use the pre-wash sink.

Washing the Crockery

1. Push each rack of crockery to the pre-rinse sink and spray thoroughly.

2. After rinsing a rack of crockery, raise the doors of dishwasher, slide the rack into the machine. Close the doors.

3. Push the time switch to "ON" position, a red light will then show that dishwasher is automatically washing and rinsing. When the light goes out, push the timer switch to the "OFF" position, and open the doors.

4. Slide the next rack of dirty crockery, pushing the clean rack of dishes onto the dish table. The dishes in the first rack will be hot and will air dry in 45 seconds. DO NOT attempt to dry them with a towel.

Cleaning the Dishwasher

After all washing up is finished:

1. TURN OFF THE HEATER (RED COLOURED HANDLE).

2. Drain the machine by turning drain handle to open position.

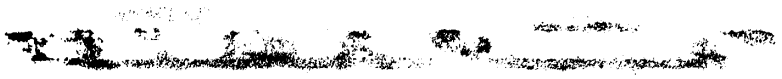
3. Clean down the soiled dish tables.

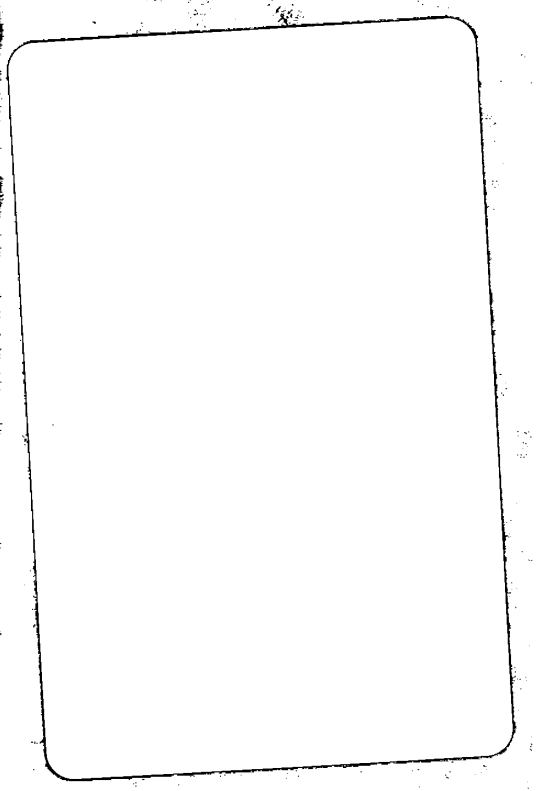
4. Take out strainer pans and empty scraps into waste bin.

5. Lift out the overflow pipe and clean thoroughly.

6. Close the doors of the machine and operate the rinse with the manual control for a few seconds (with drain open) to cleanse the inside of the machine.

7. Open doors, replace strainer pans and overflow pipe and leave machine with doors open.





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Price 1/6 *Post free*

Caxton Press of Cheshunt Ltd., Holt House, Flamstead End, Cheshunt, Herts.