

BREWING IN H.M. SHIPS.

The provision of amenities for personnel of the Services and Merchant Navy in the Far East has been under special consideration by the controlling authorities for some time, in view of the shortage of the usual shoregoing facilities. Among other considerations it was decided that a regular supply of beer of good quality should be made available, 4 pints per week per man being suggested as a reasonable scale. The world production of export quality beer is sufficient to secure such a scale, but only if shipping and containers could be made available. As facilities for distribution are scarce it has been necessary to investigate what local sources of supply could be developed.

So far as the Royal Navy is concerned, this involved consideration being given to the installation of brewing plants in certain H.M. ships. The requirements for running a brewing plant include an adequate supply of cooling water, electric current, steam, and refrigeration, all of which are usually available in a ship's existing services or can be augmented as necessary. The installation of a brewing plant afloat therefore offered few major problems.

The question of distribution of the brew, especially in a hot climate is, however, one of considerable difficulty as, for the beer to be at its best it should be consumed at a temperature not exceeding 65° F. Further, if to be subjected to high temperature and not immediately consumed, it should be pasteurised, but the flavour of unpasteurised beer is usually preferred. In tropical climates pasteurised beer should keep about 3 months, unpasteurised about 10 days.

Bottling or canning the brew has been considered inadvisable in ship's breweries for the following reasons:—

- (i) Supply and transport difficulties in maintaining stocks of bottles and/or cans.
- (ii) Space limitations—the space required for the plant would have to be trebled to permit bottling or canning.
- (iii) Extensive cold storage would have to be available at all bars where beer was to be served, and for storage.

In the amenities ships, these difficulties will be overcome by arranging for the bulk stowage of the brew to be located in the cold store necessary for the storage of the malt and hop extracts. The bulk of the output can therefore be unpasteurised and piped direct to the main serving bars located on the deck immediately above. To provide for smaller remote bars, special 5 gallon containers are being supplied which can be withdrawn from cold storage as required.

Suitable Plant.

It has been found that the most suitable brewing plant for use in a ship, is one using a patented process known as 'the totally enclosed fermentation method,' in which malt extract and hop concentrate are used. The smallest economical unit was decided to be one of 250 barrels per week, allowing 5 brews per week of 50 barrels (36 gallons) each. Apart from the saving in weight and space, the advantage of using malt extract and hop concentrate is that it eliminates the difficult processes before fermentation that are necessary when ordinary malt and hops are used.

Distilled water from the ship's exaporators will be used and allowing for losses, it is estimated that approximately 7 tons per day will be required. To give the water the necessary hardness, gypsum will be added. The maximum steam requirements are approximately 3,000 lbs. of steam/hour, but this figure

would only be reached during the $1\frac{1}{4}$ hours daily when the wort was being boiled.

The quantities of malt extract and hop concentrate required are 1 ton and 7 lbs. respectively per 50 barrels. Arrangements are made for a 3 months' supply in cooled storage.

For fermentation, the yeast required is about $\frac{1}{2}$ lb. per barrel or 125 lbs. per week. Complete fermentation of the brew takes about a week, during which time the yeast multiplies itself 7 times. Some of this is retained in brine-cooled yeast backs for subsequent use, the remainder being discarded.

The general process of brewing by the totally enclosed system is as follows:—

Distilled water is pumped from the ship's tanks to a receiving tank in the brewery. A measured volume is then passed to the wort copper, and gypsum and the necessary quantities of malt extract and hop concentrate are added. The wort copper is steam jacketed on its lower half and the wort is allowed to boil for about 1 hour, using a steam pressure of 25 lb. per sq. in.

The wort, is then pumped through a paraflow type cooler and reduced to a temperature of about 60° F. using sea water and then brine from a refrigerating plant which is part of the installation.

Fermentation.

From the wort cooler it passes to one of the fermenting vessels, which has previously been charged with the requisite quantity of yeast. Six fermenting vessels are being fitted to take five daily brews from the wort copper and to allow one vessel being empty for cleaning and sterilisation between brews. The fermenting vessels are brine jacketed for the control of temperatures during the fermentation process. A rouser, for agitating the liquor is fitted and provision for air injection is made to assist fermentation should this be necessary. Active fermentation takes from 3 to 4 days, during which period yeast is propagated and CO₂ gas is generated, both of which are passed to the yeast backs situated immediately above each fermenting vessel. From the yeast backs, the CO₂ gas is led to a compressor for charging CO₂ cylinders at 200 lbs. per sq. in. This gas is later used for distributing bright beer (by displacement) to either the canteen or the racking room where containers are filled.

When fermentation has ceased, the beer still in the fermenting vessel is chilled to 32° F. and then fined by the injection of finings (made from isinglass and a suitable acid).

Distribution.

The fining process having been completed, the beer is now pumped from the fermenting vessels through sponge and sheet filters and either direct or through a pasteuriser to one of the two bright beer tanks which are maintained at a low temperature. The beer is then ready for distribution by the application of a top pressure of CO₂. Pasteurising consists of passing the beer through a paraflow type heat exchanger which heats it to 140° F. for a short period and then cools it.

The original gravity of the beer is controlled by the quantity of malt extract originally placed in the wort copper. It is in view to make beer having an O.G. of 1038. Ordinary bitter beer in the U.K. is now about 1036 (Distilled Water=1000).

Brine and steam jackets are of copper, while stainless steel fittings are used for vessels and pipe lines in direct contact with the beer. Scrupulous cleanliness is, of course, essential, and provision will be made for the sterilisation of each part of the plant by steam or hot water before each brew.