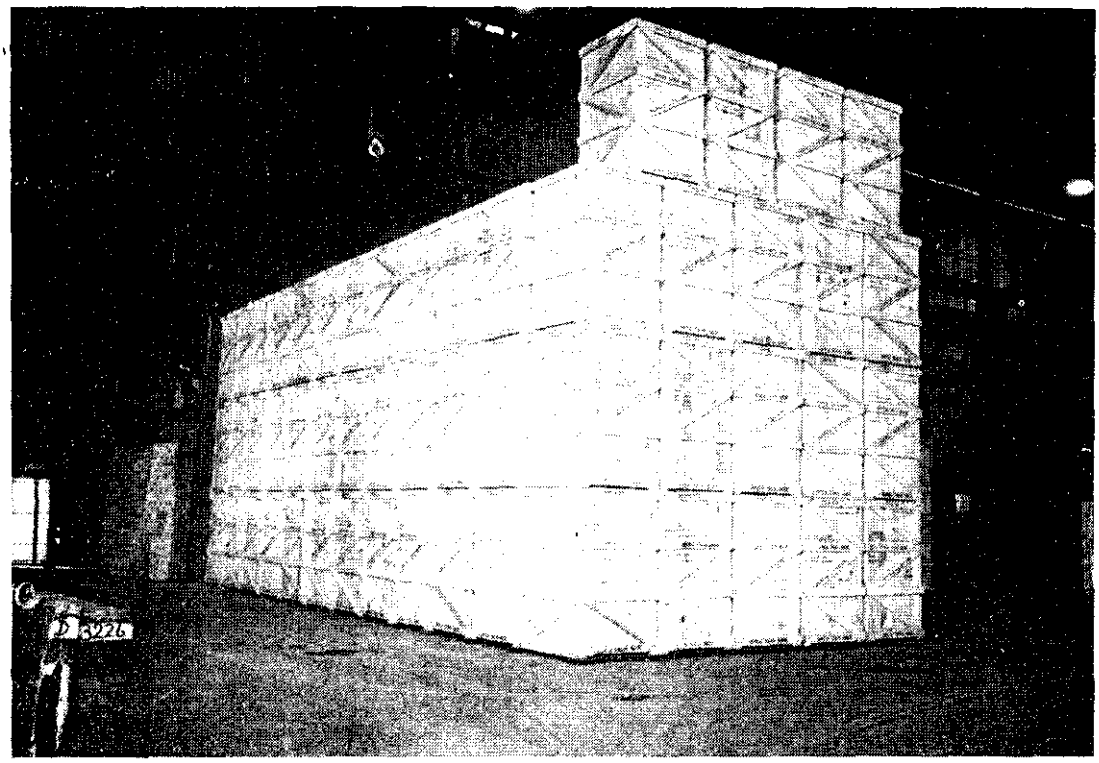

FIG. 1—UNIFORM STOWAGE

ADMIRALTY MACHINERY DEPOTS

BY

COMMANDER (E) D. G. THOMPSON, R.N.

After more than two years in charge of a large Admiralty Machinery Depot in the United Kingdom, I am still seized, on my gloomy days, with the feeling that the Navy is composed of two kinds of people—those who think that Admiralty Machinery Depots were introduced as a convenient place to which all unwanted equipment could be despatched with a sigh of relief, and those who, after their main engines have dropped through the ship's bottom, solemnly make out a demand for a new set, post it to the A.M.D., and hope for the best.

On sunny days, things do not seem so bad, and a spirit of charity tells me that most of the untoward happenings are due to two things—that the Admiralty Machinery Depots, as constituted today, are new things, and that the Fleet has been told very little about them.

This latter point is understandable, in that A.M.D.s form part of the Spare Parts Distribution Centre organization and are in the development stage. One day, all will be tidy and reference books available telling the full story, but in the meantime a short history, the point of development now reached, and the target in view, might not come amiss from one who has seen one of these depots turn from a derelict shipyard to a store holding vast quantities of valuable equipment, which can be found when wanted, and while in store, receives proper treatment.

THE DEPOT

The primary function of the S.P.D.C. organization is the distribution of spares for Vote 8 III equipment to the services that require them, when they require them, and it follows that to be able to do this they must carry stock.

Replace parts for equipment can be obtained within the structure of A.F.O. 1888/54 by ships and services demanding on S.P.D.C.s, but it is obvious that stocks of complete equipments and major sub-assemblies, for issue to approved services, must be maintained for the execution of repairs outside the normal, and as an insurance against emergency.

It is the function of Admiralty Machinery Depots to store and maintain these complete equipments and sub-assemblies for hull, engineering and electrical machinery until a requirement arises. Equipment can only be sent to them, and issued by them, on Admiralty authority, which specifies in detail the receipt or despatch to be made.

There are at present three Admiralty Machinery Depots in Great Britain, at Greenock, Leeds, and Stoke-on-Trent. S.P.D.C.s abroad each have a small A.M.D. section incorporated in them.

General Description

It is a general requirement of a Machinery Depot that it shall be capable of handling heavy units of machinery weighing up to 30 tons. The majority of the items need to be stowed under cover, but open space is necessary for the accommodation of suitable unerated machinery which would otherwise absorb large areas of covered floor space.

A covered floor area of 75,000 sq ft to 100,000 sq ft, with approximately equal open space, are the desirable dimensions for a Depot. These figures may sound astronomical, but so are the number of items required to be stowed therein. The Depots in Great Britain approximate to these dimensions.

All new machinery and equipment, despatched to Admiralty Machinery Depots by contractors, is fully P.I.Pd. for long storage. The policy of E.-in-C. is that all other machinery, that is machinery that has been in service, must be preserved as much as possible by consignors before despatch, otherwise the depots would soon be inundated with derelict equipment beyond the maintenance capabilities of depot staffs.

Personnel

A typical complement for an A.M.D. in the United Kingdom is as follows:—
Engineer Officer—as Officer-in-Charge
Inspector of Fitters
Four clerks
Three fitters
One electrical fitter
Two joiners
Two storehousemen
Two chargemen of skilled labourers
Eighteen skilled labourers
Twenty-two labourers
The skilled labourers provide the crane drivers, slingers, etc.

Floor Space: Tonnage Estimates

The theoretical capacity approximates to 1 ton per 5 sq ft of floor area. Loss of floor area to provide gangways, manning space, railway tracks, and loading areas usually reduces the capacity to about 1 ton per 10 sq ft of floor space.

Rail Goods

British Railways goods services deal with coal, coke, iron ore, rocks, sand, soot, and shingle, normally using the same trucks for all purposes. They are shunted, shored, hooked on or hooked off, perhaps a dozen times in one journey. When a heavy engine is entrained in such company it will be subjected to the same shock treatment. No harm befalls the coal and coke, but the engine may be reduced to fragments unless it is safely packed. It is therefore necessary to exercise considerable discretion in the use of rail goods services.

An uncased engine must be bolted down to a stout cradle, with continuous support fore and aft. Light ramming chocks must be inserted at the ends and sides to prevent movement of the cradle, but these chocks must be sufficiently light to allow collapse under severe shunting shock. The engine must be covered with a tarpaulin and then secured to the buffers at both ends with stout ropes. Under severe shunting shock, the ropes will hold the engine as the chocks collapse.

Cased items generally look quite safe but are in fact liable to heavy damage.

The engine must be bolted down to the bottom of the case, or suitably stopped with chocks nailed to the bottom, to prevent any fore and aft movement. If bearers are required for the engine, they must lie fore and aft inside the case, as a cross member will tear away from the base. The case must then be covered with a tarpaulin and roped to the buffers.

Cased Machinery—Neither Bolted nor Chocked

A large proportion of machinery items continues to be moved by rail, and although the incidence of damage in transit is higher than in other forms of transport, the consignments usually arrive in good order. This is due to the experience and knowledge of consignors, who never send anything by rail unless it can, in itself, withstand shunting shock, or can be satisfactorily protected.

Special types of trucks, such as fitted wagons and box cars, which are fitted with vacuum brakes, are available however, and these are used whenever they can be obtained. Large consignments of Electrolux refrigerators are now despatched in this manner, and no damage has yet resulted.

Passenger Train

Small items, under one hundredweight, which cannot be included with another consignment are better sent by passenger train. It is safe and fast, but can be expensive for short journeys.

Road Haulage

Road Services are the best method of conveying machinery. The load is normally under the supervision of one person only throughout the journey, and there is only minor transference of personal responsibility for the safety of the goods.

Road Services are able to differentiate between the various types of loads carried. Coal, coke, shingle, and sand are conveyed by rough usage lorries, light loads travel in light lorries, heavy loads are moved on specially designed heavy haulage units. The incidence of damage in transit is very small.

Conveyance by road is comparatively expensive however, and only on short journeys can it compete with rail goods. Current Admiralty Orders therefore restrict the use of road transport to the minimum, and to the conveyance of enumerated machinery liable to shunt damage refrigerator and cooler units.

electric motors, generators, internal combustion engines, switchgear and fire control equipment, and for items required urgently.

Air Freight

Despatches by air are confined to items requiring immediate delivery overseas to cover an emergency. It is costly, and cannot normally be applied to any deliveries in England, Scotland, and Wales.

Sea Freight

Transport by sea within the United Kingdom can be employed on some occasions which are usually related to a large consignment not restricted to a delivery date.

The Superintending Naval Store Officer moves considerable quantities of stores within the United Kingdom by Fleet Auxiliaries, and there are occasions when these facilities can be made available to reduce substantially the cost of conveyance of a large consignment.

STORING UNDER COVER

General

A high proportion of machinery received at the Depots is cased or crated. Large, heavy items such as turbines, gearing, catapult components, hull fittings, and propeller shafts, are not crated, and would fall out of the bottom of the case if they were. Winches and other machinery, normally installed on the weather decks of ships, are not usually cased and do not require this added expense. Machinery items from ships withdrawn from service are frequently received uncrated, because there are usually no immediate crating facilities available at the ship.

The problem of storage is consequently one of categorizing the machinery received, and stowing it in such a manner that the maximum capacity, to maximum height, may be obtained on the covered floor space available and the open ground adjacent.

Cranage

It is therefore important that the correct types of cranes are made available. The overhead travelling crane is the most useful, supported by mobile cranes to work beyond the overhead crane limits.

Overhead Travelling Cranes

This type of crane is capable of stowing to maximum height, and requires very little gangway space through the stowages. The load can be moved vertically, horizontally, and transversely with facility, and the loads of trucks, lorries, and carriers can be handled without added manœuvring space. One crane of 30 tons lift is desirable, and the remainder should be of about 10 tons lift.

Mobile Cranes

There is always a requirement for mobile cranes, irrespective of the availability of overhead travelling cranage. In particular, the mobile crane allows the full use of open ground, and there are always spaces under cover which are 'dead spots' for the overhead cranes.

One heavy mobile crane, of 8 to 10 tons lift, is a primary necessity, and the type employed should have solid tyres, to prevent bouncing under load, and power operated steering wheels, to allow movement from one lock to the other while the crane is stationary. Among the lighter types, the Hyster fixed jib crane

FIG. 2—MIXED STOWAGE

is most useful for general purposes, and the fork lift truck is fast and manœuvrable in small spaces.

Mobile Jacks

All too frequently it is necessary to move items of machinery beyond the capacity of the cranes available, or in such positions that cranes cannot manœuvre. The mobile hydraulic jack, similar to the garage car jack, is invaluable for this work. It is possible to raise a main turbine with four jacks, and push it anywhere and everywhere.

Floor and Ground Surfaces

The floor of covered spaces should be of concrete, three to six inches in thickness, to take a loading of one ton per square foot. Railway lines must be set flush with the floor, steps should be eliminated, and gradients avoided or levelled out to a minimum.

The open ground will generally be variable and should be surveyed and laid out for heavy haulage traffic, hard standing for heavy machinery, and soft standing for all other purposes.

Disposition of Machinery

As stated above, a sound appreciation of the machinery items received must be obtained to develop maximum stowage, and the following axioms form a basis of assessment :-

(*a*) Crates and cases should be stowed under the overhead travelling cranes, one on top of another to maximum height, with minimum side clearance and gangway space. Items of the same type, or associated with each other, should be stowed together on top of each other.

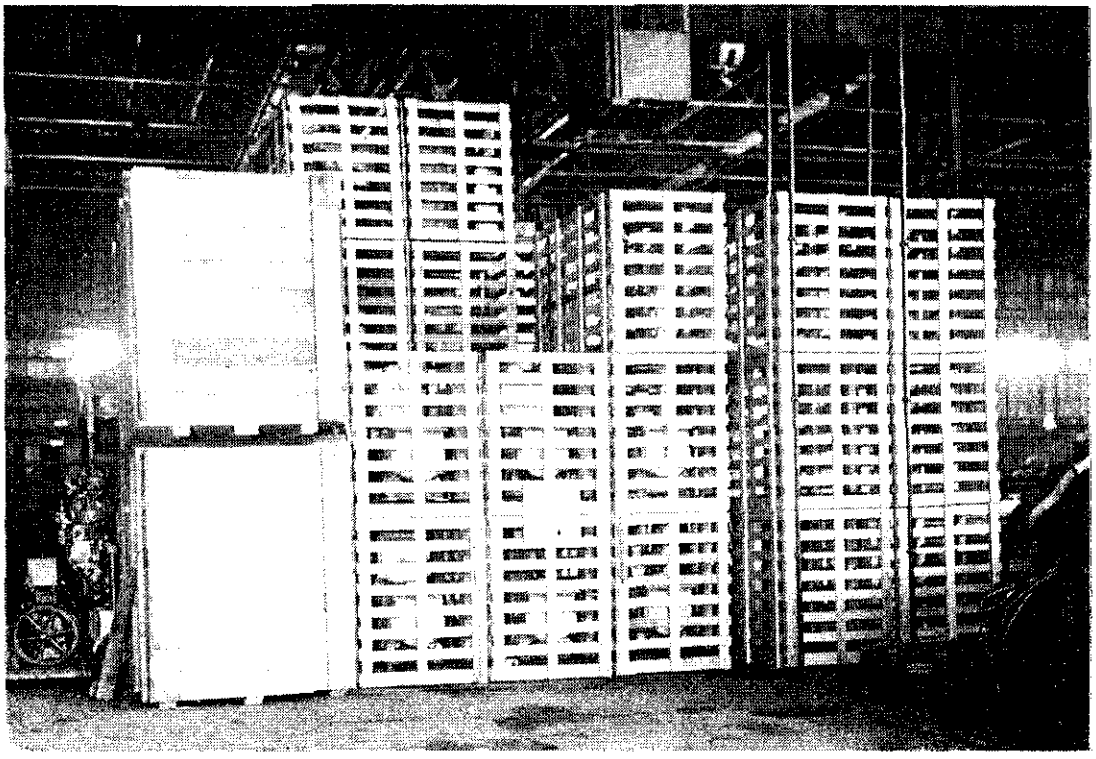

FIG. 3—UNIT CRATE STOWAGE

(*b*) Uncrated items, which cannot be placed on top of each other, must not be stowed under the overhead cranes.

(*c*) Small uncrated items should be crated to permit close stowage. (See ' Unit ' crate).

(*d*) Machinery normally fitted on the weather-decks of a ship should be preserved and placed in the open ground storage. (See ' Cocooning ').

Case and Crate Stowages

If all crates and cases were made to the same dimensions, and all cases associated with one machinery item were the same size, there would be no problem in this type of storage. These variations in dimensions, and the fact that most cases are fitted with landing battens on the top and underside, create instability of the pile when stowed to a height of some 15 to 20 feet. This difficulty can be overcome by using loose stowage battens or packing pieces as shown in FIG. 2.

' Unit ' Crate Stowage

As stated in (*c*) above, there are always numerous uncased items which cannot be piled on top of each other—pumps, steering gear components, etc., which will absorb valuable floor space. These items are usually too heavy for rack stowage, and even if this were practicable, are unsuitable for the use of overhead and jib cranes. In one of the Depots this problem has been overcome by the development of a standard size case which has been called the ' Unit ' crate.

It consists primarily of two ' U ' pieces of specified span and width set into a light crate. The ' U ' pieces, made from old railway sleepers, take the weight of

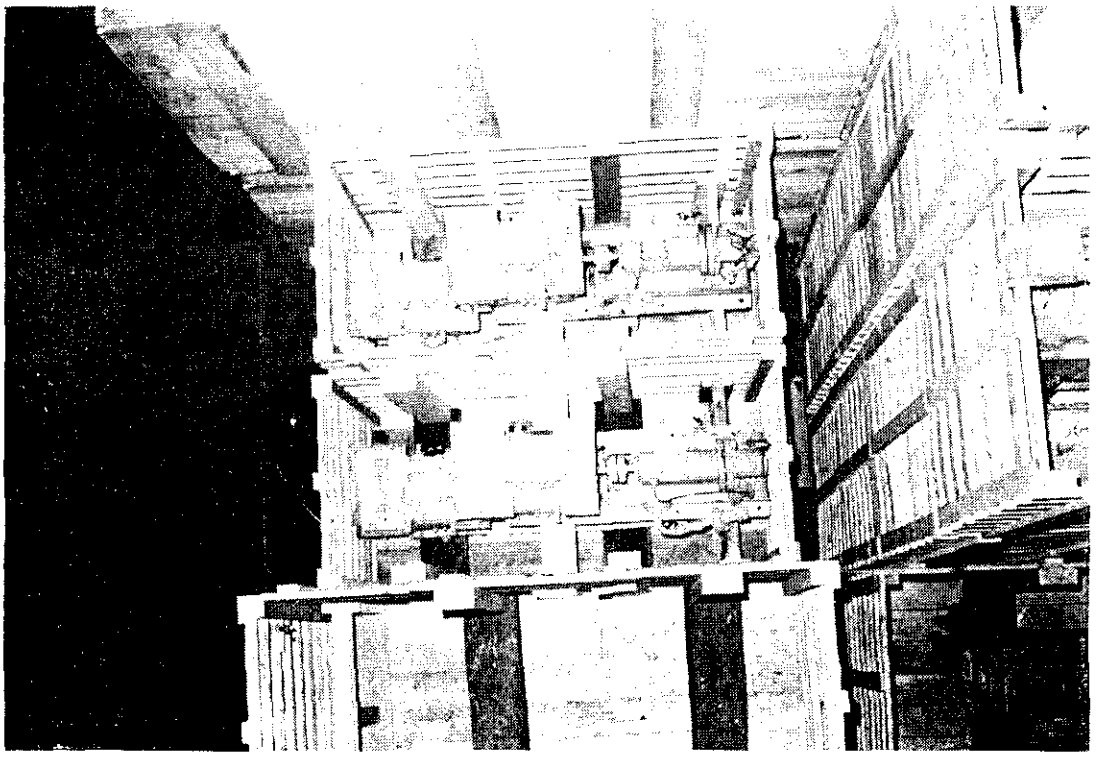

FIG. 4.—LOOKING DOWN INTO UNIT CRATES

the contents and the weight of all crates stowed on top. The crates themselves take very little weight, but battens are set on the undersides to a specified span to give rigidity to a vertical pile. 'Unit' crates are therefore made to identical dimensions overall, but the depth is immaterial to the structure and can be varied as necessary. When the crates are stowed to height, the successive 'U' pieces form a rigid vertical column. Tubular scaffolding has been clamped to outside vertical facades of some of the crates, to ensure that men can climb up and down the stowages with safety (FIG. 3).

The items to be stowed are lowered into each crate after it has been set up in the pile, and similarly are lifted out of the crate, and the crate moved separately, when dismantling a pile. This avoids the added complication and expense of fitting top braces and boundary lifting lug straps to give the crate the strength required to enable it to be lifted, with the contents inside.

It has been found that these crates can be made cheaply and quickly at a fraction of the cost and time required to make a normal crate or case.

One of the largest superheater tube manufacturers became interested in this development, and arranged for a representative of his associated crate manufacturers to visit the Depot. It was strange and exhilarating for a naval engineer officer and his staff to show a box manufacturer how to make a crate, but the standard 'U' piece design has now been incorporated in this construction, and these large crates, averaging 17 ft × 5 ft × 4 ft, can now be stowed 'six or seven up' without fear of collapse.

OUTSIDE STOWAGE

The development of outside storage is important because covered storage is difficult to obtain, expensive to purchase, and costly to build and maintain.

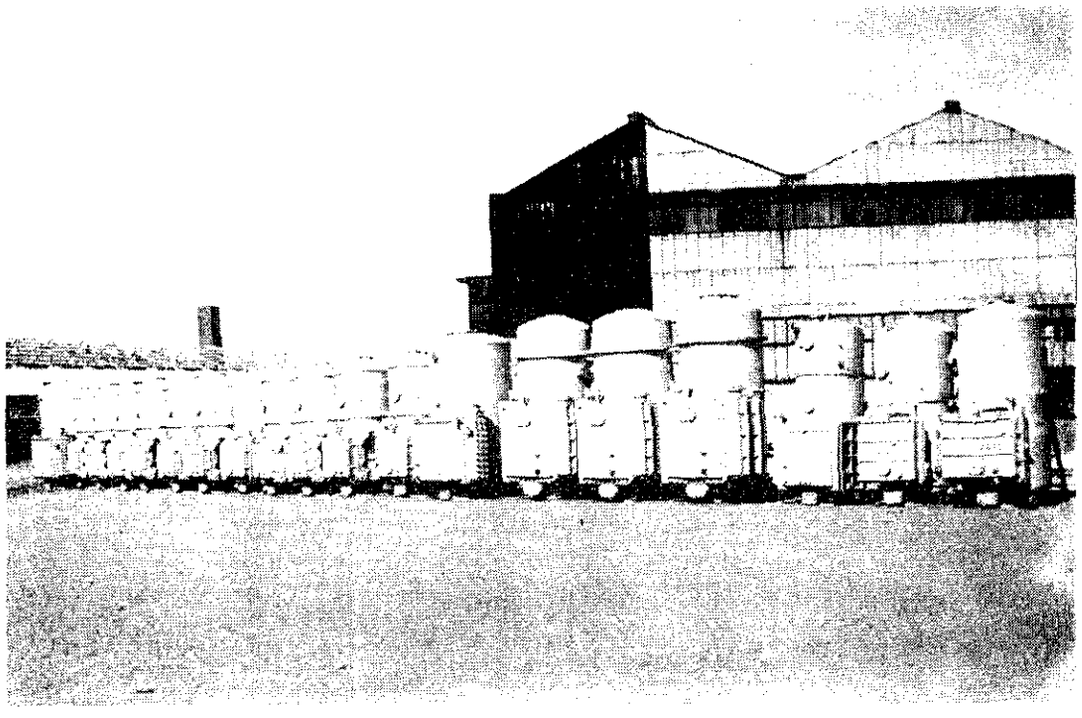

FIG. 5 OUTSIDE STOWAGE

Cocooning

One of the Depots has developed the 'Cooncote' process for outside storage, using the well established principles applied to the 'mothballing' of ships and aircraft in reserve. Minor deviations from the specified processes have been incorporated, in an endeavour to reduce the cost in labour and material.

Cocooning is an economically sound process for items which cannot be stowed on top of each other, or are too heavy for normal crating. Main engine thrust blocks and steam driven winches are good examples. Main turbines, main gearing, turbine ends of turbo-generators, and large Diesel engines can also be cocooned subject to certain safeguards. Electrical equipment is better kept under covered storage, but under certain circumstances it can also be cocooned to withstand weather.

Shafting, hull castings, winching gear, etc., can be stored outside with normal preservative coatings, without incurring the expense of cocooning.

Evaporator shells of distilling plants require only partial cocooning of mountings and cleading joints.

The Cocooning Process

The standard process consists of enveloping the machine with mosquito netting, spraying with three coats of cocoon liquid which, when dry, is heavily coated with a bituminous paint and finally sprayed with a sun heat resisting coat of gilsonite. The machine is then safe for a number of years.

The machine is first padded on the sharp corners with felt. The mosquito netting is crudely tailored over the machine, using pins or sealing compound to unite the seams. If the machine bed is a closed surface of metal, the rim is cleaned off to a bright surface and the mosquito netting is attached to it with the sealing compound provided. If a closed base does not exist, a metal tray can be used instead, or a sheet of cocoon plastic can be pre-formed by spraying the liquid on to a floor or wall, and then placing it beneath the machine.

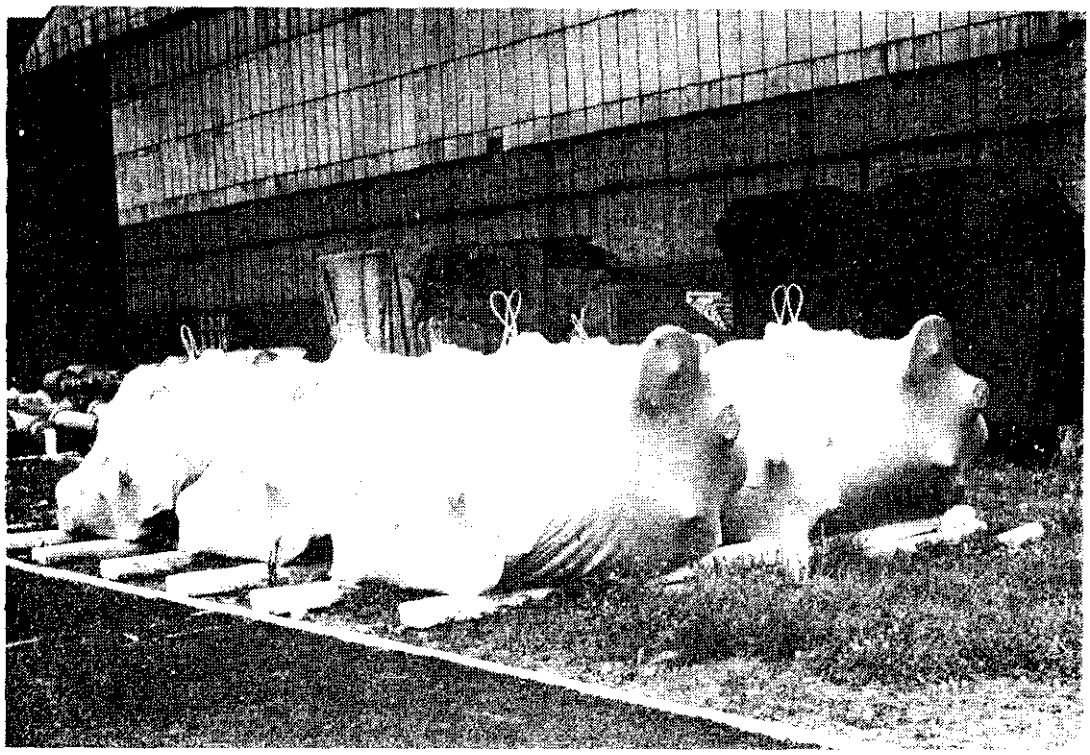

FIG. 6—COCOONED WINCHES WITH LIFTING STROPS

The spraying apparatus consists of a commercial type paint spraying plant, comprising an air compressor, cap. 25 cu ft/min at 100 lbs/sq in, a liquid container of 2 gallon size with stirring device to hold the plastic, and two spray guns with associated hoses. The size and type of the gun is important and it should be provided with a variable spray angle with maximum fluid discharge. The Aerograph DeVilbiss Type MC. with Spray Cap 765, or the Aeraspray Type 3S/BE are both very suitable.

The mosquito netting is first dry sprayed to web the plastic across the meshes of the netting. This must be done slowly using maximum air with minimum fluid. The envelope is then wet sprayed with three successive coats of plastic, using maximum air with maximum fluid, each coat being tinted with a colour additive to ensure even work. The envelope rapidly contracts to form a taut skin overall of about ·040 inches thickness.

The envelope is slit to allow the volatiles released during drying to disperse from within.

A lime or silica gel dessicant is placed inside to act as a dehydrator, and the slit in the envelope is adapted to form a small sighting window of perspex, through which can be seen a piece of planished steel, located inside to act as an indicator of the presence of dampness. The envelope is then thickly coated with the bituminous mastic, which prevents excessive drying and cracking of the plastic envelope beneath. A final sprayed coat of gilsonite is applied to act as a heat deflector.

Modifications of the Standard Cocooning Process

Lifting Arrangements

It is invariably necessary to lift and transport the finished cocooned machine. Although the envelope is surprisingly strong and elastic, it will not withstand

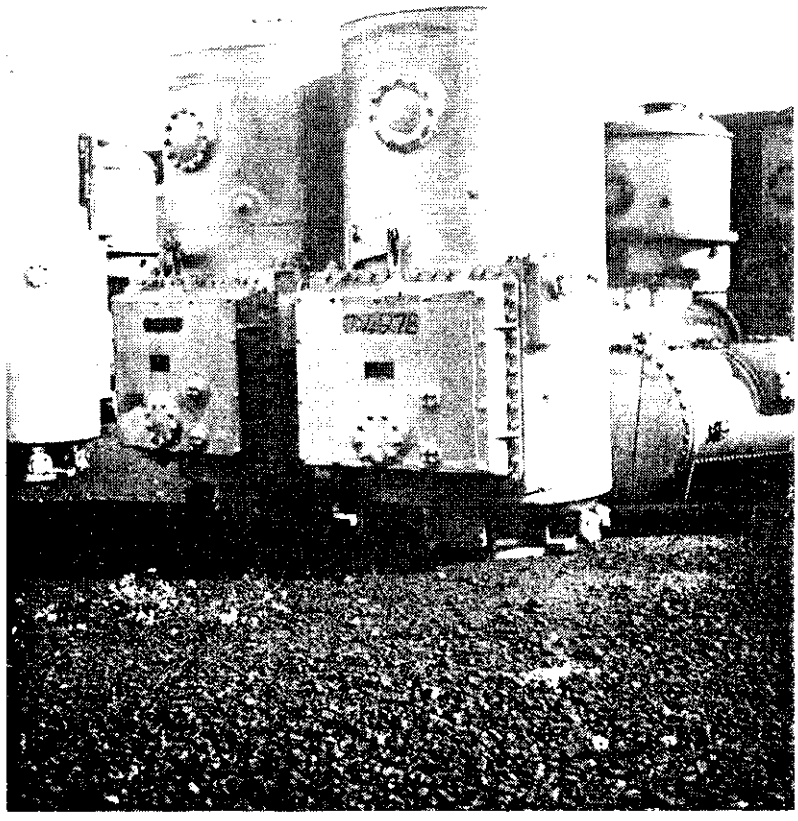

FIG. 7.—PARTIALLY COCOONED EVAPORATOR SHELLS

the cutting action of wire strops. Sometimes a machine is provided with lifting lugs, and the envelope should therefore be initially tailored round these to leave the lugs outside. Winches often have warping bollards at each end of the main spindle, and similarly these can be left outside the envelope for lifting purposes.

Where no lifting points are available, a wire strop has been incorporated within the envelope, leaving the lifting eyes outside the skin. The machine is lifted and the strop adjusted as necessary, the soft eye ends of the strop being then set rigidly with dry wooden battens. The machine is then lowered and a mosquito netting envelope is tailored overall to leave the strop eyes clear.

Partial Cocooning

Some machines require the protection of parts or mountings only. The evaporator shell is a standard example of this. The parts to be cocooned are covered with mosquito netting which is stuck to the adjacent body of the machine with sealing compound. The netting is then sprayed as in the standard process, but the inclusion of desiccant and inspection windows is omitted.

Removal and Replacement of Cocoons

Where a number of identical machines have been cocooned and any of these are subsequently despatched for service, the cocoon can be conveniently slit open and removed, and used again on the same or other identical machines, by taping up the slits and spraying with plastic.

The winches which lifted the *Empress of Canada* were loaned from the Admiralty. They were removed from their cocoons before despatch to Liverpool, and the cocoons were replaced and slits resealed, on their return to the Admiralty Machinery Depot.

MAINTENANCE

In this phase of the work the specialized knowledge of the Officer-in-Charge and his Inspector is of the utmost value. Machinery can deteriorate seriously during prolonged storage, especially when received in bad condition. All machinery, including the cases into which it may be fitted, must be thoroughly dried out before being set aside, and any, minor damage, minor deficiencies, corrosion, or preservation requirements must be assessed and rectified.

The maintenance fitters are continuously employed on this work, covering the whole range of main and auxiliary machinery from main turbines to minor pumps, including electric motors, generators and switchgear.

It must be remembered that large repairs cannot be undertaken by A.M.D. staff—nor are they intended to be. These are dealt with by the Director of Dockyards, but a piece of equipment in need of large repairs is often held in a depot for quite a long period, if it is not certain that a service will definitely arise for it. It is of course adequately preserved during its storage period.

New machinery is received, preserved and cased as mentioned in an earlier paragraph. Although this machinery does not require much initial attention it is often subjected to unfavourable weather conditions in transit. When the top of a large case, containing a steam generator, was removed on one occasion, cascades of water were deposited on the crane crew. This water had passed through the interstices of the wooden battens and had been lodged on the top of the inside waterproof packaging, loading it to a point where further movement would have caused it to tear, and empty the water into the generator.

CONCLUSION

A new equipment is never required until the old one has broken down, and then it is likely that it will be wanted in a hurry. A high proportion of machinery called for from the Admiralty Machinery Depots is in the urgent or immediate category. Engineer officers serving at sea may be comforted to know that the S.P.D.C. organisation is designed to cater for these requirements, and it is the hope of the staff that each year will show a better service, and also that one day something will be needed for despatch that is not at the bottom of the pile.