The ship was stopped by a direct hit in each boiler room on the starboard side. The main force of the explosions was taken by the Peace tanks, but the effect of the considerable splintering was as follows:-

1. Severe damage to No.1.&.2. boiler casings and uptakes and No.1. funnel.

2. Puncture and distorting of a number of tubes in No.2. boiler.

3. Total disablement of firemain, auxiliary, exhaust pipe and starboard telegraph shafting.

4. Holed bulkhead between No.1.&.2 Boiler rooms in several places.

The damage control organisation provided for the immediate closing of boiler stop valves in the event of damage occurring. The object being to conserve steam in boilers until a quick appreciation of the situation could be obtained, and not letting it escape through possible broken Steam Pipes. This was done; oil fuel was shut off and engines stopped.

No.1. Boiler room flooded rapidly through a large hole in the ship's side which extended below the waterline.

No.2. Boiler room commenced making water through the damaged bulkhead.

No.1. Boiler being under water and out of action, the situation in No.2. Boiler room was then examined. No.2. Boiler was found to contain no steam and No.3. Boiler about 60lbs sq in, with water about ½ glass. M.F.T contained 4 tons & R.F.T. contained 10 tons. No.3. boiler being apparently intact, the oil fuel hand pump was rigged and a sprayer flashed. When steam commenced to rise the stop valves were opened and necessary machinery started in Engine Room and Boiler room in preparation for trying main engines.

As soon as the vacuum had risen to 20" main engines were tried, the steering engine run from the bridge and the port Telegraph tried. Steam for "Slow Speed" was then reported and the ship was got under way about 1715 at 30 revs, increasing to 60 revs during the next hour, 4 sprayers being used at 100-150lbs. While steam was being raised the water was rising in No.2. Boiler room and considerable steam leakage was heard to be taking place somewhere in the darkness. Having got the ship moving it was next proposed to try and reduce the water and then investigate the steam leakage. The F.&.B.pump was no use on the fires in the Focsle and paint shop, the after Fireman being intact and hoses were led from it. These fires at the moment were a primary consideration. Ejectors were started in No.2. Boiler Room and the Water level in the bilge, which had reached nearly to the top of the lower drums of the boiler, was checked but not reduced. Several splinter holes in the bulkhead were plugged with wood plugs, and when the fires For'd were controlled and the bilge pump put on the bilges the water level began to fall.

The steam leakage was found to be from the damaged auxiliary exhuast pipe and a flange joint on the steam to fans, the nuts of which had slacked right back, probably due to concussion. These nuts were on the steam joint of S,F.Fan in No.2. Boiler room They had slacked back ¾". This flange is considered to have been nearest to the centre of explosion. It was easily dealt with, although it meant stopping the ship for about 15 minutes, while steam to fans was shut off. The auxiliary exhaust pipe was so badly damaged that it was not possible to repair or blank it, especially with an engine room complement recuded 50% by casualties.

It was realised that this steam leakage, and in addition, the continual use of the ejectors would result in complete loss of feed water, bu the close proximity of the enemy coast, and the need for keeping ejectors and bilge pump working made the maintaining of steam a matter of extreme urgency.

The following steps were taken to conserve feed water:-

1. The evaporator was started.

2. C.E. was opened to H.P. turbines.

3. C.E. to condensers was opened until a slight vacuum was showing on the engine room gauge.

4. An attempt was made to run down No.2. boiler but it seemed empty. In spite of 2 & 3 exhaust steam continued to escape from the broken pipe, it is thought for the following reasons:-

Owing to the large hole in the ship's side, it was impossible to maintain an air pressure in the Boiler room and in order to burn the oil fuel the fans had to be run at high speed. Most of the auxiliary steam must have been used on these fans, and the exhaust pipe was damaged only about 3 feet away.

3 was beginning to cause a drop in vacuum in the main condensors, so these valves were closed down until a slight pressure was showing.

An attempt was now made to shut off the ejectors and rely on the F.&.B pump to keep the water from rising in the Boiler room. Several holes in the bulkhead had been plugged with wooden plugs, but owing to the darkness the main damage to the bulkhead was difficult to find and still more difficult to repair. The ejectors had to be restarted as the F.&.B.pump was incapable of controlling the water and was ocasionally required to deal with the fire in the paint shop which continued to break out at intervals during the night.

By this time (about 1830) speed had been increased to 80 revs (6 knots); owing to the damaged condition of the ship and the many compartments flooded, this was considered the limit. On getting underway the main feed tanks contained about 4 tons and the Reserve about 10 tons. At about 1930 the R.F.T. was almost empty and the 2½" sea connection to the M.F.T. was opened. In spite of this the water level in the feed tank continued to drop until at abouth 2030 the feed pump lost suction and the water in the boiler disappeared from the glass. The boiler was shut off with about 150lbs sq in remaining.

It was not apparent that any water was entering the feed tank from the sea and as there was some water in the engine room bilges, search was made for holes in main or reserve feed tanks through which water might have escaped to the bilge.

After some time spent in investigation, a hose was rigged from the F.&.B. pump and connected to a hose connection on the top of the M.F.T. The auxiliary stop on the boiler was opened and the pump was run to pump water into the tank.

During this period the water in No.2. Boiler room had risen considerably and the ship had drifted beam on to wind and sea. The weather had deteriroated and the ship was rolling sluggishly, the free water in No.2. Boiler room giving her a list of about 15° to starboard. Counter flooding was <u>not</u> resorted to, but the 1st Lieut: was requested to jettison anything he could from the Upper Deck. This had already been done in the early stages, but he improved matters by actually disconnecting a number of fittings that were secured to the deck.

At about 2100, water was seen to be rising slowly in the glass on the M.F.T. The feed pump was started and a suction obtained. When water was showing in the boiler, the top sprayers were flashed and steam raised: Machinery was started and the main engines once more were got under-way.

(<u>Note.</u> I have examined the sea connection to M.F.T and found it clear. No reason for its failure to flood the M.F.T. at a critical moment can be given. It may possibly have been affected by its position on the main inlet pipe and robbed of water by the circulating pump.

On the whole, I think the Engineer Officer may have misjudged the position under the stress of circumstances, and expected the sea connection to flood the M.F.T faster than its actual capacity to do so. He tells me that, when he had settled down at 80 revs, the sea inlet was adequate for feed purposes).

The water level in the Boiler room Bilges was by now up to the top of the lower drums of the boiler and the ejectors were started again, the F.&.B. pump being retained for topping up the feed tanks. These ejectors well repaid the trouble spent on their frequent testing and maintenance in harbour.

The ship proceeded at about 2130 and speed was gradually worked up to 80 revs, with 4-5 sprayers in use, and maintained until arrival in Harwich at 0930 the following morning.

During the passage the boiler was blown down every hour for about 2 minutes. The ejectors were working continuously and the Main & Reserve feed tanks kept up to 4 & 15 tons respectively.

The auxiliary machinery worked satisfactorily with the following exceptions:-

1. The Port Circulating and Port Dynamo "knocked" occasionally.

2. The starboard Forced lubricating pump stopped frequently.

3. The O.F. pumps stopped occasionally and on arrival stopped finally the steam being maintained by hand pump going alongside.

4. The Boiler feed regulator became salted up after about 5 hours steaming on salt water and the boiler was fed by hand. Water in glass remained steady and no priming occurred.

At no time were more than 5 sprayers in use on the boiler, and after settling down it was possible to come down to 4 at 80 revs.

Since the ship came in hand for repairs the following examinations have been made:-

1. H.P.&.L.P. turbines through sight doors. No trace of salt.

2. Condenser tubes, steam side, at top and bottom of condenser. No trace of salt.

3. Turbine journals and carbon packing. No trace of salt.

4. Sections of main and auxiliary steam line. No trace of salt.

5. Bearing and gearing. Good condition.

6. The only indications of salt were found on pipe glands and valve spindles where slight leaks existed previous to the action. As previously indicated, Weirs shuttle valves were unreliable, but no signs of salt deposit were found on opening up here. The Engineer Officer removed a salt deposit in Harwich.

7. The Boilers showed very little trace of deposit. No.3. had been washed out in Harwich previously.

Electrical.

Extensive damage was done to the wiring and although a dynamo was started at about 1800 only the Engine Room lights would burn. The Engine Room supply and exhaust fans were out of action and the atmosphere in the engine room was only bearable for short periods after "Black-out Time". When the supply fan was repaired it made a vast difference to the efficiency of personnel below.

EVENTS OUTSIDE THE E.R. DEPT. IN H.M.S. WORCESTER DURING ACTION WITH GERMAN BATTLE CRUISERS ON THE 12th. FEBRUARY, 1942.

Hits were received on the ship as follows:

1. Abreast the 12 Pdr. on Starboard side.
2. Starboard Bow.
3. Wardroom.
4. Oerlikon R.U. magazine, starboard side of Forecastle, under Bridge.
5. Both Boiler rooms.
6. Foremost Funnel.

These hits caused the following damage:

1. Large hole in deck and ship's side which extended from 124 Station in E.R. to 131 Bulkhead, causing no damage to machinery or No.3 O.F. Tank and well above Water Line. This put the 12 Pdr. out of action.
2. Set Paint Shop on fire, damaged anchor and flooded compartments as far as No.11 Bulkhead.
3. Flooded After magazine, Shell room and Provision room through a number of holes about one to two feet square, set calcium charges burning in Gun Store.
4. Oerlikon Magazine exploded wrecking W/T Office and T.S. and setting after end of Forecastle on fire.
5. No.1 Boiler room completely flooded through hole in ship's side about 10feet square. No.2 Boiler room ship's side hole ab-out 6 feet square. Bulkhead between Boiler rooms pierced by splinters in several places. Firemain to For'd shot away.
6. Large hole in For'd Funnel.

The mast was shot away at the base by one of the above or possibly by a splinter from a near miss. It is thought that near misses caused a number of splinter holes in deck and upper works.

The following casualties occurred which affected damage control:
The majority of the Ammunition Supply, fire and repair parties.
The whole of the 12 Pdr. gun crew and a percentage of the other guns crews.
A high percentage of lower bridge and W/T personnel.

Fires:

In attempting to deal with the fires it was found that the firemain was shot away in No.2 Boiler room and was not repairable and some hoses were ruined by splinters. All available Nuswifts and Foamites were used with considerable success and when these were exhausted a chain of buckets was formed. Eventually enough undamaged hose was found to rig the Downton and later the F & B pump on the after section of the firemain which was intact.

The fire in the after end of the Forecastle was quickly controlled but that in the Paint shop continued to break out at intervals during the night, at times burning fiercly.

Nuswifts were found to be very efficient but are not of sufficient capacity for a big fire.

Foamites, although efficient, when used where the fire was burning fiercly were inclined to splash and burn personnel.

There was very little smoke and the smoke apparatus was not used.

No time was wasted on the Calcium charges in the Gunners' Store; the compartment was shut down and left.

Flooding:

Bulkheads were examined and the extent of the damage flooding ascertained. The only compartment making water was No.2 Boiler room and this was through splinter holes in the bulkhead between No.1 & 2 Boiler rooms. These holes were plugged with wooden plugs. The bulkhead was damaged between the peace tanks and water was making its way through but, owing to inaccessibility and darkness, this was not discovered until after arrival in harbour. This ingress of water into No.2 Boiler room was just kept under control by the combined efforts of the ejectors and the F & B pump. When steam failed owing to lack of feed water the flooding and free water in No.2 Boiler room caused the ship to roll sluggishly with a list of about 15° to starboard. Counter flooding was not resorted to but everything possible was jettisoned from the Upper Deck. During this period, the water in the Boiler room rose to about the top of the lower drums of the boilers. When steam was once more raised the water was checked and eventually reduced.

/to below

to below the deck plates. It was afterwards found possible to occasionally spare the F & B pump for a few moments at a time on the fire in the Paint shop.

Consideration was given to cutting away the broken mast to reduce the top weight but this was abandoned owing to the danger of the tangled rigging getting round the propellers.

Conclusions:

1. Without steam the ship would not have remained afloat. A diesel dynamo in conjuction with the non-submersible pump being supplied would have kept her afloat and fit fortowing if no steam had been available.

2. Innumerable splinter holes stress the need for a supply of literally hundreds of wood plugs from 1" to 6" diameter.

3. More Foamites and Nuswifts can be accommodated in various parts of of a Destroyer. The firemain systems are very vulnerable and any portable form of fire extinguishing appliance which can be easily transported from an undamaged area to the scene of the fire is a valuable addition to a fixed system which, when damaged by shell fire, is rendered useless.