USS Manchuria (ID). Ships Engineering Instructional Notebook, 1919.
George Fox Corse I, USNRF, Ensign.

WHL/FWV

OVERSEAS CRUISE.

Daily Notebook Work Only.
For watch directions see rest of Cruise Instruction Sheets.

COAL BURNER

Week "K" ---- Fire Room Operation.

FIRST DAY:

A. General Information:

Name of ship	Type Engine
Type	No. of propellors
Tonnage	Approx. H.P.
Speed	Fuel used.
Length	Type boiler.
Beam	

1. Make a plan view of the ship showing location of fire rooms, engine rooms, feed tanks, ballast tanks, bunkers and shaft alleys. Keep proper proportions throughout. Do not indicate machinery in compartments.

2. Make separate sketches for each pipe line shown below for the entire ship in a similar manner to previous assignments. Note that as mentioned in cruise instructions these pipe lines should have been traced before leaving port. However, these sketches should be completed and entered under this day's work:

(a) Main feed.
(b) Auxiliary feed.
(c) Main steam and exhaust.

3. Repeat for

(a) Auxiliary steam.
(b) Auxiliary exhaust.

4. Make a classified list of all machinery in both fire and engine rooms.

5. Of what material is each of above lines in items #2 and #3 made, and why is this particular material used? Discuss fully the adaptability of any other material for this work under the conditions found on your ship.

Answer this question

Overseas Cruise
4 Week - Fire Room Operation

First Day

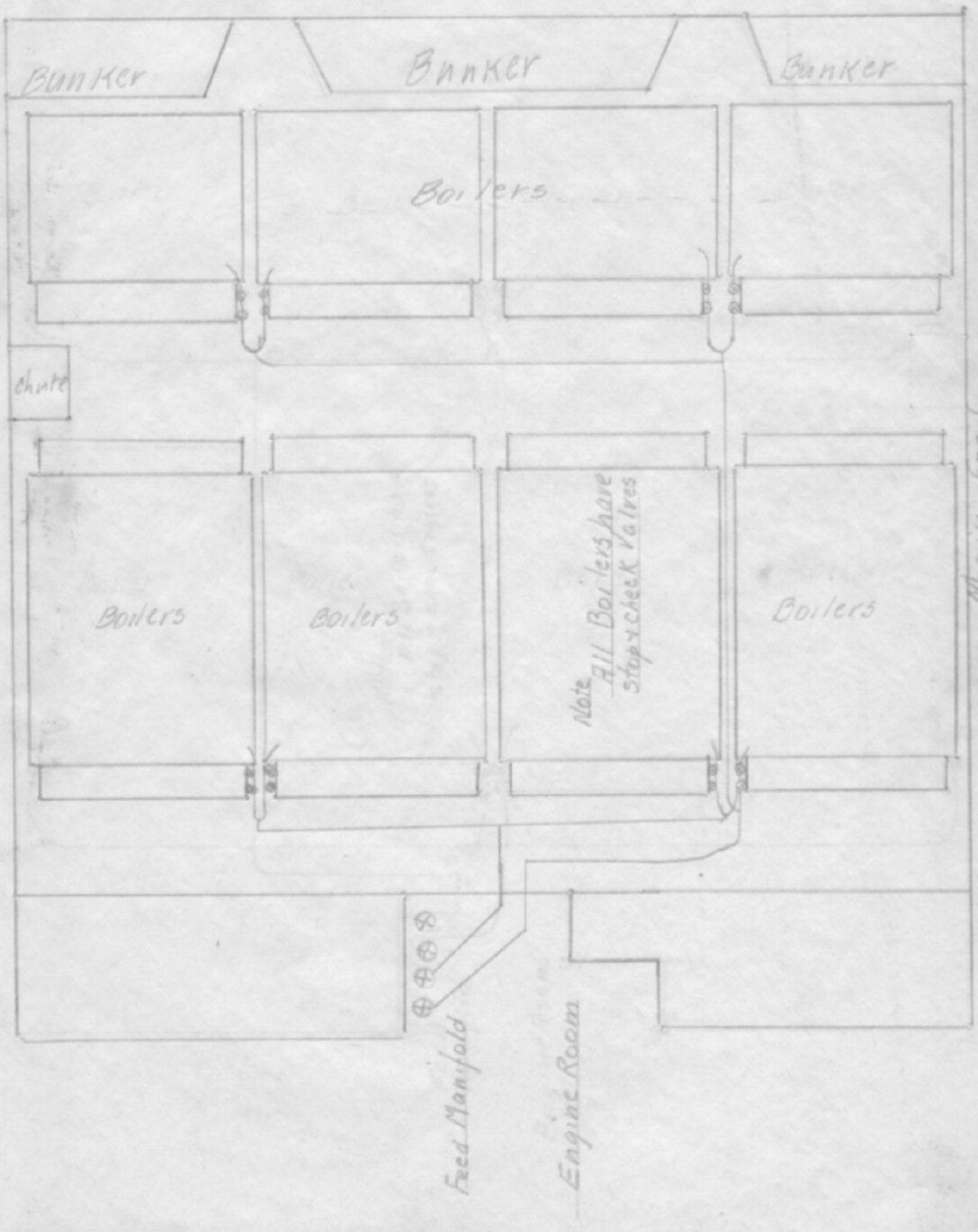
A. General Information

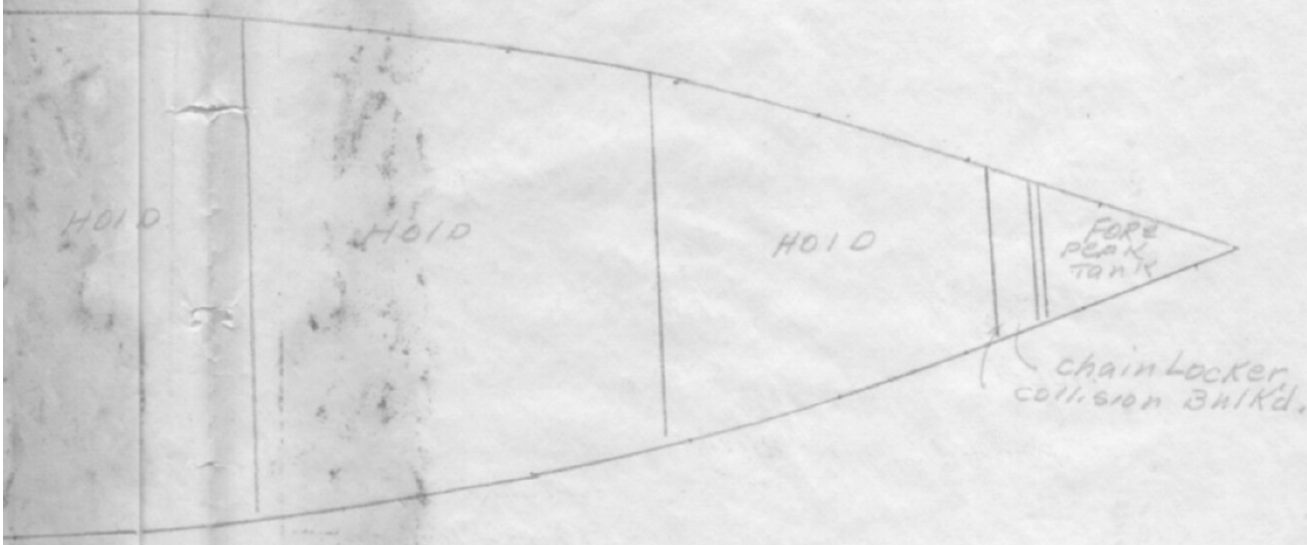
1. Name of Ship ----- U.S.S. Manchuria
2. Type - Originally for freight alone. However remodeled to accomodate passengers too. At present time is used as a cargo and troop transport liner.
3. Tonnage 13,650
4. Speed --- 15 Knots.
5. Length --- 615 feet.
6. Beam ---- 63 "
7. Type engine - Quadruple expansion, twin screw vertical inverted, direct acting, condensing.
8. No. of propellers - Two.
9. Approximate H.P. - 10,000 total.
10. Fuel used - coal.
11. Type boilers - Scotch Marine, coal burning equipped with Howden forced draft. There are four single ended and four double ended boilers.

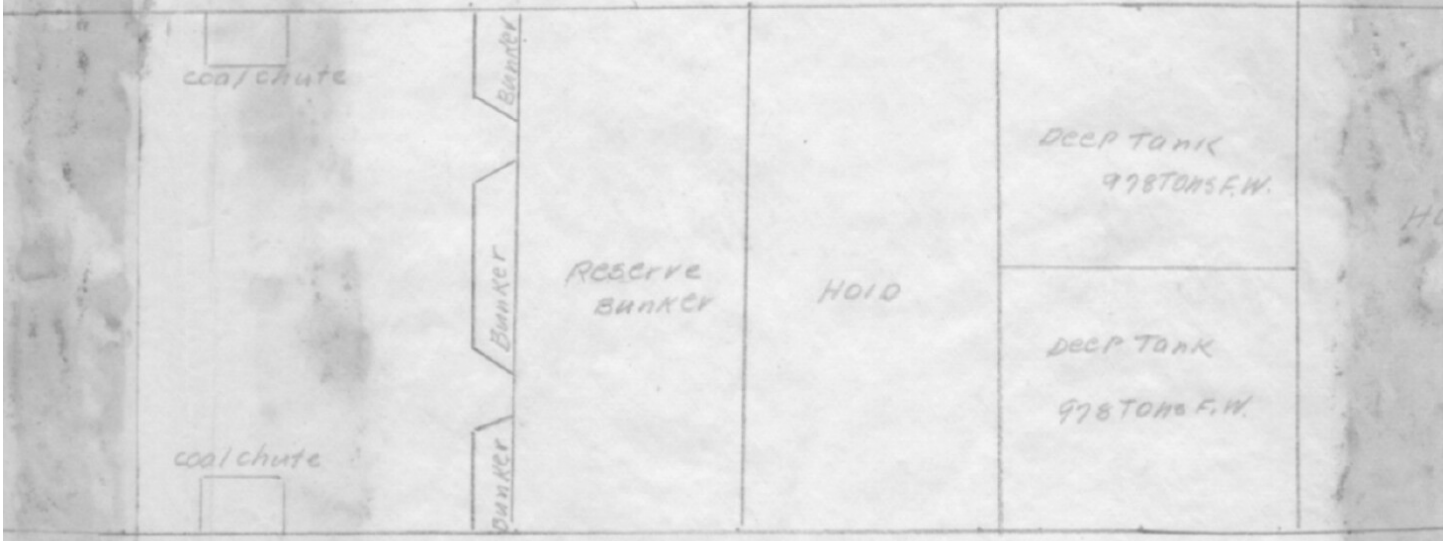
(1) Plan view of ship attached.
(2) (a) Sketch attached
(b) " "
(c) " "
(3) (a) " "
(b) " "


HOLD
FRESH Water
PORT SHAFT
AFTER PEAK TANK
HOLD
STARBOARD SHAFT
HOLD
FRESH Water

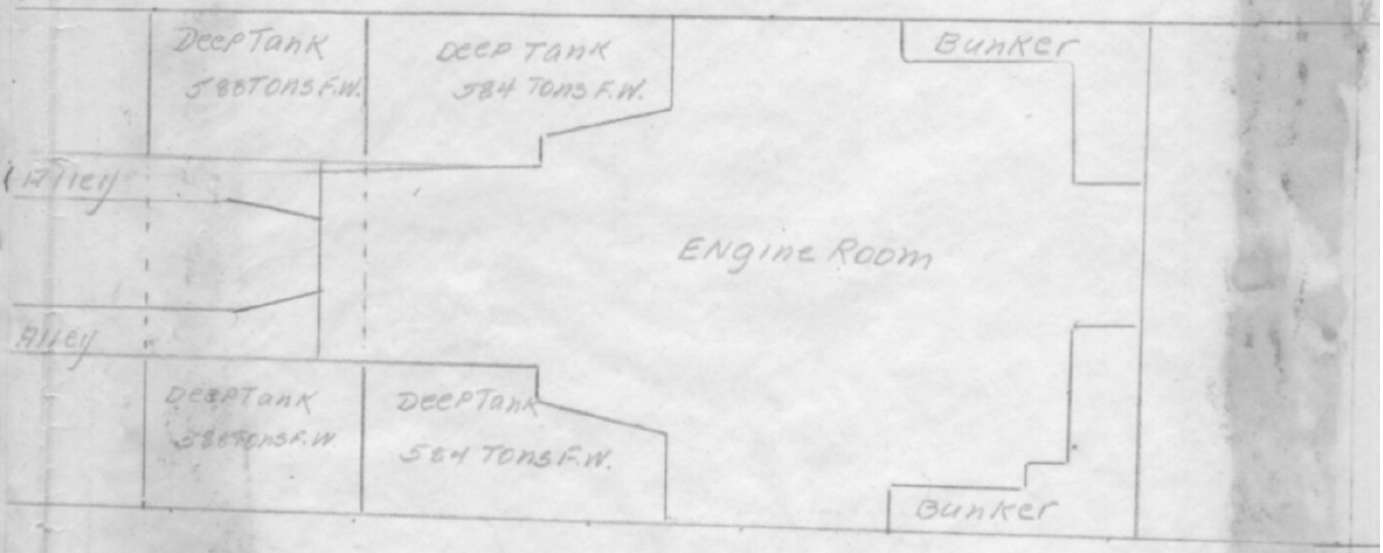
O. F. Carse


Bunker
Bunker
Bunker
Boilers
chute
Boilers
Boilers
Note All Boilers have Stop x Check Valves
Boilers
Main Feed Fire Room Lines
Feed Manifold
Engine Room

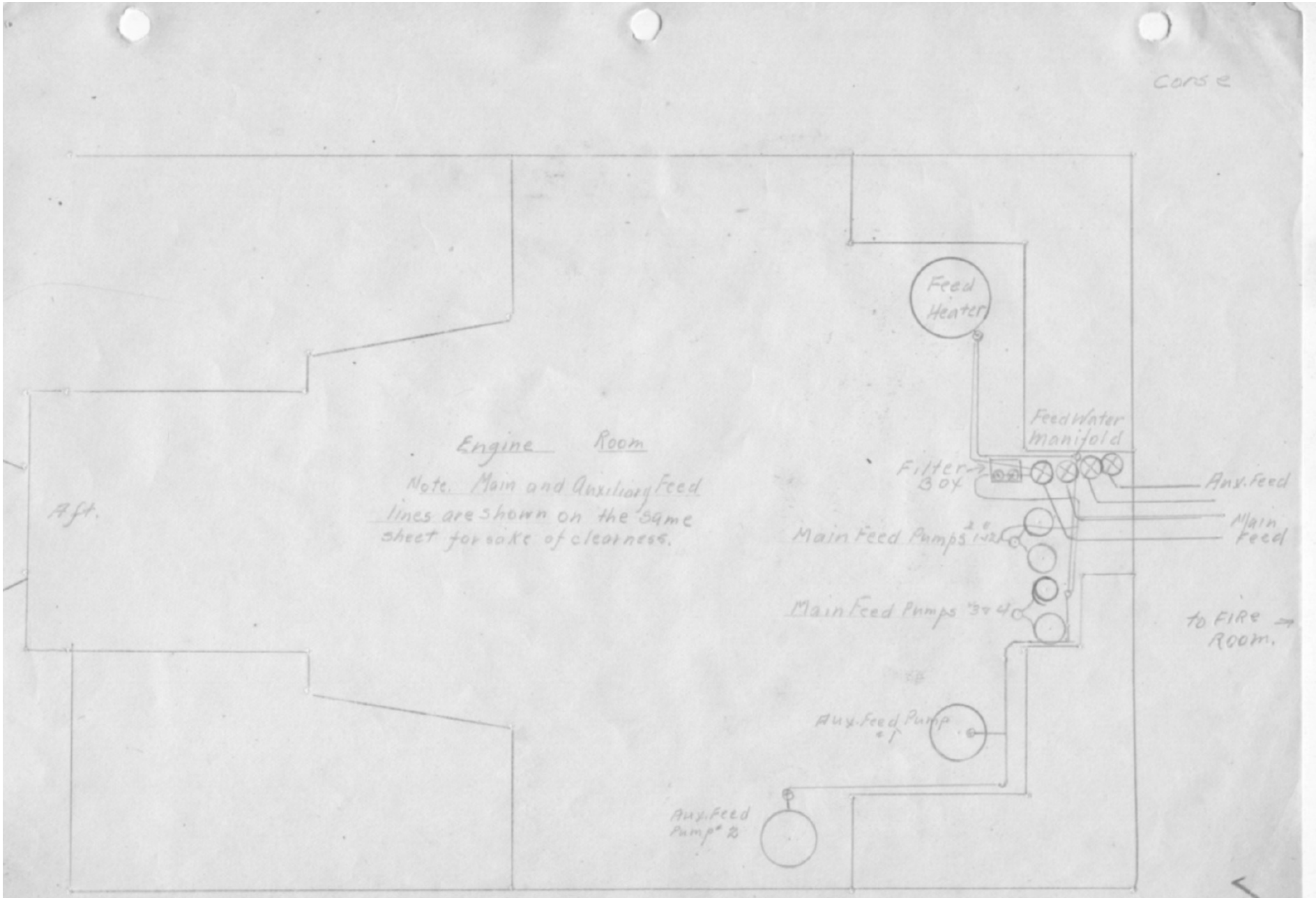

HOLD
HOLD
HOLD
FORE PEAK TANK
chain Locker
collision Bhd.


coal chute
Bunker
Bunker
Bunker
Reserve Bunker
HOLD
Deep Tank 978 Tons F.W.
Deep Tank 978 Tons F.W.
coal chute

PLAN VIEW OF U.S.S. MANCHURIA

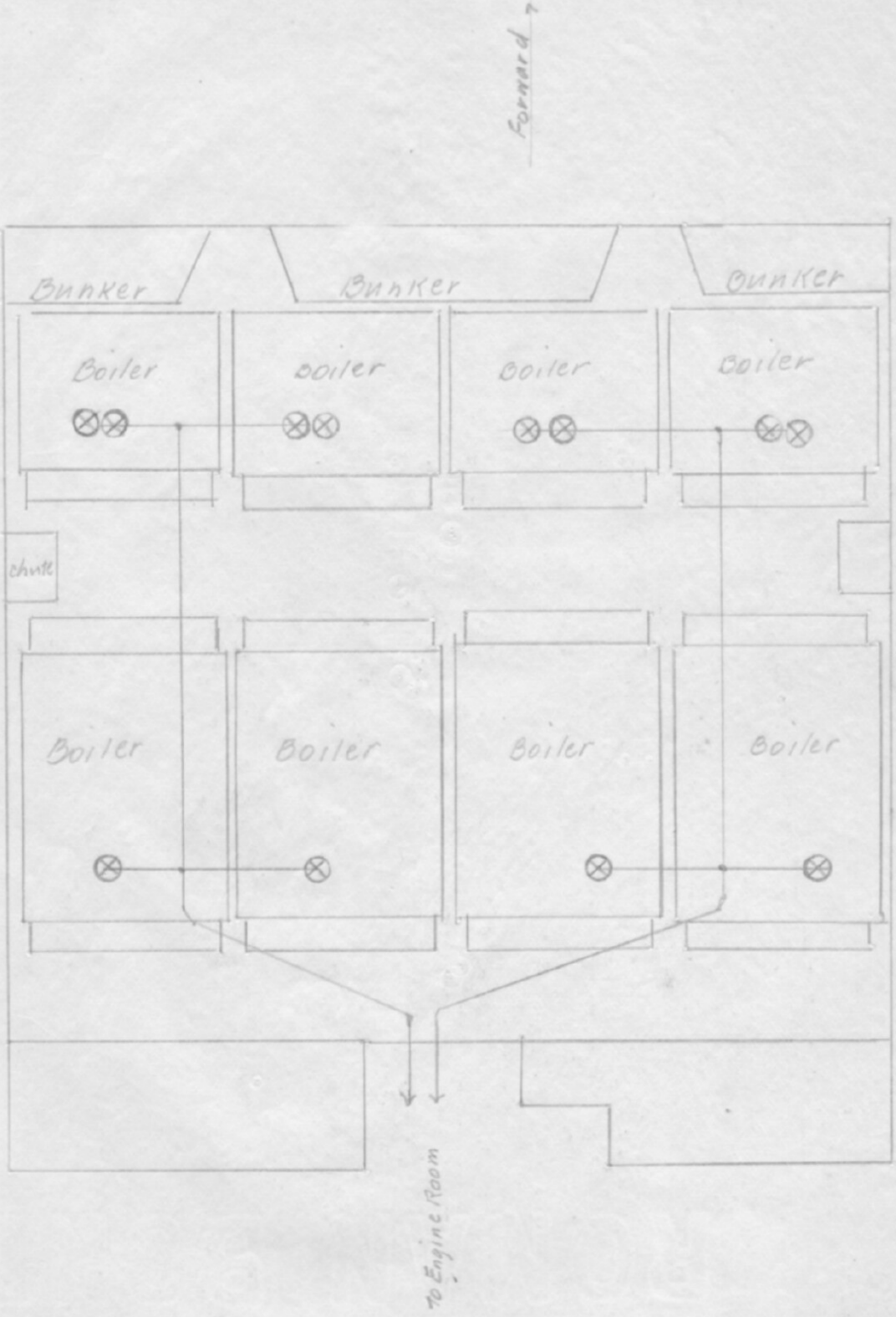


Corse

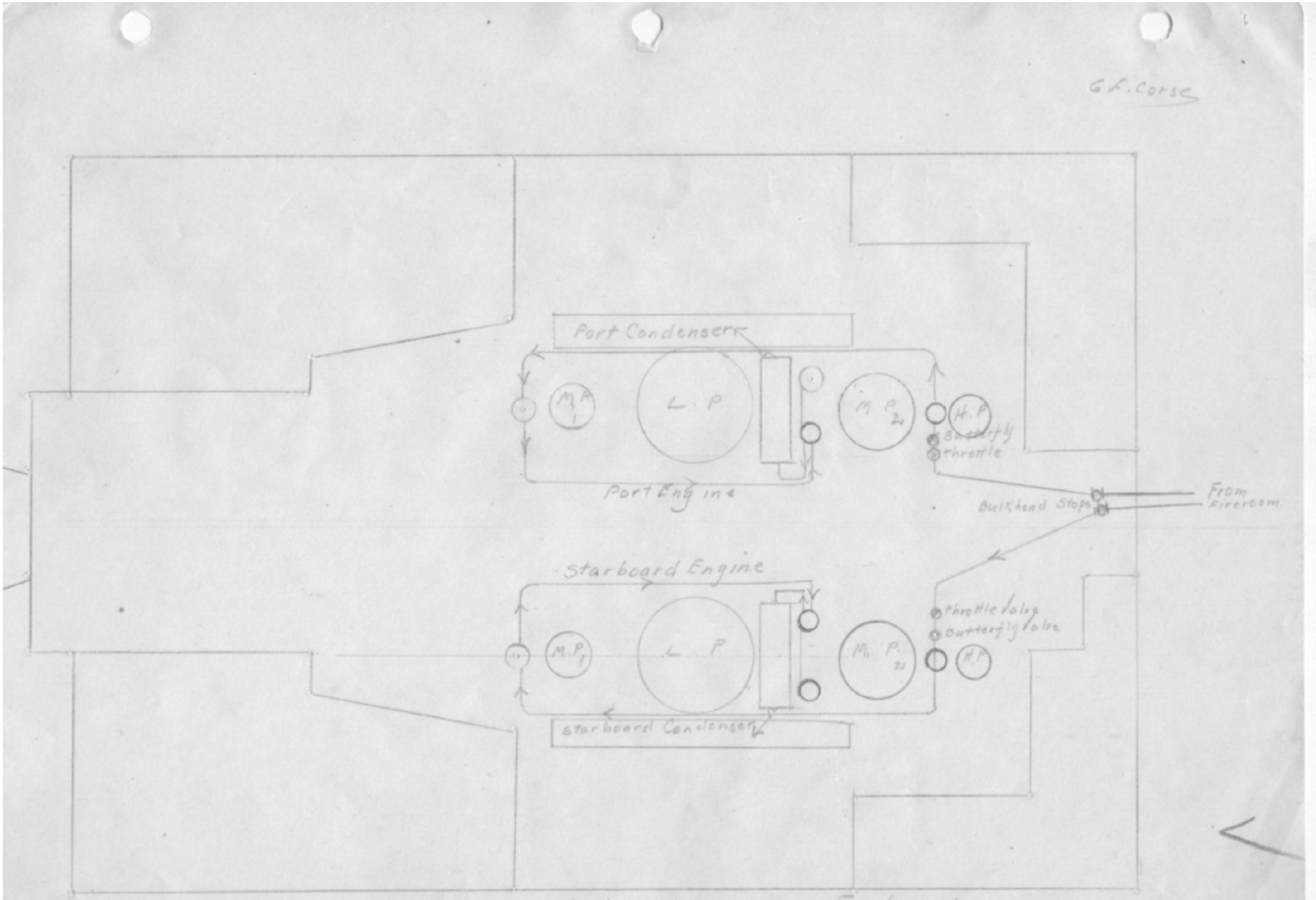


Main And Auxiliary Feed Lines
Engine Room

G.F.Corse

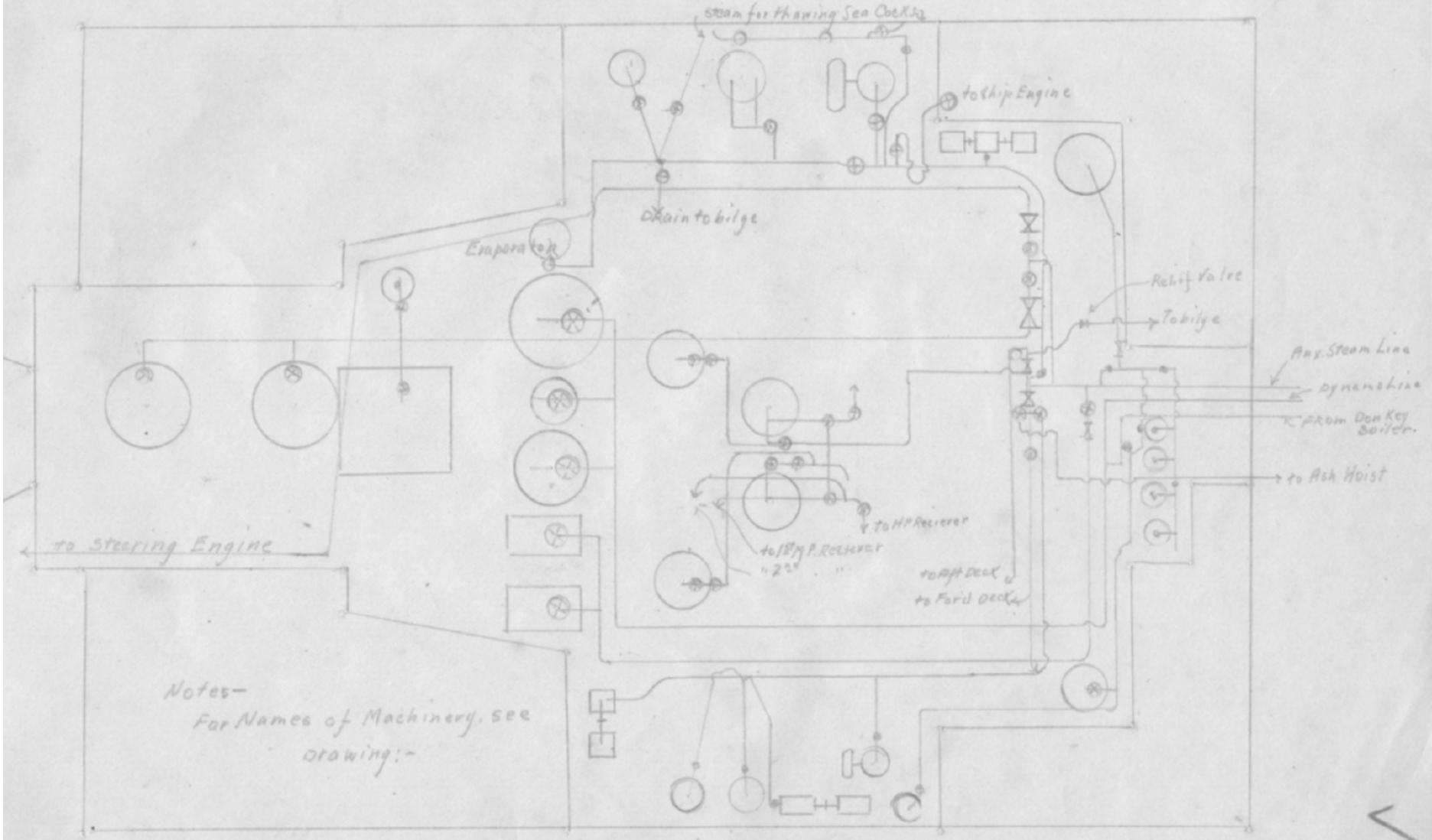

Forward
Bunker
Bunker
Bunker
Boiler
Boiler
Boiler
Boiler
chute
Boiler
Boiler
Boiler
Boiler
To Engine Room
Main Steam
Fire Room Lines

G.F. Corse



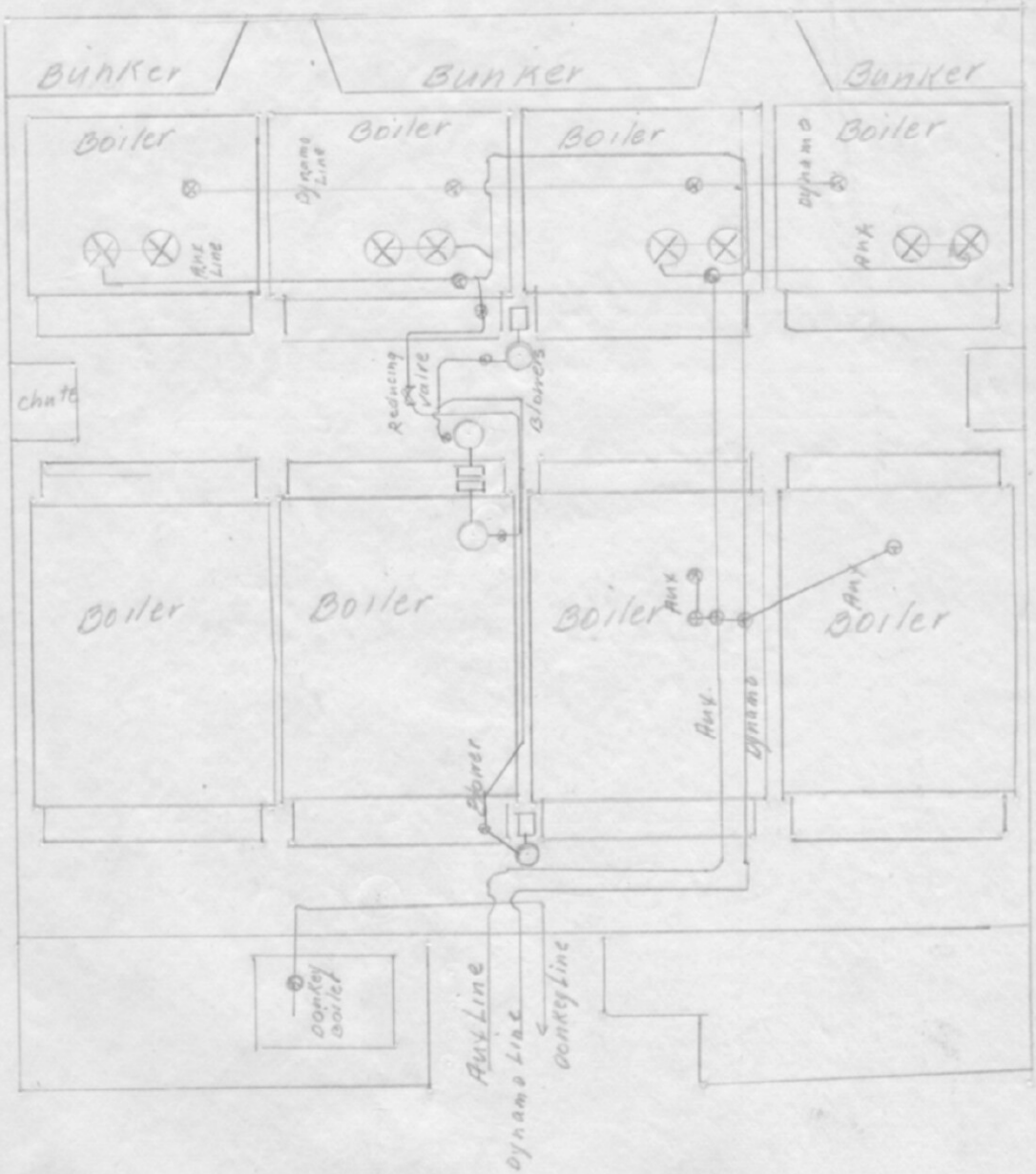
Main Steam and Exhaust
Engine Room Lines
For fire room lines see Sketch.

Corse-

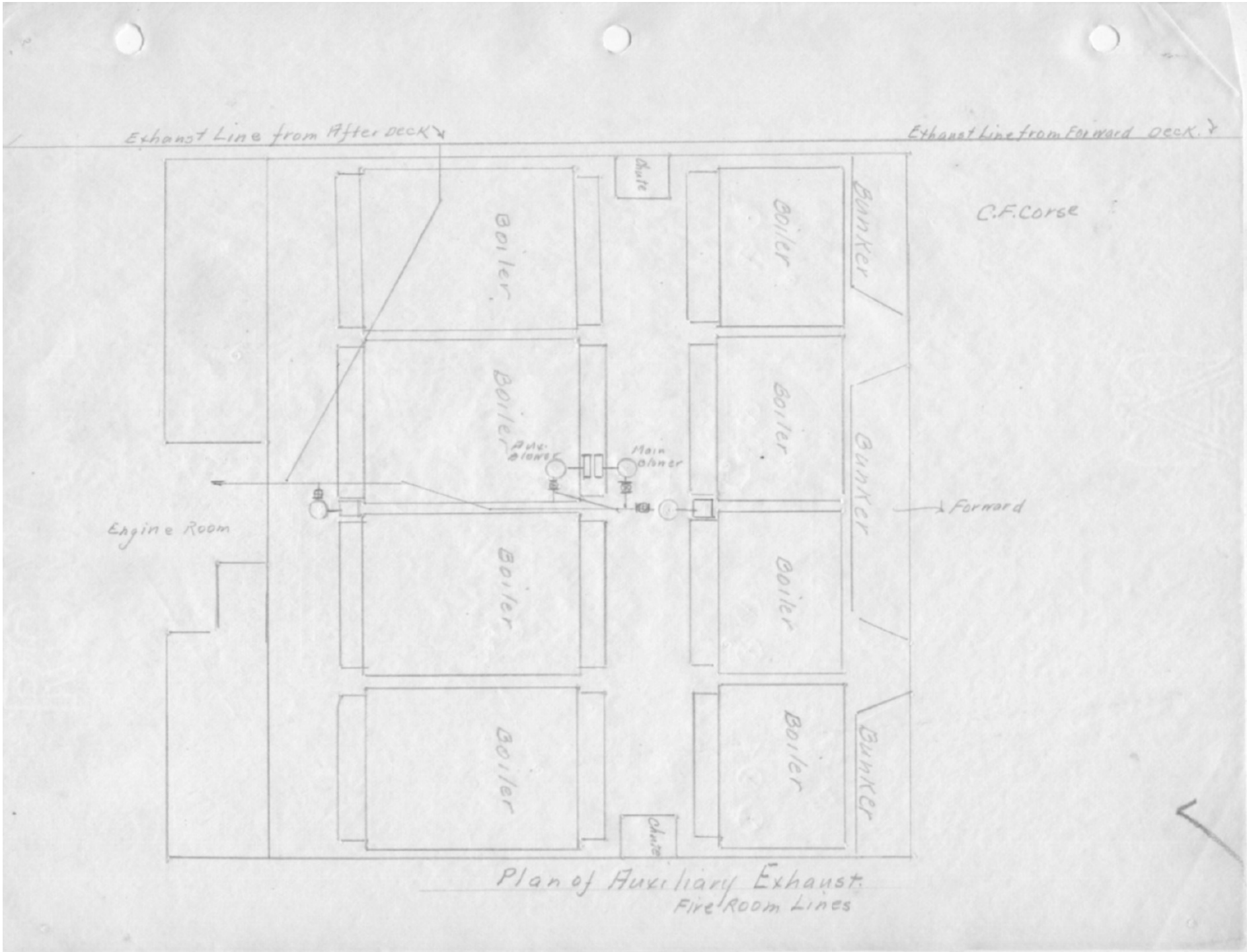


Plan of Auxiliary Steam
Engine Room Lines

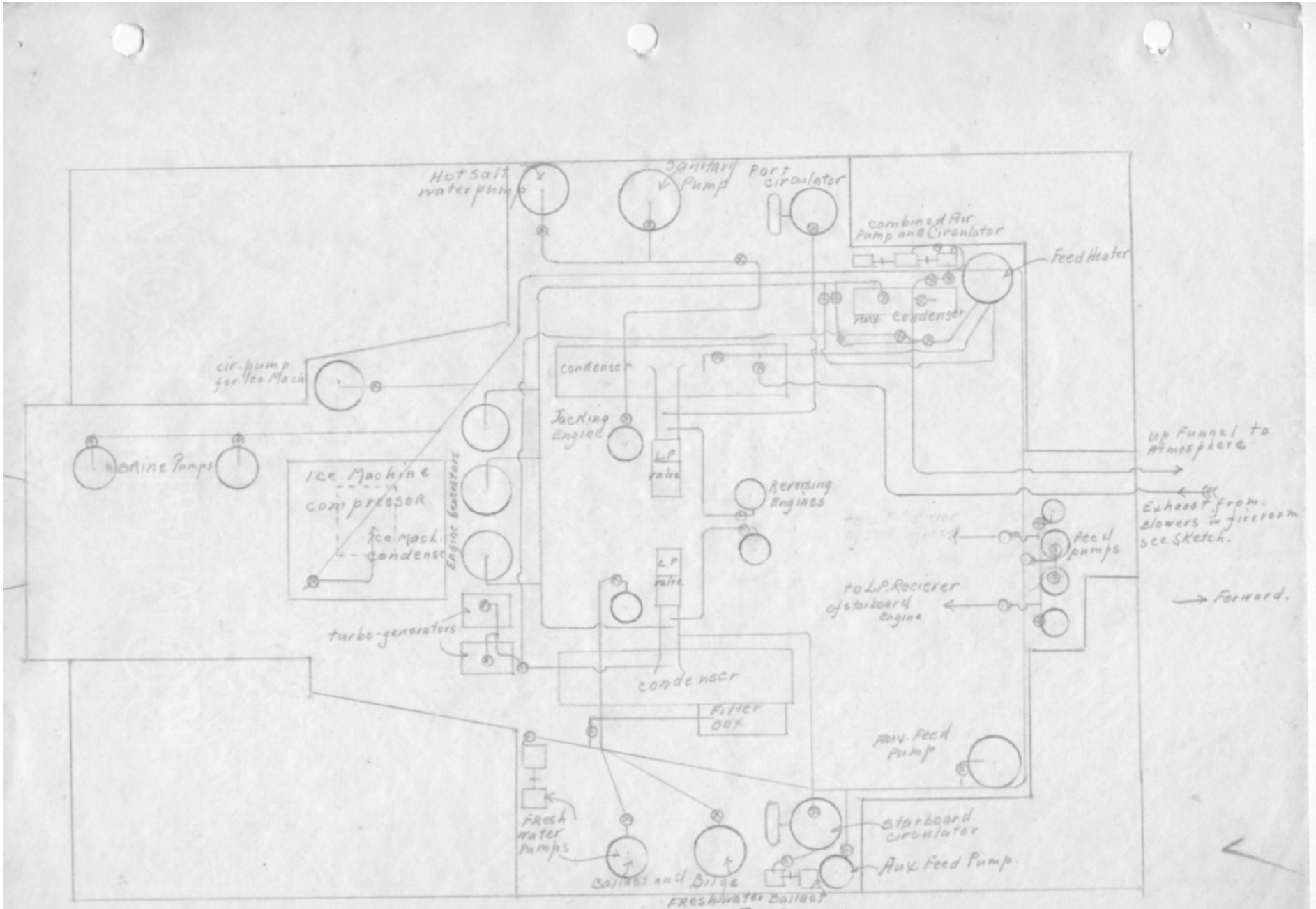
G.F.Corse



Plan of Auxiliary Steam Fire Room Lines



Plan of Auxiliary Exhaust.
Fire Room Lines



Plan of Aux. Exhaust
Engine Room Lines
Fire Room Lines see Sketch.

(11) Classified list of fire and engine room machinery.

1. Port and Starboard main engines
2. " " " " circulators
3. " " " " condensers
4. " " " packing engines
5. " " " link handling engines.
6. Distillers
   - (a) One Paracoil Distiller
   - (b) Two Reilly Distillers
7. Evaporators
   - (a) One Paracoil Evaporator.
   - (b) One Reilly Multicoil Evaporator.
8. Reilly Multicoil feed water heater.
9. Dynamos.
   - (a) Three engine driven D.C. generators
   - (b) Two horizontal direct connected turbo-generators.
10. One six panel switchboard.
11. One squirrel cage fan for dynamos.
12. Four engine driven blowers for boilers.
13. Steam Ash handling device.
14. Main boilers.
   - (a) Four single ended Scotch marine boilers
   - (b) Four double ended Scotch marine boilers
15. One single ended Scotch donkey boiler.
16. Port and Starboard main filter boxes and hotwells.
17. Auxiliary filter box and hotwell.
18. Auxiliary Condenser.
19. Auxiliary circulator and air pumps.
20. One refrigerating system consisting of:-
   - (a) One horizontal cross compound steam driven compressor having two carbon dioxide cylinders.
   - (b) One attached wet air pump.
   - (c) One " circulating pumps for steam and CO_2 condensers.
   - (d) One attached dry air pumps.
   - (e) One steam condenser, built-in type.
   - (f) One CO_2 condenser, built-in type.

(g) Two vertical duplex brine pumps.
(h) One CO_2 evaporator.
(i) Two oil separators.
(j) Two expansion valves.

(21) Steam separators, steam traps, reducing expansion, check, and gate & globe valves.

(22) One fuel water oil separator.

(23) Pumps as listed below.
(a) Crank pit pump.
(b) Hot salt water pumps.
(c) Sanitary pumps.
(d) Four main fuel pumps.
(e) Two auxiliary fuel pumps.
(f) Fresh water ballast pumps.
(g) Ballast and bilge pumps.
(h) Two fresh water pumps.
(i) Auxiliary condenser air and circulating pumps.
(j) Evaporator pumps.
(k) Auxiliary air pumps, independent beam type.
(l) Two attached beam bilge pumps.
(m) " " " air " .

Second Day: Week "K". C

1. Explain operation of trimming bunkers when coaling and steaming.

2. Describe method used in getting coal to the fireroom floor and to boilers.

3. Describe all fittings such as water tight doors on bunkers. Give their location. Include apparatus for fire protection.

4. Criticize the method of handling coal. How would you improve the process?

5. How is data for the noon coal report obtained?

6. What duties are required of firemen and coal passers?

7. What precautions are observed in going into a bunker, and how do they compare with those required by regulations?

Second Day.

① When the ship is being coaled, a number of coal passers are stationed inside the coal bunkers in order to evenly distribute the coal as it comes in from the barges.

Shovels are used to distribute the coal so that all corners are taken care of and filled, and thus the largest possible amount of coal is stored in each bunker.

During steaming the bunkers are trimmed only when it is necessary to estimate the quantity of coal remaining in them.

This process consists in merely leveling the surface of the coal with a shovel.

② On account of the forward fire room having its forward bunkers on a level with the fire room floor, no assistance is necessary to remove the coal to the floor.

At each side of this fire room however there are bunkers at some distance above the fireroom floor. The coal from these bunkers runs down through a chute and through a door onto the fire room floor.

The same sort of arrangement is used in the after fire room.

At the beginning of each watch a few coal passers are sent up into these four bunkers to move enough coal over above the coal chutes to last for the entire period of the oncoming watch.

Wheelbarrows are used to carry the coal from the forward bunkers to the boilers. The identical method is used to move the coal from the piles in front of the chute doors to the boilers.

(3) The only bunkers that are provided with water tight doors are the two in the after fire room. These two are equipped with vertical sliding doors that cover the chute openings. Each door has a vertical rack which is driven by a vertical worm.

This worm is capable of operation either from the fire room floor or from the third fire room grating.

There is no fire protection of any sort in connection with the coal bunkers.

(4) As has already been stated the coal has to be carried from the bunkers and the chutes to the boilers in wheel barrows. With the existing equipment no improvement is possible.

However it would be very desirable to install chutes from the bunkers to the centers of both fire rooms. These chutes could then used for the inboard boilers, while the present chutes could still be used for the outboard units. By this way the slow and tedious wheel barrow system could largely be eliminated.

(5) The daily coal report is compiled at midnight along with the other data for the preceding twenty four hours.

The coal used is measured in barrows and the chief water tender reports hourly to the bridge and to the engine room the number of barrows used during the preceding hour.

At midnight these hourly reports are added up and the sum is recorded.

(6) The fireman's duties are:-

(a) To shovel coal into the fires.
(b) To work the fires with the hoe and slice bar, and break up the clinkers with the grate picker when necessary.
(c) To clean the fires.

The coal passers' duties are:-

(a) To pass coal from the bunkers to the boilers
(b) To keep the chutes filled with coal.
(c) To clean ash pans.
(d) To shovel ashes into buckets, raise them with steam ash handling device, and throw them overboard.

(7) There are no precautions observed whatsoever in entering the coal bunkers.

Navy Regulations provide that a test shall be made for explosive and poisonous gases before any man is allowed to enter a bunker.

This is only one of a long list of regulations that are not carried out on this ship.

Third Day: Week "K". C

(Tools)

1. Make a list and give function of all firing tools used by the fireman.

2. Describe fully how coal is actually fired in one boiler, including rotation of events and make any suggestions as to how the method of firing may be improved.

3. Describe how the slice bar is used aboard your ship. Make any suggestions you might have observed as to its use.

4. Discuss the condition of the fires from the viewpoint of the engineer officer on duty.

5. Make out a complete fireman's watch bill, telling the extent of the duties of each man.

6. How would you replace a fallen grate bar?

7. Is the time firing device used? If not, explain and discuss the system used.

8. Upon what factors does the fireroom space between boilers and bulkhead or boiler fronts depend?

9. How many shovelsfull of coal are used each time? How is the numberdetermined.

10. If when steaming at close to popping off pressure, a sudden order to stop is not transmitted to fireroom until safety valves are about to lift, describe a good method of checking fires.

third Day: TOOLS

① Firing tool's functions.

the shovel — ⓐ. The shovel is probably the most used and most important of the firing tools. It is used to feed the coal to the fires, to clean the fire-room floor of ashes, to fill the wheel-barrows when passing coal, to throw the ashes near the ash hoist and to place the ashes into the hoisting bucket.

the grate pricker — ⓑ The grate pricker is used under the grate to break up the clinkers that form between the bars.

ⓒ The slice bar is used to break up the clinkers, stir up the fire, and raise the coals so as to allow more space for the air to get through the fuel bed.

grate bar replacer — ⓓ. The grate bar replacer is used in inserting new grate bars.

working hoe — ⓔ The working hoe is used to pull out the ashes after one side of the fire has been hurriged over.

ash pan hoe — ⓕ The ash pan hoe is used to pull the ashes out of the ash pan after the fire has been cleaned.

② Method of firing one boiler

In firing any one boiler an attempt is made to have equal intervals between the times of coaling the three furnaces. This is desirable because the steam pressure would drop if all furnaces were fired in quick succession.

The average charge per furnace is about twelve shovels full of coal.

After four or five minutes have elapsed, the door is opened and the coal is worked up and down with the slice bar. The door is then closed

and after an interval of several minutes it is opened and the working hoe is used.

In abnt five or ten minutes a new charge of coal is put in. This is in general the procedure in any one furnace. However it is varied slightly according to the condition of the fires and the steam pressure.

The average time interval between charges to any one furnace is from 10 minutes. This interval is much longer when in port or when standing by.

In regards to improvements as to the method of firing, I would suggest that the coking system should be more ridigly adhered to. At present some few of the firemen do not use it to a slight degree, while on the other hand some of the firemen use the coke spread system.

Although the coking system is more economical, the fact remains that it has been found impossible to make over 72 R.P.M. with this particular system of firing. The coke spread however has produced as high as 80 R.P.M. and averages 75 R.P.M.

Since the ship is now engaged in work when speed is very necessary and economy of secondary importance, the coke spread system cannot be criticized.

However when the ships were engaged in ordinary freight or passenger service, where economy is a feature, they then I would suggest that the coking system be ridigly adhered to.

A second criticism involves the firing interval. This seems unusually long and it is possible that greater economy would be effected by reducing the average interval to about five or six minutes.

Such a change would increase the efficiency of combustion,

but the loss due to opening the furnace doors would be increased.

The only sure method to determine the net effect on economy would be to run a careful test on one boiler for a period I say forty eight hours, using a long interval and then repeat the test for a short interval. A comparism of results would settle the question.

Such a test as the above should be run and it might result in a great saving in the use of the ships fuel.

Efficiency tests however are not in line with the beliefs of the old engineers to be found in the merchant marine service.

③ First the slice bar is inserted under the fire along one side until the point reaches the rear end of the furnace.

Then, using the dead plate as a fulcrum, the fireman pushes down on the handle, thus raising the point of the bar and lifting the coals.

He then withdraws the bar a foot or so and lifts the coals again.

This is continued until the bar is entirely out of the furnace.

The process is then repeated on the other side of the furnace and again in the center.

The chief precaution that should be observed in using the slice bar, is to bear down on the handle and not bear up, because the latter method will work only the front of the fire and leave the back untouched.

(4) At the time the fires were inspected by me their condition was altogether satisfactory from the view point of the engineer officer on duty.

Forced draft was being used and the fires were being carried from ten to twelve inches thick.

The watch, which had been on duty for three hours, was by far the best of the three since they easily maintained 215 to 220 pounds pressure.

Whereas the other watches had difficulty in keeping the gage at 210 pds.

At the time of inspection the gage read 217 pounds, and it had become necessary to increase the firing interval to about 25 minutes in order to prevent the safety valves from blowing off.

The engines were turning 78 R.P.M. which is a little more than usual.

In brief the conditions of the fires were very good from the view of the engineer officer.

⑤ Watch bill for fire room.

First Section

Name of man	Rating	Duty.
"	CWT	In charge of boilers
"	WT	tend water in forward fire room.
"	WT	" " " " " "
"	WT	" " " after " "
"	F_2	Forward fire room
"	F_2	" " "
"	F_2	" " "
"	F_2	" " "
"	F_2	" " "
"	F_1	" " "
"	F_1	" " "
"	F_1	" " "
"	F_1	after fire room.
"	F_2	" " "
"	F_1	" " "
"	F_1	" " "
"	F_3	For. fireroom to pass coal.
"	F_2	" " " " " "
"	F_2	" " " " " "
"	F_2	" " " " " "
"	F_2	" " " " " "
"	F_2	" " " " " "
"	F_3	Aft " " " " "
"	F_2	" " " " " "
"	F_2	" " " " " "

Second Section - same as first
third " - " " "

The firemens and coal passers duties have already been explained.

The chief water tender has general charge of the fire room and he is responsible for maintaining the pressure at its proper figure. He looks after the work of the water tenders. He also selects which fires will be cleaned and denotes the time.

The water tenders are responsible for the water level in their respective boilers.

(6) To replace a grate bar, the fire must be winged over to the other side of the grate and a new grate bar run in, until it rests on the bars adjacent to the fallen one.

Then with a replacing tool, grasp the grate bar and turn it up on edge allowing it to drop into the vacant space and onto the bearer bars.

Then adjust the position of the bar until it is correct and any tool that is handy may be used for this final adjustment.

(7) There is no time firing device installed on this ship and there is no time system used in the firing of the boilers.

The firing is left to the discretion of the firemen. If the pressure is high the firing takes place at long intervals, while if it is low he fires more frequently.

The time firing system would be preferable and should be installed.

(8)

The fireroom space between the boilers and bulkheads must be sufficient to permit proper working of the fires.

It is evident that this requires a few feet more than the length of the furnace.

(d) The number of shovelfull of coal fired at one time varies from five to twenty but averages about 12.

If the fires are thick and the pressure is high, a small charge would be used.

This would also be true when the ship was standing by. If however the fire was thin and the pressure was low, the fire would be built up by frequent charges of average size.

The maximum charge is used when it is desired to check the generation of steam for a few minutes only, as when a sudden order to stop is given and it is anticipated that the engines will be started soon.

A good example of this situation is the taking in of the floating mine protection apparatus, which is now being used aboard the N.S.S. Manchuria.

(e) There are several ways to check the fires under such a situation.

The fires may be heavily charged in the situation mentioned in question d.

The draft may be shut off by closing the butterfly valves in the funnel front.

If this is done, the ash pit doors may be opened for natural draft, or if no draft is desired the ash pit doors may be kept closed.

Another way of checking combustion is to open the fire doors, but this is prohibited on the Manchuria by reason of the great waste of heat.

An excellent method of checking is to increase the boiler feed, but there is a limit

to this method on account of the limited size of the hotbed.

Any or all of the above means may be employed to check combustion; In general, however, the draft would be reduced and the feed increased.

Fourth Day: Week "K". C

1. Describe in detail the draft system used.

2. Make a sketch of the boiler front and side showing how all boilers are connected to stack.

3. Sketch the uptake system showing how all boilers are connected to stack.

4. What is the procedure in handling dampers and doors at different speeds? How may this procedure be improved in your judgment?

5. How would you test for and repair any air leaks found in boiler casing?

6. What use is made of ash-pit doors for checking combustion?

7. What effect does damper position have on smoke? Is it proper to use uptake dampers? Why?

8. Is there any method of obtaining furnace temperatures? Where would you install a device for finding combustion temperatures?

Week K. K.

Fourth Day.

① Draft system. The draft system used on the Manchuria is the Howden Forced Draft system.

Blowers are located above the boilers, and these blowers force air thru sheet steel ducts down to the boiler front. Here the ducts are connected with two openings near the top of the boiler.

The air enters these openings, and is warmed up considerably by passing over tubes containing the uptake gages. The warm air then travels downward through large ducts on each side of the boiler front, and is admitted through butterfly valves to the ash pit and the furnace.

These valves are readily operated by levers passing through the furnace front.

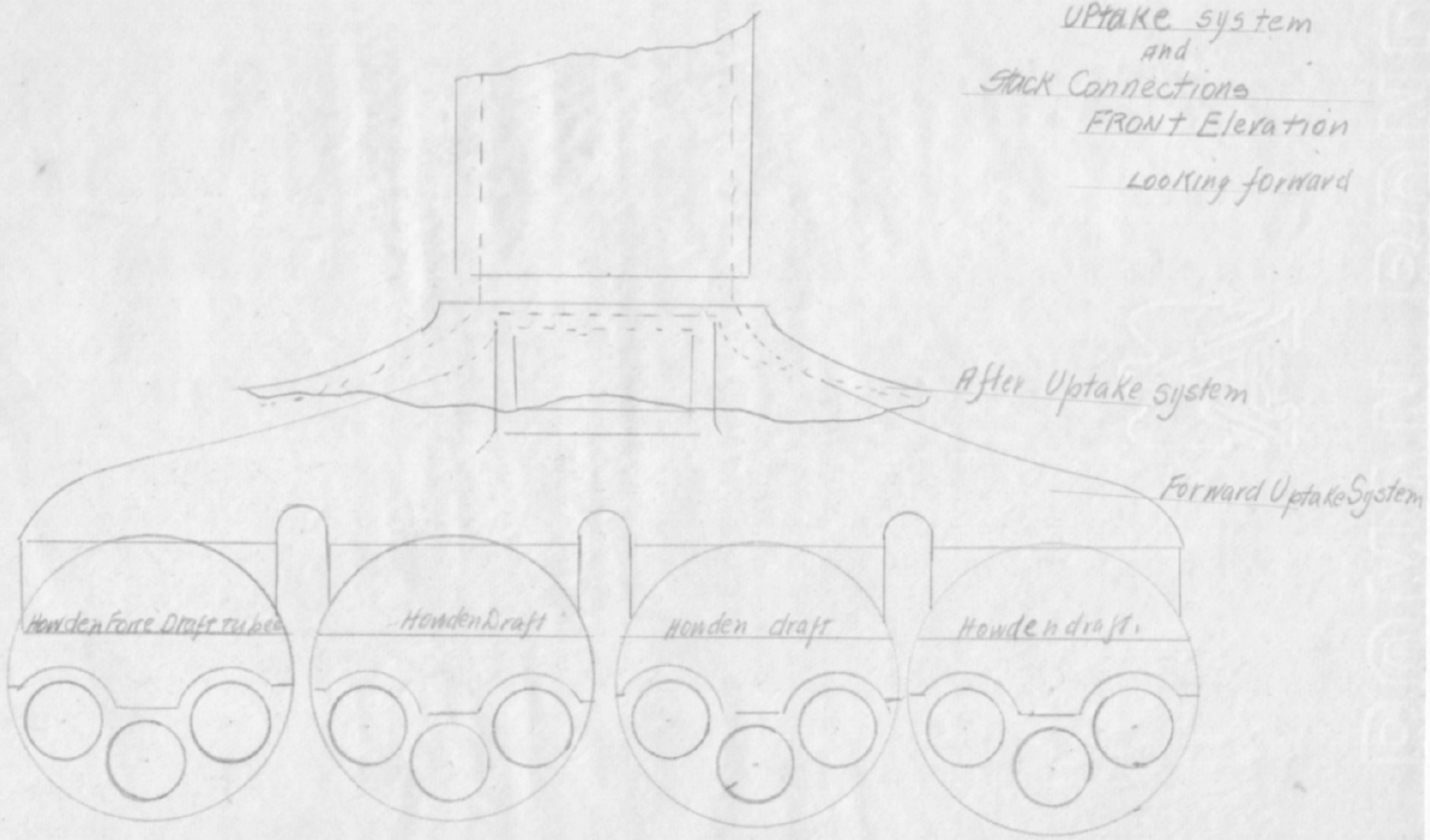
This system uses the open fire room and the closed ash pits.

Before opening the furnace doors, the fireman shoved shut off the air supply in order to prevent the coals from being blown out into his face.

② Front and side view of boiler attached.

③ Sketch is attached.

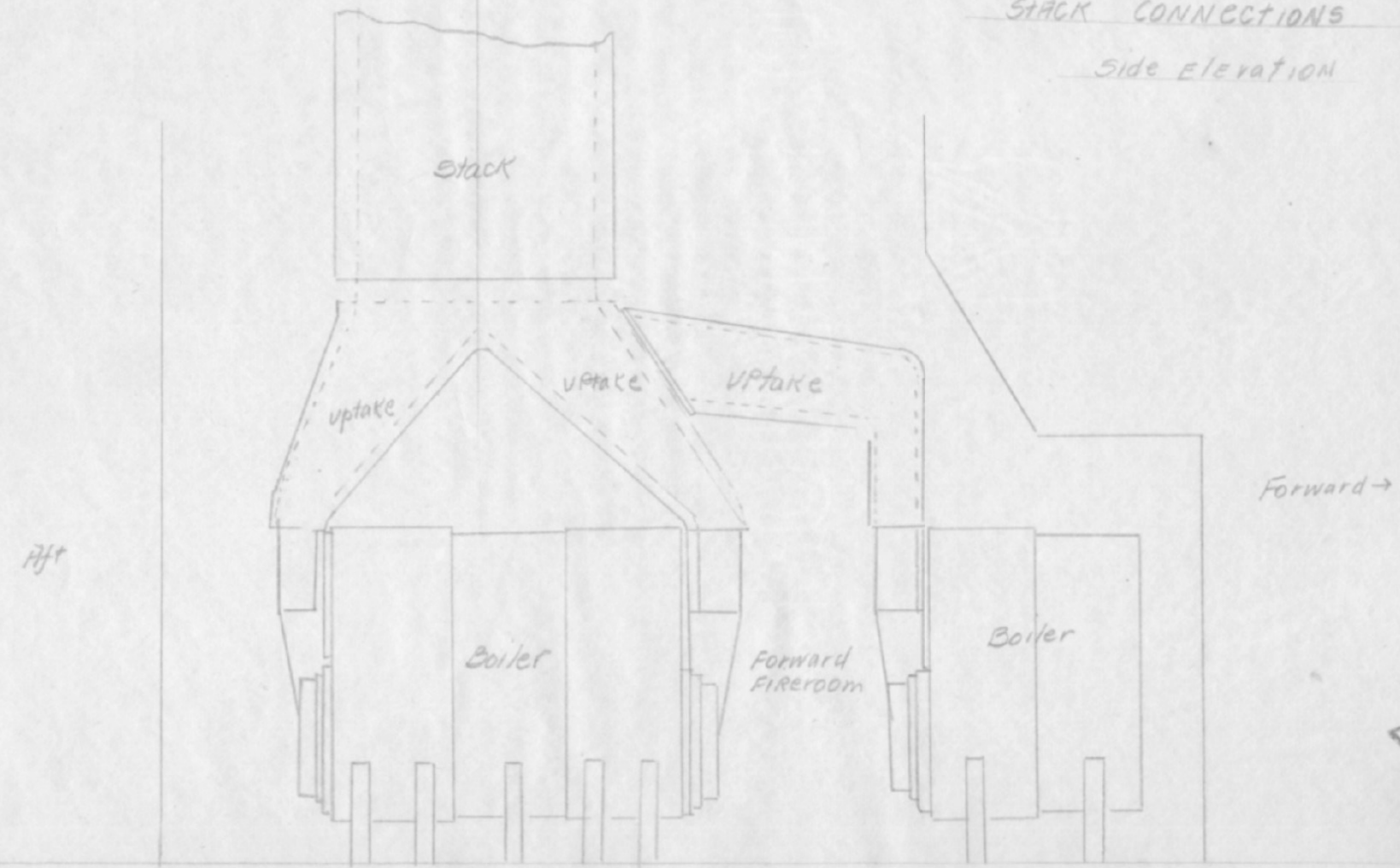
Uptake system
and
Stack Connections
FRONT Elevation
Looking forward



UPTAKE SYSTEM

STACK CONNECTIONS

Side Elevation



④ The Manchuria is not provided with dampers, and the doors are not usually used at any speeds, except when a sudden reduction is required. In this case the firing doors might be opened. The draft is usually controlled entirely by the valves on the Howden draft system.

⑤ Air leaks in the boiler casing are tested by puling along the seams. Escaping hot air may be easily felt by the hand. If it were desired to detect very small leaks a lighted candle could be used. Leaks may be sometimes stopped with manganasite paste, but as a rule they are let alone until port is reached. Then they are repaired by taking the joint apart and putting in a new gasket. Red leaded canvas is used for this purpose.

⑥ As has already been stated above combustion is usually checked by shutting the draft valves. Checking can be effected, however, by merely opening the ash pit doors. This changes the forced draft to natural draft.

⑦ Since there are no dampers it is not possible to observe the effect of damper position on the smoke. The use of uptake dampers when fitted is preferable to the use of a stack damper because the former method allows separate control of each boiler. This is desirable because each boiler may require a different amount of draft because of differences in the condition of the tubes.

⊗ There is no method of obtaining furnace temperatures.

Combustion temperatures could be obtained by installing thermopile pyrometers in the combustion chambers

Fifth Day: Week "K". C

1. Describe in detail the process of cleaning fires on this ship.

2. Sketch any ash handling means used.

3. Describe in detail when, by whom, and how ash pans are cleaned and ashes handled. Discuss ant improvements you would make in the system, giving your reasons.

4. Discuss any system of rotation used for cleaning fires.

5. How much good coal is wasted with ashes? How may this be avoided?

6. While fires are being cleaned, how much does the steam pressure drop and what steps should be taken to prevent a drop of more than 10 pounds?

7. Are any precautions observed in regard to wet ashes against bulkhead?

8. In case of a small hole in the fire, will the grate bar immediately under the hole burn out or not? Give reasons for your answer.

9. What are the indications of a burst tube in a Scotch and a water tube marine boiler and how repaired?

WEEK K

Fifth Day

① Process of cleaning fires.

In a period of about half an hour previous to cleaning the fires, the fireman allows one side to burn down by charging the other side only.

When one side has burned down well and the signal for cleaning is given by the Chief Water Tender the fireman opens the door and if there are still good coals on the burned down side he pushes them over with the working hoe.

He then pulls out the burned down side with the cleaning hoe. As the hot coals fall to the fire room floor they are sprayed with a hose. After one side has been entirely cleaned the fireman wipes all the good coals over on to the clean side and charges this side with green coal.

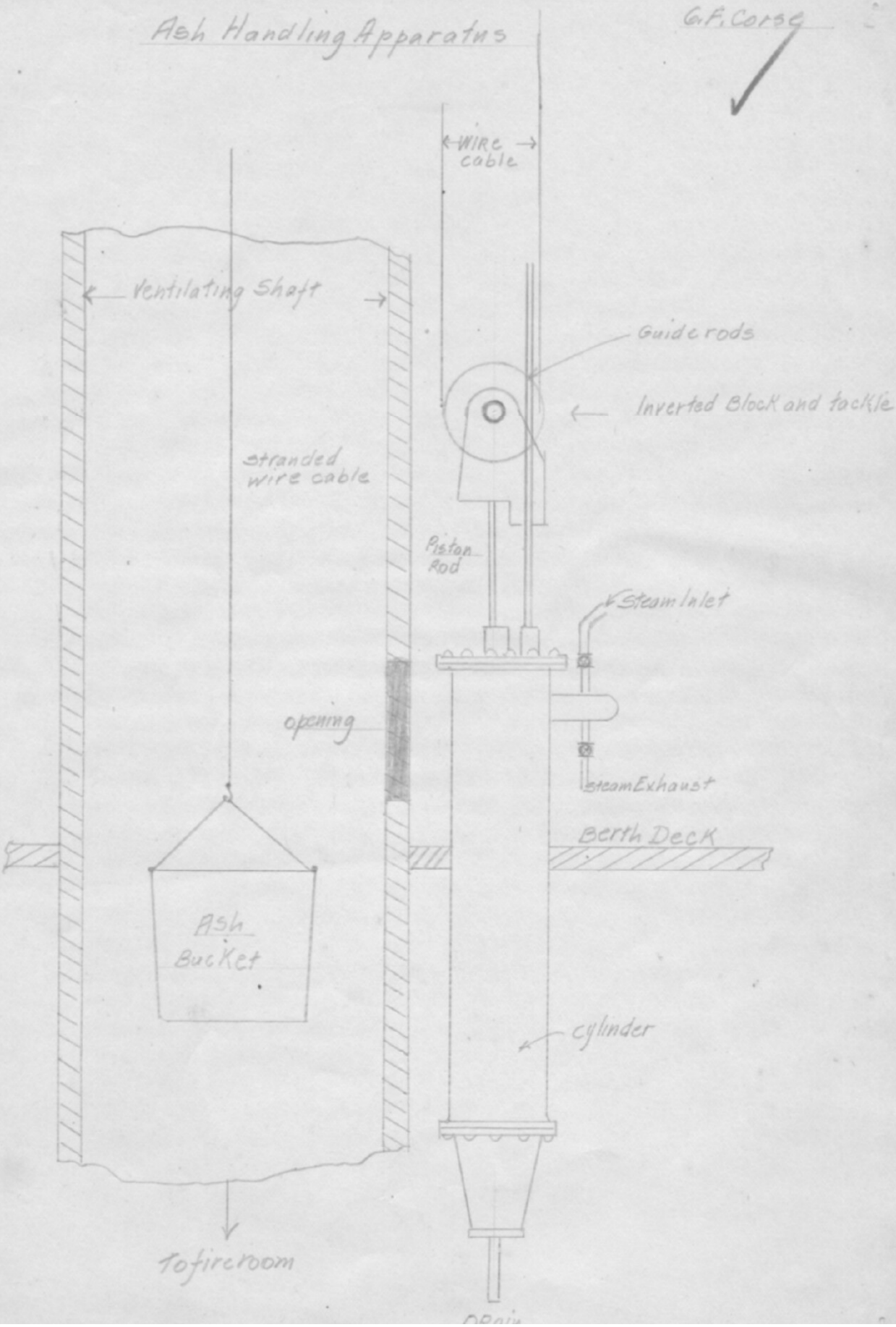
He then closes the door and allows the low side to burn down for a few minutes. When the high side is well built up and the low one is well burned down, the fireman pulls out all the coals on the low side, using the cleaning hoe.

He then wings the good fire over so as to cover the entire grate evenly, puts in a good charge of coal, and closes the doors.

For the next hour this furnace is fired quite frequently, until the fuel bed is of the proper thickness.

Ash Handling Apparatus

G.F. Corse



(2) Sketch of ash handling apparatus is attached.

(3) Immediately after the fires are cleaned the ash pans are cleaned.

The cleaning is actually done by the coal passers, and they handle all the ashes.

The cleaning process consists merely in pulling out all the ashes with an ash pan hoe.

As they fall to the floor they are sprayed with a water hose.

The first step in handling ashes is to shovel them over to the floor space beneath the ventilator. Whenever the ash can comes down, it is filled and hoisted by the ash handling apparatus located in the berth deck.

This is operated by two men, and the cans are carried to the side and dumped overboard. Explain ash handling apparatus more in detail.

Cleaning the fires requires the hoisting of about sixty cans of ashes.

The installation of an ash ejector would be a great improvement.

(4) Each watch cleans one fire per boiler, and any one watch always cleans the same fire. Since there are three watches and three furnaces per boiler, any one fire is cleaned every twelve hours. This system of rotation works out very satisfactorily.

⑤ It is not possible to state how much coal is wasted with the ashes, because there are no facilities for ash analysis aboard, and a chemical analysis cannot be made by sight alone. However the ashes very evidently contain some good coal.

The ammount of good coal wasted depends on the care used in cleaning. To minimize this waste, each side shoud be well burned down before cleaning, and care shoud be exercised in wringing the fire over. This requires good firemen and able instruction.

⑥ If the fires are properly cleaned, the pressure drops only about five pounds. The drop never exceeds ten pounds. To prevent an excessive drop, there shoud be a considerable interval between the times of cleaning the two sides. This allows the fire to be built up and keeps the pressure up. Of course it is also of great importance for the firemen to work fast in order to avoid keeping the doors open any longer than absolutely necessary.

⑦ No precautions are observed in regard to wet ashes against the bulkhead. The Chief water tender fails to see the slightest reason why the shoud dump wet ashes wherever he pleases.

③ A small hole in the fire will not cause the grate bar immediately under the hole to burn out, because this part of the bar will be cooled by the draft around it.

The part most apt to be burned is that part touching the coals at the edge of the hole.

These coals are heated to a high temperature by the unusual draft, and they transmit their heat to the bars on which they rest.

④.

In either a Scotch or a water tube boiler a burst tube causes admission of high pressure steam to the furnace. This will be evident when the firing doors are opened, or if the leak is large, steam will leak around the outside of the doors.

In either case the boiler must be cut out and shut down.

The Scotch boiler is repaired by plugging both ends of the tube.

Each plug is drilled and threaded so that a stay rod can be screwed into it. One plug is screwed on the rod which is then run through the tube.

The other plug is then screwed into the far end of the rod and set up so as to make both plugs tight. When the number of plugs in a Scotch boiler becomes excessive all are removed, and new tubes put in.

In the case of a water tube boiler a new tube must be inserted.

First the old tube is taken out by cutting the ends with an oyster knife and bending them inward.

Then a new tube is inserted, rolled, and expanded.

Sixth Day: Week "K". 0

1. Describe the feed pump as fitted.

2. Make a cross section sketch of the injector as fitted. When would it be used and how cut in?

3. In case the main feed check should stick, describe the exact sequence of action you would employ to maintain boiler feed.

4. Does pump hold pressure constant throughout stroke? What would you do to remedy this if it did not?

5. Describe how a gasket is made and installed in the inner head of water end of feed pump.

6. What kind of packing is used in all parts of feed pump, and why?

7. Discuss the suitability of any system of automatic feed control for this ship.

8. What is cause of feed pump getting hot? How does it affect operation?

9. Discuss the advisability of using strainers on a feed line.

10. Make a pipe line sketch of the fire mains for entire ship.

Week K.

Sixth Day

There are four main fuel pumps. Each is of the vertical, direct acting, simplex type. The dimensions are ??
The steam end has the Worthington type of simplex valve gear with the auxiliary piston moving at right angles to the main valve. The water end has two vertical cylindrical valve rests having bronze heads.
These pumps are unusually satisfactory. Their operation is very smooth and their capacity is quite ample.
One pump can fuel all boilers if necessary, but two are always run in order to reduce the strain and keep the pressure more nearly constant.

(2) There are no injectors on this ships.

(3) If the main check showed stick, go to the engine room and have the engineer officer open the valve marked "Aux. Fuel to Boilers."
Return to the fire room, go up on the grating and open the auxiliary stop valve on the boiler.
Return to the fire room floor and open the auxiliary check.

④ The feed pumps do not hold pressure constant throughout the stroke. In a single stroke the pressure often varies from 200# to 240#.

The variation depends on the phase relation of two pumps in operation. Since they run independently this relation is continually changing.

At times the pressure varies only ten pounds during a stroke.

With the existing equipment the only remedy for the pressure variation is to run all four pumps and even then there would be considerable variation at times.

The best remedy would be the installation of a properly connected system of air chambers.

⑤ The gasket for the inner head of the feed water pump is cut from measured dimensions.

One method of installing this gasket is to remove the water piston from the rod and pass the gasket over the lower end of the rod.

The method used on the Manchuria however, is to remove the upper head of the steam cylinder, disconnect the valve gear, and jack the pistons up until they leave the top of the cylinders.

The gasket is then slipped in under the water piston.

⑥ Flax packing is used on the water end and high pressure packing used on the steam end. What is packing for used

(1) The packing should make a steam tight joint and opposing minimum frictional resistance.

(2) It must be durable, even under the temperature of modern high pressure steam, and also easily removed and replaced.

(3) The packing should be free to move transversely, to follow the rod, and also maintain a steam tight joint.

(a) At present no automatic fud control is installed, although steam to the fud pumps is controlled by the water level in the hot wells.

Since this ship is unusually steady an automatic fud control would be quite satisfactory.

The gage glasses could be placed in the center of the boiler front so as not to be seriously affected by the rolling of the ship.

There is no reason why automatic fud control would not prove suitable.

It has not been installed probably because like most Merchant ships, this one favors simplicity.

This is evident throughout the plant. A ship which has no ash ejector could hardly be expected to have an automatic fud control.

(b) When a fud pump draws from a supply below the pump so that there is a suction lift it is possible for the pump to become hot. This would happen if the fud water were too hot, because on the suction stroke the reduction of pressure necessary to lift the charge of water would cause vaporization of the water. The result would be that the pump would draw only steam, and it would pump no water.

This would cause it to speed up.

The pumps on this ship cannot become hot because the hot wells are higher than the water cylinders, causing the water to flow to the pumps by gravity.

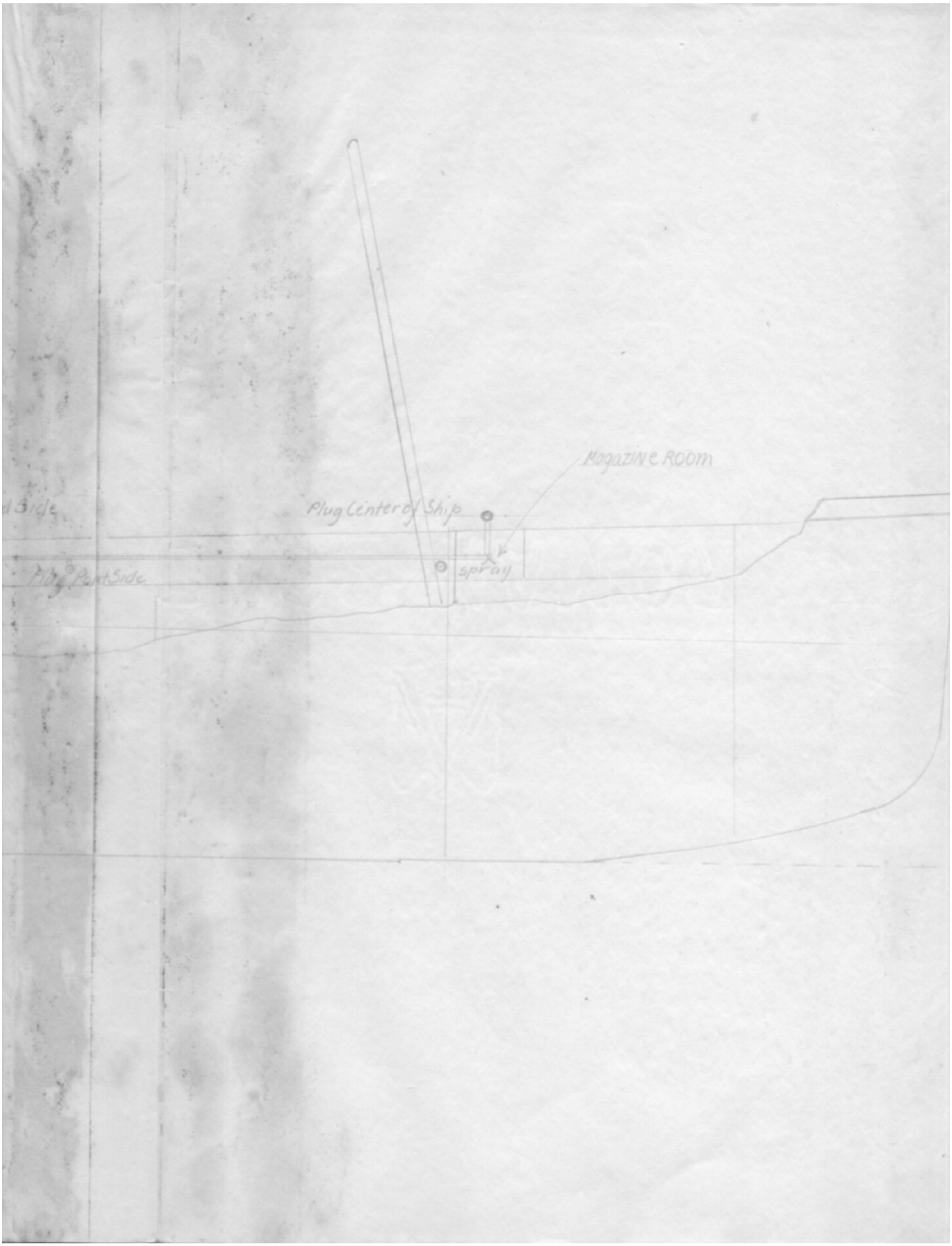
Attached clean fud pumps are apt to become hot.

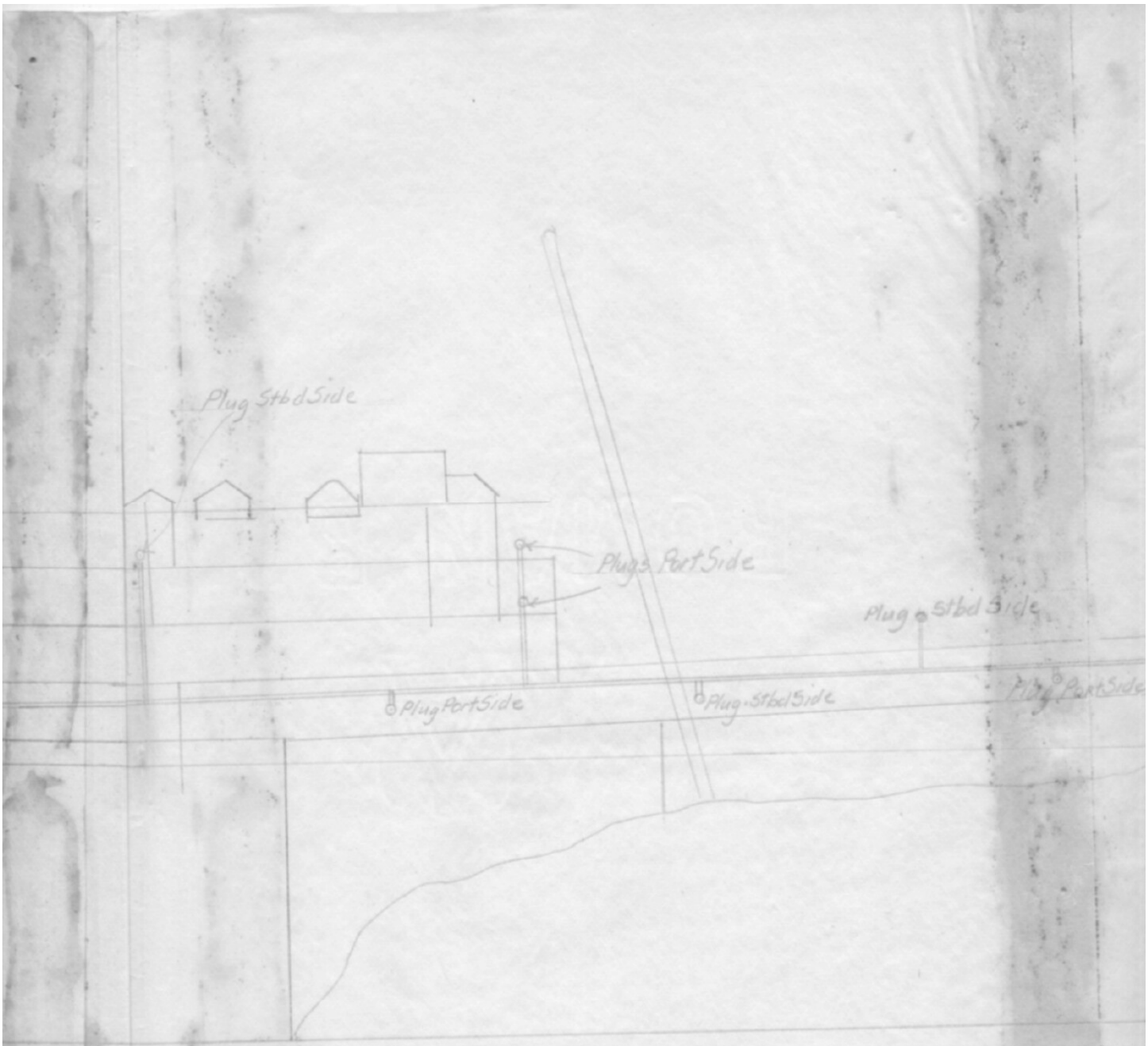
(9) This ship has a strainer and oil separator on the feed line. It has proved to be of great value, for its action is one of the big factors which make it unnecessary to blow down the boilers.

If a strainer can accomplish this it is certainly advisable to have one.

The only objection to a strainer is the liability of its becoming stopped up. However this objection has little weight, for it can be overcome by frequent cleaning of the strainer.

(10) Sketch for fire mains is attached.

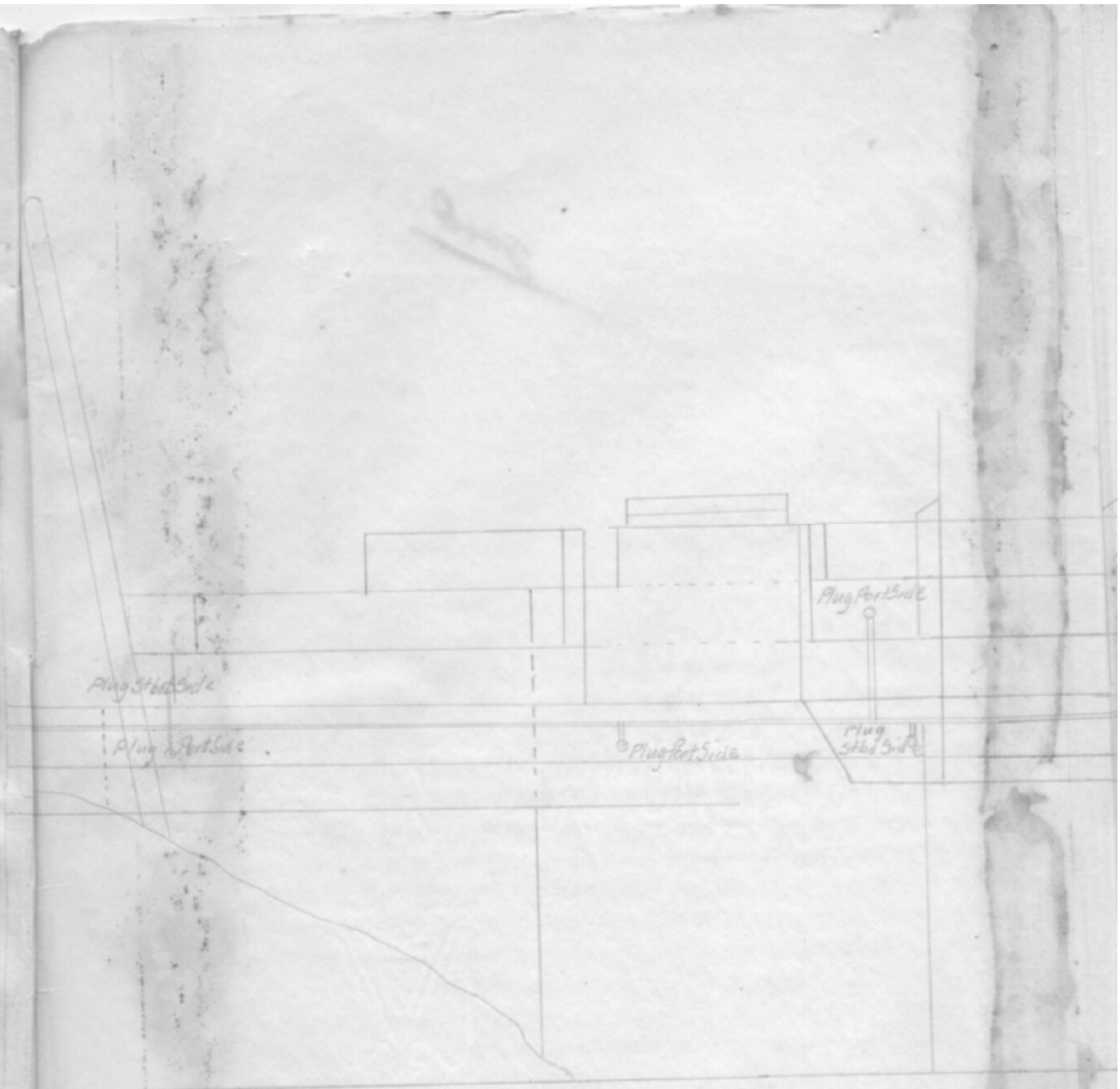

Magazine Room
Plug Center of Ship
spray
Plug Port Side



E TRAINS

of

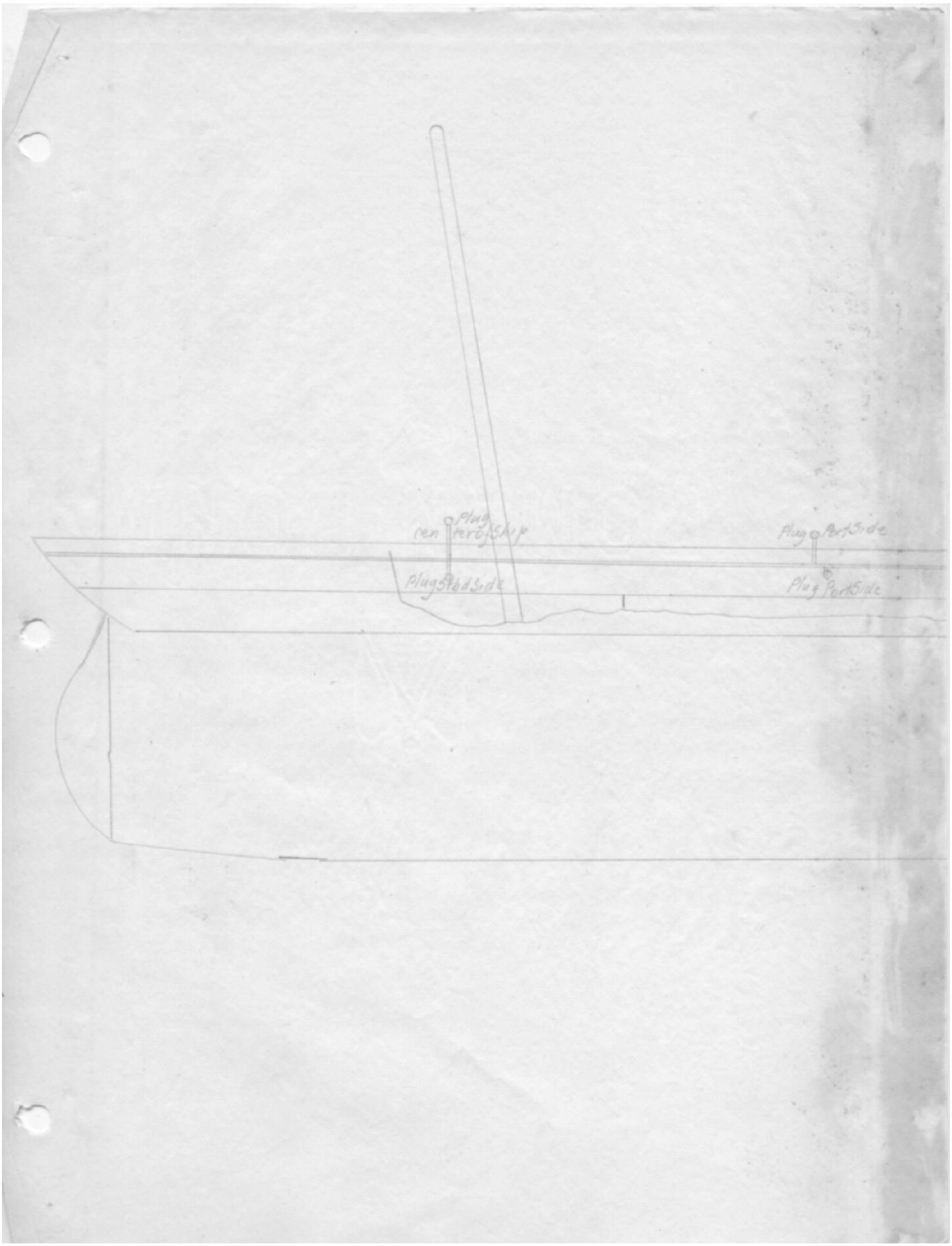
ENCURIA



FIRE

of

U.S.S. MAINE


Plug
Center Forward Skip
Plug Port Side
Plug Stbd Side
Plug Port Side

OVERSEAS CRUISE

WEEK "L"

FIRST DAY:

FOR ALL TYPE OF SHIPS:

1. Make sketches of boiler (exterior) showing actual location of all connections and fittings and saddles.

2. In raising steam in what sequence and manner are all boiler fittings tried out?

3. What means are provided to prevent corrosion and scaling of the boilers.

4. Sketch the salinometer and describe its use.

5. Sketch hand lifting gear for safety valve showing its attachment to valve.

6. Describe in detail how you would set your safety valve to 150 pounds.

7. What means are provided to ascertain water level under following conditions:

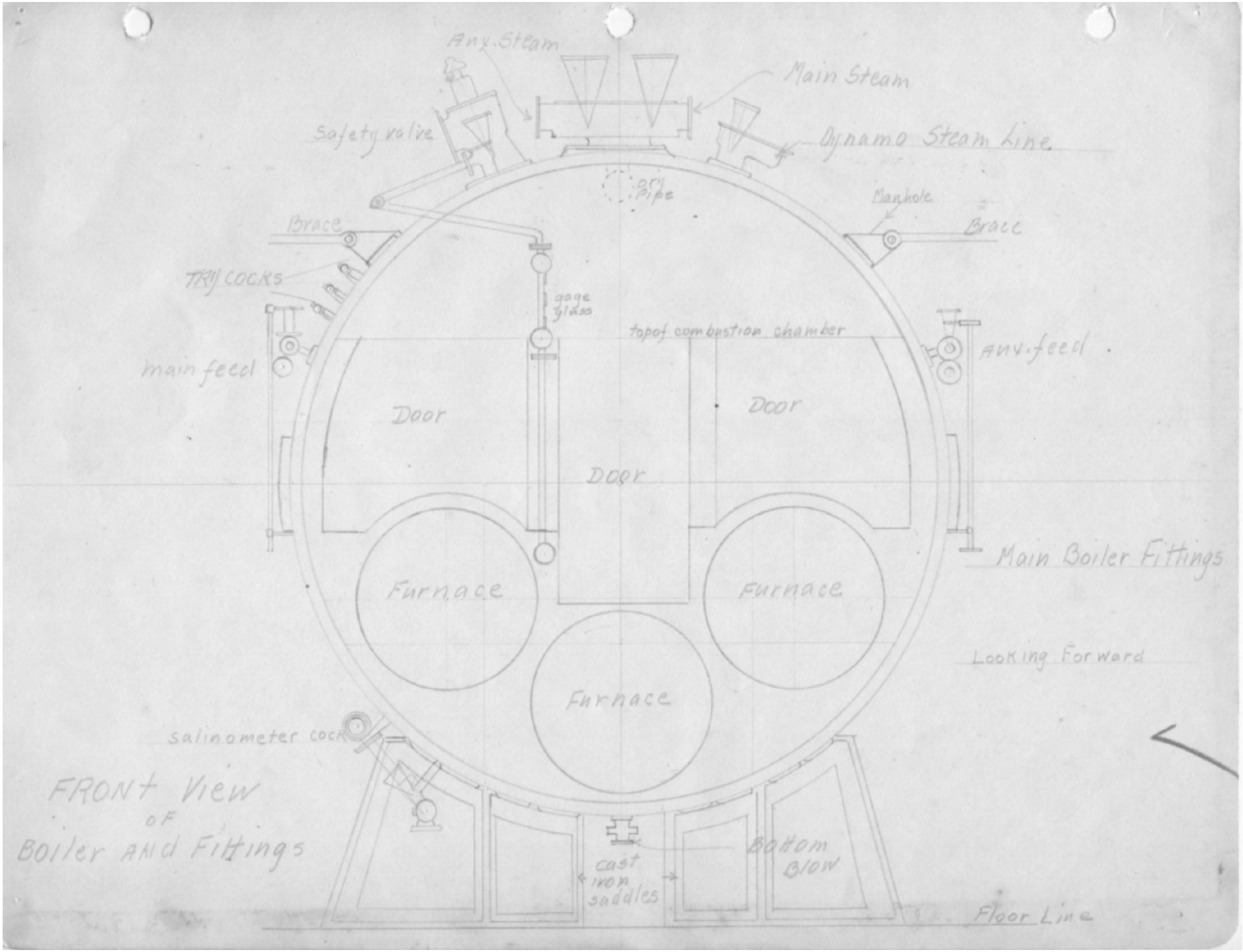
(a) When gauge glass becomes inoperative.
(b) Ship rolling badly.

8. Discuss any reasons for making the bottom blow of the material you find it to be. How often is it used.

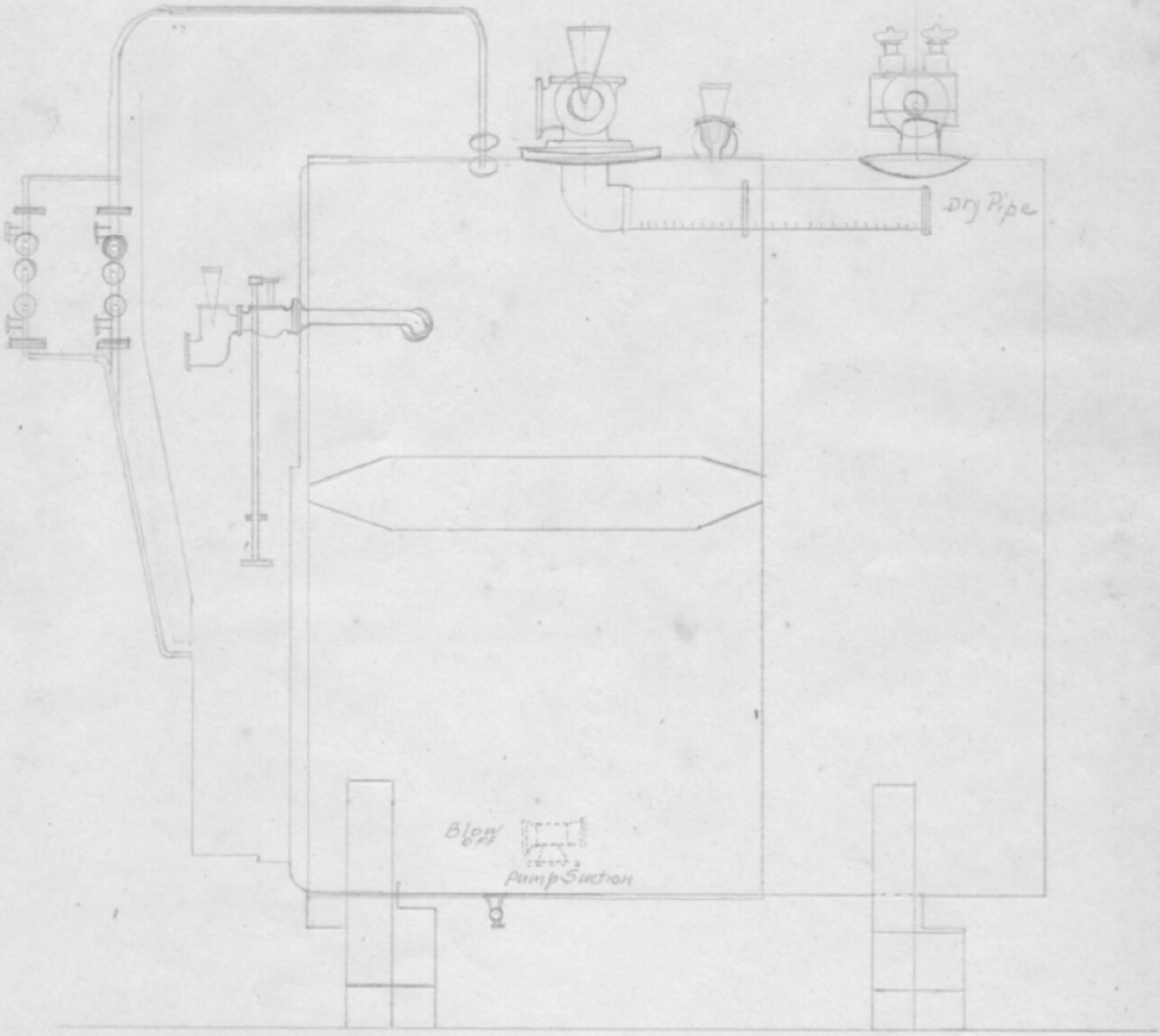
9. How often are gauge glasses blown through and try cocks used? Compare with Navy Regulations.

10. What precautions are observed when raising steam in regard to man hole plates? Describe how you would fix a leaky manhole plate.

11. What connections of fittings are used to circulate water while getting up steam? How may this method be improved?


Any. Steam
Main Steam
Safety valve
Dynamo Steam Line
Brace
Manhole
Brace
TRY COCKS
gage glass
top of combustion chamber
main feed
Any. feed
Door
Door
Door
Furnace
Furnace
Furnace
Main Boiler Fittings
Looking Forward
salinometer cock
FRONT View
OF
Boiler AND Fittings
cast iron saddles
Bottom Blow
Floor Line

Boiler - Side View



- Forward

G.F. Corse

Week 1

First Day.

① Sketch is attached.

②

All the fittings are looked over before the fires are lighted and all valves and openings except the air cock are closed.

The fires are then lighted, and 36 to 48 hrs. are taken in raising steam.

During this period the circulation is assisted by pumping it by means of a hydrokinetor.

When the pressure rises to two or three pounds and steam is blowing thru the air cock this cock is closed. When the gage shows twenty pounds all manhole and handhole plates are inspected, and set up if necessary. The surface and bottom blows are inspected for leaks. The water glasses are blown through and the try cocks are tested.

The pressure is then raised until the safety valve lifts and the gage is read at that instant. The receiving pressure is also noted.

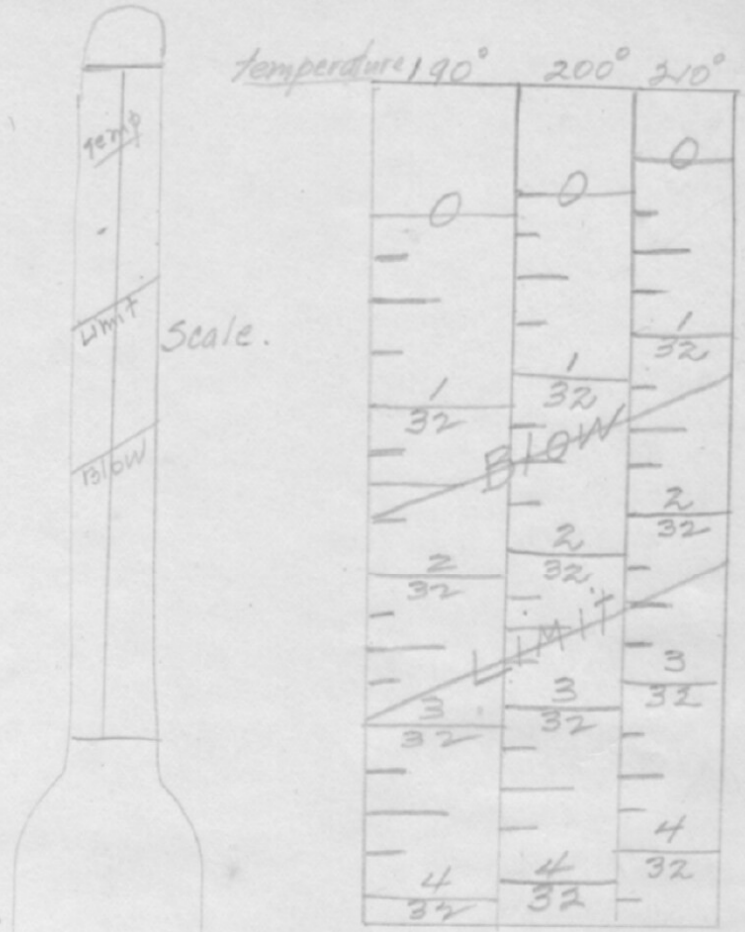
The boiler is now ready to be cut in as soon as its pressure is approximately equal to that of the line.

To prevent corrosion and scaling Navy Compound was formerly used. This caused so much priming, that it has been done away with and soda is now being used.

When in port half a bucket of saturated soda solution is put in each boiler, and while at sea one half gallon is added to the feed water every day for all the boilers.

The uses of zincs prevent galvanic action from taking place.

Corrosion and scaling are greatly reduced by the action of the grease extractor which is installed in the feed line.



Scale rolled out flat, showing density and at what corresponding temperature, the boiler water should be blown out.

Salinometer

Fresh make up feed greatly helps the keeping of the boilers in good condition - The ships carries all its fresh water, something over a million gallons. Hence the evaporators are not used, and the make up feed is quite fresh.

The various methods used to prevent corrosion and scaling have been so successful that it is not necessary to use the bottom and the surface blows.

Once a week the boiler water is tested for salinity and alkalinity. The boilers are frequently inspected for scaling and corrosion, and whenever necessary they are cleaned.

On Jan. 3 at 7 P.M. I assisted in making a salinity test on the boilers - A hydrometer was used for 170° F. The water was a little above 0 in purity, as far as salt goes.

(4) Sketch is attached.

The salinometer is used to determine the salinity of the boiler water. It does this indirectly by measuring the specific gravity.

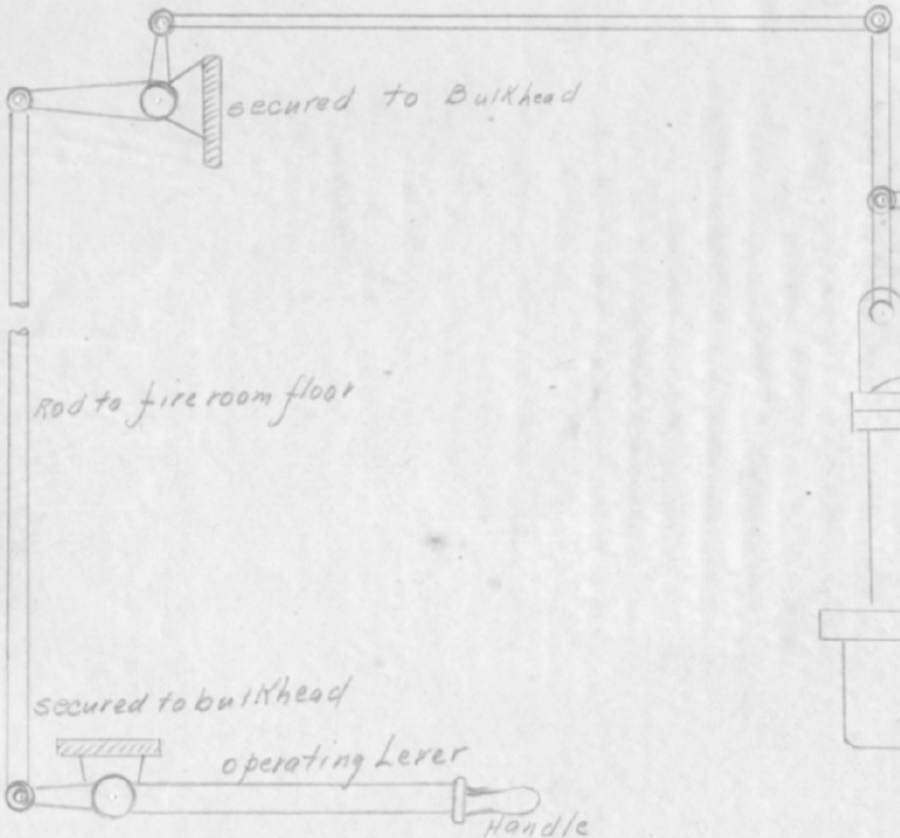
A sample of water is drawn in a copper holder, & temperature taken. Then salinometer is immersed, the reading is observed as it floats for the corresponding temperature, registered on a thermometer.

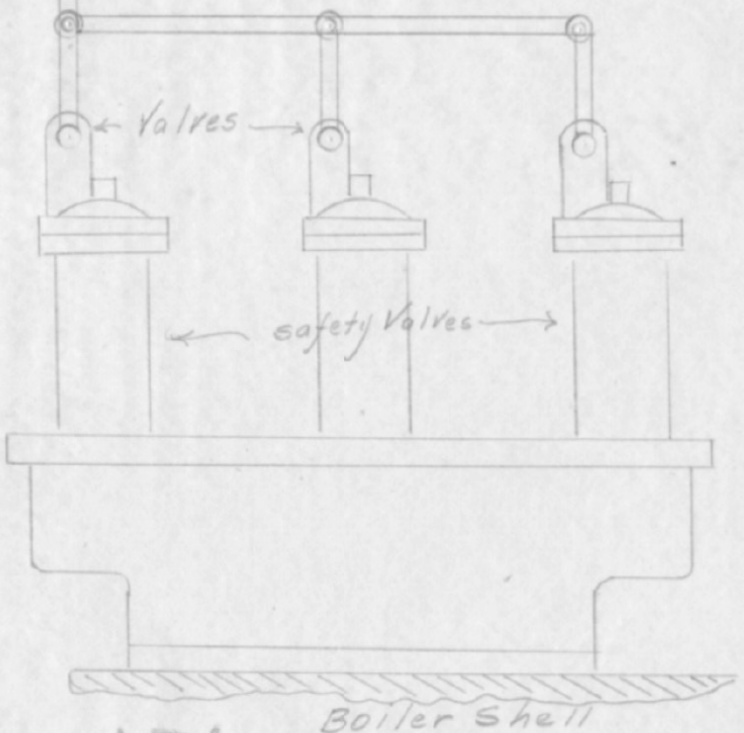
(5) Sketch is attached.

(6) To set the safety valve to 150# from a higher setting proceed as follows:

If the boiler is steaming reduce to 150# and then unscrew the nut holding the spring until the valve lifts. Raise steam again and check the setting. Then lock the nut. If boiler is under hydrostatic test proceed in same manner, but set at about 160# because the valve lifts more readily when under steam pressure than when under water pressure.

Hand Lifting Gear for Safety Valves.





your sketch doesn't show that the arrangement will work

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(7)(a) When the water glass becomes inoperative the water level is determined by use of the try cocks which are fitted to the water column and to the shell.

(b.) In case the ships is rolling badly the only way to determine level is to assume that it is the mean of the two extreme values shown by the gage glass.

The water columns help a great deal in keeping the gage level steady when the ship rolls.

(On June 3 there was a roll to the Manchuria of something over 25°- before this trip I understand that the greatest roll has been on 15°)

(8) The bottom blow valve is made of cast iron. If other than a ferrous metal were used there would be electrolytic action between the valve metal and the boiler plate. The escape pipe is made of copper in order that it may be hammered together to stop the flow in case the blow valve sticks open.

The bottom blow however isn't used because the fresh water make-up and the grease extractor make it unnecessary. Salinity tests and boiler inspections show that this is well justified.

(9) Gage glasses and try cocks are blown through once every watch. Navy regulations specify once an hour.

(10) Before raising steam the manhole plates are set up lightly. When the gage shows 20# they are set up tightly.

A leaky manhole plate should be tapped and tightened as much as possible. Should it still leak a rag should be thrown over the manhole.

in time scale deposits would probably close the leak. If however the leak is large, the only thing to do is to cut out the boiler and put on a new gasket.

The practice of driving a wooden wedge into a leak is dangerous and should be avoided.

(11) On all but three of the boilers, hydrokinetics are used to aid circulation while getting up steam.

Two boilers use the Eckliff tube circulation system and the remaining one has an automatic circulator.

All boilers are connected so that water may be drawn thru the bottom blow and pumped back into the main feed inlet.

There is little room for any improvement in this feature. Probably the Eckliff circulator is superior to the hydrokinetics, but the latter is very satisfactory.

W E E K "L"

SECOND DAY.

1. Discuss the relative advantages of manipulating the checks, versus using the stop valve to control feed.

2. What is the effect on boiler operation of having a widely varying feed control?

3. How do changes in rate of feeding affect feed water heater operation?

4. Make a cross section sketch of the gauge glass as fitted showing all parts. Indicate usual water level carried.

5. If the "clicking" of the feed check stopped what would you proceed to do.

6. What are the causes of false lead in a water glass?

7. Discuss the location of gauge glasses with respect to ease of water tending.

8. Discuss the method in use of locating the check with relation to feed stop valve.

9. What would you do on your ship in case of low water in a boiler.

10. What steps would you take to replace a broken gauge glass?

11. How would you detect the tendency of a boiler to prime? Where would you look for it? How remedy it?

G.F. Corse

Week L.

Second Day.

① The check valve is preferable to the stop valve because the check attends to momentary reductions in feed pressure and hence requires less frequent adjustment.

The check valve leaves the stop valve in good condition and to be relied on if the check fails.

If stops were ordinarily used the check would have to be relied upon in emergencies. This would not be very safe, because the check valve is complicated and easy to get out of repair.

② Priming, irregular steam pressure, pitting, expansion and contraction of the plate are some of the effects of irregular feed control.

③ In case of an open feed heater irregular feeding will cause a change of temperature and it may also cause an overflow. In the case of a closed heater the only effect is to change the feed temperature.

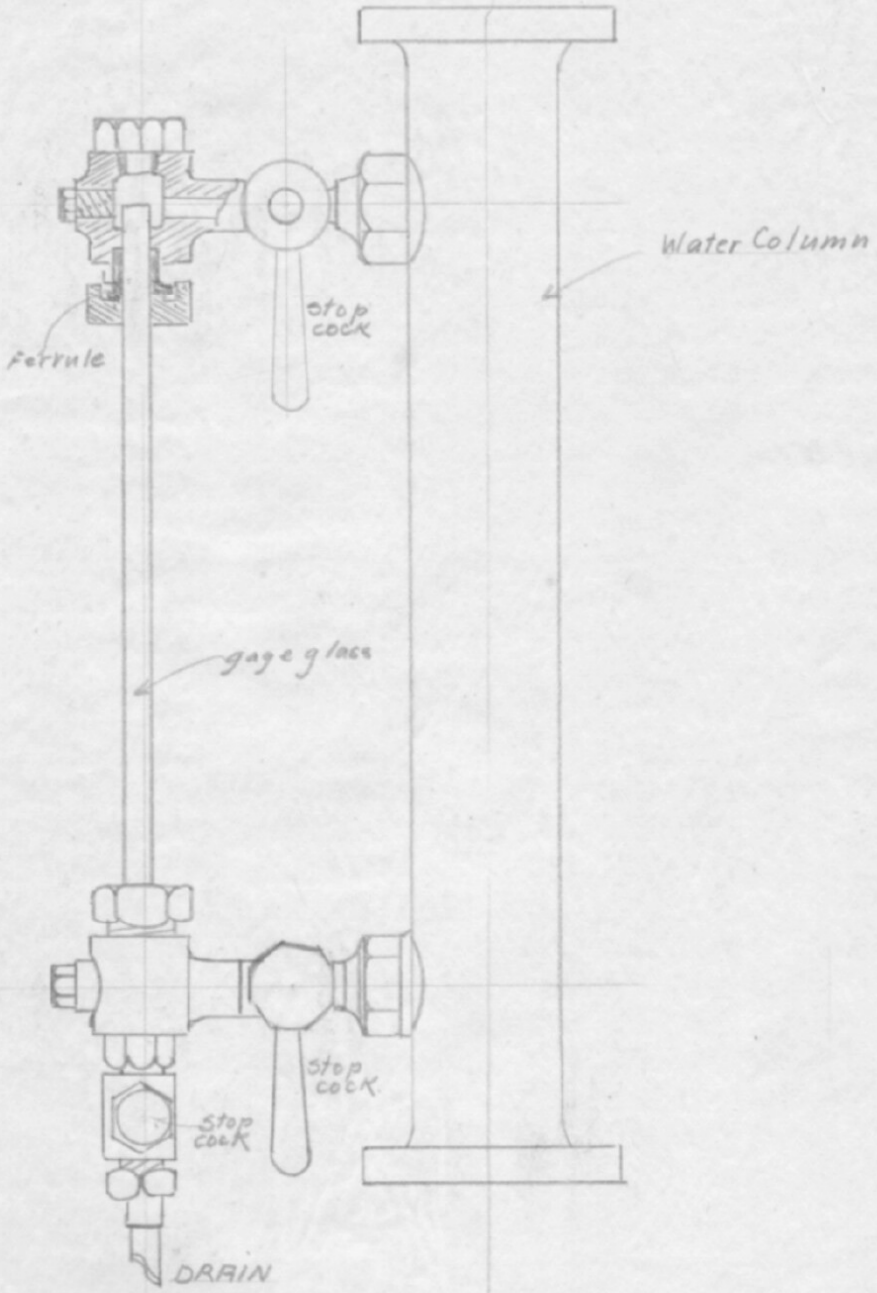
④ Sketch is attached.

⑤ If the feed check stops clicking it indicates there being out of repair, or that no feed water is being delivered. The proper procedure is to open the auxiliary feed valves and then locate the cause of the clicking stoping in the main feed.

If the check is stuck only one boiler will be effected, but a stoppage of the feed pumps will effect all boilers.

Gauge Glass.

G.F. CORSE



⑥. A false lead in the water glass is due to clogged of the glass or the connections to the boiler. It is remedied by blowing through the glass and its connections.

① It is very important to have the gage glasses located where they may be easily seen by the water tender, while he operates the check.

If the glass is inconveniently located or hard to see, the water tender will look at it less often.

The result will be that boiler will be filled up and then let alone until the level has dropped considerably. This irregular feed is bad as has been explained.

②

The stop valve is located closer to the boiler than the check valve. The latter is more delicate, and with its more continual usage, makes it more apt to get out of order.

When this happens, the above mentioned arrangement of valves allows the check to be repaired the steam being held back by the stop valve.

③ If the water level drops out of sight, & it is known that this happened during the preceding two or three minutes, the procedure usual is to open the main check wider & if it fails to check open the auxiliary feed. Also check the fire shutting off the draft, and throwing on green coal.

If there is doubt as to time level dropped, safest thing is to draw fires and look up the cause of the feed failure.

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(10) When a gage glass breaks, the first step is to close the water cock. Then close the steam cock and dig out all the pieces of broken glass. Insert a new glass and secure it.

Then warm up the glass gradually by blowing steam through it. When it is well warmed, the water cock may be opened and the glass is ready for use.

(11) Priming may be detected by a clicking sound in the main engines, and by a slowly down fall machinery.

The remedy for priming is to slow the main engine and check the fires for the few minutes. If the water level is too high, as it will usually be in such cases, reduce the feed by means of the checks.

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Week-L.

Third Day.

① Before the ships gets under way an inspection of the fire room is made by the engineer Officer on watch.

He notes whether the proper number of boilers are cut in, sees that all valves are open up to the throttles, and notes whether the steam pressure is at its proper point.

He inspects the firing tools, blowers and all other fire room apparatus. He looks over all valves and fittings, and notes that the safety valves are not lifting at steaming pressures.

During steady steaming the watch officer inspects the fire room to see that the water levels are correct that the fires are in good condition and that the fire room is clean and orderly, he also notes the steam pressure and the fed water temperature.

② The engineer watch officer inspects general condition of fire room each watch and notes label of gages, however he makes no report and other wise the inspections according to navy regulations are not followed.

Regulations require that the engineer Officer shall every evening carefully inspect his dept. and see that everything is in a satisfactory condition for the night. at 8 P.M. he shall report the result of his inspection to the executive officer. Each day before 10 A.M. he examines the engine and fire rooms to see that they are ready for inspection and that the work of the day is progressing in a satisfactory manner.

The engineer officer shall frequently examine the coal bunkers in person. A material leak or deficiency shall be reported to the C.O.

The Officer having days duty shall inspect dept between 7 & 8 A.M. & satisfy himself everything is O.K. and report to the engineer officer before 8 A.M. the condition of the dept.

Previous to raising steam for testing condition of boilers care shall be taken to see that dry pipes are not clogged. also inspect following.

1. Main and auxiliary stop valves.
2. Safety and sentinel valves.
3. Surface and bottom blows.
4. Steam and water gages.
5. Feed check and stop valves.
6. Drain cocks and pipes
7. all other boiler fittings.

(3) The routine report made by the fire room each watch includes the number of barrows of coal used; the number of cans of ashes hoisted, and the number of minutes extra fuel is used.

The daily report states the condition of the boiler water.

(4) The feed water is tested daily for salinity. A sample is drawn ~~from~~ boil into a pot, and a thermometer and a salinometer are immersed in the water. The latter is read and the reading is corrected for the temperature as shown by the thermometer.

Under normal conditions the feed water is very satisfactory, because the make up feed consists of fresh water taken aboard in port. The main object of the test is to detect large salinity, which might be caused by a condenser leak, an error in feed pump connections. These conditions are too rare to be of much importance.

(5) Whenever there is reason to believe that boilers are worn or corroded such parts of the structure shall be drilled and their thickness measured.

The boilers shall be tested by water pressure at such times as the engineer officer may deem necessary or advisable.

(6) The boiler saddles are inspected every three months to determine their condition and to detect loose rivets and stays.

To determine whether a rivet is loose, it is pounded with a hammer. A rattle or a clatter indicates looseness.

Incrustations of salt left by water leaking around the rivets are also indications of looseness.

(7) (a) To cut in a boiler the following operations are necessary.

(1) See that the fires are in good condition.

(2) Get the pressure within five or ten pounds of the line pressure.

(3) Open the main stop valve slowly. If a by-pass is fitted open the by-pass valve first, and when the pressure is equalized, open the main stop valve.

(b) To cut out a boiler the following operations are necessary.

(1) Allow the fires to burn down until the rate of combustion is small.

(2) When the boiler is making no steam, close the main stop valve.

(3) Close the draft and let the fires die out, first shutting off the feed.

hand steam (Regulations)

(8) Safety valves are tested once a week by ~~steam~~, and they are ~~supposed~~ to be lifted by ~~hand~~ very little steam is raised. The latter test is often overlooked, because it takes about ten men to operate the hand lifting gear.

(9) (a) About the middle of run, the boiler efficiency becomes considerably reduced, by deposits of soot in the tubes. The tubes of each boiler are blown out in turn, only one boiler at a time being blown on account of the loss of steam pressure during blowing.

The process consists of closing the drafts opening the fronts and blowing a steam jet through the tubes.

(b) On port the tubes are blown with a steam jet as described above, and then they are wire brushed.

(c) If a tube is bursted or badly split the fact will be apparent when the fire doors are opened. Small leaks are however not easy to detect. The usual procedure is to let the fires die down, cut the boiler out, and inspect the tube sheets and tube ends after they have had all soot blown off with a steam jet. Rust and salt deposits are indications of leaks around the end of a tube.

If the leaks cannot be detected in this way it is customary to put hydralic pressure on the boiler and watch for the water to leak around the tubes ends.

The method of repairing a leaky tube depends on the severity of the leak, and on whether the ship is at sea or not. If a tube bursts while steaming it is necessary to plug the ends with the type of patent plug described on another page.

If no such plug is available, a pair of tapered wooden pine plugs will serve as soon as port is reached

all plugged tubes should be renewed.

Small leaks around the tube ends can usually be stopped by re-expanding. Of course can't be done if tube has become brittle. If this is the case, the tube will have to be plugged or renewed.

Some stay tubes are fitted with nuts at each end. These tubes often leak around the nut. The usual method of stopping such a leak is to remove the nut and put a turn of red-leaded asbestos packing around the tube. When the nut is again tightened, the joint will usually be tight.

(11) Idle boilers should contain water of lower salinity than steaming boilers, and the water in idle boilers should be slightly alkaline, a condition seldom found in steaming boilers.

Idle boilers tested for alkalinity & salinity once a week.

W E E K "L"

FOURTH DAY

1. Make a cross section sketch of the feed water heater as installed, labelling all connections and fittings.

2. Discuss the relative merits of using exhaust steam for feed heating, versus main line steam method as applied to the plant of your ship,

3. How would you determine whether a tube in the heater was leaking and what steps would you take in this emergency?

4. Discuss the use of open heater for your ship, as compared to a closed heater.

5. What pressure is the relief valve set for? What back pressure is carried in heater? If this pressure were increased how would it affect operation of rest of plant?

6. Discuss the use of traps versus water seals on feed heaters for your ship.

7. Describe in detail what operations you would perform in cutting out a feed water heater.

Where is your sketch of feed water Heater?

G.F. Corse

Week 1.

Fourth Day.

(1) Sketch is attached.

(2) There is no arrangement on the Manchuria for using main line steam in the fuel heater. The question of main steam versus exhaust steam for fuel heating is a little more one-sided on this ship than on the average ship.

In the first place, the unusually large number of auxiliaries aboard this vessel ensures a sufficient auxiliary exhaust for fuel heating at all times. Next the fuel heater is unusually small for a ship of this size and hence requires less steam than would ordinarily be expected in a 10,000 H.P. plant.

In fact the heater is so small that the engineer on watch often finds it desirable to slow the main circulator and decrease the vacuum, thus raising the fuel water temperature.

In general it is preferable to use exhaust steam for fuel heating because it results in a small net gain in economy. There are comparatively few ships which use main steam for fuel heating and on account of the unusual conditions found on this vessel it is reasonable to assume that the argument for auxiliary exhaust is even more potent here than it ordinarily is.

(3).

(3) If a tube in the heater were leaking it would readily be noticed that the water level of the heater would be rising faster than usual. If it were a serious leak there would be difficulty in keeping the pressure on the feed line.

In case the heater was leaking it should be cut out, opened up and given a water pressure test to determine what tubes leak. Clean the heater, repair the tubes and give the heater another hydrolic test. If everything is found in good shape, close up and start operation.

(4) The feed water on this ship is carried as near 210° as possible and if they wished to maintain this feed temperature it would be difficult to do so, with an open feed water heater. This type of heater is not adaptable for temperatures much over 180° or 190° as it must be placed on the suction side of the feed pumps and the vapor coming off the water at temperatures above that breaks the suction of the pump.

Closed feed water heaters are generally placed between the feed pump and the boiler requiring that they stand a pressure equal to that of the boiler.

With these the injecting water temperature may be raised to that of the water in the boiler.

It is usually considered that due to the high pressure carried on the closed feed heater that they are harder to keep in repair and give more trouble than the open type.

But the closed type on this ship has not been opened for cleaning for more than two years and is still in good condition.

(5) The relief valve on the shell of the heater is set for 18 lb.

A back pressure of 14 to 15 lbs. is carried in the heater. If this pressure were increased it would have the effect of slowing down all the auxiliary machinery.

(6) On this ship the condensate is controlled by a water seal. The valve is marked so that the water will rise to about 3 or 4" in the gage glass on the side of the heater. This requires frequent attention, as the amount of condensate varies with the number of auxiliaries in use.

If in the place of this water seal, a trap of the ball or bucket type were used it would automatically take care of any variation in the amount of condensate requiring but very little attention.

(7) In cutting out a feed heater the first thing to do would be to change the exhaust from the heater to either the main condenser or into the by pass for the low pressure main engine cylinder. It would be much more economical to do the latter as steam would efficiently used down to a 24" or 25" vacuum. When the steam is by-passed and shut off of the heater, the valve of the water by pass on the side of the heater should be opened and valves leading the water to the coils should be closed. This will by-pass the water from the coils so that they are relieved from pressure.

The heater should be drained, both shell and coils, and is then in a condition to be opened up.

W E E K "L"

FIFTH DAY

1. Make a sketch showing location of blowers with respect to boilers, showing all air ducts with dampers at proper location.

2. How may natural draft be used alone? What precautions are taken to prevent fire from blowing back through firing doors when opened?

3. Sketch and descirbe the blower showing location of any fittings.

4. Discuss the suitability of using engine, turbine or motor driven blowers on your ship.

5. How is air pressure determined? Give a curve showing variation of air pressure for various blower speeds. Note fire condition for each reading.

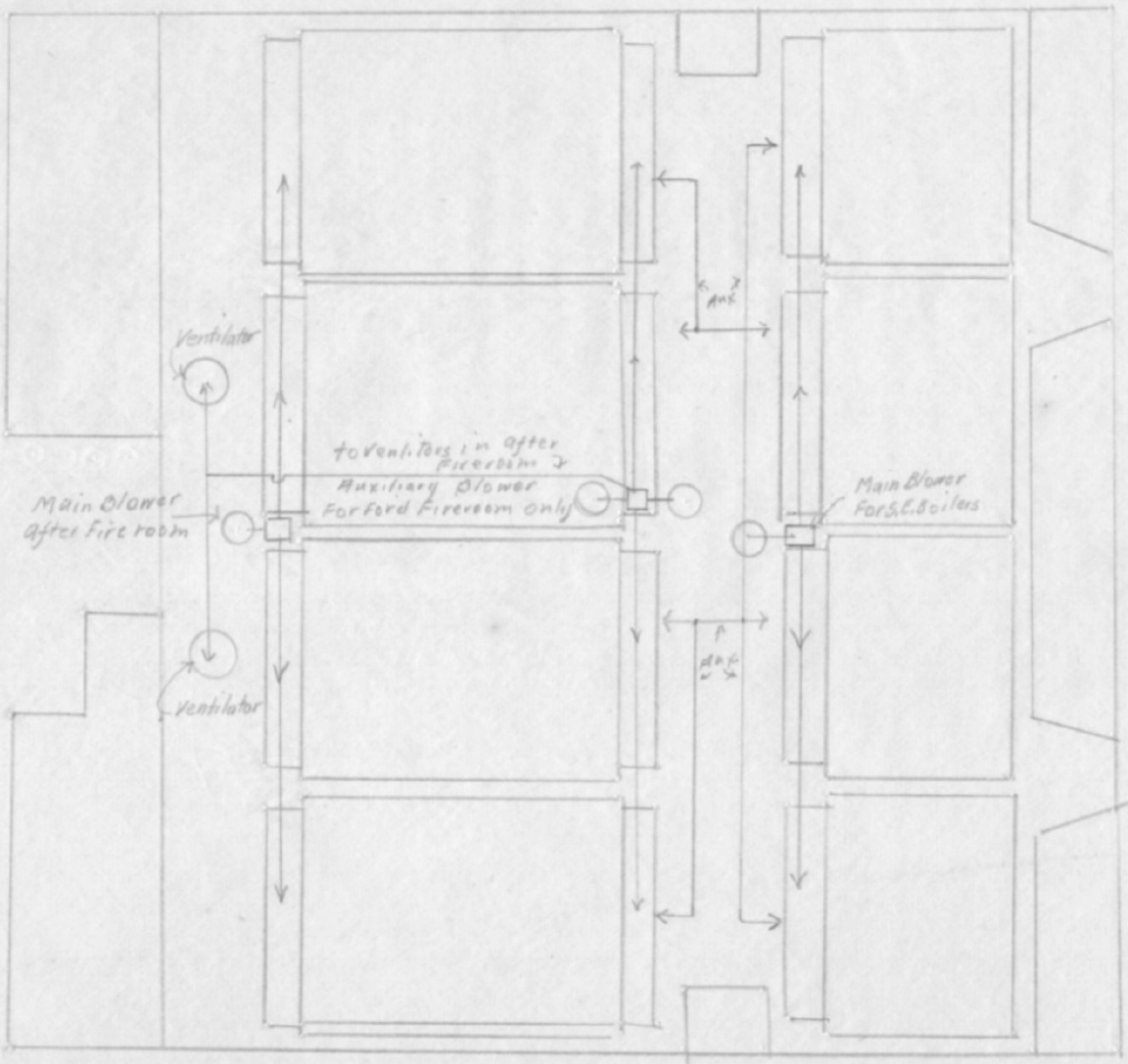
6. What is affect on blower operation of closing the outlet? The inlet?

7. Compare the systems of induced and forced draft for shipboard use.

8. How is blower engine coiled? At what temperatures do bearings run? Is oil cooled in any way?

9. Why is too great a blower speed poor operating method?

C.F. Corsc



Plan of fire room
showing
Location of Blowers
with respect to Boilers

Week. L.

Fifth Day.

① Sketch is attached.

② With the Howden forced draft system as is used the air is forced into a closed ash pan. To this system to be changed to natural draft only requires that the ash pan be opened to the fireroom which may be accomplished by opening the ash pan door. The air will then come down into the fireroom through ventilators provided for that purpose.

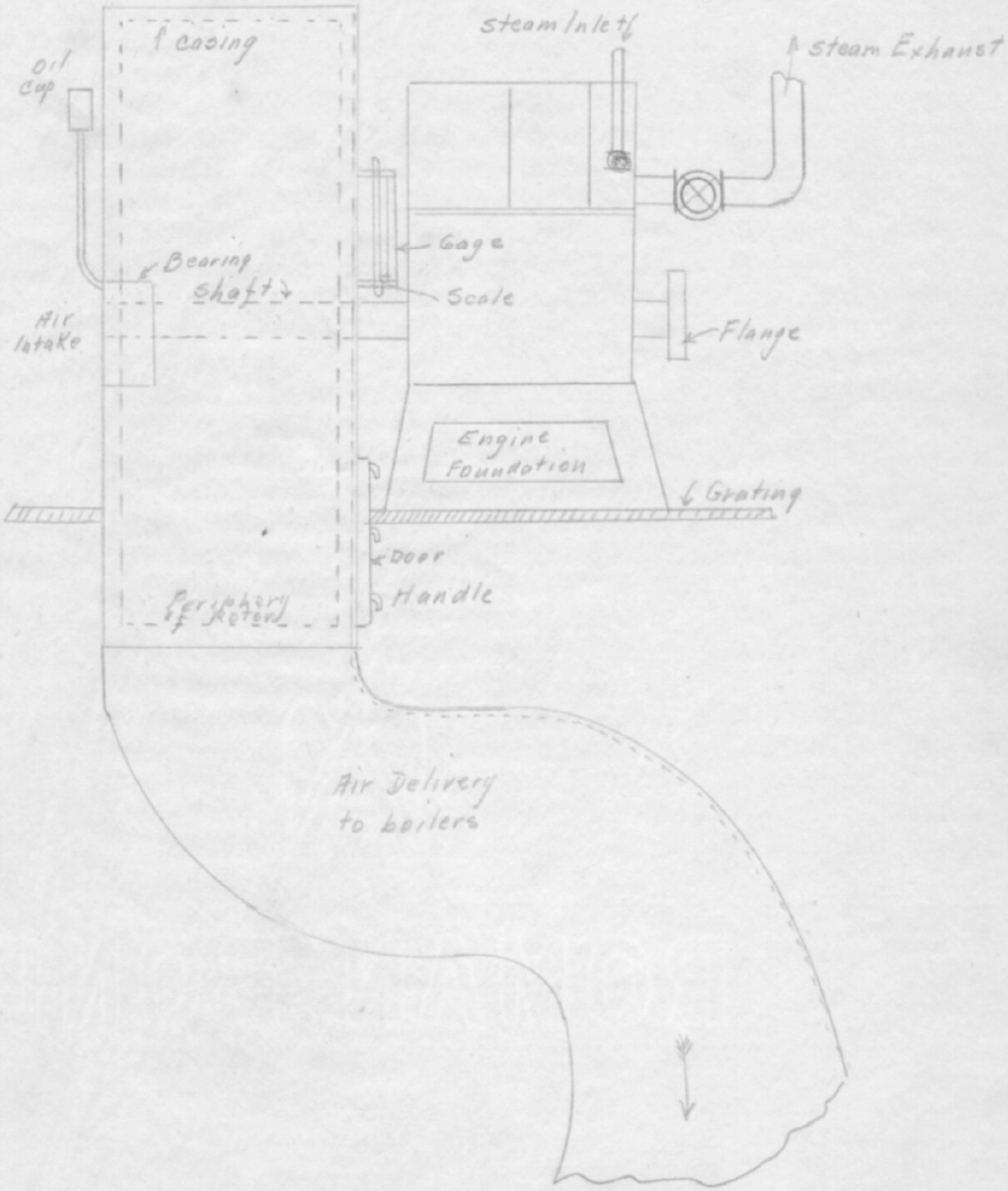
When working under forced draft if the furnace doors were opened with a pressure of air in the ash pan the fire would blow back through the door and make it very difficult and dangerous firing, to prevent this dampers in the air delivery system are provided so that the air supply may be temporarily shut off of the ash pan, and also off of the opening supplying air to the upper part of the furnace.

③ A vertical high speed engine drives each of the four blowers. The engine is direct connected. The blower and engine are shown in sketch.

The blower itself is a fan shaped rotor keyed to the shaft supported by two bearings. The rotor is surrounded by a cylindrical sheet steel casings having a circulate opening in the end farthest from the engine. Air enters thru this opening. [redacted] It is channeled thru a rectangular duct in the bottom of casing toward the engine end.

An inspection door is located near the bottom of the engine end of the casing. At the same end but just above the center line there is a water gage.

Blower and Fittings



which indicates the air pressure. An oil cup is fastened to the other end, and has a small line leading down to the bearing.

④ The engine driven blowers now in use are rather unsatisfactory, for the engines are usually knocking and giving trouble.

Turbine driven blowers, would probably cause less trouble, but they would require an attendant, just as the engine driven ones do. They would also use more steam which would be undesirable.

Motor driven blowers would compare favorably with engine driven blowers in regard to economy, because their power would be supplied by the large turbines driving the dynamos. These turbines are probably enough to compensate for the losses in the dynamo motor and line. The motor drive would have the additional advantage of requiring little attention. In addition it would be quite reliable and on the whole it would probably prove the most satisfactory system.

⑤ The air pressure may be determined by the use of a water column but the pressures on this ship, are determined by the condition of the fires. The engines are set for a good running speed, is not changed unless the boilers get extra dirty and steaming becomes hard or a demand is made for extra high steam pressure.

⑥ If the inlet of a blower under operation were closed it would raise the pressure and slow down the blower. On the other hand if the inlet were closed, it would lower the pressure of the air delivered and the engines would speed up.

→ Very Very little

Q. Induced draft reduces the pressure of the air in the furnace and sucks the air through the fire bed and delivering it up the stack. The gasses it handles are very hot and necessarily of a large volume than the cold air as handled by the forced draft system. These hot gasses tend to destroy the blower and to heat up the bearings, so that the bearings and rotor will need constant repair.

Also since the system is handling a large volume of gas the installation to take care of the boilers must be large than a forced draft installation.

In shipboard use this is quite a drawback! However it has advantages in that furnace being more open makes a fire easier to work and also fireroom is kept clean & free from smoke and dangerous gases, as gases tend to be sucked into rather than forced out through holes in the flues and uptakes.

Summing up, I find that there is more in favor of the forced draft than there is in the others for ships use.

(3) There is no provision for cooling either the blower engine or its bearings. In cold weather the bearings run at about 100°F. While hot weather often increases this to 125°F.

There is no provision for cooling the oil.

(4) Excessive blower speed causes inefficient combustion and if long continued it is apt to overheat the uptaker and cause hot spots in the combustion chambers

For a given thickness of fire there is a certain blower speed which gives maximum efficiency of combustion.

Any speed higher than this causes waste of coal, large quantities of heat being carried up the stack by the excess air.

Excessive speed causes smoke in blower set.

W E E K "L"

SIXTH DAY:

1. Make a pipe line sketch of the bilge drains for the entire ship.

2. Describe the type of bilge pump fitted, including all alternate means which may be used to pump out bilges.

3. Of what material are the bilge drains? What are the advantages and difficulties with this material as bilge piping?

4. If the bilge pump is plunger type, what is the shape of the plunger and why this shape?

5. Show by reference to pipe line sketch how each bilge pump may be used for serverel compartments, both suction and discharge.

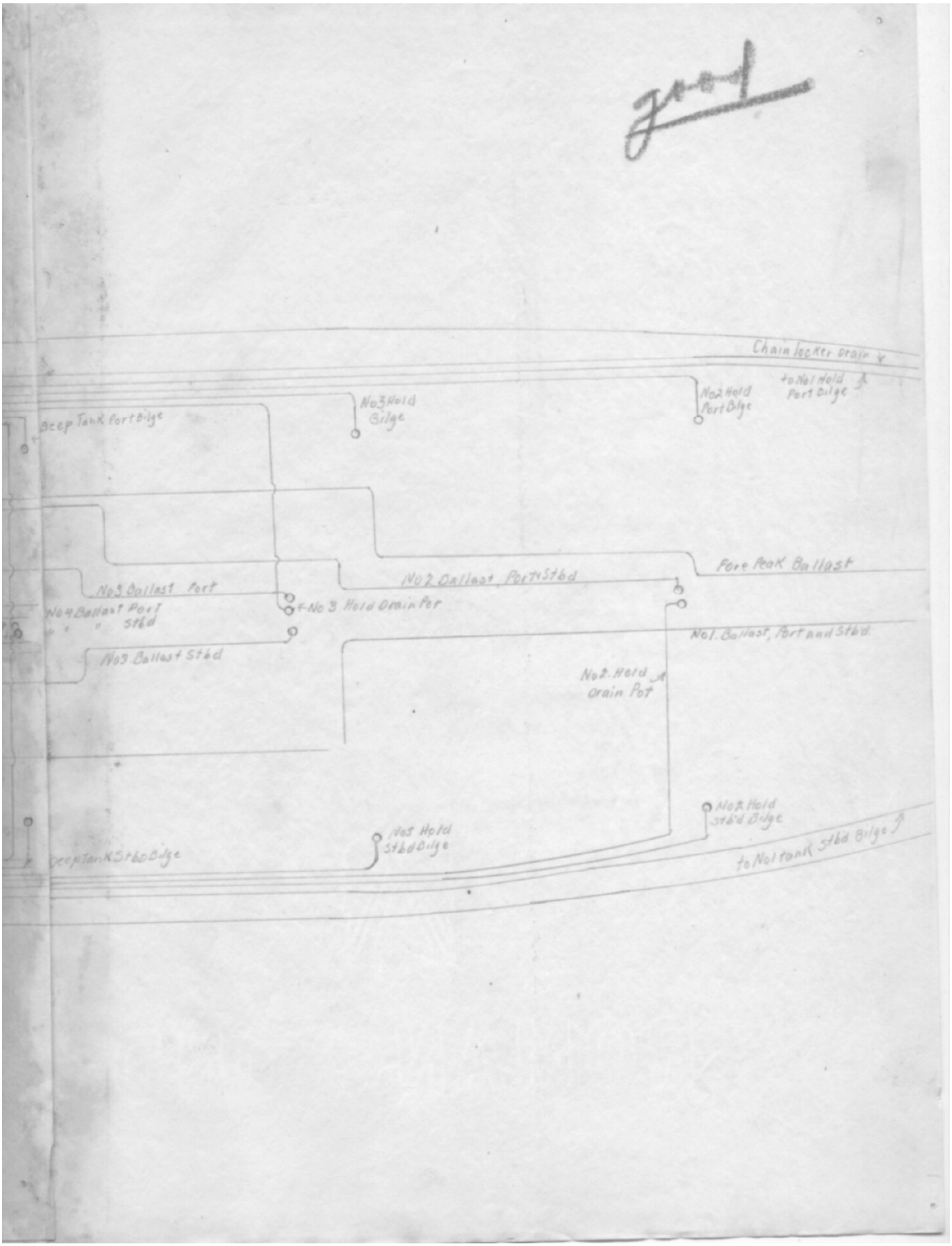
6. How would you temporarily repair a damaged piece of bilge piping at sea?

7. In case one of the discharge valves in the bilge pump was damaged and could not be replaced, how would you continue operation of pump?

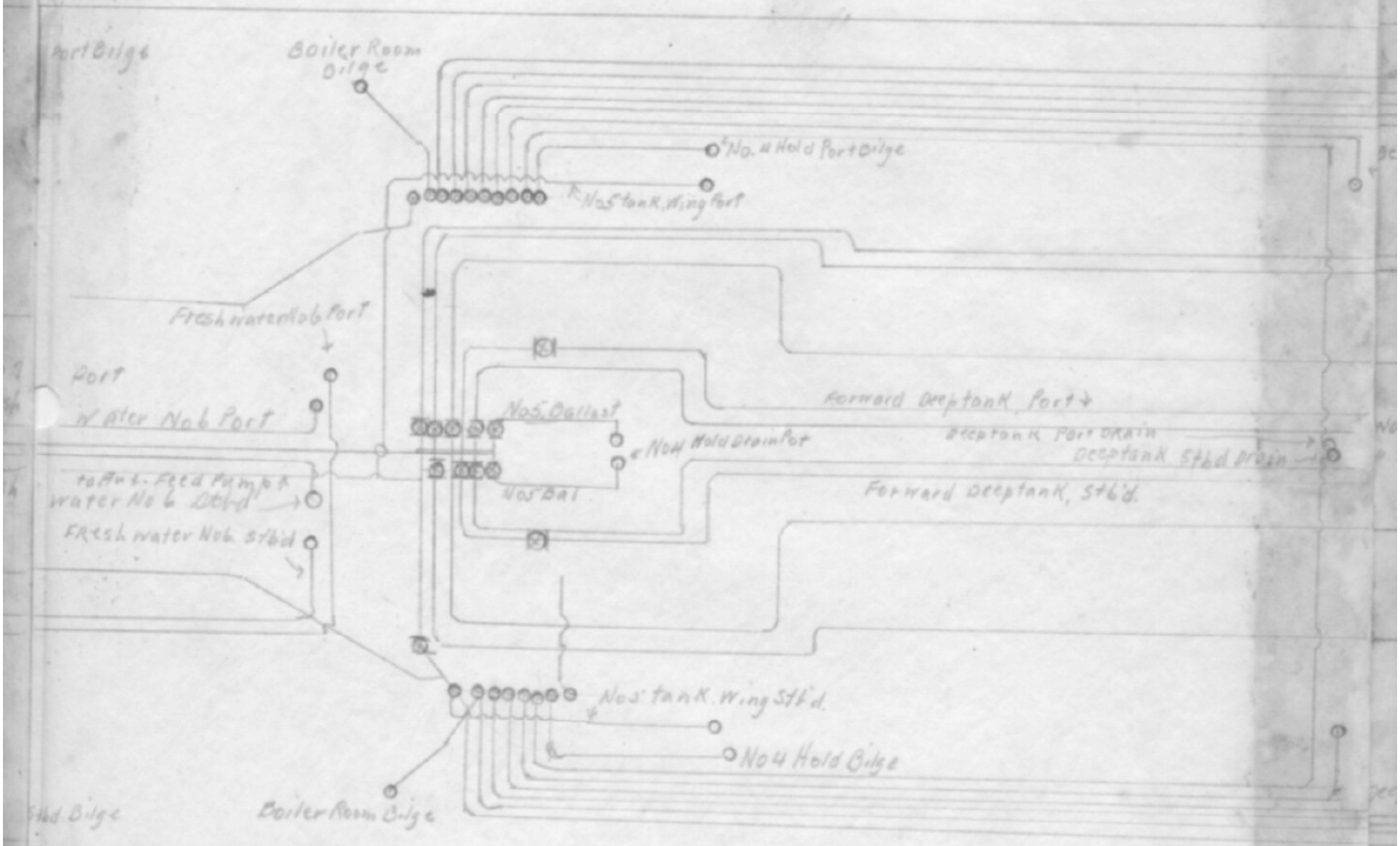
8. Sketch form of bilge strainers used showing how they can be cleaned.

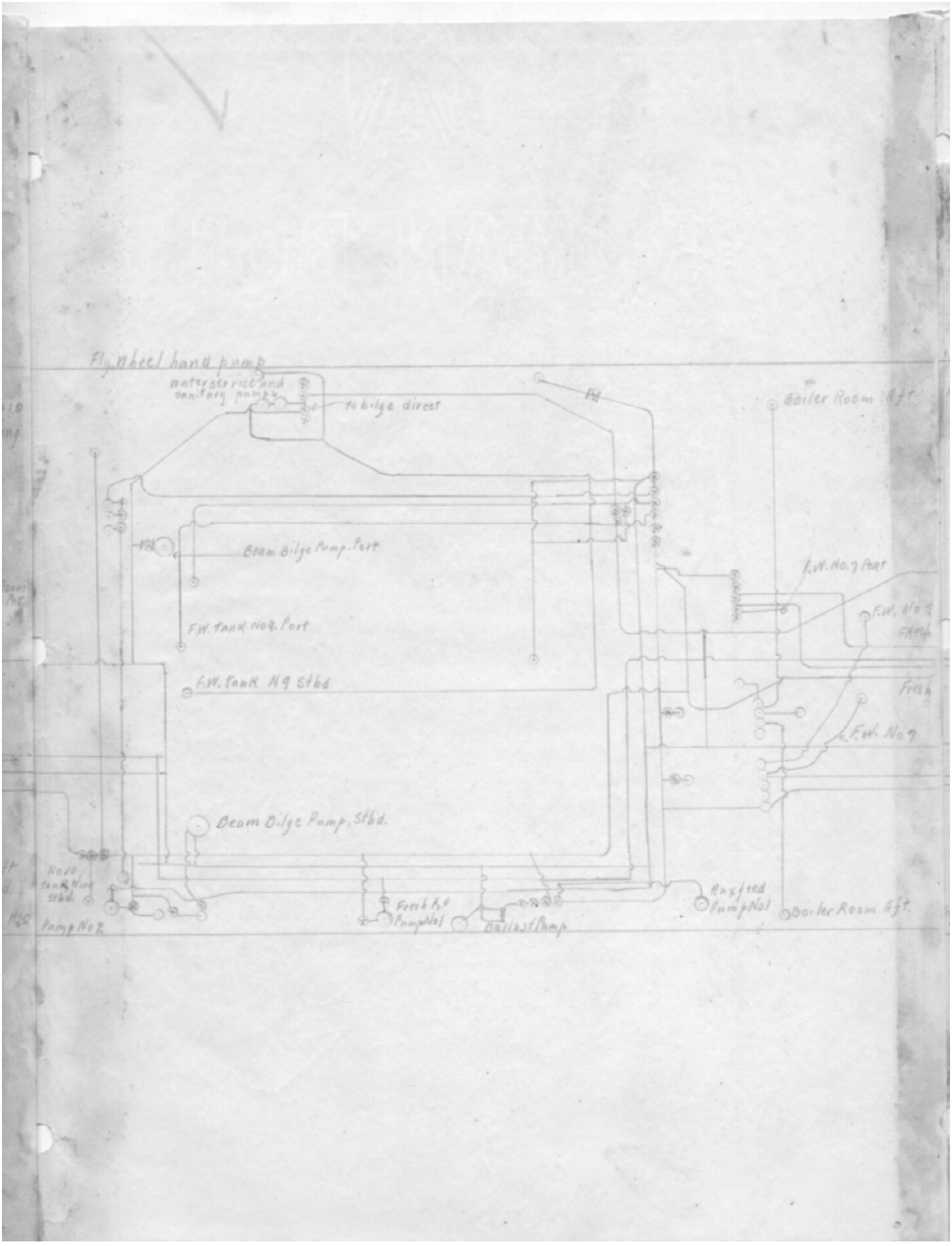
9. If both salt and fresh water connections are fitted to pumps, what precautions are taken to keep salt water from getting into feed?

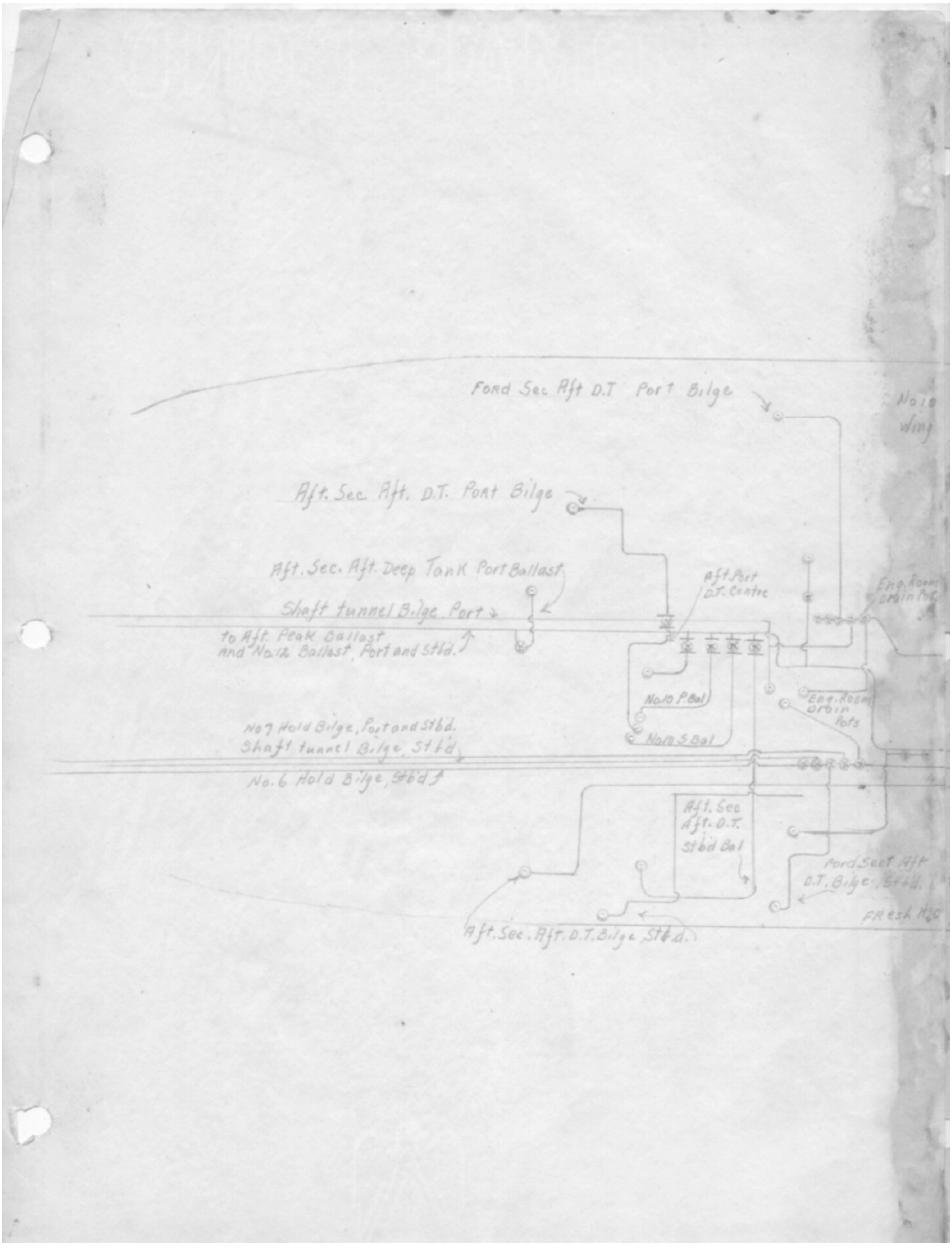
10. Are snifting valves fitted? What is their functions?


Chain locker drain
to No1 Hold Port Bilge
No2 Hold Port Bilge
No3 Hold Bilge
Deep Tank Port Bilge
Fore Peak Ballast
No2 Ballast Port & Stbd
No3 Ballast Port
No 3 Hold Drain Pot
No4 Ballast Port Stbd
No1. Ballast, Port and Stbd
No3 Ballast Stbd
No2. Hold Drain Pot
No2 Hold Stbd Bilge
No3 Hold Stbd Bilge
Deep Tank Stbd Bilge
to No1 tank Stbd Bilge

PLAN
OF
BILGE DRAIN
AND
BALLAST SYSTEM
FOR
ENTIRE SHIP




Flywheel hand pump
waterservice and sanitary pumps
to bilge direct
FH
Boiler Room Aft.
Beam Bilge Pump. Port
F.W. tank No9. Port
F.W. tank No9 Stbd
F.W. No.7 Port
F.W. No 7
Fresh
F.W. No 7
Beam Bilge Pump, Stbd.
No10 tank Wing Stbd.
Pump No2
Fresh H2O Pump No1
Ballast Pump
Aux feed Pump No1
Boiler Room Aft.


Ford Sec Aft D.T Port Bilge
No.10 wing
Aft. Sec. Aft. D.T. Port Bilge
Aft. Sec. Aft. Deep Tank Port Ballast
Shaft tunnel Bilge Port
to Aft. Peak Ballast and No.12 Ballast, Port and Stbd.
Aft Port D.T. Centre
Eng. Room Cabin Pot
No.10 P. Bal
Eng. Room Cabin Pots
No.7 Hold Bilge, Port and Stbd.
Shaft tunnel Bilge, Stbd
No.6 Hold Bilge, Stbd
No.10 S. Bal
Aft. Sec Aft. D.T. Stbd Bal
Ford. Sect Aft D.T. Bilge, Stbd.
Fresh H2O
Aft. Sec. Aft. D.T. Bilge Stbd.

Week L

Sixth Day.

① Sketch is attached.

② The bilge line pumps are two solid plunger ram type of pumps. they are direct acting.

The plunger is of the built up type the center being steel surrounded by a brass sleave.

The pump cylinder is of the ordinary cast iron type, there being no bearing surfaces within the pump it is not necessary to fit it with a brass ~~liner~~ liner.

Common clapper valves are used for both the suction and discharge valves.

To cushion the pump a snifting valve of the ball check type is fitted directly to the cylinder of the pump.

The bilge pumps are in operation all the time that the main engines are running.

To assist in doing the work, the following pumps may be used.

An independent bilge pump of the vertical duplex type with cylinder and stroke 12 × 10½ × 18.

A pump used for either ballast or bilge duplex type, Deane make.

A Deane vertical duplex pump is also used for general service.

③ All bilge drains are fitted with lead piping.

This piping is of a permanent nature, not being effected by the grease and bilge water, but it has its disadvantage in that it is hard to work around it without heating it or injuring it in any manner.

④ The plunger of the line bilge pump is a cylindrical plunger of the ram type, the driving end is attached to the beam of the dependent air pump.
The plunger is carried one size all its length so that it will be strong enough for the work it has to perform
Its shape is cylindrical so that a good packed joint may be made when the plunger enters the pump.

⑤ Sketch is attached.

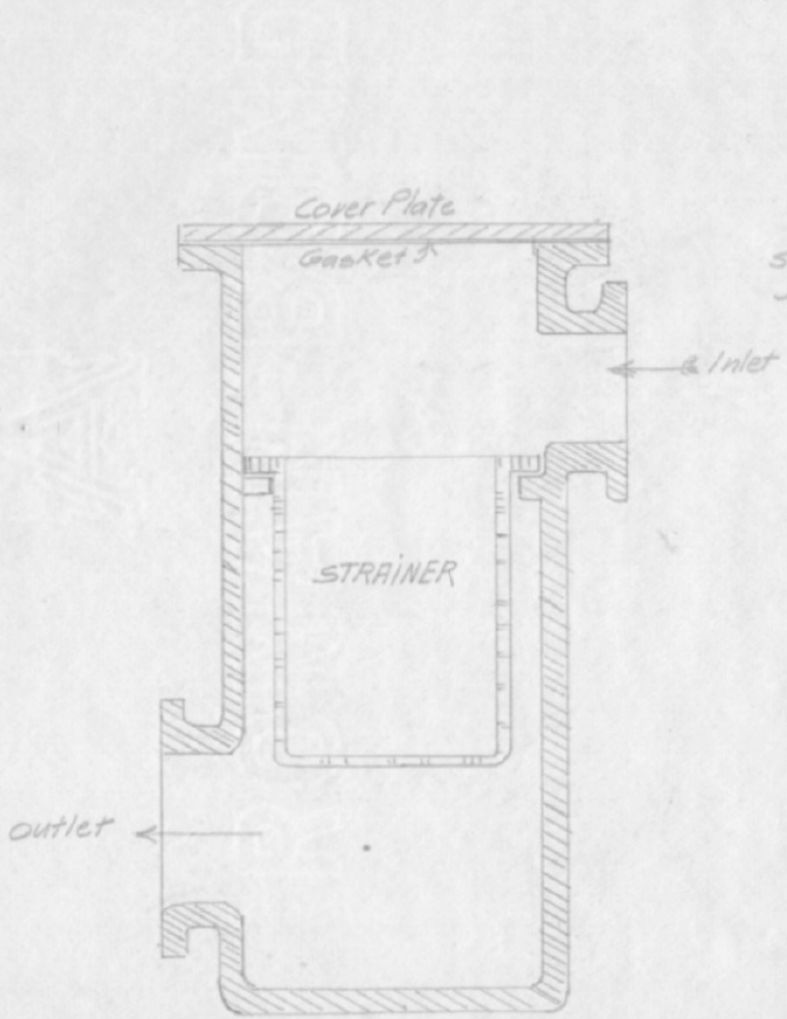
⑥ To temporarily repair a damaged piece of bilge piping at sea, a patch should be clapped around the pipe.

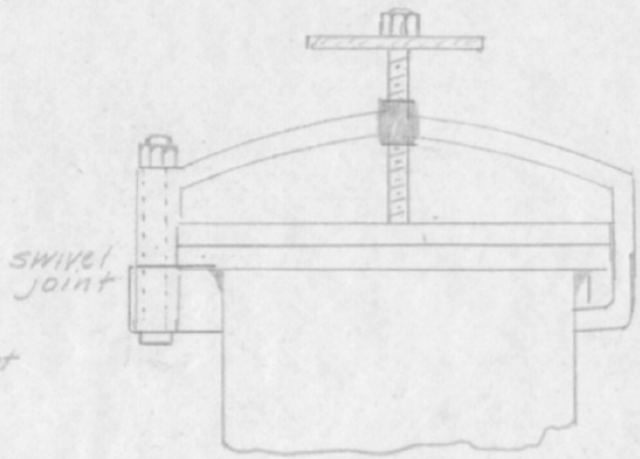
⑦ The bilge pump discharge line has two valves in it, one at the overboard discharge and one at the pump. In case one of the discharge valves give out, the use of the pump could be continued by using the valve at the overboard discharge.

⑧ Sketch is attached.

⑨ If a pump is fitted with both fresh and salt water connections and is to be used permantly as a fresh water pump the salt water connections have their hand wheels either removed or locked and as an extra precaution a second valve is fitted at the other end of the pipe.

⑩ Snifting valves are ~~fitted~~ to all large water pumps. Their function is to admit a small quantity of ~~steam~~ of air in with the the water on the suction stroke so that this will act as a cushion on the compression stroke, and prevent knocking.





BILGE STRAINER

11-15-18
WSL/HCE

OVERSEAS CRUISE

WEEK "N" - For Reciprocating ships -

FIRST DAY:

1. Observe process of warming up and getting underway in engine room. Make a classified table showing order and time of all events which take place during the process.

2. Write a brief description of the mains to include the items shown below. This is in order to gain some familiarity with the relation of the various parts and any peculiarities found:

(a) Type engine.
(b) Cylinder arrangement.
(c) Size cylinder & Press.
(d) Stroke.
(e) Speed (full) & RPM.
(f) Horsepower (Approx)
(g) Type valve (each cyl.).
(h) Jackets.
(i) Cylinder attachments
(j) Pistons.
(k) Crossheads & guides.
(l) Connecting rods.
(m) Main bearings.
(n) Link motion.
(o) Thrusts.

3. Explain fully the oiling of the topside parts aboard your ship. Tell what parts are oiled and how frequently; the kind of oil used and how applied. How could these operations be improved?

4. Make cross section sketches of crosshead and guides showing how they are lubricated, cooled and any provisions for adjustment in case of wear.

5. In case of wick feed, what governs the rapidity of oil flow? What tally is kept of lubricating oil used each day?

6. Sketch cylinder lubricators as fitted showing the operation of these devices.

7. What is the cause and how remedy the following conditions:

(a) Hot crosshead and guide.
(b) Hot crosshead pin.
(c) Hot piston rod.
(d) Hot valve rod.
(e) Hot tail rod.

Overseas Cruise

Week "N"

1st Day.

① In getting under way and process of warming up cylinders the procedure is as follows.

First see that the packing engine is out of gear that no stray tools are lying around and that everything is clear.

The next step is to open the by-pass and allow steam to enter and warm up cylinders. Four or five hours is allowed for this warming up process. Forty pounds is allowed on the H.P. Cylinder, and fifteen on all the others.

Bells on leaving dock.

Dec. 28-1918.

Starboard Engine.		Port Engine.	
stand by	1.50 P.M.	stand by	1.50 P.M.
slow ast	.0-3	slow ast.	5-3
stop	54	stop	5-4
half ast	03-	half ast	05-
full ast	07	full "	07
half ast	5-8	stop	205-
stop	59	slow ahead	03
half ahead	201	half "	05-
slow "	02	full "	09
half "	03	stop	30
full "	04	slow ahead.	31
full "	08	half ahead	33
Stop	30	full ahead	42
half ahead	31	half ahead	43
full "	33	slow "	47
half "	42	half "	49
slow "	43	slow "	350
half "	47	stop	5-2
slow "	49	half ast	0-2
stop "	50	full "	5-2
half astern	51	slow ahead	5-2
full ahead	5-2	full ahead	5-4
slow "	0-2		
full "	54		

(k) (a) On the U.S.S. Manchuria there are two, inverted vertical quadruple expansion, condensing engines.

(b) The cylinders are arranged as follows. The H.P. cylinder is forward, next comes the 2 M.P. cylinder, next the L.P. cylinder, and last the 1. M.P. cylinder.

In order to have the best possible crank torque the two highest pressure cylinders are arranged at each end of the engine, thereby giving the best balancing arrangement.

The H.P. exhausts the entire length of the engine into the 1. M.P. cylinder, the M.P. exhausts into the 2. M.P. and the 2 M.P. into the L.P. cylinder. Thus we get the four complete expansions

(c) The H.P. cylinder diameter is 30 inches
" 1 M.P. " " " 48 "
" 2 " " " " 63 "
" L.P. " " " 89 "

The pressure carried on the L.P. cylinder is 19 pds.
" " " " " 2. M.P. " " 45 "
" " " " " 1. M.P. " " 105 "
" " " " " H.P. " " 205 "

(d) The stroke is five feet.

(e) Full speed is fifteen knots and seventy nine revolutions per minute.

(f) Six thousand horse power is the approximate figure arrived at by the taking of indicator cards.

(g) There is a piston valve on the H.P. cylinder.
" " " " " " " 1. M.P. "
" are two " " " " " 2. M.P. "
" is a slide " " " " L.P. "

(h) There are no steam jackets on any of the cylinders. The by-pass is used for warming up the cylinders instead of having steam jackets.

(i) There are two assistant cylinders, one on the 2. M.P. cylinder and one on the L.P. cylinder. There are also indicator cocks, attached to the cylinders.

(8) The pistons are in general, dished shaped, for added strength. They are secured to the piston rod by nuts screwed against shoulders on piston rod, these being tapered fits and dowels between nuts & the shoulders.

The pistons do not touch the cylinder walls or lining the space between being made steam tight by packing rings of cast iron.

There are three rings on each of the pistons of a good gray cast iron.

The packing rings are held in place by follower plates one per piston and are free to adjust themselves to fill the spaces between pistons and walls.

The rings are now generally solid with springs behind them. They were formally split and under slight compression to keep them springing out, being made slightly larger than the cylinder and compressed to size.

8. The crosshead is the head or block at the outer or lower end of the piston rod to which the connecting rod is attached and guides the piston rod in a line through the axis of the cylinder in its up and down motion. The crosshead travels between two fixed bars parallel to the axis of the cylinder in a straight line, known as the crosshead guides.

On the two sides of the guides are removable slippers whose sliding surfaces are faced with 'White' metal fitted into dovetailed recesses.

The slippers slide on the guides bolted to the inverted Y- Columns of the engine framing. The ahead guide is made hollow to permit the circulation of water to assist in keeping it cool, and the guide surface is scored with channels for the distribution of the oil.

(l) The connecting rods are made of high-grade machinery steel forgings and they are hollow. The type used on this ships has a T end at the bottom with a forked end at the top for holding the cross head pins, and is fitted with adjustable brasses and connections.

For the bearing at the crank end and for each bearing at the crosshead, there are two brasses and caps with distance pieces. The parts are connected by through-bolts and each bolt is fitted with a collar nut with a set screw for locking the nut and one for holding the bolt in place while backing off the nut.

The distance pieces are fitted between the brasses and held in place by small dowel pins. The brasses are lined with white or anti-friction metal.

The length of the connecting rod is measured from the center of the crank pin to the center line of the cross head and in the naval service is about twice the length of the engine stroke. or as is generally expressed.

$$\frac{\text{Length of crank}}{\text{Length of connecting rod}} = 1/4$$

(m) The large bearings used for the shafting are made so that they may be readily removed for adjustment as need occurs, and thus prevent distortion of the shaft.

The bottom crank shaft brasses are made concentric with the shaft so that they may be revolved and taken out without having to remove the shaft.

The bed plate is recessed to recive the bottom brass, which is round at the bottom and can be removed by supporting the shaft and revolving the brass in its cylindrical bed until it comes to the top and so can be taken off for adjustment and repair.

The bearing has a cap of cast steel, the part coming next to the shaft as well as the bottom brass being lined with white metal scraped to a true fit.

Each cap has an oval hand hole

for the purpose of feeling the journal when under way, the cap is secured by four collared bolts, the nuts locked to prevent their backing off, and the bolts prevented from turning by set screws.

The brasses, as usual are fitted between the distance pieces and caps, to admit adjustment of the brasses after wear.

(n) The double bar link consists of a pair of bars curved in the arc of a circle, of radius equal to the geometrical length of the eccentric rod.

The bars are connected at the ends by bolts and by a block between so as to maintain the desired distance between them. To these are attached a pair of bars or links usually known as bridle bars. These lead to the weigh or rock shaft, and serve to control the gear, and to hold it in any desired position.

It is customary to so adjust the line of motion of this block that when the gear is in the go ahead position, it shall lie neatly in the line of the bridle rod so that any movement of the block will be communicated to the link without loss. In the backing position the line of movement of the block will lie across the line of the bridle rod at a considerable angle, and the movement of the block back and forth will give but slight motion to the link.

When the piston valves are driven side by side as is case in one of the cylinders aboard this ships the two valve stems are connected across by a yoke, which in turn is connected to the link block by a form of bearing similar to that for the single stem.

The guide is attached to the yoke the arrangement consisting of a dovetailed or gibbed slide and guide, the first formed on the yoke and the second by a vertical plate or bar, projecting downward from the bottom of the cylinder head.

(2) Thrust is taken care of by horse shoe collars. The arrangement being to have collars on the journal bearing against the corresponding surfaces of the thrust bearing, and thus transmit the thrust of the propeller to the ships. There are eight of these horse shoe collars on each thrust, with adjustable nuts on each collar. The thrust is water jacketed and runs in oil.

(3) Two oilers remain standing on the first grating directly in center of bottom engine room platform, and have a supply of oil handy to oil the topside parts of the machinery. The oilers observe the hours of the regular watches, and they never leave their post while on watch.

The crossheads, the guides, the links, and the piston rods are oiled every twenty minutes. A good grade of engine oil is used. Cylinder oil is used on the rods.

These operations could be improved upon with the introduction of a forced lubrication system.

(4) Sketch is attached.

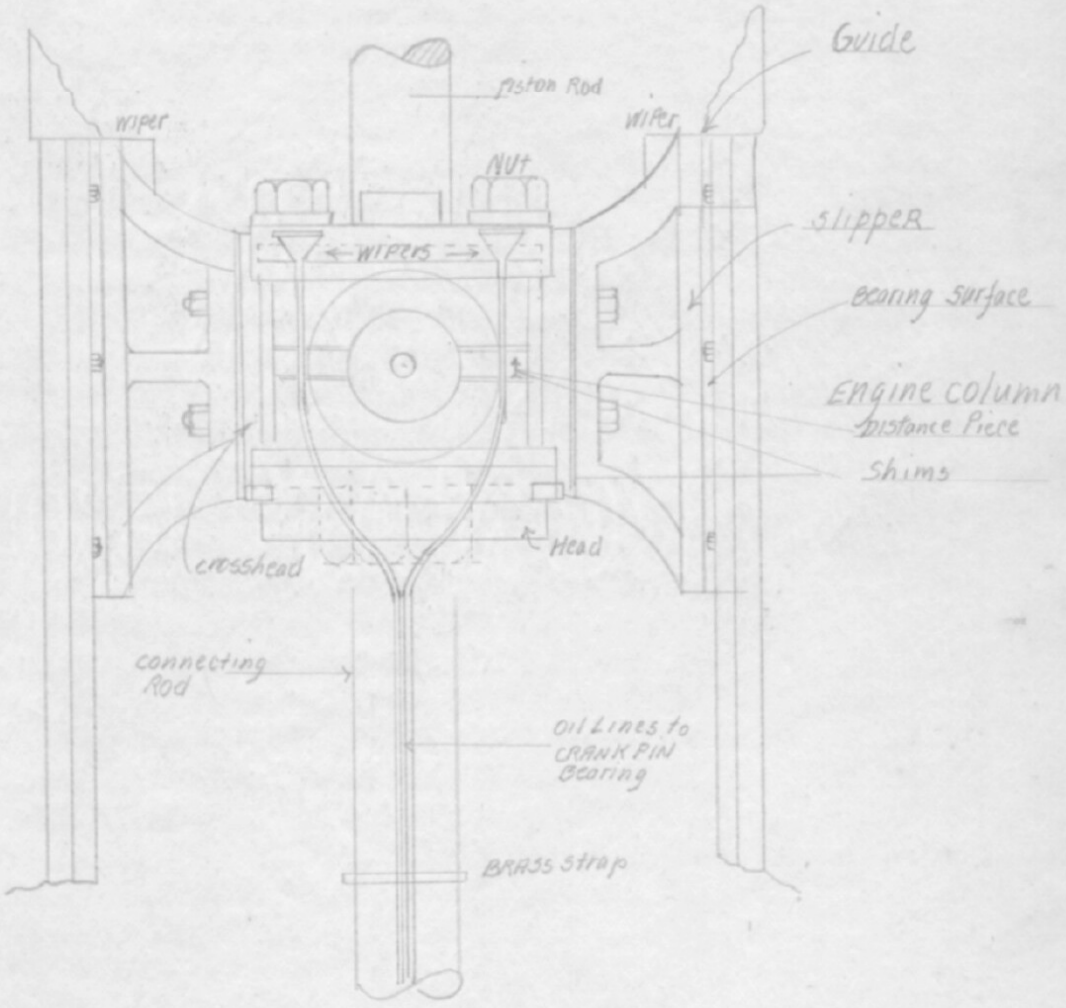
(5) In the case of wick feed the number of strands of wick and the grade of oil used governs the rapidity of flow.

There is a log record kept of the number of gallons of oil used each day.

(6) Sketch is attached.

G.F. CORSE

CROSSHEAD AND GUIDES



7. (a) The causes of a hot crosshead and guide are, the presence of dirt or grit, the lack of sufficient lubrication, the use of bad oil, the oil ways may become clogged up. The remedy for this casualty is to change the oil or oil more frequently and use more oil.
The guides are water jacketed, insufficient supply of H_2O causes heating.

(b) A hot crosshead pin is caused by having the bearing too tight, the lack of oil, a poor grade of oil.
To remedy this state of affairs, wash out with soap and water, and use lots of good oil.

(c) A hot piston rod is usually caused by having the packing too tight, or by having a bent rod.
The only remedy for such a condition while under way is to keep swabbing the rod with lots of oil.

(d) A hot valve rod may be caused by too tight packing - using wrong grade of oil and by being bent.
To remedy this, swab well and often with oil.

(e) A hot tail rod may be caused by dirt, lack of oil or poor oil.
Swab freely to remedy.

+ OVERSEAS CRUISE +

11-15-18

WEEK "N".

SECOND DAY: - Reciprocating.

1. Explain fully the duties of bottom side oiler, telling what parts are oiled and how frequently. Also what kind of oil is used. What does lather on a bearing indicate?

2. Make a cross section sketch of a main bearing showing its construction and method of oiling.

3. Make a sketch of the engine showing water service lines to parts concerned. How may the water service pipes be cleaned out and how often is it done?

4. Make a cross section sketch of the stern tube showing how it is lubricated.

5. Describe the thrust, giving type, number of collars, number ahead and number astern, clearance used, and method of adjusting same, also method of lubrication and cooling.

6. Would it increase plant efficiency to save the lubricating oil after use? How would you proceed to accomplish this?

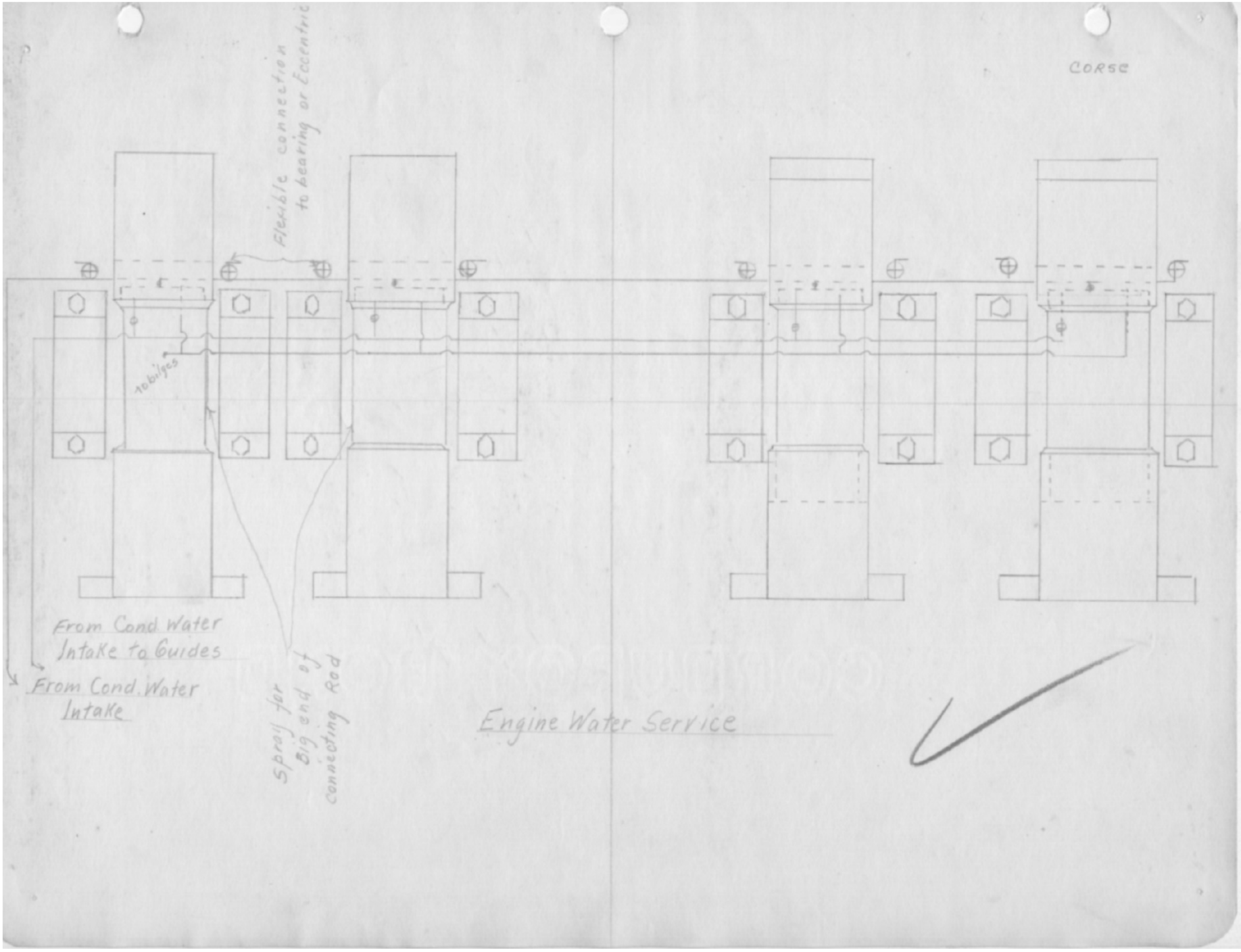
7. What are the causes, effects and remedies of following conditions:

(a) Hot crank pin.
(b) Knock in crank pin.
(c) Cracked main bearing cover.
(d) One collar of thrust bearing hot.
(e) Hot eccentric strap.

8. Are cylinder drains open or closed under following conditions and why?

(a) Warming up.
(b) Getting underway.
(c) Steady steaming.
(d) Securing.

CORSE



Engine Water Service

Week N

Second Day.

① The bottom side oiler, takes care of the oiling of the auxiliary machinery, the main bearings, the eccentrics. Engine oil is used. The frequency of the oiling is varied but most oilers, oil their side every fifteen minutes.

Lather on a bearing indicates the presence of water.

② Sketch is attached. ✓

③ sketch is attached ✓

④ sketch is attached ✓

⑤ The shaft immediately abaft the crank shaft is constructed with a number of collars on the journal to bear against corresponding surfaces in the thrust bearing and thus transmit the thrust of the propeller to the ships. The pressure, (same) exerted on one side of the collars in the ahead motion and on the reverse side in going astern. The bearing is secured firmly to a bearer or seating rigidly connected to the structure of the ships and extending over several frames.

The usual form of horseshoe collar thrust block is used. It consists of eight collars secured on the shaft with the same number of thrust collars on the bearing.

The bearing consists of a pedestal bolted to the sole plate with holes in the former, so that as wear takes place on the collars the whole block can be adjusted bodily by means of wedges bearing against lips on the sole plate.

Means of adjustment are necessary otherwise the shaft will gradually occur forward throwing the cranks out of line and bringing heavy strains and bending stresses on the engine.

The oil trough in the pedestal contains a circulating pipe, or coil, for cooling water to reduce the temperature of the oil

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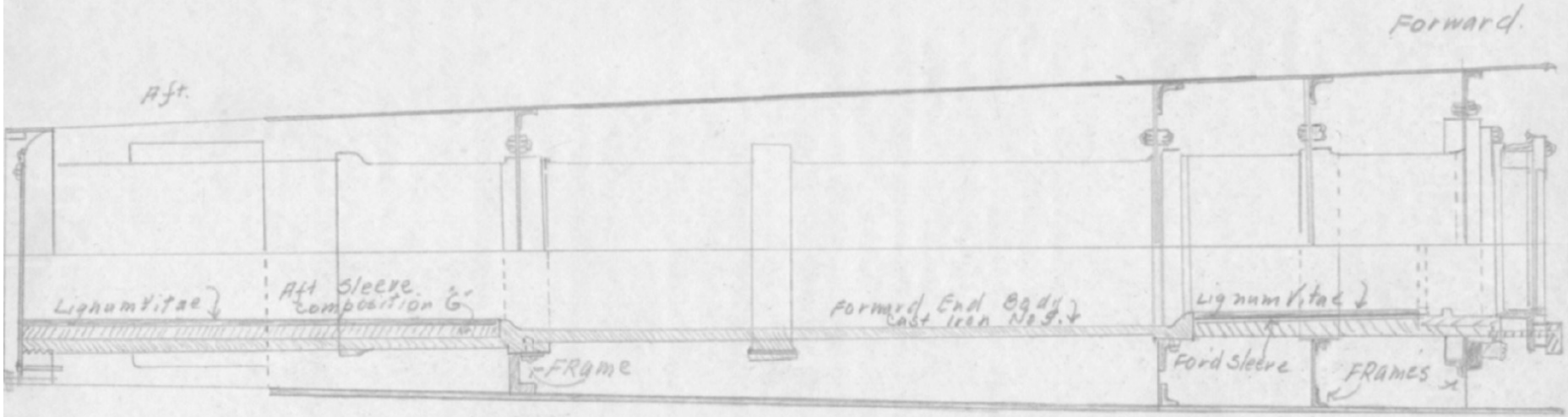
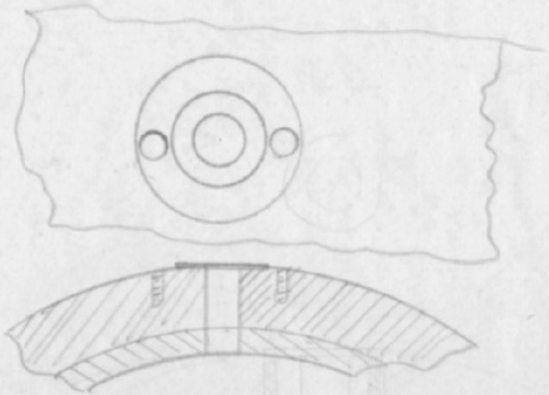
Stern Tube

Quarter section View





Section of Stern tube showing water service connections

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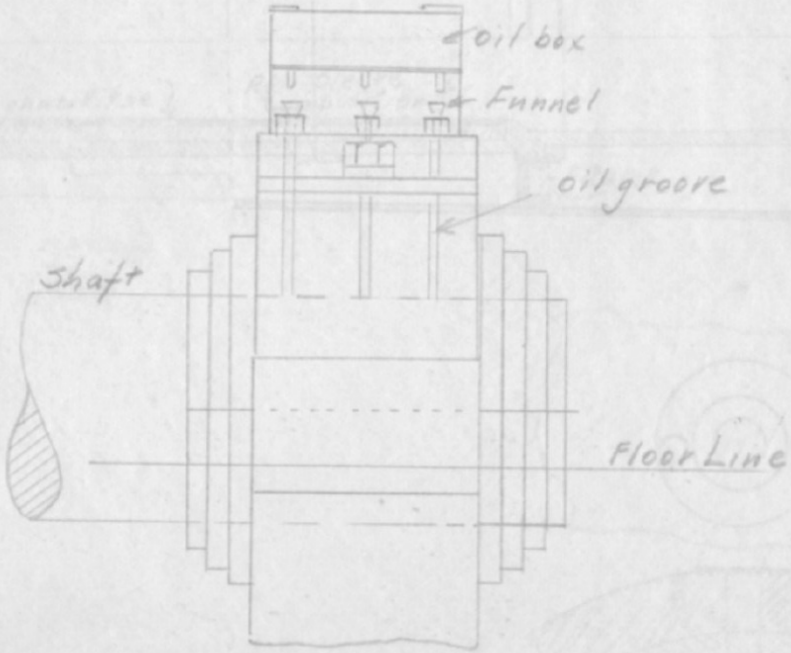
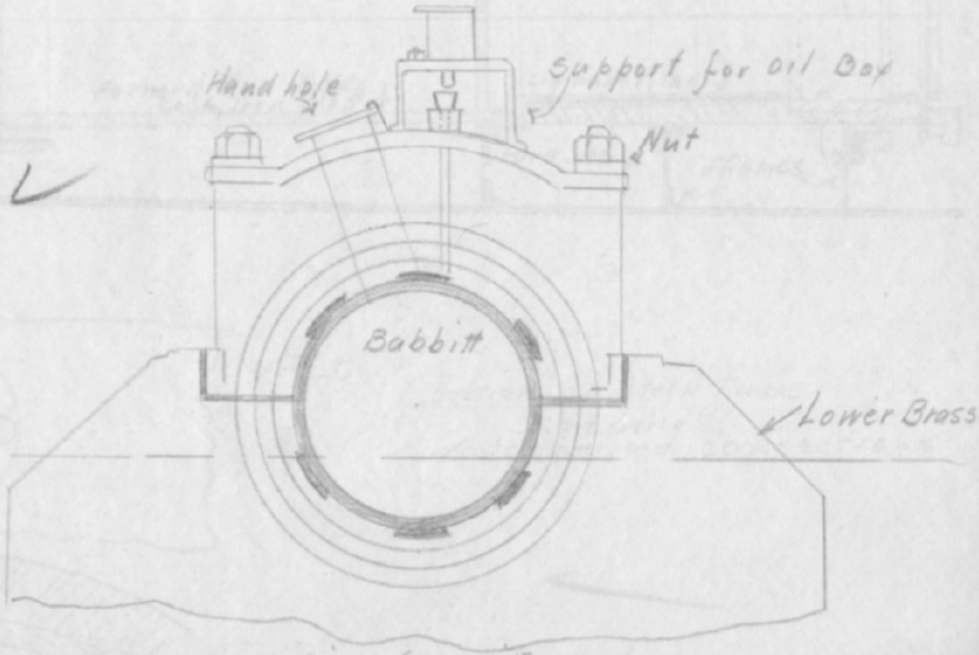
Forward Main Bearing

Plan View - Top Brass Removed



Eleration from Starboard



Elavation from Forward

The horseshoes are still further secured to keep them from rising by means of bolts.

They are made of cast steel, cored for lightness and faced on each side with white metal and channeled for distributing the oil. Each is provided with an oil box on top, with tubes leading to both faces.

(6) Yes, it does increase the plant efficiency to save the lubricating oil after it's having been used.

The oil is taken and boiled in a tank and after this process of refining can be used on the shaft alley thrust bearings, on the deck engines and winches, and on the blowers. This is as is done aboard the Manchuria.

(7) (a) A hot crank pin is caused by using a poor grade of lubricating oil, the presence of dirt or grit or by having the bearing set up too tight. The shafting not properly aligned also will cause the above condition.

To remedy this - wash out with soap and water, renew the oil or loosen bearing.

(b). A knock in crank pin is caused by too much clearance. The pin may be worn.

To remedy - reduce clearance.

(c). A cracked main bearing cover may be causing by the engine racing or by having an extra heavy load on it. Improper clearance.

The remedy used depend on whether it was the cover that was cracked or not - If so you would have to cut out that engine and take the load off of it. It might be possible to repair it, and then it used same as a spring bearing if the top cover alone was cracked.

(a) If one collar of the thrust bearing becomes hot the probable cause would be that the water service to that particular collar might be ~~to~~ clogged up; improper adjustment of the nuts would also cause this. ~~Hard~~ However is trouble is very seldom.

To remedy - readjust the hot collar and increase its clearance - repair the faulty water service tube.

(c) A hot eccentric strap may be caused by dirt or grit, low water, or set up too tight.

To remedy wash out, increase amount of water and readjust.

(8)

(a) The cylinder drains are open when the engine is being warmed up to allow the escape of the water of condensation in the cylinder.

(b) In getting underway the drains are still open for a short time until the condensation is greatly reduced, to allow also for the escape of the water of condensation.

(c) The cylinder drains are closed while under steady steaming, in order to save the vacuum.

(d) The drains are open when securing - to allow for the drainage of the cylinders.

11-11-13
WSL/HCE

✝ OVERSEAS CRUISE ✝

WEEK "N"

THIRD DAY: - Reciprocating -

1. Make a classified list of all pumps indicating their type, size and all the uses to which they may be put.

2. Explain in detail the operations you would perform in starting and securing:
   (a) Main circulator.
   (b) Main air pump.
   (c) Bilge pump.
   (d) Fire pump.

3. Sketch the pipe lines in plan and elevation of the sanitary system on board.

4. Make cross section sketch water end of any pump used for bilge drainage, also showing clearly the suction and discharge manifold, and indicating where suctions may be taken from and where discharged to.

5. Sketch the complete fire lines for your ship showing pumps and controlling valves.

6. How often are all pumps not in use moved? Compare with requirements of Navy Regulations.

7. What is the cause of a groaning noise in a pump steam cylinder? Discuss means of remedying.

8. Describe in detail exactly how you would adjust the steam end valves of the fire pump.

G.F. Corse

Week "N"

Third Day.

① Classified List of all pumps.

Pump	No.	Maker	Type	Size	Uses.
Circulatr	2	C	Centrif		Main and auxiliary condenser cooling water.
Aux Condenser	1	Wheeler	Horizontal Simplex Tandem		Aux. condenser air and circulating water.
Main Air	2		Vertical Beam attached		Air pumps for main condenser
Aux. Air	1		Vertical, Beam 1 Steam cylinder 2 air cylinders		auxiliary air pump not yet in operation.
Bilge	2		Vertical, beam attached		Bilge Pumping
Ballast & Bilge	1	Dean	Vertical, Duplex		Aux Stbd circulatr
Fresh Ballast	1	Worthington	Horizontal Duplex	7½×11×12	Fresh water ballast
Fresh water #1	1	Dean	Vertical Duplex		Fresh water pumping
Fresh water #2	1	Worthington	Horizontal Duplex	6×5¾×6	" " "
Sanitary	1	Dow	Vertical Duplex	12×10½×18	Sanitary bilge & ballast
Hot Salt	1	Dean	Vertical Duplex	7×8×8	Hot salt system bilge, evaporators.
Brine	2	Mumford	Vertical Duplex		Brine circulation.
Crank Pit	1	"	Vertical Duplex		Crankpit – ice mach. condenser circulatr
Main Feed	4		Vert. Simp		main feed
Aux feed	2	Dean	Vert. Dup	4×6×10	Aux feed, distiller, fire sanitary ballast
Evaporator	1	Dean	Vert. Simp		Evaporators.

(2) (a). In starting up the main circulator, the following procedure is followed.

(1.) See that the exhaust is open.
(2.) " " " discharge " "
(3.) " " " suction " "
(4.) Admit steam slowly, keeping the drains open, allowing the pumps to warm up gradually. Always start the pumps slowly, allowing plenty of time for it to warm up. Close the drains after the pumps has operated satisfactorily for a few strokes.

In securing the main circulator
(1.) Shut off the steam.
(2.) Shut off the exhaust.
(3.) Shut off the suction,
(4.) Open drains.

(b.) In starting up the main air pumps.
(1.) open the discharge
(2.) open the suction.
To secure the main air pumps.
(1.) Secure the suction
(2.) " " discharge
(3.) open the drains.

(c.)(d) operation of starting the bilge pumps and bilge pumps.

They discharge overboard and into the fire main and flushing system.
(1.) Open the exhaust
(2.) Open the discharge
(3.) Open the suction.
(4.) Crack steam on easily.

After a pumps has been run on the bilges it is necessary to run it for about five minutes with sea suction and discharge overboard valves open, to clean out the cinders and grease, before securing it or running it on any salt water system.

To secure.
(1.) Shut off steam
(2.) " " exhaust.
(3.) " " suction
(4.) Open drains.

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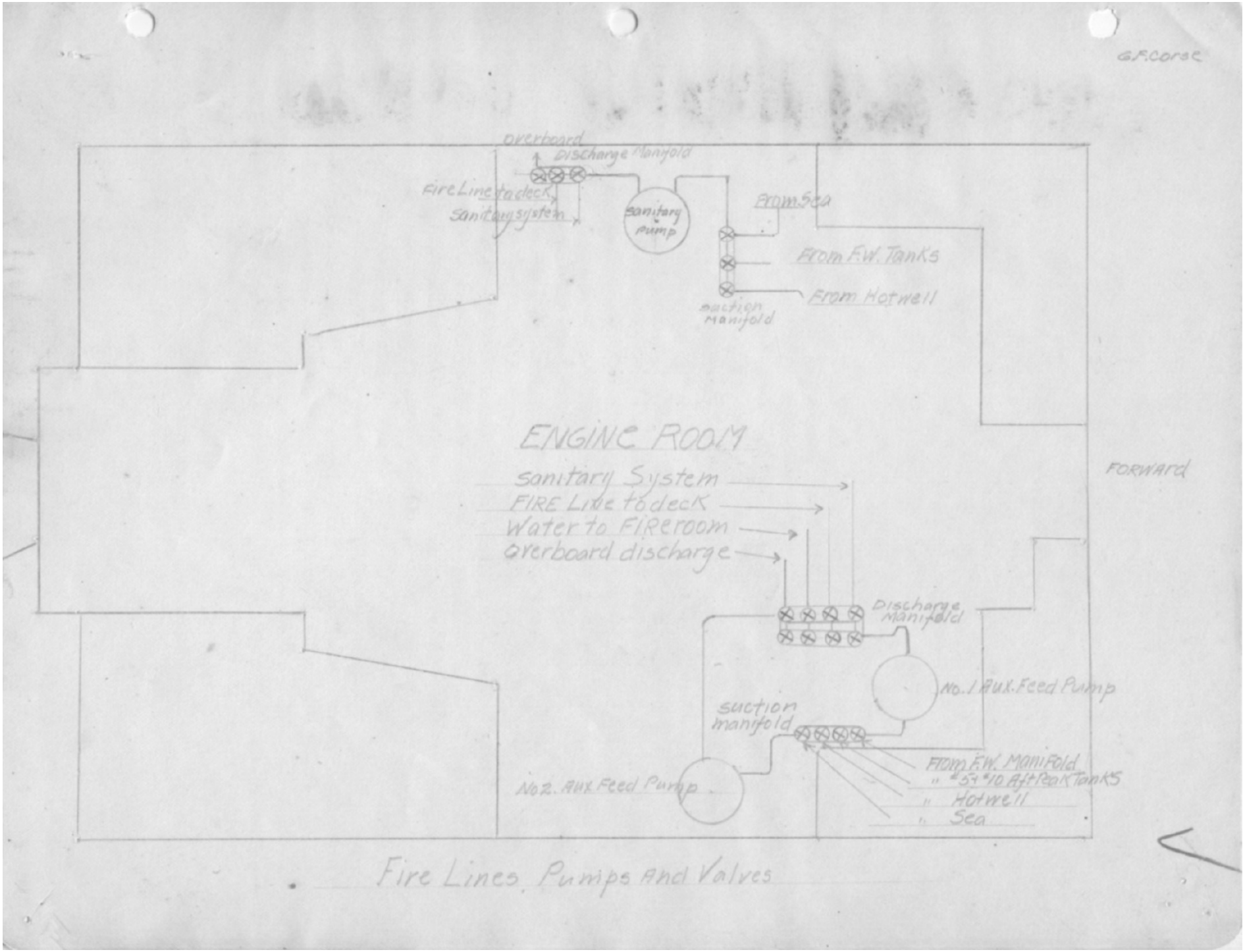


Fire Lines, Pumps And Valves

(3) Sketch is attached.

(4) Sketch is attached.

(5) Sketch is attached

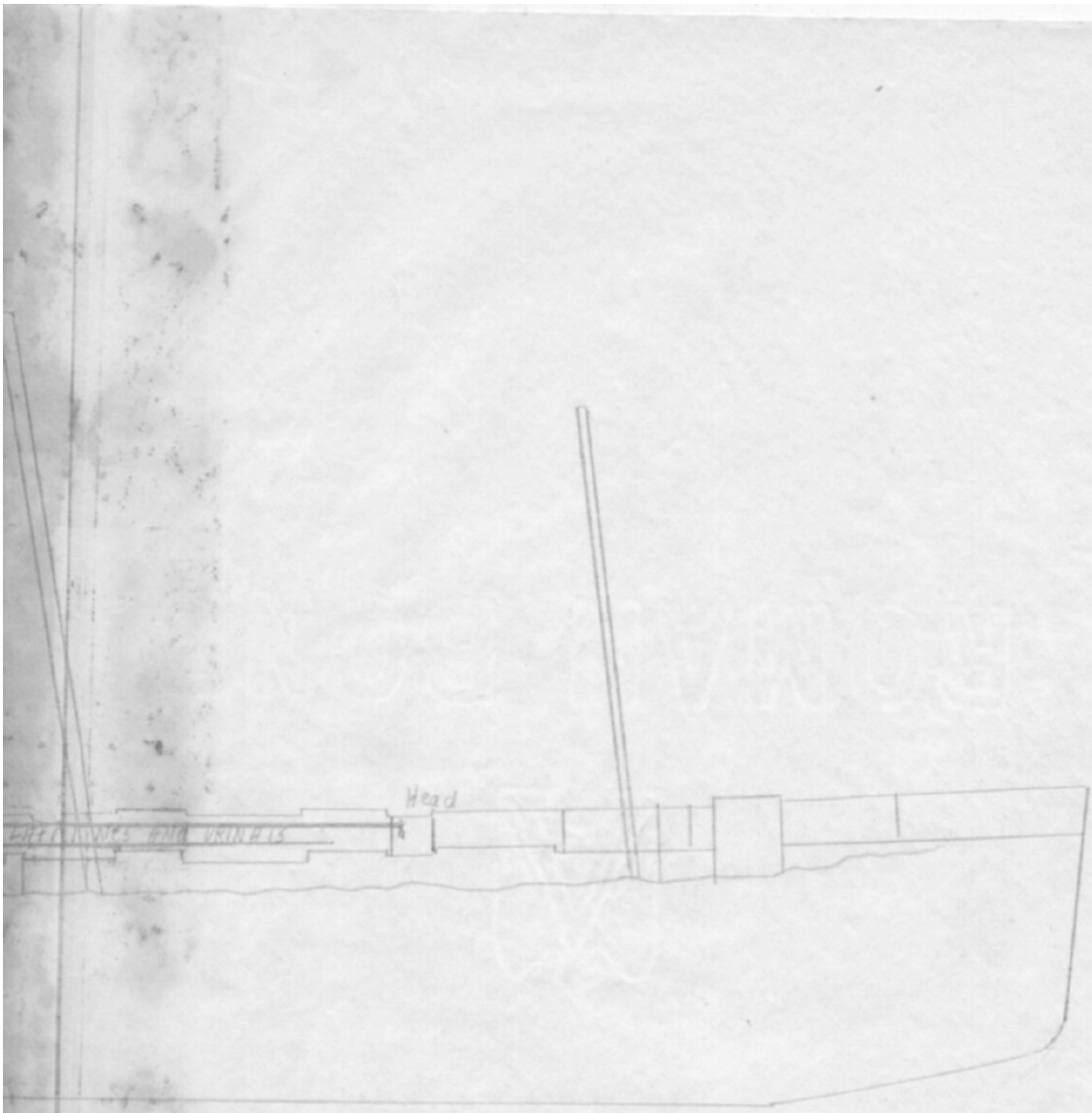
(6) all pumps not in use are moved every twelve four hours. Navy Regulations require that all pumps be moved at least once a week.

(7) Grunting or a groaning noise in a pumps steam cylinder is caused by one of the following.

(1.) Cylinders are out of line.
(2.) Piston rings are tight
(3.) Piston rings are rubbing
(4.) Packing is tight.

To remedy this trouble first examine and find cause of noise. Then either line up cylinders loosen piston rings, remove some of the packing.

(8) Keep the stuffing boxes well packed with a good quality of packing. Don't screw the glands too tight, and dont allow the same packing to remain in the stuffing-boxes long enough to become hard and scratch the piston valve.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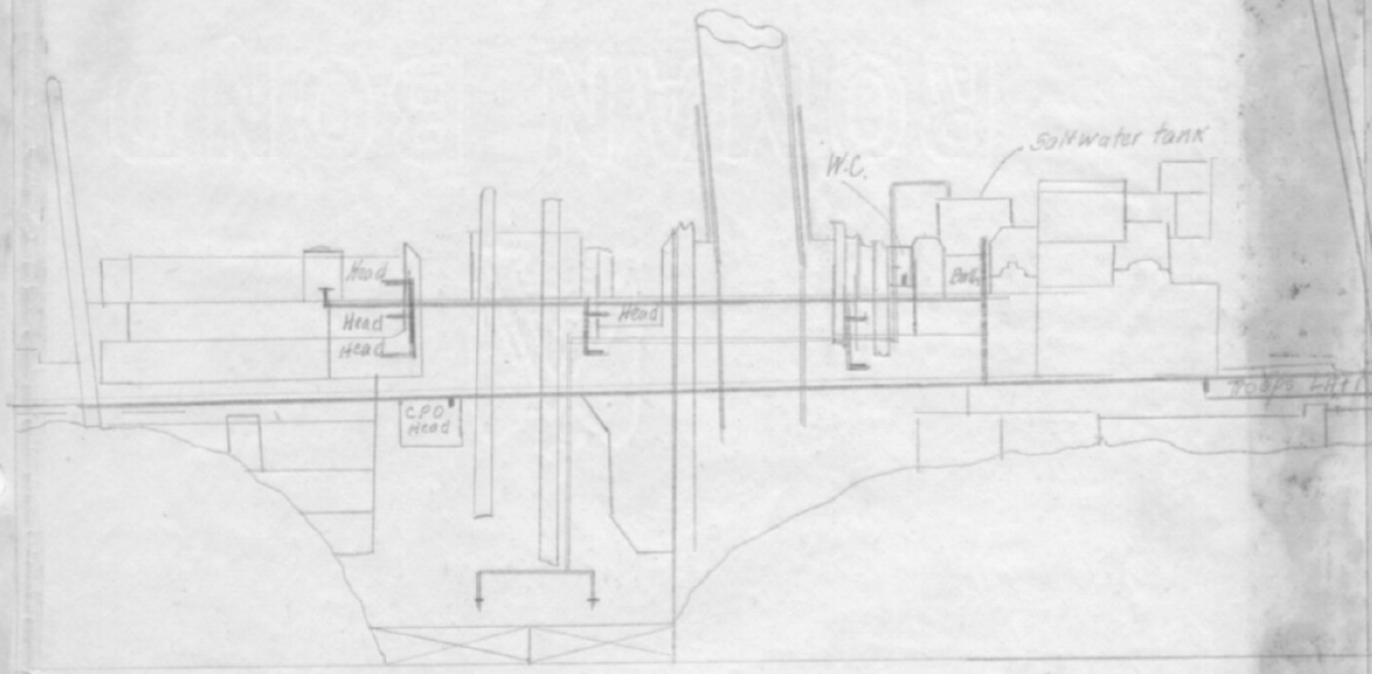
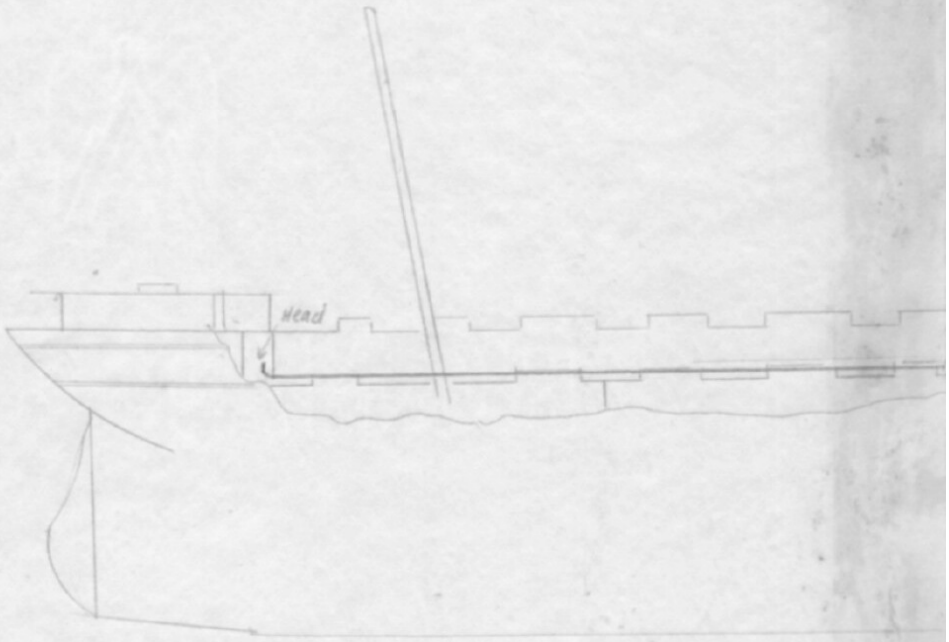
SANITARY SYSTEM of SHIP

EIEVATION VIEW

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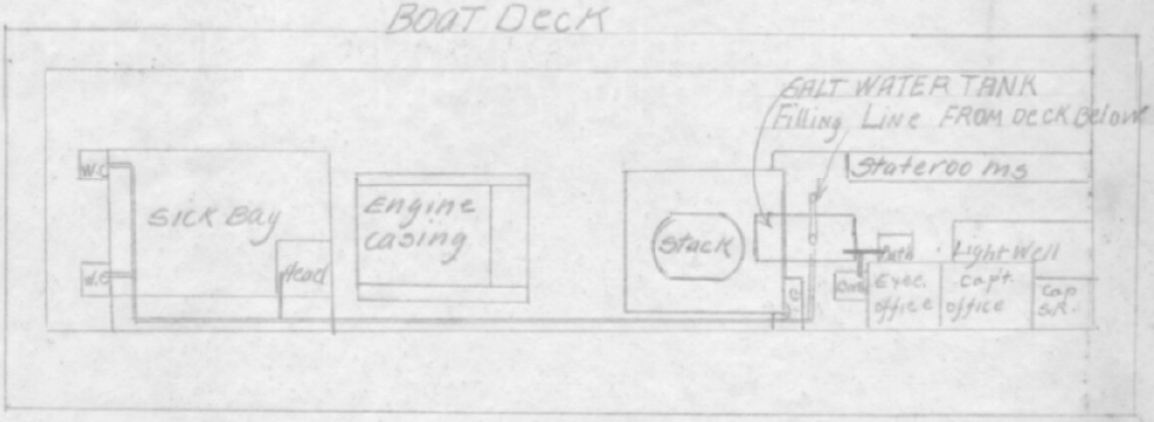
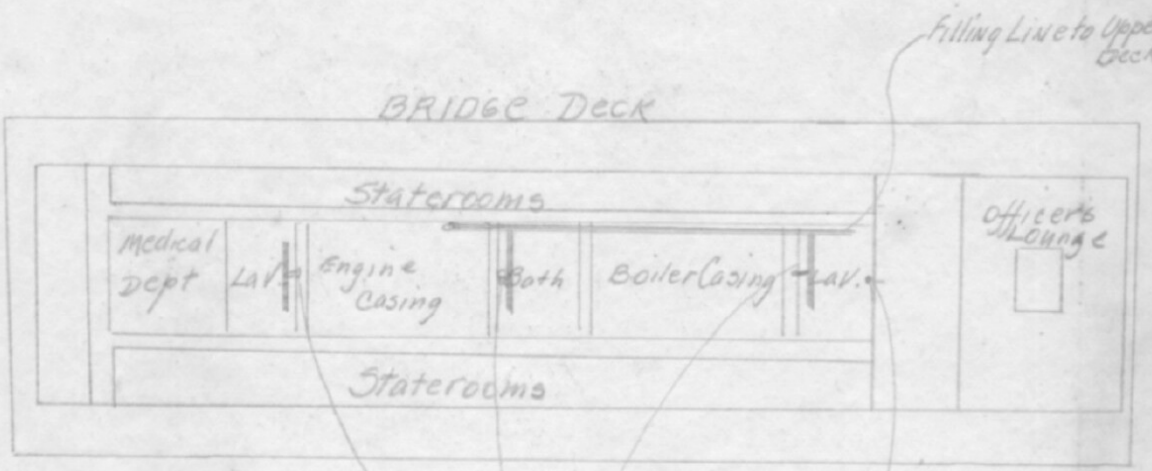
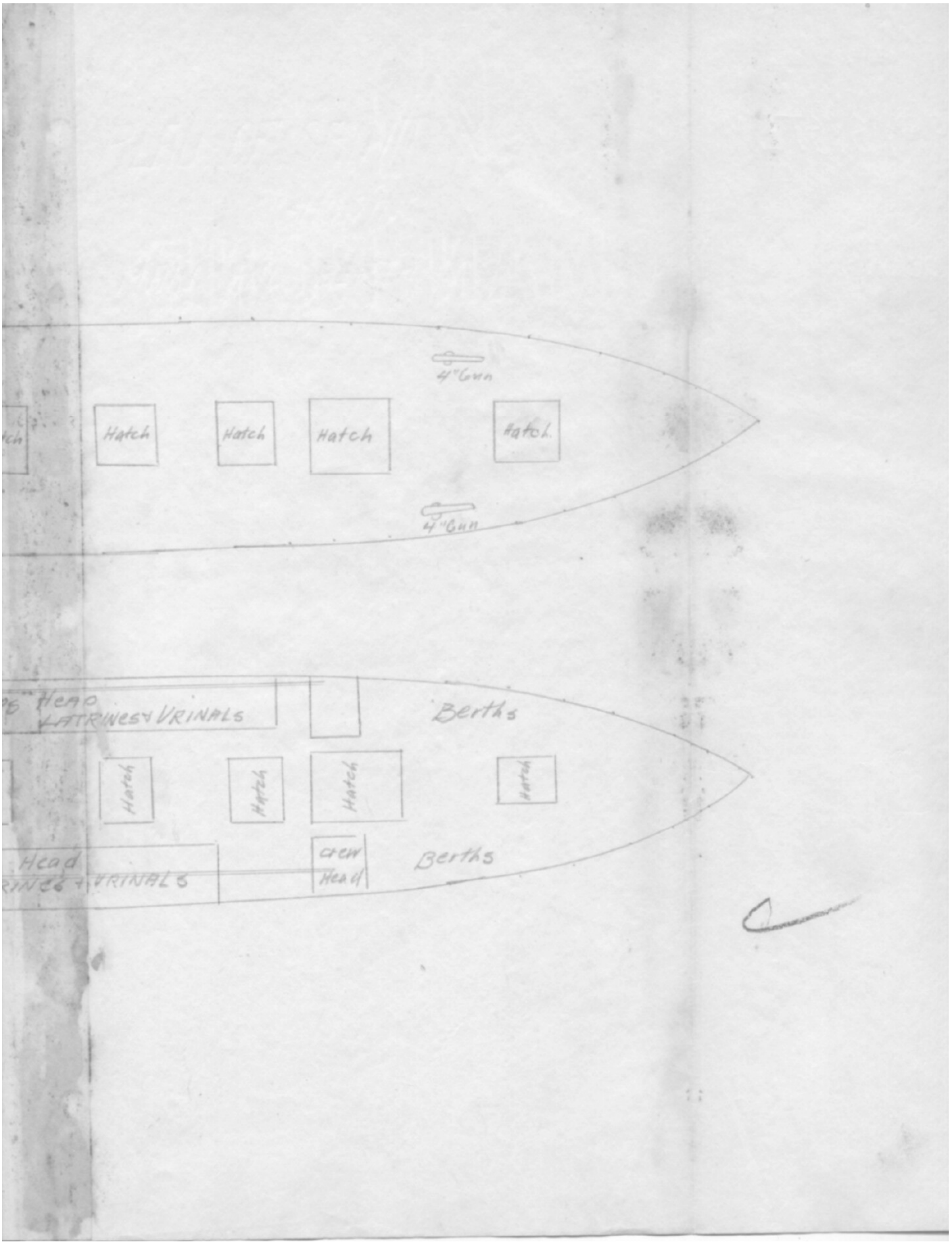
C. F. CORSE

PLAN VIEW
OF
SANITARY SYSTEM
BOAT AND BRIDGE DECKS

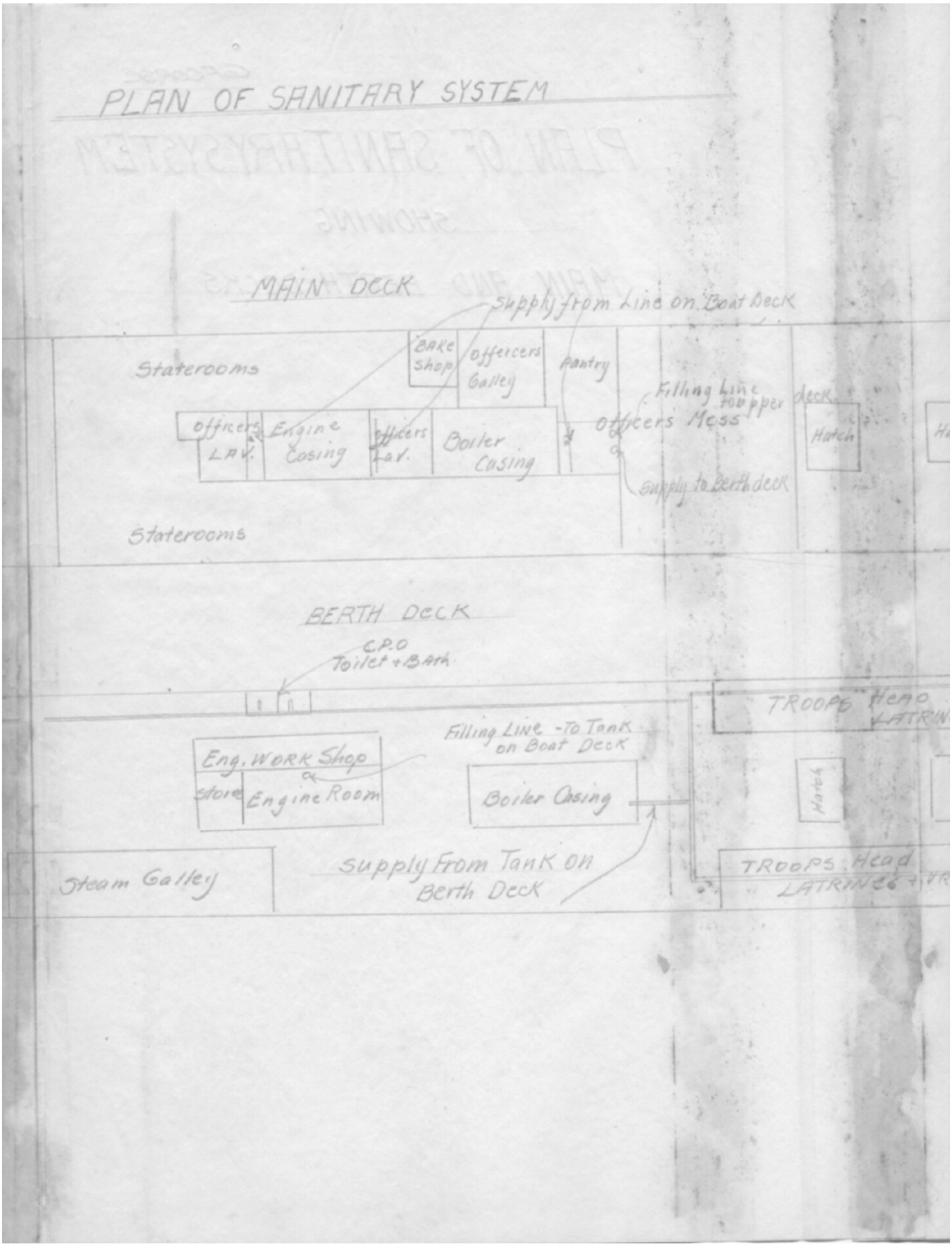


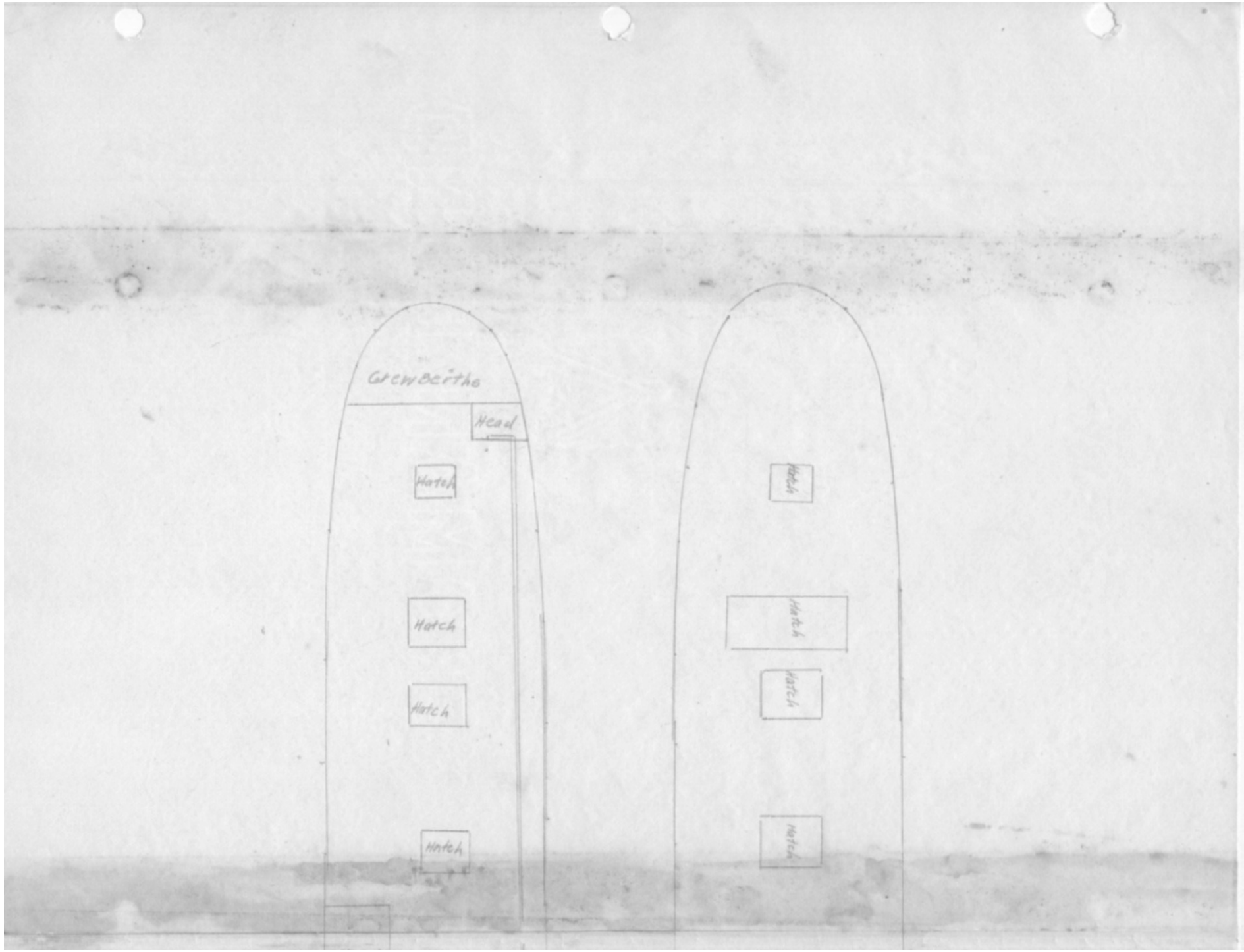


For other decks see Succeeding Drawings


4"Gun
Hatch
Hatch
Hatch
Hatch
4"Gun
Head
LATRINES & URINALS
Berths
Hatch
Hatch
Hatch
Hatch
Head
RINES & URINALS
crew
Head
Berths

PLAN OF SANITARY SYSTEM




Crew Berths
Head
Hatch
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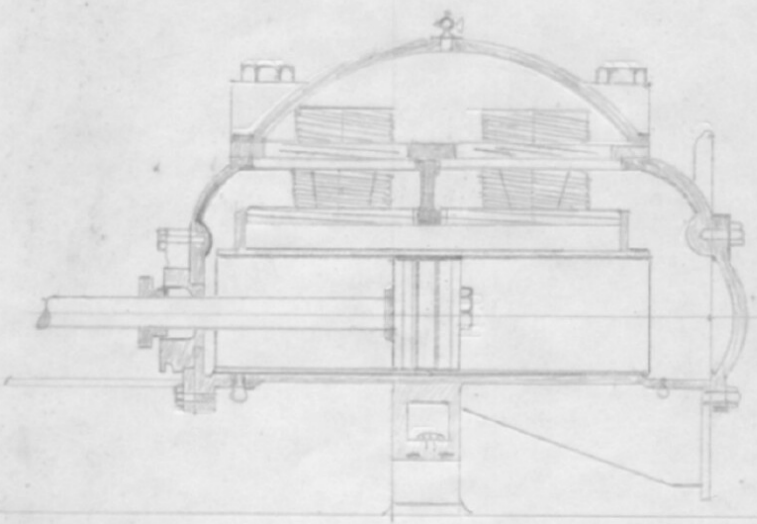
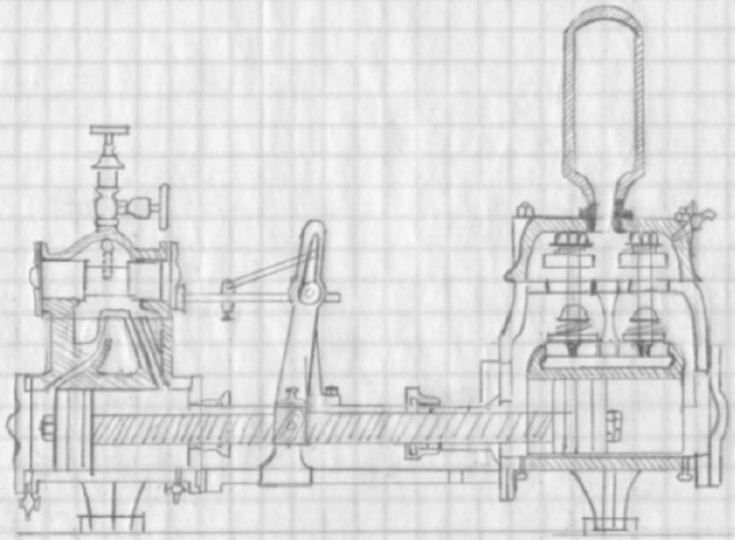
CROSS SECTION OF WATER END



BILGE PUMP.

George F. Corse



Direct Acting Feed Pump.

To set the steam slide valves of the fire pump.

(8.) Place one piston in the middle of its stroke, disconnect the link from the head of the valve rod on the opposite side. Then set the valve in its central position, place the valve nut evenly between the jaws of the back of the valve, screw the valve rod in or out until the eye on the valve rod head comes in line with the eye of the valve rod link, then re-connect.

Repeat the operation on the opposite side and the valves will be properly set.

11-15-13

WSL/HCE

+ CRUISE +

WEEK "N"

FOURTH DAY: - Reciprocating

1. What are the duties of the man assigned to throttle watch What does he control from his station? What gauges has he near him? Sketch them, showing pressures indicated on each for full spee

2. Explain fully all means of communication used between bridge and engine room, giving examples to show how an order is carried out. Repeat for engine room to fire room communication. How could this system be improved? How are the signals for general quarters and abandon ship drills made?

3. Tell in logical order what operations are carried out by the throttle man in the engine room when following orders are received; in sequence;

(a) Getting underoway.
(b) Full speed ahead.
(c) Full speed astern.
(d) Stop.
(e) Manoeuvering.

4. Make a cross section sketch of the throttle valve showing how it is controlled.

5. Make detailed sketch of the reversing gear, showing operation of rod and position of links for ahead motion. Also make separate sketch showing construction of independent linking up gear.

6. How is the procedure for emergency full speed carried out in fire and engine rooms.

7. What special precautions are taken in operating the throttle in a heavy sea? If any emergency speed governor is installed describe its action with a sketch.

8. How is the throttle handled if the boilers show a tendency to prime? How are cylinder drains handled under this condition?

Week "N"

Fourth Day

The throttle man is a chief machinist mate and his duties are as follows.

(1) He controls the throttle, and operates the reversing engine.

(2) Answers the telegraph, and by swinging handle back and forth acknowledges the various signals and orders coming from the pilot house. If the telegraph registers full speed ahead and then changes to stop, the throttleman will throw the handle of the telegraph over, thus answering the bridge and leave it in a corresponding position on the dial to correspond to the stop position already registered on the dial from above.

(3) The throttleman answers the speaking tube, by replying "Engine room" and takes any orders coming from the bridge.

(4) Figures "Counter", both for the starboard and the port engines.

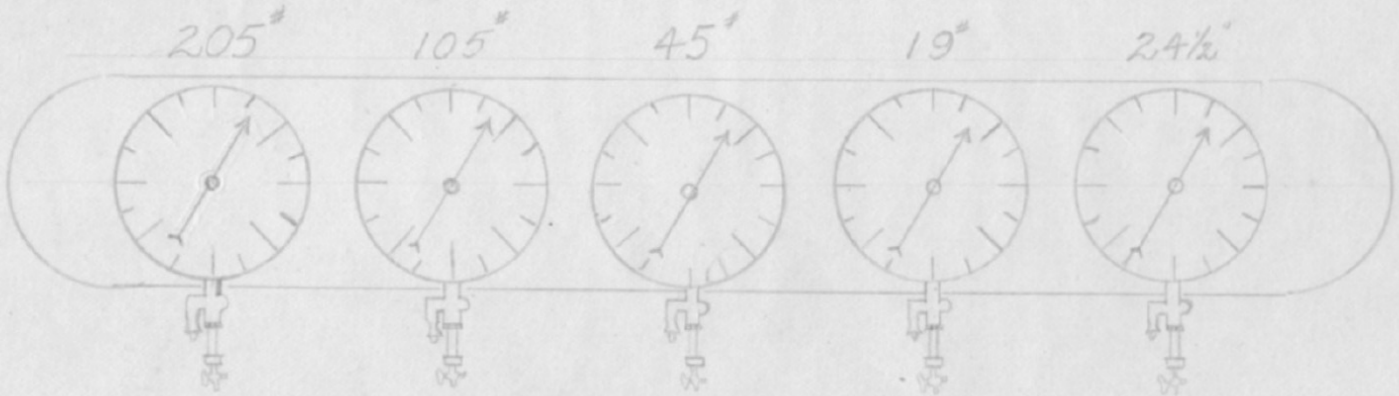
(5) Takes all steam pressures.

The throttleman has the four steam chest gages, the vacuum gage and the boiler pressure gage under him.

Sketch of these gages attached.

MAIN ENGINE GAUGES

Full Speed Conditions



HP 1st M.P. Rec. 2nd M.P. Rec. L.P. Vacuum

(2) The means of communication most used between the bridge and the engine room is the speaking tube.

any order or any information is communicated by this instrument. The speaking tube is the only way an order can be sent from the bridge to the engine except by sending a messenger with the message, or by signals to stop the engine.

Each day at twelve o'clock the bell rings at the speaking tube and the throttleman answers and says "Engine Room". He is told that the annunciator or engine room telegraph will be tried out. Then he merely answers the signals and does not touch the throttle during this test.

All gage readings and steam pressures are transmitted to the bridge by the speaking tube.

The electric telegraph is not used at all now and was only used when the ship was in convoy during the period of the war.

There is an electric bell which rings when an answer is wanted over the speaking tube.

There is no means of communication between the engine and the fire rooms, except by messenger through the bulkhead.

The system could be much improved I believe with the addition of an electric telephone.

The signal for general quarters is by means of the electric bell. One continuous ring is the call.

The blowing of the sirens is the signal used for abandon ship drill.

③ @.

One half hr. before getting under way the following is done.

(1) Turn steam on steering engine and open the exhaust. An Engineman will go to the steering engine room and see that the engine is properly oiled.

(2) Turn steam on whistle and siren.

(3) Turn on water service thrust bearing. watch gage on anchor engine before leaving it.

(5) Set clocks by bridge clocks.

(6) Test int the telegraphs from bridge.

(7) Put wicks in manifolds and see that they work properly.

(8) Ask permission of the Officer of the Deck to try int main engine.

(9) Turn main engine slowly a few turns each way.

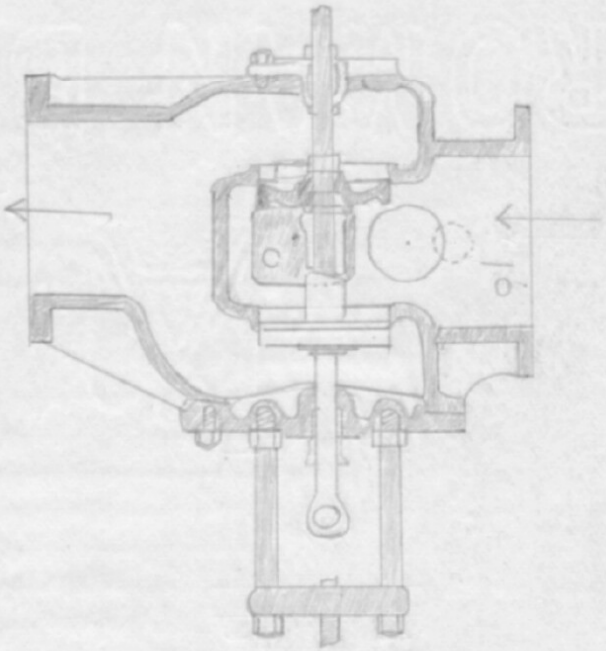
(10) Correct any faults found in operating of the main engine.

(11) Report to O.D. "Ready to get under way."

In getting under way the throttleman answers the telegraph - throws the engine into the ahead motion and opens up the steam slowly. Closes the cylinder drains after a few turns of the engine. The count of the revolutions are watched with care.

Log is kept of time and order of all signals for getting under way.

#4



Double-Poppet throttle Valve

3. (b) The throttleman stands by the throttle, throws in full ahead position, and opens up steam slowly.

(c) When order comes for full speed astern, the throttleman shuts off the steam to the engine, starts reversing engine, and throws over the link into the astern position, and then opens up the steam.

(d) When the order to stop comes, the order is acknowledged, the throttle is secured, and the link placed in the neutral position.

(e) When maneuvering the throttleman stands by the throttle, answers the telegraph and carries out orders from the bridge.

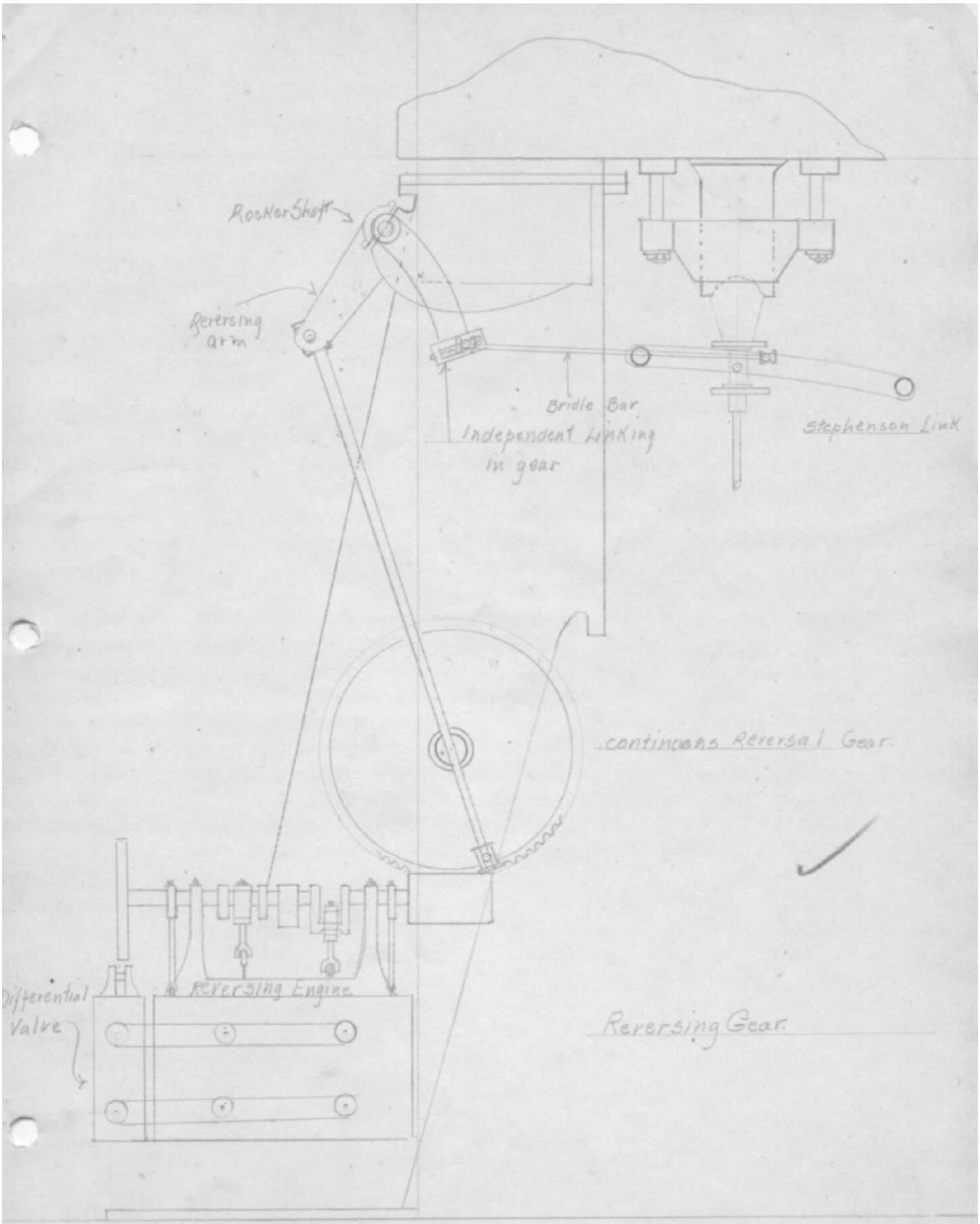
(4) Sketch is attached.

(5) Sketch is attached.

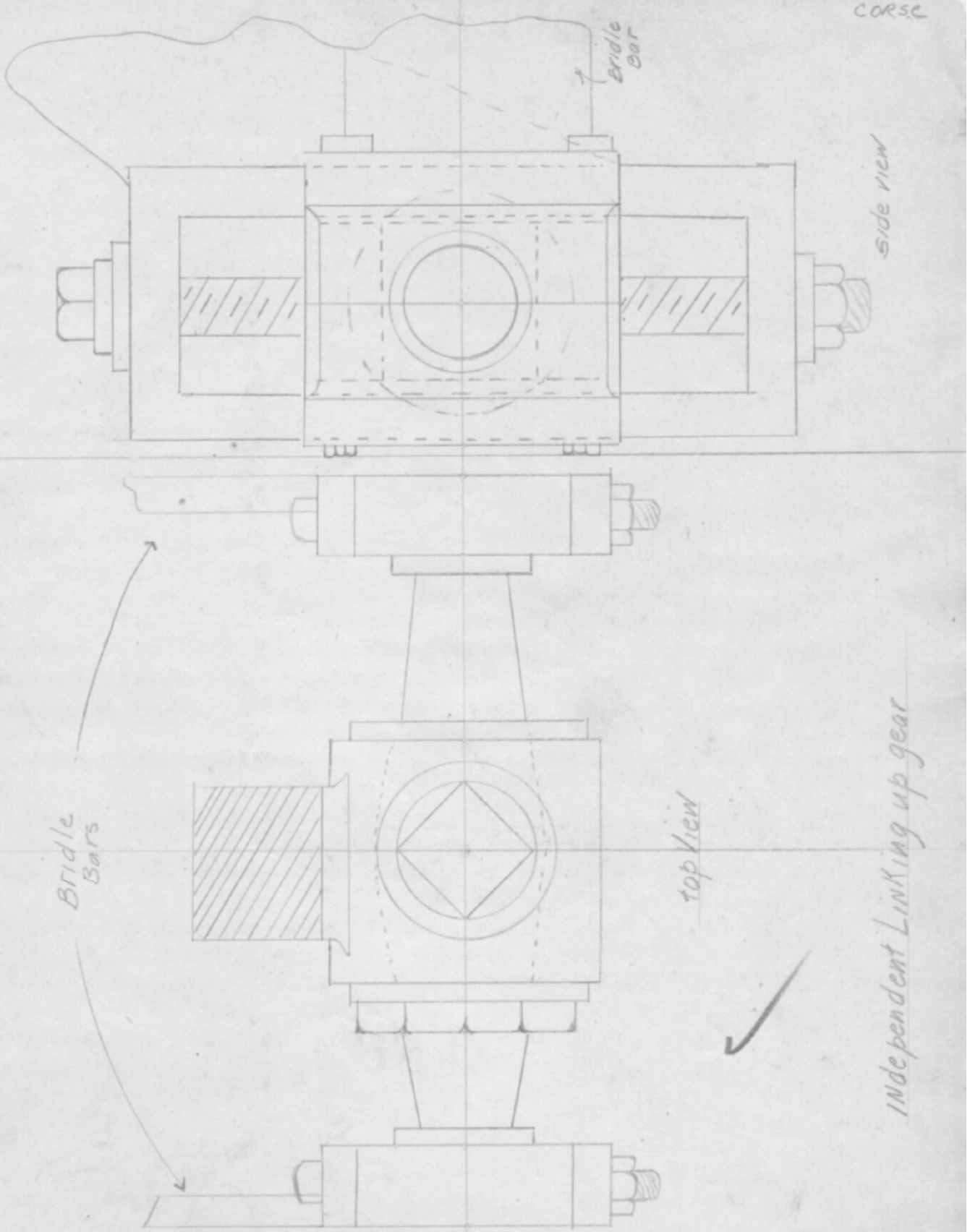
(6) For emergency full speed the order would come to the engine room by way of the speaking tube, the word would be carried into the fire room by a messenger, the blowers in the fire room would be speeded up all all possible steam pressure, (with safety) would be raised.

The throttle valve would be opened as wide as possible.

~~Never~~ However, according to the chief machinist mate on my watch no such order has ever been received in the engine room.


Rocker Shaft
Reversing arm
Bridle Bar
Independent Linking in gear
Stephenson Link
continuous Reversal Gear
Differential Valve
Reversing Engine
Reversing Gear.

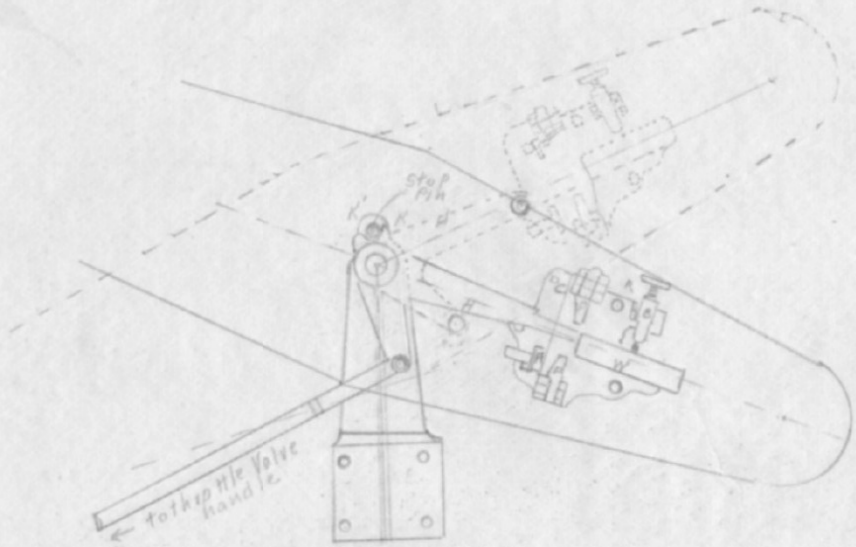
CORSE



Independent Linking up gear

(1) Racing must be prevented by working the throttle to meet the period of least immersion of propeller (when the stern goes up) a governor is put in, and is connected on to the cross arm or walking beam of the main air pumps. shaft attached

(2) Priming, or carrying over of water must be met by slowing down and opening the cylinder drains.



Aspinall - Marine Governor.

W = Large Weight
P = Pawls
D = Detent
H = Engaging Lever
A = Small Weight
B = Spring Buffer
R = Regulating Screw

(7) The aspinall governor consists of a hinged weight operating two pawls carried on a frame which is bolted to the air pump lever.

When the revolutions of the engine are increased by abnt 5% above normal speed, the weight is left behind, & reverses the position of the pawls, causing one to engage the other with a lever, lifting it throughout the whole upward stroke, and thus shutting of steam by closing the throttle valve.

On the return stroke a detent is lifted, liberating weight, and if the revolutions have moderated, the position of the two pawls is again altered, the top pawl now engaging with lever depressing it, and thus re-opening the throttle valve.

11-15-18
WSL/HCE

- OVERSEAS CRUISE -

WEEK "B"

FIFTH DAY: - Reciprocating -

1. Make cross section sketch of the indicator aboard, explaining its operation.

2. Take a full set of indicator cards for all cylinders. From these indicator cards calculate the I.H.P. of the engine and indicate all calculations. Attach the cards taken to your report.

3. Analyze as completely as possible the cards taken, explaining all peculiarities found and suggest means of improving the cards.

4. Explain in detail the complete operation of setting the H.P. valve, also telling what measurements you would take and what records you would keep.

5. Make a table of readings of all the steam gauges for following speed conditions, noting the speed:

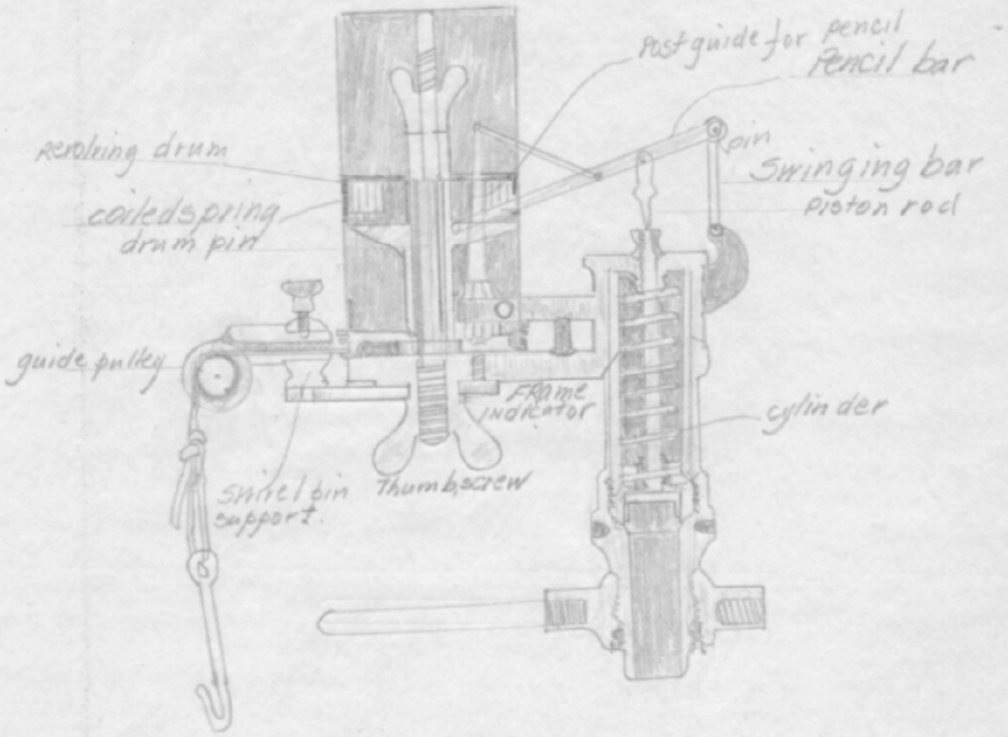
(a) Standing by.
(b) Slow speed.
(c) Half speed.
(d) Full speed.

6. From the propeller pitch, speed of ship and number of revolutions calculate the slip for a definite speed.

7. How would you determine the clearance in the main engine cylinder? How much is it for each cylinder on your ship? How is large clearance indicated on a card.

8. Just how would you improve the distribution of work among the cylinders; how would this show up on the indicator cards.

Cross section of Indicator



E. 5th. Day Week N.

① Sketch is attached

② Indicator cards see page.

The senior engineer officer refused to allow cards to be taken, except for the port L.P. cylinder for which he had no need. The cards taken for this cylinder are attached to this report. The other cards were obtained from the senior engineer officer. It was impossible to obtain cards for the starboard M.P.1. cylinder.

Sample calculations

④ Calculation of piston areas:

H.P. cylinder

A.H.E. = .7854 × 30² = 706.9 in²

A.C.E. = .7854 × 20² = .7854 × 9² = 706.9 − 63.6 = 643.3

M.P.₁ cylinder A.H.E. = .7854 × 43² = 1452 in²

A.C.E. = 1452 − 63.6 = 1388 in²

M.P.₂ cylinder A.H.E. = .7854 × 63² = 3118 in²

H.C.E. = 3118 − 63.6 = 3054 in²

L.P. cylinder A.H.E. = .7854 × 89² = 6220 in²

A.C.E. = 6220 − 63.6 = 6156 in²

(b.) Areas of cards were obtained with a K & E. planimeter.

(c.) Average height of cards = $\frac{\text{area}}{\text{length}} = \frac{3.33}{4.70} = .709$ in

(d.) Mean effective pressure = Average height × spring scale

= 100 × .709

= 70.4 pounds.

(e.) $I.H.P._{H.E.} = \frac{PLAN}{33000} = \frac{70.9 \times 5 \times 706.4 \times 75}{33000} = 364$ I.H.P.

(f.) Total I.H.P. per cylinder = $I.H.P._{H.E.} + I.H.P._{C.E.}$

= 364 + 483

= 1052 I.H.P.

Note:- The engines were turning 75 R.P.M. at the time the cards were taken.

Fifth Day

⑤

Table of readings of all steam gauges for the following speed conditions, noting the speed.

ⓐ Standing by - There is a warming up pressure of abmt 20# on the H.P. cylinder, and nothing on the other cylinders. There will be no R.P.M. Here.

ⓑ Slow speed - 80# pressure on the H.P - 40# on the 1st M.P. 20# on the 2nd M.P. the L.P. is a vacuum.

abmt 30 R.P.M. for this speed.

ⓒ Half speed. - 120# on the H.P. - 60# on the 1.M.P. 25# on the 2nd M.P. Nothing on the L.P. Cylinder.

abmt 45 R.P.M. for this speed.

ⓓ Full Speed. - 205# on the H.P. cylinder - 100# on the 1.M.P. Cylinder - 45# on the 2nd M.P. cylinder and nothing on the L.P to 05#

74 R.P.M. for full speed.

G.F.Corn

Engine	cylinder	Area of Piston		Area of Card		Length of Card		Average Height of Card		Scale	M.E.P.		Indicated Horse Pow		
		H.E.	C.E.	H.E.	C.E.	H.E.	C.E.	H.E.	C.E.	Lbs/in	H.E.	C.E.	H.E.	C.E.	Tot
Stbd	H.P.	706.9	643.3	3.33	3.10	4.70	4.70	.709	.660	100	70.9	66.0	569	483	10
Stbd	M.P.	1452	1388							50					
Stbd	M.P$_2$	3118	3054	2.93	2.61	4.40	4.36	.666	.598	24	15.98	14.35	367	498	106
Stbd	L.P.	6220	6136	2.80	2.28	4.39	4.39	.638	.520	12	7.65	6.24	541	437	97
Port	H.P.	706.9	643.3	2.44	2.50	4.60	4.60	.531	.544	100	53.1	54.4	427	398	82
Port	M.P$_1$	1452	1388	3.40	3.30	4.50	4.60	.756	.733	50	37.8	36.7	621	580	120
Port	M.P$_2$	3118	3054	3.10	2.80	4.57	4.48	.686	.638	24	16.5	15.0	585	522	110
Port	L.P.	6220	6136	3.03	2.50	4.40	4.49	.689	.557	12	8.27	6.64	585	464	105

Results of Calculation of Indicated Horse Power
for Sample Computations on Page Attached.

Week N. Fifth Day

G.F. CORSE

N. S. E. 50 Dl.

U. S. S. Manchuria, , 19 . M. Port Engine. No.

Pressures. (Gages.) Boiler / Engine / Rec'r

Temp. Fahr. Injection / Discharge / Feed / Air-Pump dis

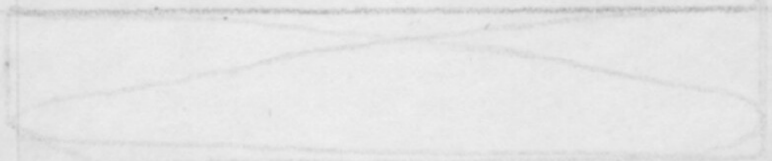
Vacuum

Throt. tenths.

Coal. Kind / Lbs. per hour

4—595

L. P. Cylinder. 8.77 M. E. P. Top. 6.69 M. E. P. Bottom.



I. H. P. This card / This cyl. / This engine / Auxs. in use

Indicator. Make / No. / No. of spring / Scale, 1"= lbs.

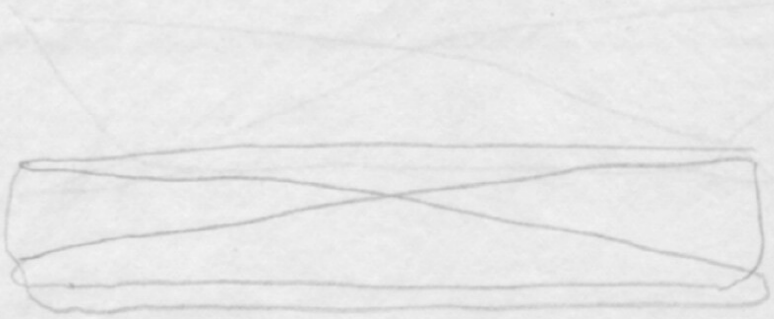
Revs. per min.

Speed

Slip of screw

Stbd Engine

L.P. Cylinder 7.65 MEP top 6.24 MEP Bottom.



Stbd Engine

H.P. Cylinder 70.9 MEP top 66.0 MEP Bottom

M.P.2 Cylinder 15.98 M.E.P. top 14.35 MEP Bottom.

✓

M.P. Cylinder 16.5 M.E.P. Top 15.0 M.E.P. Bottom

Port Engine

L.P. cylinder 8.77 M.E.P. Top 6.69 M.E.P. Bottom

Nearly all the cards show peculiarities, and unmeaning perfect cards. The cut off cond be sharper. This is show by absence of a sharply defined point of cut off. The cards have earlier compression on the upper end than the lower. This should be reversed, so that the moving parts would be cushioned at the lower end. The point of release is satisfactory on all cards except for the Crank ends of the H.P. cylinders. Here release is to late as shown by the loop. Admission is a little too early for upper ends of H.P.

The calculations show distribution of work is poor. The upper end does too much of the work. The distribution among various cylinders is also poor. The Port H.P. cylinder does only 19% of the work done by port engine.

Cards coned be improved by a readjustment of the valve gear. but on whole they are as good as coned be expected from slide and piston valves.

With this type of valve the four events of steam cycle are not independent for one another.

It is impossible to have all events occur at desired point.

The cards having late release, showed increase angular advance or lengthening valve stem,

The lack of a sharply defined cut off is due to inherent qualities of a slide valve and cannot be remedied.

If sharp cut off is to be obtained, some other type of valve gear, such as the Corliss, must be used. This gear is not used on marine engines.

(H) Before setting H.P. valve place engine on the upper dead center by usual method. In the case of a slide valve remove the valve chest cover. & in case of piston valve remove the plugs from the peep holes. Observe lead place engine on lower dead center, and again observe the lead. Adjust the length of valve stem until the two leads are nearly equal. Observe points of cut off for both ends. If widely different valve stem must be adjusted, effecting a compromise between equal leads and equal cut offs.

Next the point of average cut off is regulated by shifting the eccentric. If a large shift is made a readjustment of valve stem will be necessary when desired average cut off is obtained. The valve chest cover or plug may be replaced. The setting should be verified by indicator cards at first opportunity. The valve may also be set by

⑥ Calculation of slip. Data taken Jan 20. 1918

Days run - 333 nautical miles

Running time = 24.33 hours.

Average R.P.M = 74

$$\text{speed} = \frac{6080 \times 333}{60 \times 24.33} = 1387 \text{ ft/min}$$

$$\text{Distance per revolution} = \frac{1387}{74} = 18.75 \text{ ft.}$$

Pitch = 23 feet.

$$\text{slip} = 23 - 18.75 = 4.25 \text{ feet.}$$

$$\% \text{ slip} = \frac{4.25 \times 100}{23.} = 18.5\%$$

⑦ To determine the upper end clearance remove the head and place a ball of putty on the piston. Turn the engine over after replacing the head. Remove the head and caliper the piece of putty. For the lower end the process is similar except that the putty may be inserted thru the manhole.

The clearances are the same for all cylinders. - 1/2" at the upper end and 3/4" at the lower end. If clearance is large a considerable amount of steam must be admitted to the cylinder before the pressure rises to the maximum value.

⑧ The distribution of work among the cylinders could be improved by adjusting the cut off points of all cylinders except the H.P. the independent linking-up mechanism would be used.

The H.P. cut off would not be adjusted because this would affect the total power but not the distribution of power among the cylinders.

A redistribution of work would change the appearance of the cards, for the cut off points would vary and area would change. The other events of the cycle would also change, giving the cards a slightly different form.

11-15-18
WSL/HCE

- OVERSEAS CRUISE -

WEEK "N"

SIXTH DAY: - Reciprocating -

1. Make cross section sketches of the main condenser showing all fresh water and salt water connections to it with their proper valves. Tabulate on your sketch general data about the condenser, including type, manufacturer, size tubes, number of tubes, vacumm used, etc.

2. Explain in detail how both an air leak and a salt water leak is detected and repaired.

3. Make a cross section sketch of the main circulator showing how the circulator bearings are sealed and position of outlet and inlet.

4. Compare the speed of circulator for proper operation, giving a curve of speed of circulator against vacumm maintained and also against main engine speed under following conditions:

(a) Warming up.
(b) Slow speed.
(c) Half speed.
(d) Full speed.
(e) Standing by.

5. How may the circulator be cleaned of marine growth and how often is this done? How can a clogged injection be cleaned?

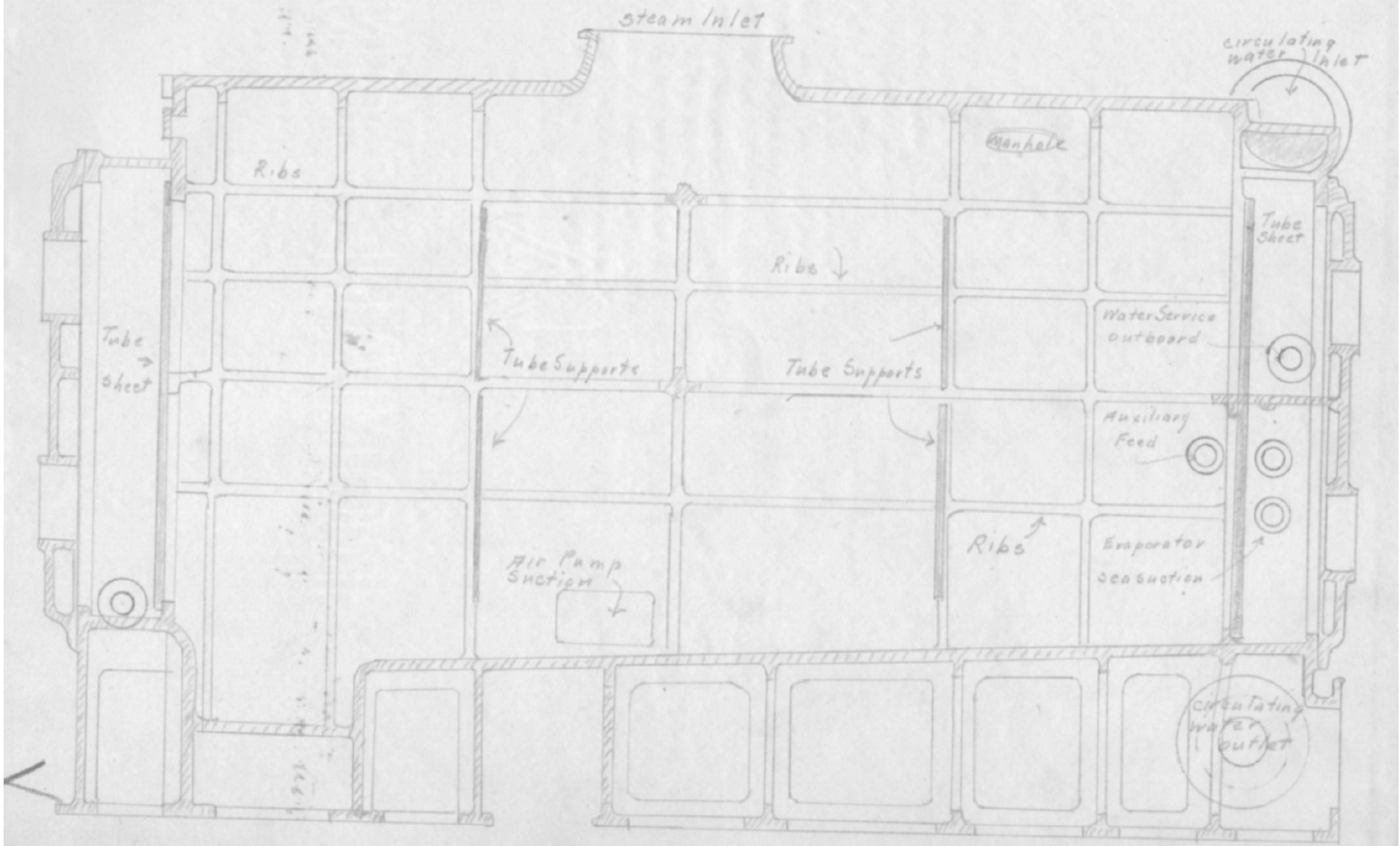
6. When would you shift to auxiliary condenser and how is this done?

7. Give a pipe line sketch of all circulating pipes showing how any other pump may be used in case of failure of main circulator.

8. Explain in detail with the aid of sketches just how condenser tubes are packed on board.

Main Condenser
Longitudinal section

G.F. Corse



Week N.

Sixth Day

(1) Sketches are attached. ✓

(2.) Leaks of salt water and air into the condenser are serious. The water salts the boiler feed water, the air reduces the vacuum. Tubes are drawn quarterly and inspected for strength. Leaky ones found by test must be plugged until they can be removed. Oil and grease carried over from the engine coat the tubes and reduce their efficiency, therefore the condenser has to be boiled out with water and soda at intervals. They are tested for leaks by putting a vacuum on them, draining the salt water from the heads, and applying a candle flame around the tube ends. More recent types of condensers are designed to distribute the exhaust steam over greater tube surfaces, to reduce the time the condensed water remains in the condenser (to save the heat of the water) and to remove air by separate means either by a steam jet or by a pump. Condensers when not in use for some time are filled with fresh water on the steam side and are drained on the salt-water side. Zincs are fitted in condenser heads to arrest corrosion & prevent rust.

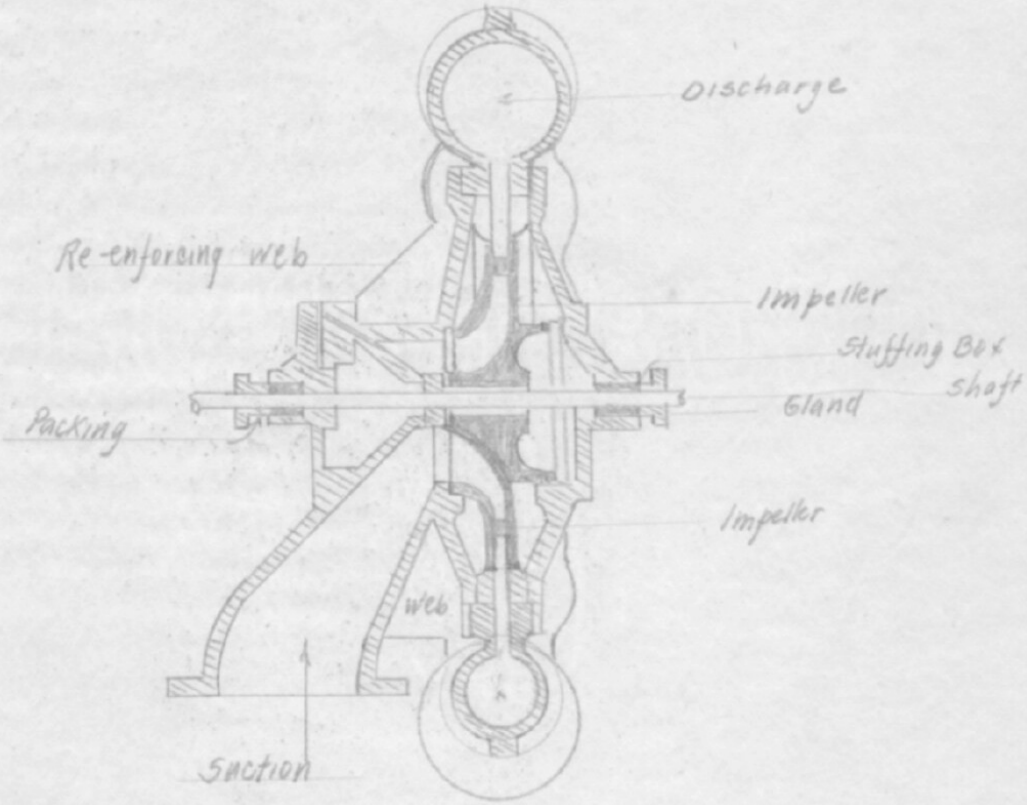
(3) Sketch is attached. ✓

(4) The speed of the circulator is not changed for different speeds and it runs at approximately 100 R.P.M. at all times.

Amount of cooling water is varied by operating the amount of opening of the suction valve. ✓

Corse

MAIN CIRCULATOR



(5) The circulator may be cleaned of marine growth by unbolting the side and removing same, and by aid of a scraping tool and hammer the growth may be cleaned off.

The circulator is cleaned about once a year, but if it is running O.K. sometimes it will not be cleaned for a period of eighteen months.

The injection supply should not come to the pumps under a head, since they would destroy the efficiency of the vacuum breaker and might allow water to be drawn into the engine cylinder.

A clogged injection may be cleaned by blowing out by steam.

(6) The auxiliary condenser is used for condensing the exhaust steam from the auxiliaries when the main condenser is secured.

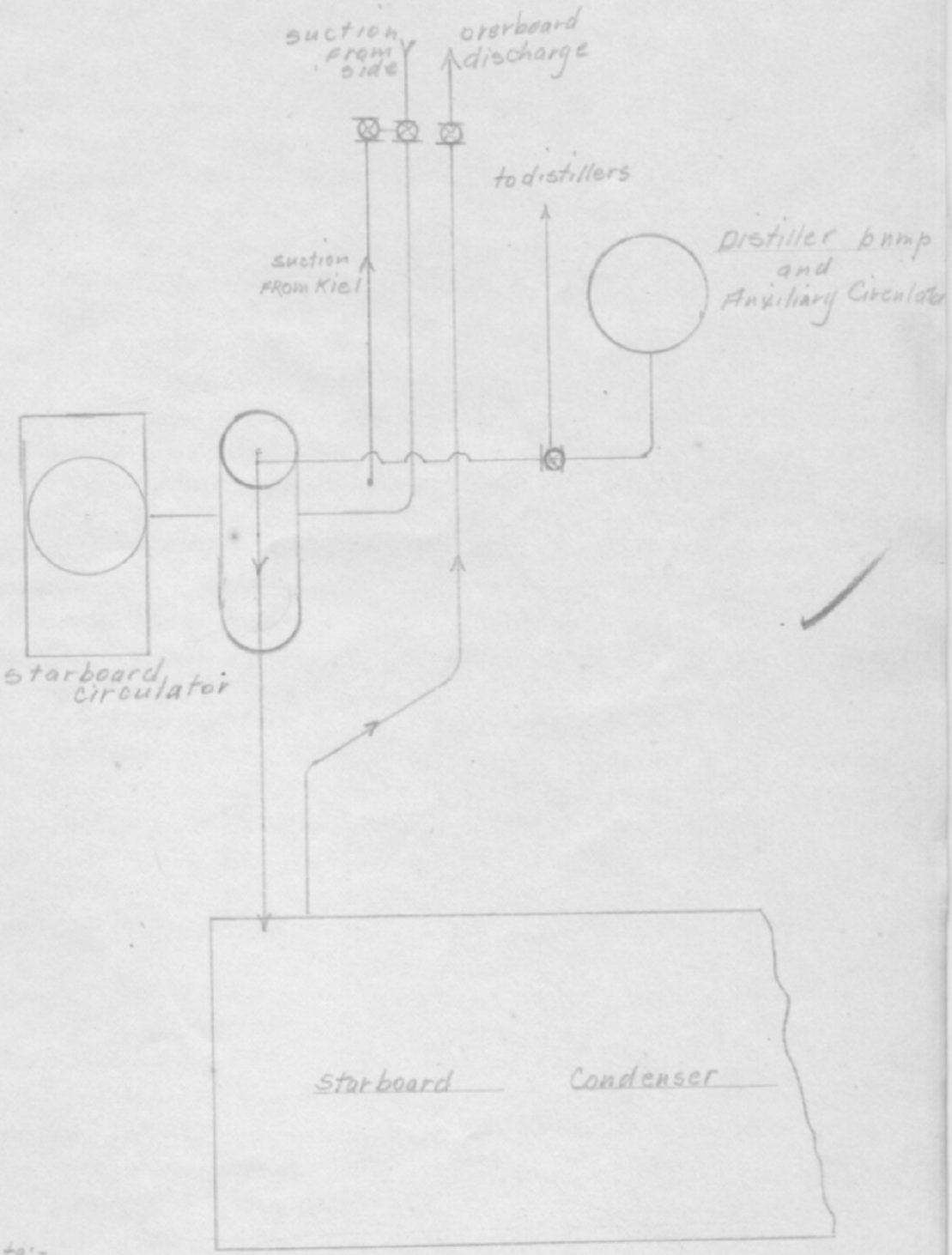
Following is the sequence of events in shifting to the auxiliary condenser.

(1) Start the circulating and the air pumps.
(2) Open the sea suction.
(3) " " discharge.
(4) " " suction to the air pumps.
(5) " " discharge to the Hot well.
(6) " " steam to the auxiliary condenser.
(7) Close steam on the feed heater.

(7) Sketch is attached.

CORSE

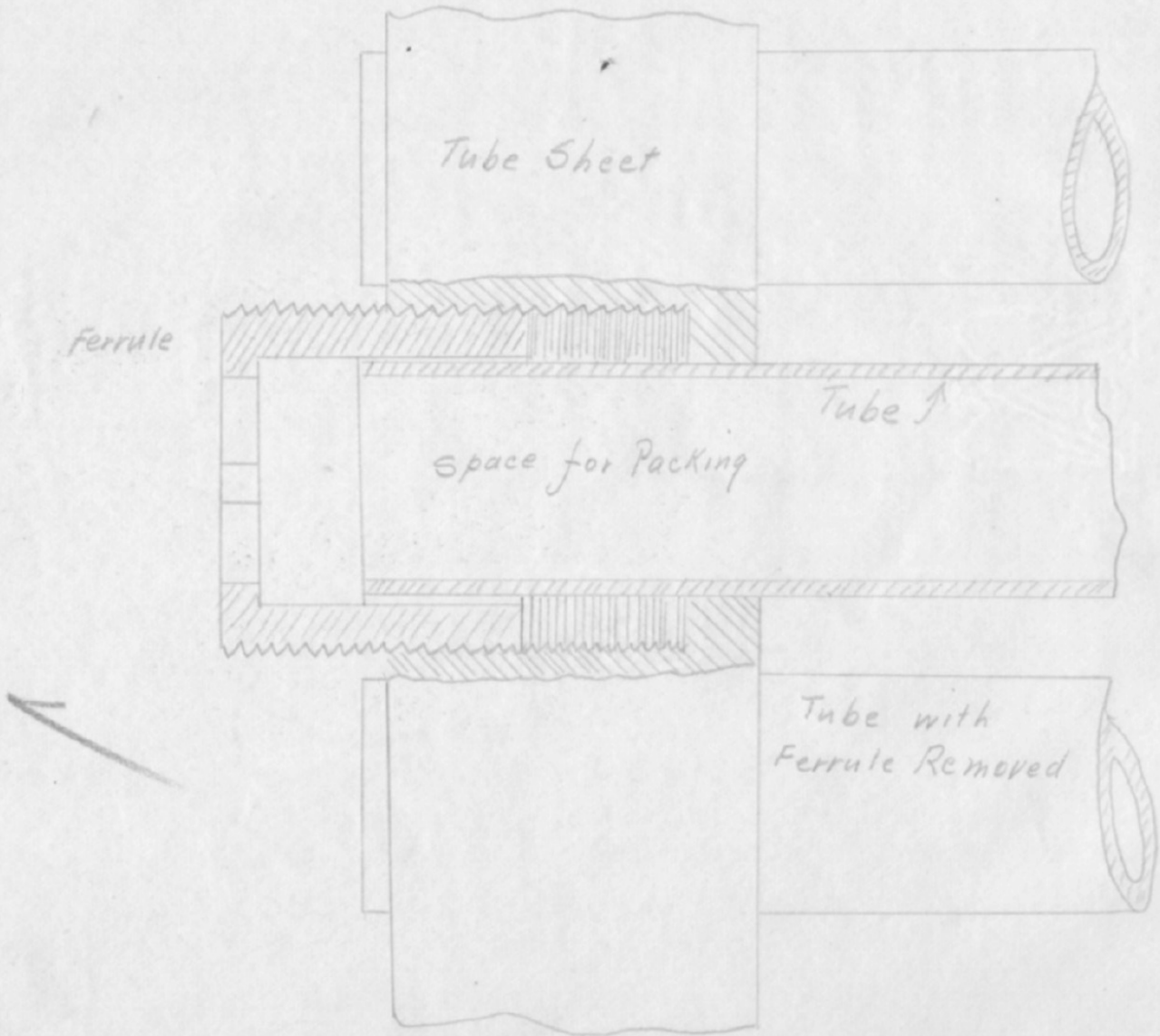
Starboard Main Circulator and Connecting Lines and Pumps.



Note:- connections on portside are the same except that there is no distiller and no auxiliary circulator.

(E) The tubes and tube sheets are of composition to prevent corrosive action. Each tube is packed with cotton tape or fibre ferrule inserted around the tube at the bottom of the counterbore in the tube sheet. The screwed glands, fitting around the tube, are screwed into the tube sheet, compressing the packing and making it watertight.

Sketches are attached.



Method of Packing Condenser Tubes

11-15-18
WSL/HCE

OVERSEAS CRUISE

- For all shipps -

WEEP "P"

FIRST DAY:

1. Make cross section sketch of the main air pump. Give complete data of pump as to type and size, etc.

2. Sketch one of the valves as installed, naming material of all parts (from spares on hand). How often and in what manner are the air pump valves inspected and over-hauled?

3. What is done in case of failure of main air pump? If any other pumps may be used for this purpose, make a pipe sketch with explanation showing exactly how they may be connected and what valves you would open or close in shifting over.

4. Sketch and describe any appliance fitted to increase the vacuum above that obtainable with main air pump alone.

5. Discuss the advisability of using attached or independent main air pumps for your ship.

6. How would you proceed to overhaul an air pump valve? What difference in adjustment is made for foot and head valves? Why? How is the air pump packed?

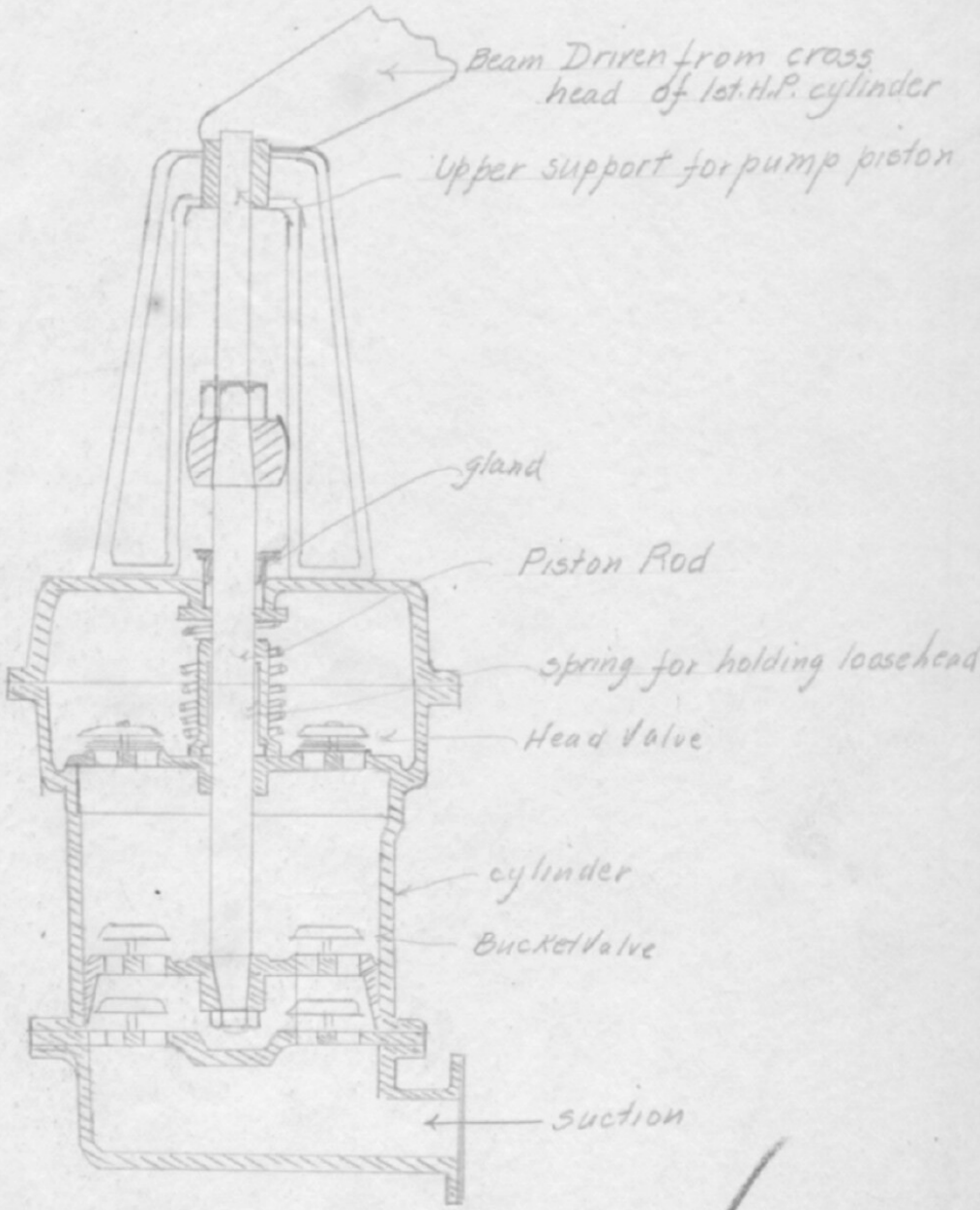
7. How may a condenser become air bound? What would you do to detect this and what procedure would you follow?

8. What steps would you take in the following cases:-
   (a) Main condenser loses vacuum.
   (b) Main condenser heats.
   (c) Air pump heats.

9. Make cross section sketch of filter box showing fittings.

corse

CROSS SECTION AIR PUMP



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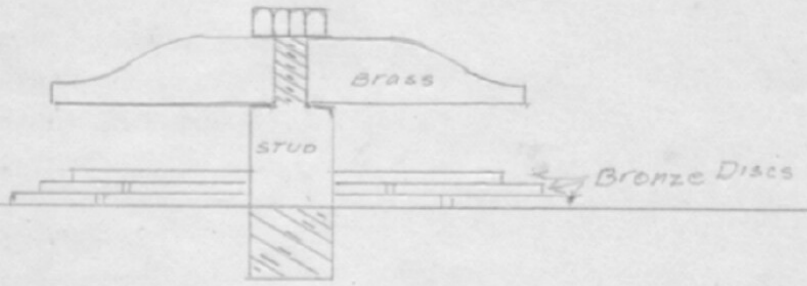


MAIN AIR Pump Valve

G.F. Corse

Week 8.

First Day

① Sketch is attached.

② Sketch of air pump valve attached.

The air pump valves on this ship do not have to be inspected and overhauled any oftener than once every four or five months. This is due to the fact that the fuel water is kept free from oil and grease. There is no tendency for the valves to become gumed up and stick.

③ There is no provision on this ship for an auxiliary air pump. If one of the main air pumps broke down, the only thing that could be done would be to either exhaust the engine to the atmosphere or shut it down and run on the other engine until repairs were made.

Sketch attached.

④ There is no appliance fitted to increase the vacuum above that obtainable with the main air pump. The vacuum desired by the engineer is about 24.5" or 25" of mercury.

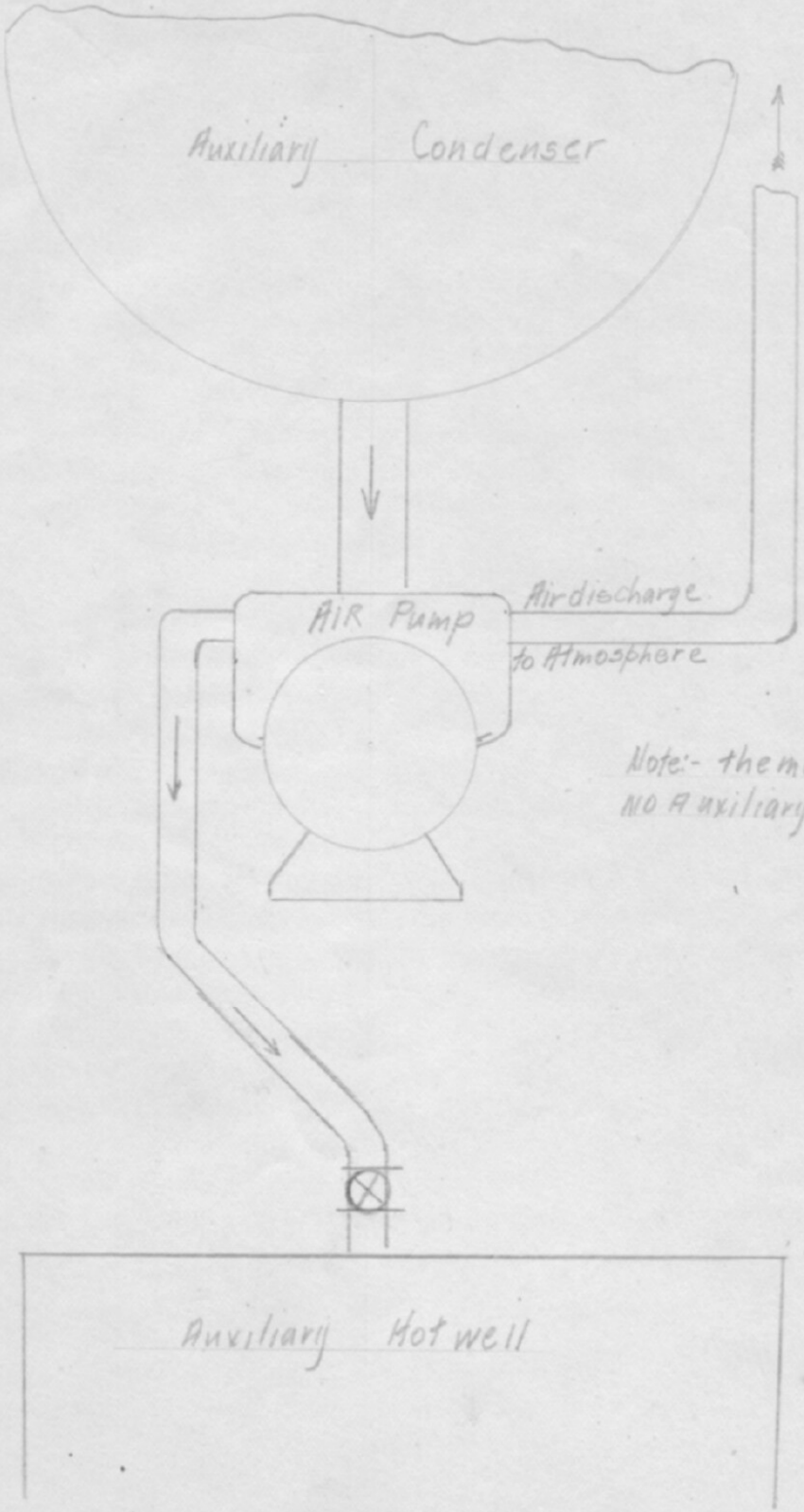
⑤ Attached air pumps are dependent upon the running of the main engines for the maintenance of the vacuum. This is the main objection to them. They can not maintain a vacuum while warming up the engine or for drying out the cylinders after the engine has stopped. Also if the engine is turned over at slow speed the vacuum will fall as the speed of the air pump is dependent upon the speed of the main engine.

The large advantage however is that they are economical

Corse.

Auxiliary Air Pump Connections

Elevation from forward.



Note:- the main condensers NO Auxiliary Air pumps

and positive in action

Being driven by a beam from the main engine the power that they consume is produced with the economy of the main engine; this probably ranges from 12 to 20 pounds of steam per I. H. P. where as if it were run independently by a small cylinder it would consume probably 40 to 50 pounds of steame per I.H.P. developed. The driving of the pumps by the beam from the main engine insures positive drive for the pumps.

Independent air pumps on the other hand have the advantage that they can be controlled separately from the main engine.

This permits a vacuum to be maintained while the engine is not running which aids in warming up and in drying out the cylinders after the engine has stopped.

It also permits the maintaining of any degree of vacuum, independent of the speed of the main engine. This is especially useful when the engines are turning over slow.

This ship has the attached form of air pumps, installed, but also has an auxiliary pump, provided if they come to give out. As an auxiliary they are installed an independent air pump, which may be connected to either or both of the main condensers. By this auxiliary pump they can overcome the main objections to the attached pumps and at the same time while under way they may be gaining the advantage of this type of pumps.

Either the attached or independent air pumps could be used to advantage on this ship, but the combination of the pumps as explained in the latter method is hoped to show better results than either of the methods used singly.

(6) The procedure for overhauling an air pump head valve would be to loosen top head raise it up and secure it well by bracing, cut off the stud chicks and lift the valve discs out. These discs, three of them, should be cleaned well, of oil and grease, with kerosene, before they are put back and when putting them back, each disc should be put back in the ~~the~~ inverted position from that which it came out. This is to prevent their being sprung to a dish shape.

After cleaning the valve seat, and cylinder head well, the valve is ready to be assembled, and the whole closed up. The valves are not spring loaded they mearly consist of three thin bronze discs, each disc, larger in diameter than the disc above it.

They are controled by an adjustment which limits their lift.

To overhaul a foot valve, place the pump on the upper center of the stroke, remove, an inspection plate on the outboard lower part of the pump cylinder. This will furnish access to the valves. To overhaul, proceed as with the head valves, they are the same type and weight valve, the only difference being that they are given 1/8" more lift than the head valves.

The foot valves are given more lift than the head valves because the difference in pressure between the condenser side of the valve and the piston side of the valve should be maintained as low as possible. The valve is allowed to open as much as it can so as to allow free passage to the air and water coming from the condenser.

As the piston comes down it forces the condensate out through the head valves. Here the difference in pressure between one side of the valve and the other is not material. The lift may therefore be cut down, providing a quicker acting valve but one, which offers considerable resistance to the clearing of the condensate.

The tightness of the piston is not provided for in the very common way of two grooves for a water seal, but it has a soft packing instead.

The piston rod is packed with soft packing packed in a gland.

(7) The condenser may become air bound on the water side by cutting the circulator in and out without taking precautions to remove the air, by closing the injection and discharge valves too quickly ~~as~~ working in port with the heads off. The condition may be readily detected by a very low vacuum and the heating up of the condenser.

The condenser may heat up so much that it would cool and odder, enough to detect by the sense of smell.

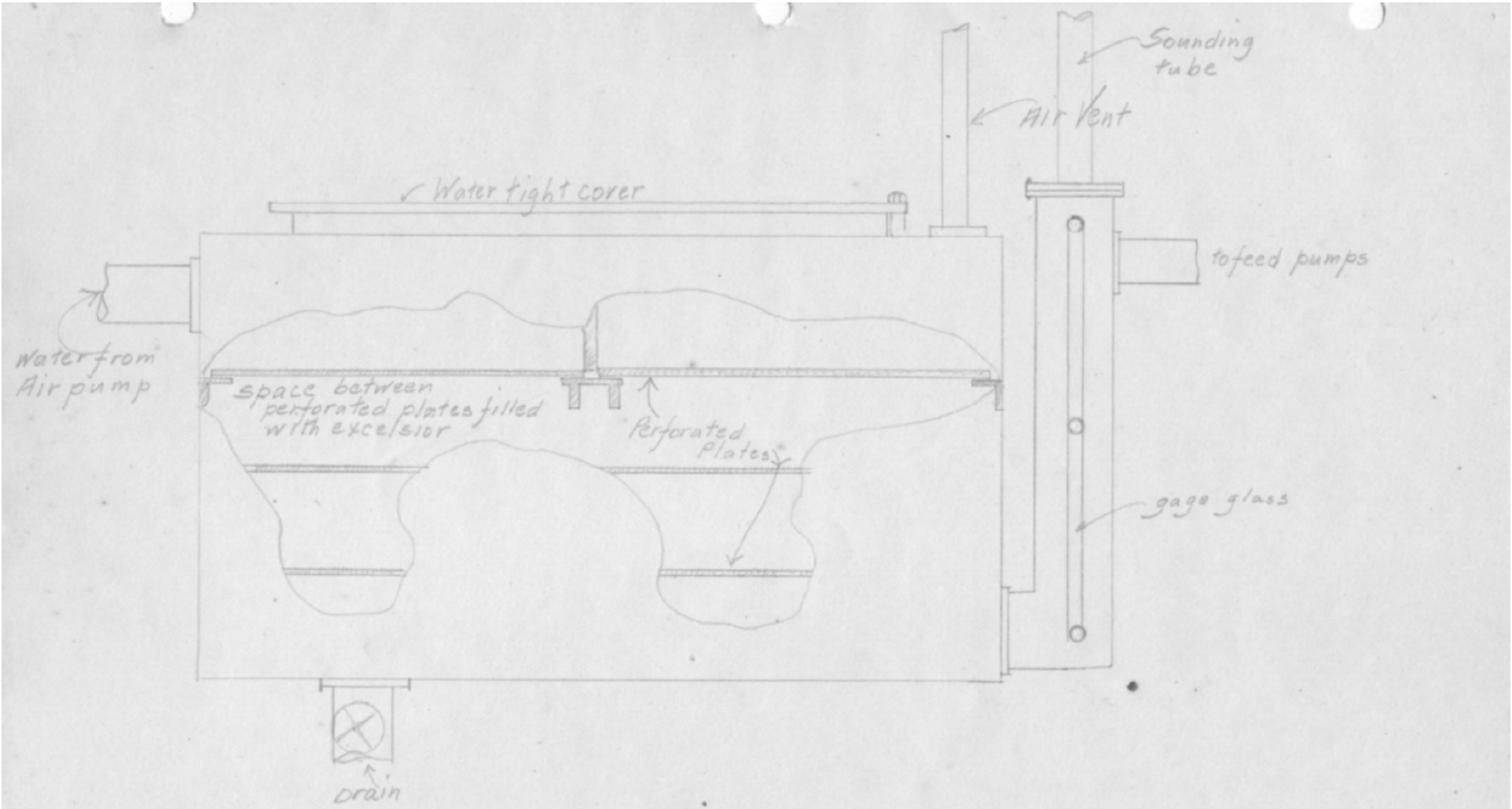
An air Cock is usually provided at each end of the condenser and by opening these until water flows out the air may escape and the water will flow again.

(8) (a.) If the main condenser loses its vacuum, the first thing to do would be to speed up the circulator or if an independent air pump were used, speed up both the pump and the circulator. If this did not remedy it look for air leaks or not sufficient circulating water.

(b.) If the main condenser heats I would speed up the circulator, see that the Kingston valve and discharge valve are to wide open, and that the injection valve strainer is not clogged.

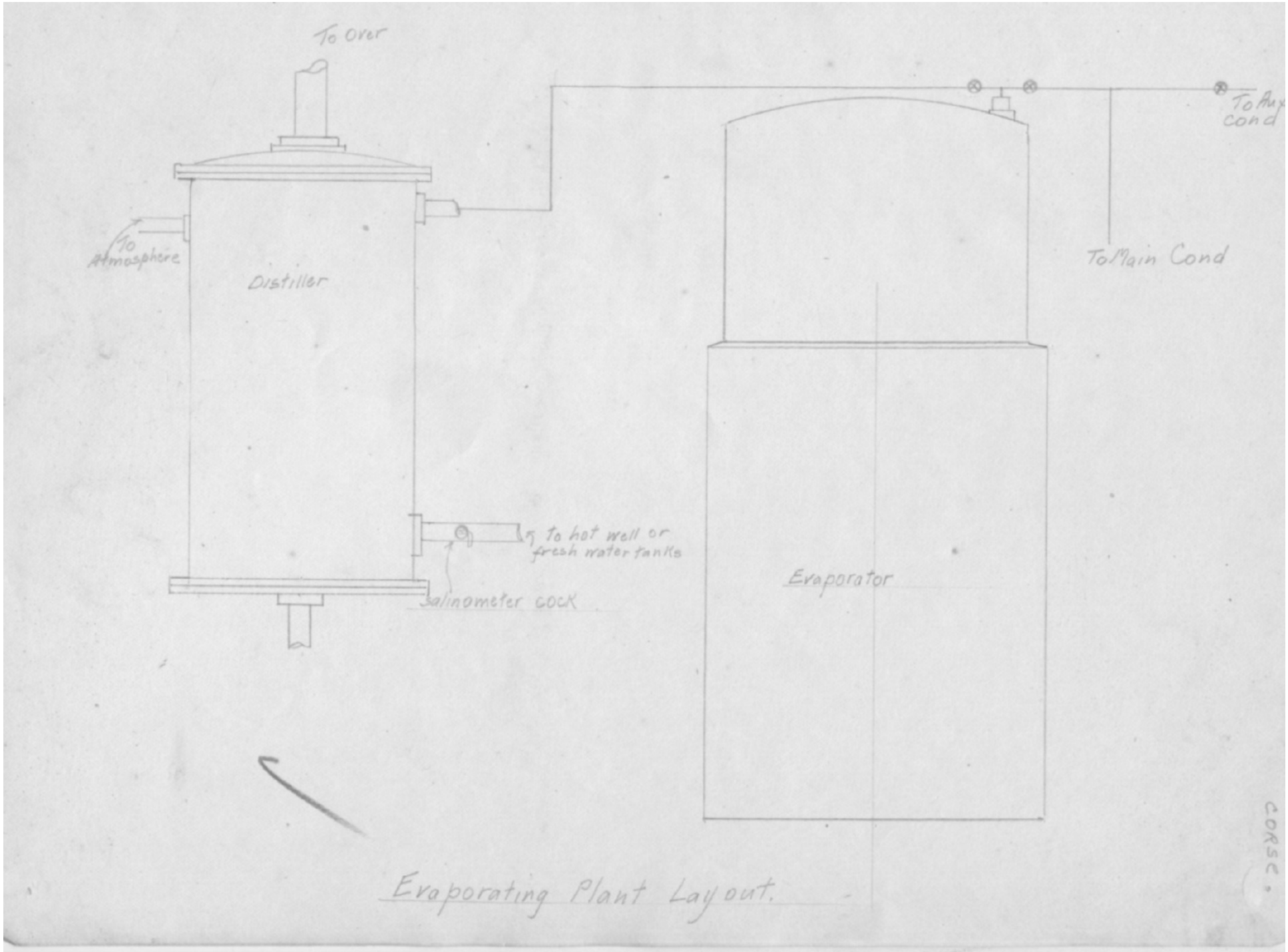
(c.) If the air pump heats it is a sign that there is not enough circulating water. The procedure would be to speed up the circulator and see why it is not delivering water.

(9). Sketch is attached.



Filter Box

CORSE.



Evaporating Plant Lay out.

CORSC.

OVERSEAS CRUISE

WEEK "P"

- For all ships -

SECOND DAY

1. Make cross section sketch of the evaporator showing all fittings and connections. Give complete name plate data on your sketch.

2. Give a complete diagrammatic layout of the evaporator plant showing all valves, traps, etc. Indicate with arrows the direction of flow of water and steam at each point in the process.

3. How often and in what manner is the evaporator blown down? How does this operation affect the various pressures and steadiness of the rest of the system?

4. Make an enlarged sketch showing how one coil is fastened.

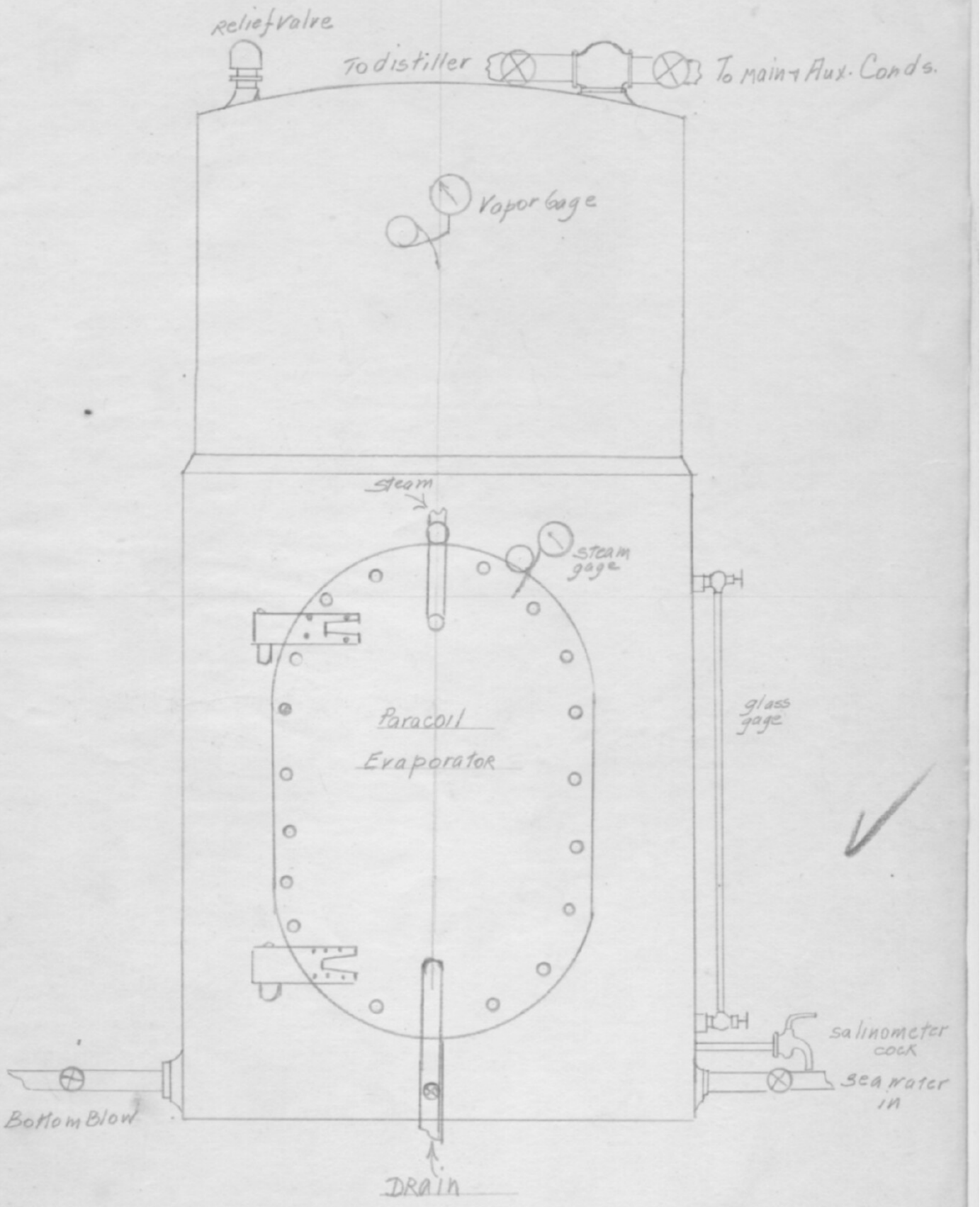
5. Make a cross section sketch of a steam trap used on board.

6. Suggest any improvements in the evaporator plant which would use the steam or water more economically.

7. What provision is made for inspection of the coils and how often is this done?

8. What is the shell pressure on evaporator and how is excess pressure guarded against? What coil pressure is used to obtain this shell pressure? What is height of water carried What is the daily output?

CORSE


Relief valve
To distiller
To main + Aux. Conds.
Vapor Gage
Steam
steam gage
glass gage
Paracoil
Evaporator
salinometer cock
sea water in
Bottom Blow
DRain

G.F. Corse

Week 2.

Second Day

① Sketch is attached. ✓

name plate data:-

Row and Davis, Engineers Inc.
90 West St. New York U.S.A.
Paracoil Vaporator
No 25 Tons S.O. 1450

② Sketch is attached.

③ While the evaporator plant is in use the ships operation rule is to blow it down every hour. This rule is in effect, because they do not have the proper provision for making the necessary salinity tests to determine when it should be blown down.

It is blown down by allowing the pressure in the evaporator to reach 20 lbs. then opening the bottom blow until no water is in sight in the gage glass.

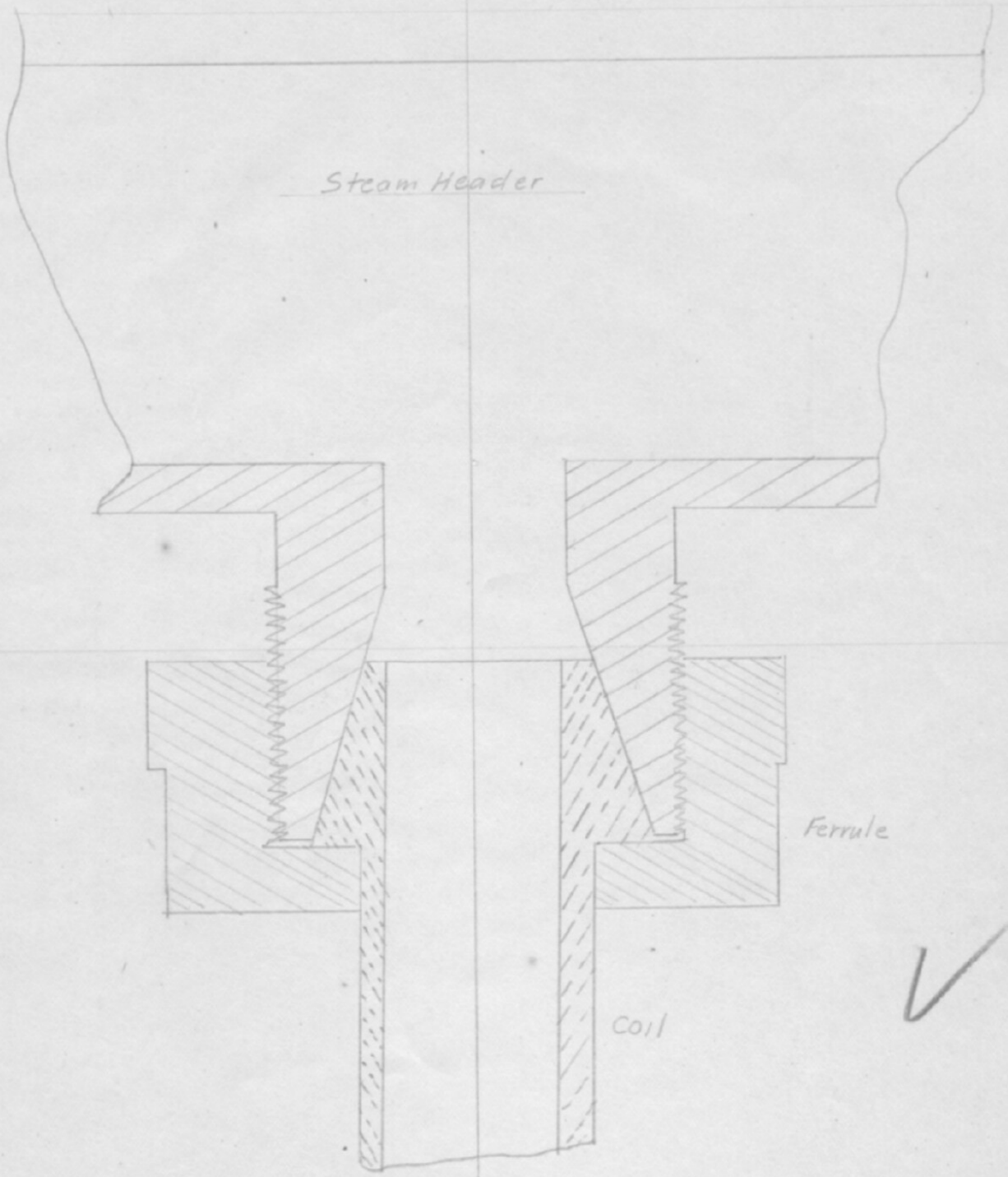
The pressure is reduced and salt water allowed to flow in from the connection to the discharge side of the condenser circulating watch.

When the vapor is sent to the distiller the blowing down operation is very noticeable since while the pressure is being raised in the evaporator, preparatory to blowing down there is very little vapor being sent to the distiller. This causes quite a reduction in the pressure in the distiller, and a subsequent reduction in the amount of condensed vapor.

On the other hand if the vapor is being led directly to the main condenser, the effects of the blowing down process is hardly noticeable on anything but the pressure within the evaporator itself.

④ Sketch is attached ✓

CROSS section showing fastening of Evap Coils



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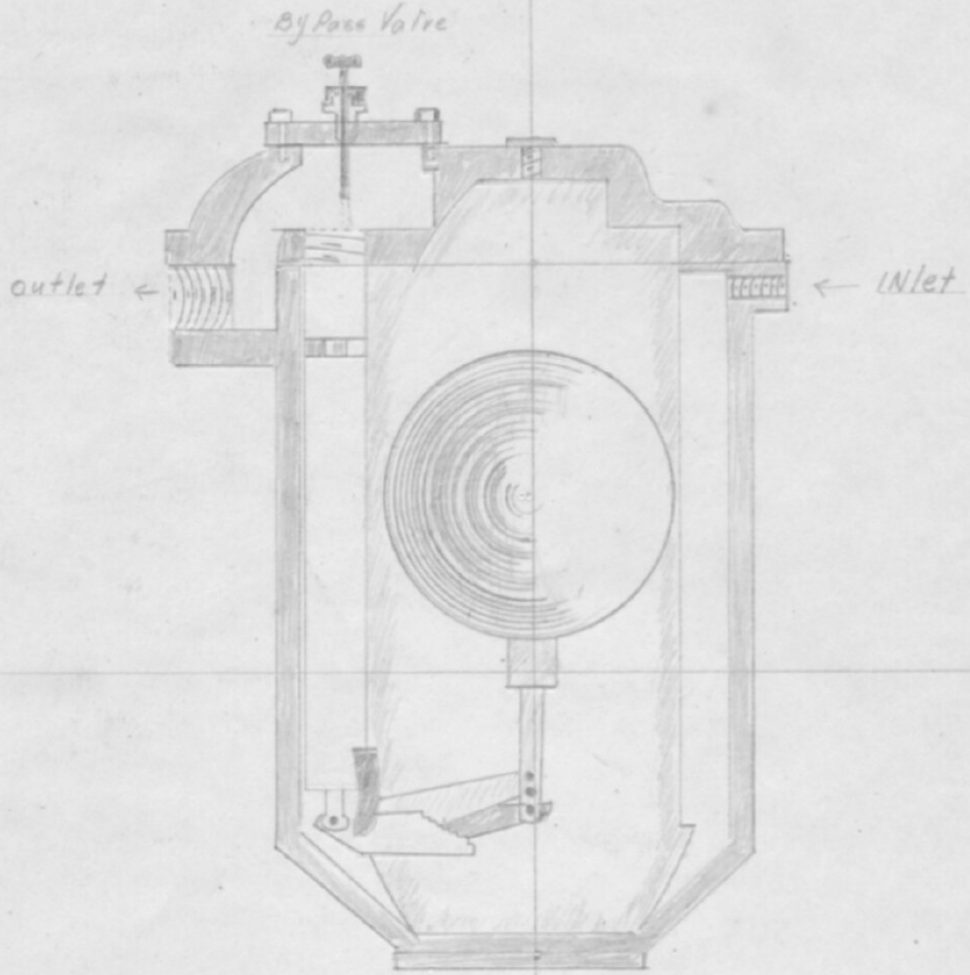
Steam Trap



(5) Sketch is attached.

(6) The layout of the evaporator plant is in every way modern and conducive to efficiency.

The evaporator receives warm salt water at a temperature of about 100° F. from the overboard discharge of the condenser.

This is quite a factor in its economy of operation. To improve the layout to gain better steam economy would only be done by making a multi-stage evaporating plant.

There are some points in operation which seriously effect its efficient operation. The practice of blowing down the plant every hour is inefficient.

The plant probably could be operated much longer between blowing down periods and still not have the charge get to saline for efficient use.

This would reduce the heat lost through the bottom blow, by the process of blowing down.

(7) The steam coils of the evaporator are all attached to the inspection door. When this door is swung open the coils come out of the evaporator and are entirely open for cleaning and inspection. This is usually done after the plant has had three days of use.

(8) The shell pressure of the evaporator is carried at about 65 lbs. and to guard against excess pressures on the evaporator shell a relief valve is set at 75 lbs.

The relief valve is set to blow at a pressure so much higher than the operating pressure to allow for an increase in pressure for blowing down.

A oil pressure of abnt 60 lbs. is carried and its maintainance maintains the oil pressure of from 15# to 18#.

The water is carried abnt three inches in the gage glass: If it is allowed to rise above 3" it will prime very badly.

The capacity of the plant is 25 tons of fresh water per day.

OVERSEAS CRUISE

WEEK "P"

THIRD DAY - For all ships -

1. Describe in detail the actual method used for operating the evaporator plant under the following conditions:
   (a) Starting up.
   (b) Running.
   (c) Securing.

2. Describe any tests made of the water in the evaporator and also of the distilled water. How often are these tests made and what points of operation do they indicate? Compare with Navy Regulations.

3. How often and in what manner is the evaporator cleaned? What condition would you expect to find the evaporator in and what parts would you to expect to replace?

4. Describe the process of getting shell ready for cementing, mixing cement and applying it.

5. How and how often are coils and shell tested? Compare with Navy Regulations.

6. How would you detect and remedy a leak in distiller tubes?

7. Should coils or zincs be cemented? Should cement be applied over layer of salt? Why?

8. Is process of "cracking" salt off tubes by using cold water permissible? Why?

9. What is the difference between apparent and real water level? Why is this difference so important in operating an evaporator plant?

Week "P"

Third Day.

@ @ The evaporator is left with considerable water in it for the purpose softning up and dissolving some of the salt that has collected on the coils and shell. Before sending vapor to the distiller this must be removed.

The steam is started in the coils and a shell pressure of 20# is built up. With this pressure the bottom blow is opened and of the original water discharged. The bottom blow is then closed, allowing salt water from condenser to fill the gage glass to 3". The vapor valve is regulated to give a back pressure of about 12# on the shell.

Once the evaporator is well under way the salt water feed should be sufficient to keep 3" in the glass and drain valve should be cracked so as to drain out the heaviest brine.

@. When under operation, the steam and shell pressure are noted and kept in proper adjustment. The water in the glass kept at 3" and plant is blown down every hour.

Under proper conditions a steam pressure of 60# should give a shell pressure of 12#. It is found that if the water level be allowed to rise much more than 3" in the glass the evaporator will prime badly. This level is kept constant during operation by cracking the salt water intake valve enough to make up for the water evaporated. At the same time the bottom drain is cracked to allow the heaviest brine to run out. After an of this operation the vapor discharge valve is closed and the pressure allowed to build up to about 20#.

The bottom blow is opened and the brine forced out. The bottom blow is allowed to remain open and as the pressure decreases the cold salt water will fill the evaporator.

The cold water is allowed to come in until the coils are covered. This cold water will have the effect of cracking the salt off of the tubes and wash out some of the salt water that would collect in the shell.

The pressure is again allowed to rise to 20# and this water blown out. as soon as the water is out, the bottom blow is closed and the hot salt water from the condenser allowed to fill the evaporator to the working level of 3". The vapor valve is opened and the other valves are adjusted as discussed for working conditions.

(c) In securing - all the brine is blown out and the evaporator filled with fresh, salt water to a little over a half a glass. All valves are shut.

(2) The method of operation on this ship is to blow down every hour whenever the evaporator needs blowing or not. Under those conditions it is not necessary to give a salinity test since it is absolutely sure that the water is not up to 4/32. If they were operating under conditions where the evaporator would not be blown down until it was necessary a salinity test would be given every hour. It is given in the same way as it is for boiler water test. There is also no necessity of giving the water the acidity test as acid does not form until the water is 4/32 or above.

The distilled water is lead directly into feed line or into fresh water service, without giving the water any tests. If the evaporator was not blown down so often and it had a tendency to prime the distilled water would have to be tested for chlorine to determine if the evaporator was priming

This test used to be made by filling a standard test bottle to a zero mark on the bottle with distilled water. Add some potassium chromate until the water turns light red, then add silver nitrate until it takes this color out.

Read the scale on the side of the bottle and it will give no grains of Ch. per gal. of the water. Navy Regulations provide the evaporator water shall be tested every watch and not allowed to run over 4/32 Also that the water from the measuring tanks, shall not be let out until it is given the chlorine test.

(3) Often about 100 hours of use the evaporator is opened up and cleaned. The coils and shell are chipped of salt and given a cement wash. With such frequent cleaning I would expect to find the evaporator in good condition. The shell and coils would exist until with salt but it would be in a condition for easy removal. The coils would be the only part that you would expect to replace.

(4) The shell is first chipped of scale and wire brushed. All parts except the tubes are tested in this manner. The cement is mixed with water until it is liquid enough to be applied with a brush. It is applied and allowed to dry.

(5) Navy Regulations provide that the coils shall be tested by steam after every 300 hours of use. and that the shell itself shall be tested when ever there is a reason to believe that corrosion has taken place to any extent.

On this ships when ever the coils are opened up they are tested after chipping. The shell has never been tested.

(6) If there was a leak in the distiller the water would show of salt when you knew that the evaporator was not priming. To locate the leak the distiller should be shut down and the coils filled with water open up the shell and observe any leak in the coils. If it is a split coil renew it or if it is a leaking ferrule tighten up on it.

(7) The zincs should not be cemented because it would defeat their purpose. Cement should never be applied over a layer of salt. The cement is put on a metal so that the salt is easy to remove. If it were put on over a layer of salt it would be of no use.

(8) According to regulations, the process of cracking salt from the coils tubes by using cold water is not permissible. It is common practice to do it in this ships since it is easy and cheap.

② The difference between water level within the evaporator and the level in the gauge is abut 8" to 12" the water level in side being higher than that shown in the gauge.

This is important in operating so that the shell will not be filled with water to such a height that it will prime.

OVERSEAS CRUISE

WEEK "P"

FOURTH DAY - For all ships -

1. Give a general description of the electrical plant, giving a classified list of all equipment and name plate data of generators.

2. Make a simplified wiring diagram of the switchboard and generators. Show and label all switches, bus-bars, meters, circuit breakers, etc.

3. Make a diagram of the method of controlling all ship lights from the bridge.

4. Describe fully all the steps you would take in starting a generator from a cold engine to full load on the generator at normal voltage. Repeat for the case of shutting down one machine and shifting to the other.

5. Describe with the aid of a sketch the construction of any circuit breaker aboard, telling how it is adjusted.

6. How would you put in parallel two compound generators and adjust them to take equal load? Give diagram and enumerate all steps in the process.

7. If any storage batteries are aboard show how they are charged.

8. How would you test for a grounded wire on the lighting circuit and how would you remedy it?

9. How would you detect, locate and remedy the following faults:

(a) Short circuited armature coil.
(b) Open armature coil.
(c) Short circuit on one field coil.

G.F. Corse

WecR. — P

Fourth Day

① The electrical plant is of the type installed on naval ships built ten or fifteen years ago. There are five D.C. generators all capable of operation in parallel, and feeding at two wire system. All wires are encased in rigid steel conduit.

Three of the generators are an old type of compound machine driven by vertical engines. At present these are used only in case of heavy loads, and one of the two turbo generators is always in operation. These latter units are of the high speed horizontal type, and consist of a compound D.C. generator direct connected to a Curtis Turbine.

All machines and all circuits are controlled from a 6 panel switchboard in the dynamo room.

The dynamo room is level with the first gratings and just aft of the main engines. It is about 15 ft. wide and extends from the starboard side to a point just beyond the center of the port side.

It has a low ceiling and is so poorly ventilated that special fans have been installed for the purpose of cooling the starboard turbine.

The following is a list of all electrical equipment.

① — 3 Engine driven D.C. generators
② — 2 Horizontal direct connected D.C. Turbo generators.

Rheostats

③ — 2 D.E. for turbogenerator field control.
④ — 3 Cutler Hammer for engine driven generator fields.

Circuit Breakers.

(5) — 3 G.E. Single Pole Form C.D.
(6) — 2 G.E. Double Pole " P Type C.
(7) — 2 I.T.E. Double Pole.

Meters

(8) — 1 G.E. D.C. Voltmeter 0-130
(9) — 3 G.E. D.C. Ammeters 0-400
(10) — 2 G.E. D.C. ammeters 0-600

Switches

(11) — 5 Triple pole, single throw copper knife switches.
(12) — 53 Double Pole, single throw copper knife switches
(13) — 1 Six Point voltmeter selective switch.

Blowers.

(14) — 1 Massachusetts squirrel cage fan, 400 cu. ft. / Min.
(15) — 1 Ck squirrel cage fan 1.35 H.P.

(16) — Fuses.

(17) — Fans
(18) — Lamps.

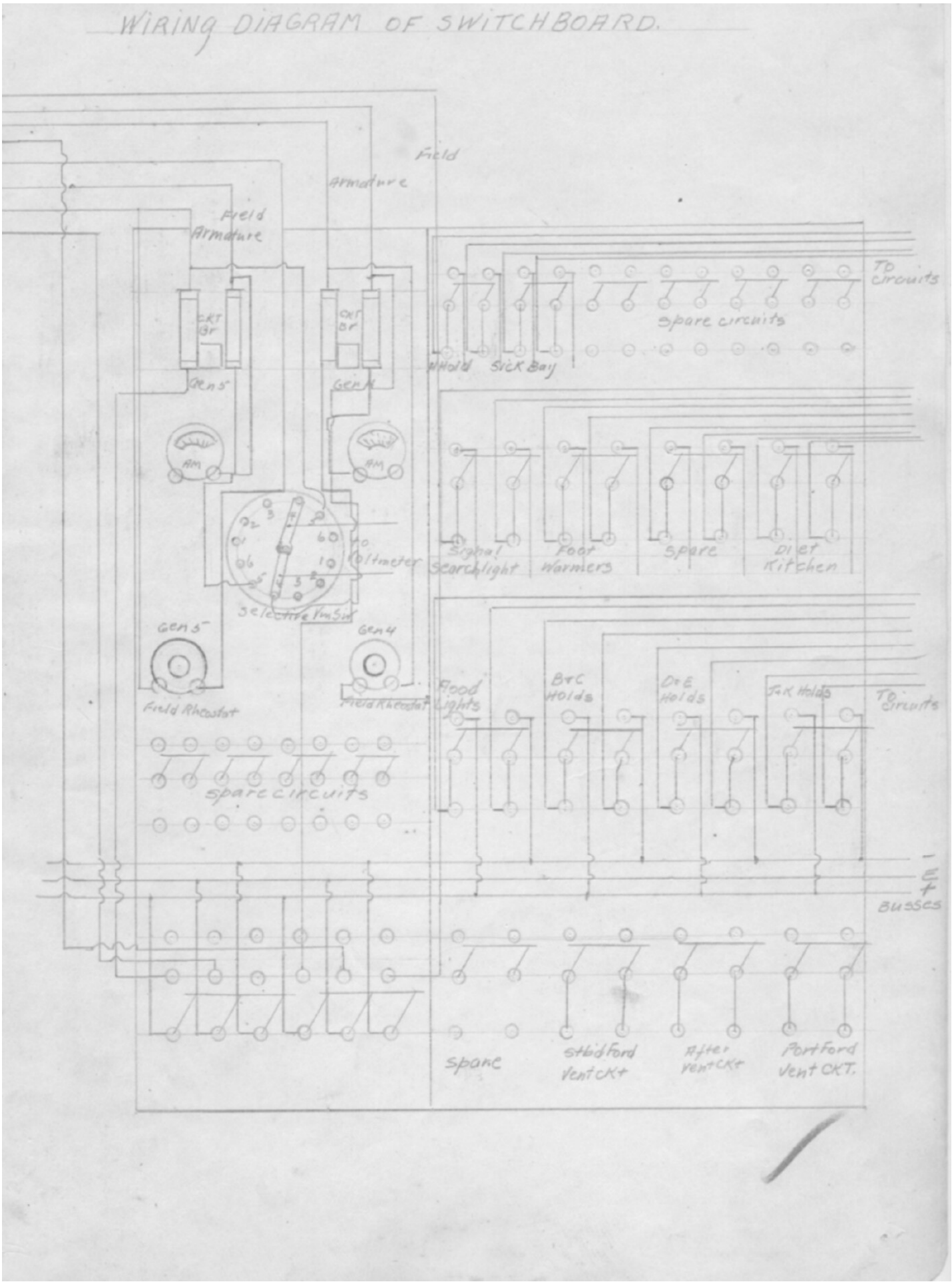
(19) — Search Lights

(20) — shop motors.

(21) — Galley motors.

Name Plate Data of Generators:—
made for Bureau of
Steam Engineering by
General Electric Company.
Schenectady. N.Y. - U.S.A.
Contract No - 33554
Reg No - P.A. 117300 3/3 - 1917.
Type CC Class - 2 - 35 - 3600.
Form T generator No 663016
Volts 125 Shunt Current.—
Amps 280 K.W. 35 Spud 3600.

WIRING DIAGRAM OF SWITCHBOARD.



Name plate data of engine driven generators.

Electric Generator.
Type M.P.
No. 54557 - Spec. No —
Class 6-25-400 Form A.
Amps. 243. Speed 400
Volts no load 100 - Full load 111.
General Electric Co.
Schnectady, N.Y. U.S.A.

(2) Sketch is attached.

(3) There is no way of controlling all ships' lights from the bridge.

(4) Steps required in starting a generator from a cold engine to full load, on the generator at normal voltage. It is impossible to conceive a case where a generator would be started and have full load thrown on immediately, unless it were to be paralled with another machine, as in the second part of this question. To answer the first part we shall assume that there is some artificial load, such as a lamp bank, which can be thrown on at will.

The steps are, then

(a.) Open circuit breaker and all switches.
(b.) Fill oil cups, turn on oil, and see it working properly.
(c.) Jack engine to see that all is clear.
(d.) Open cylinder and valve chest drains.
(e.) Open exhaust valve.
(f.) Crack steam valve and warm engine, jacking to a new position occasionally.
(g.) Open steam valve enough to turn engine slowly.
(h.) When water stops coming from drains close them.

(i.) Open the throttle slowly, until it is wide open, allowing the governor to control the speed.

Measure the speed with a tachometer and if it is far from correct, shut down and adjust the governor.

(j.) Close the circuit breaker.

(k.) Turn the field rheostat to the weak position.

(l.) Close the field switch.

(m.) Adjust the rheostat until the voltmeter shows normal no load voltage.

(n.) Close the line switch.

(o.) Throw the load on gradually until the ammeter indicates full load.

(p.) If necessary, readjust the voltage by means of a field rheostat.

(q.) If the voltage is changed materially in "P." above, readjust the load to the correct value.

If one machine is to be shut down and the load shifted to the other, the following steps should be taken.

Let "A" designate the machine to be shut down and "B" the incoming machine.

(a.) Start B. as described above to and including step l. Then proceed as follows.

(b.) Adjust field rheostat of B. to give voltage equal to that of A. If each machine has its own voltmeter, check against standard voltmeter.

(c.) Close the two switches connecting A. and B. to the equalizer bus.
(d.) Readjust voltage B to equal voltage A.
(e) Watching voltmeters, close line-switch B.

(F.) By means of the field rheostats strengthen field of B. and weaken field of A until the load on A is very small.

(G.) Open the line switch of A.

(H.) Readjust rheostat B. to give correct voltage.

(I.) Open the equalizer switch and the circuit breaker of A.

(J.) Reduce the voltage of A to a very low value and then open the field switch of A.

(K.) Close steam valve of A.

(L.) Shut off oil supply of A.

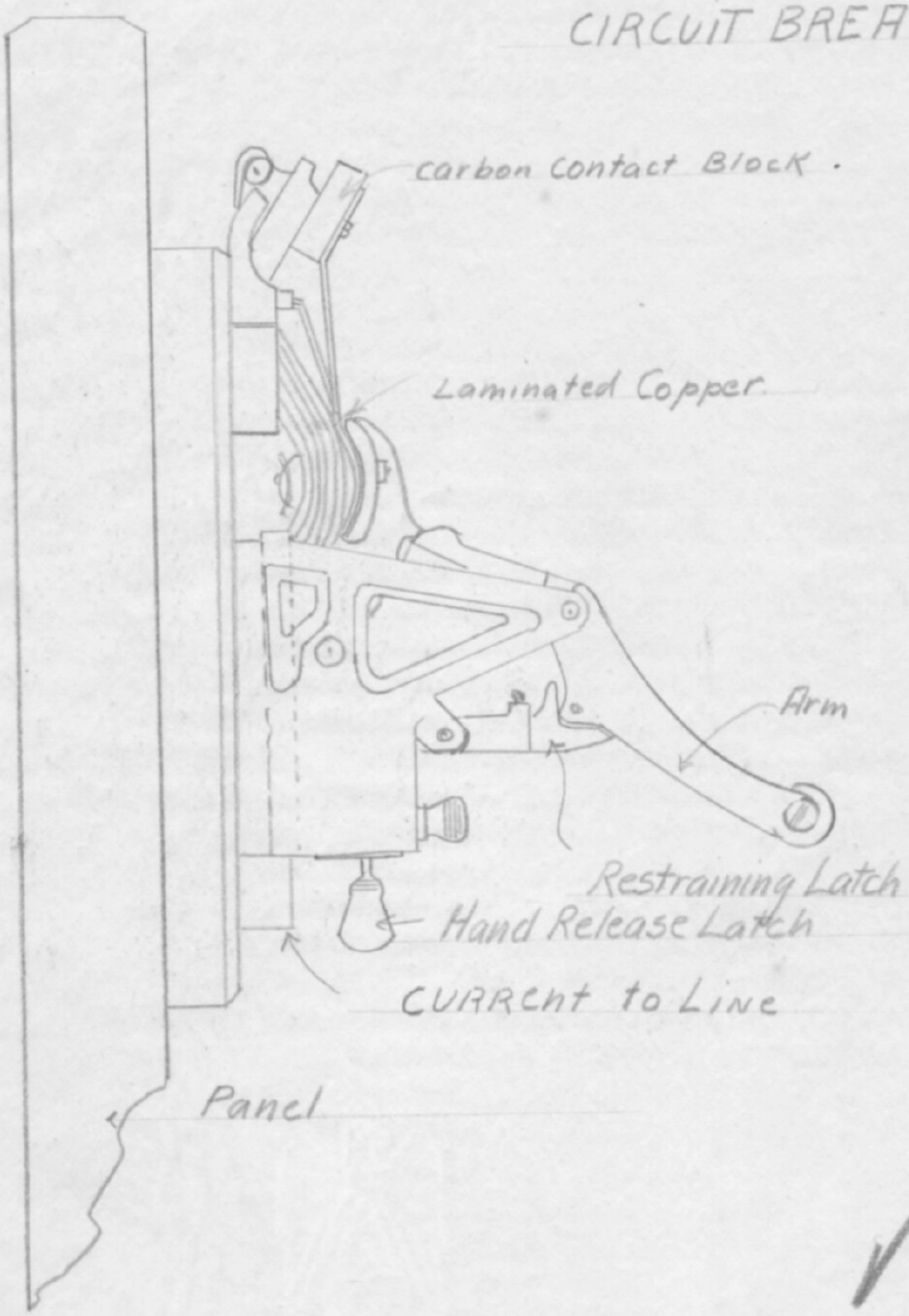
(M.) Leave the exhaust valve of A open to the condenser for a while in order to dry out the cylinders.

(N.) Close the exhaust valve of A.

It should be noted that the above procedure applies only to direct current machines as far as the electrical features are concerned, and to engine driven machines as far as steam features are concerned.

CORSE

CIRCUIT BREAKER



(6) Sketch is attached.

(a) The accessories of machine no. 1 are lettered for in reference, while those of no. 2 are named for explanation.

Subscript 1 refers to machine no 1 and subscript 2 refers to machine no. 2.

To place the two compound machines in parallel and divide the load equally proceed as follows:-

(a.) Get both machines running at normal speed and make their voltages equal by adjusting R_1 and R_2

(b.) Close T_1 and T_2 after closing K_1 and K_2

(c.) Readjust R_1 and R_2 if necessary to equalize voltages.

(d.) Watching the voltmeters, close S_1 and S_2

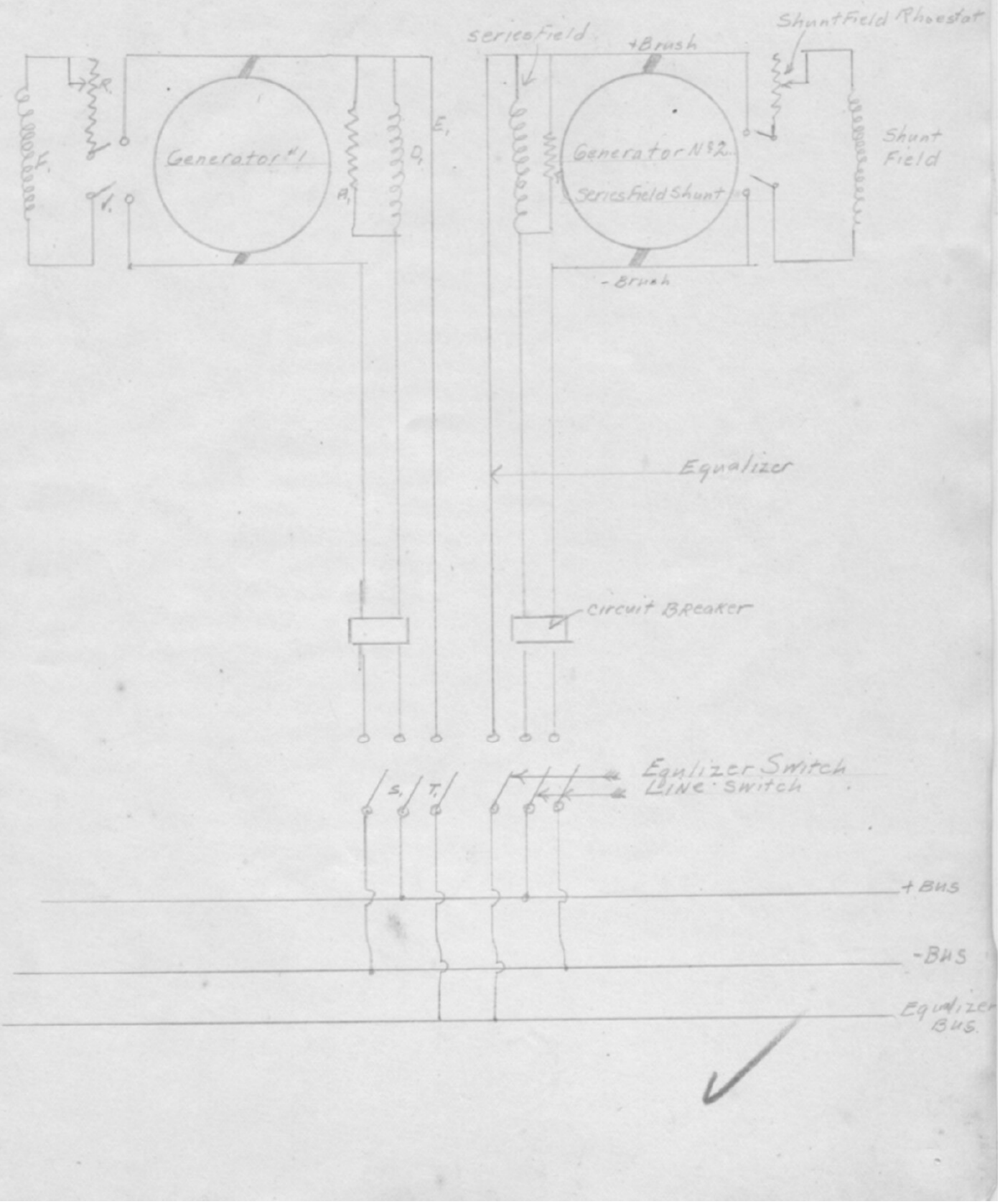
(e.) As the load comes on divide it equally by strengthening the field of the machine which takes the least load and weakening the field of the other machine.

This adjustment is made with R_1 and R_2 and it should be done at full load so there will be less danger of overloading one machine while the other is running at a fraction of its full load.

The purpose of the equalizer bus is to put the series field in parallel with one another. If this were not done a slight increase in the load on No 1 would strengthen E, causing no 1 to assume still more load. Again E would be strengthened, and the process would continue cummulatively until no. 1 had the entire load.

It is evident that in order to fulfill its function the equalizer bus and leads must have a very high conductivity.

connections For Parallel Operation OF compound Generators.



① There are no storage batteries aboard the Manchuria.

② A simple way to test for a grounded wire on a lighting circuit is to connect two 110 volt lamps in series across the terminals of the machine and ground the wire between the two lamps. If one of the lines is grounded the lamps on the opposite side will glow brightly because there will be a drop of 110 volts across it.

If there is no ground the lamps will both glow dimly or not at all.

The only way to remedy the ground is to inspect the faulty side until the ground is detected, and then renew the insulation on that part of the wire.

③ (a.) A short circuited armature coil is indicated by sparking at the brushes. To locate the fault, stop the machine, apply full voltage across the terminals, and measure the drop between adjacent commutator bars with a voltmeter. Good coils will show a few volts drop, but the short circuited coil will show zero drop. The remedy is to find the point of short circuit and remove the cause of the trouble.

(b.) An open armature coil is indicated by overheating of the machine and failure to build up the usual voltage.

It is situated by the same method described in (a) except that the open coil will be detected by the voltmeter reading full applied voltage.

To repair it, a new coil is put in.

(c.) If one field coil is short circuited the machine will overheat and fail to build up the voltage.

To locate the fault, measure the drop across the each winding.

the faulty one will give you drop. Find the point of short circuit and re-insulate the parts.

OVERSEAS CRUISE

FIFTH DAY WEEK "P" - For all ships -

1. Make a complete layout sketch of the refrigerating plant as installed. Show all machinery, pipe lines and valves. Name material of all pipes and give operating date of plant on your sketch.

2. Describe the refrigerating plant in detail referring to the above sketch. Give the function of each piece of apparatus in your description.

3. What safety measures are provided in case of ice machine leaks? How are small leaks detected and remedied?

4. Describe in detail the process of starting the ice machine. Repeat for method of securing.

5. Give a list of all pressures and temperatures indicated when running on normal load. What is rated out-put?

6. How are any serious leaks made up?

7. Sketch the lubricant separator with all fittings.

8. What kind of oil is used. Why?

9. Where are spare refrigerant drums carried? What precautions are observed in this regard?

10. Discuss the advisability of using ammonia CO_2 and dense air machines for your ship.

Week - P.

Fifth Day.

① Sketch is attached.

② As shown in the sketch, the refrigerating plant consists of a steam driven carbon dioxide compressor, a steam condenser, a carbon dioxide condenser, two expansion valves, two evaporators, two oil separators and two brine pumps.

Attached to the compressor, is a circulating pump, a wet air pump and a dry air pump.

When the plant is in operation the cycle is as follows. The gas is compressed in the CO_2 cylinders to 50 or 60 atmospheres. This causes it to become very hot. It is then cooled and liquified by passing through the CO_2 condenser which is supplied with cold circulating water, by the direct connected circulator.

The cold liquid CO_2 then passes through a pair of expansion valves by means of which the pressure is reduced to about 20 atmospheres.

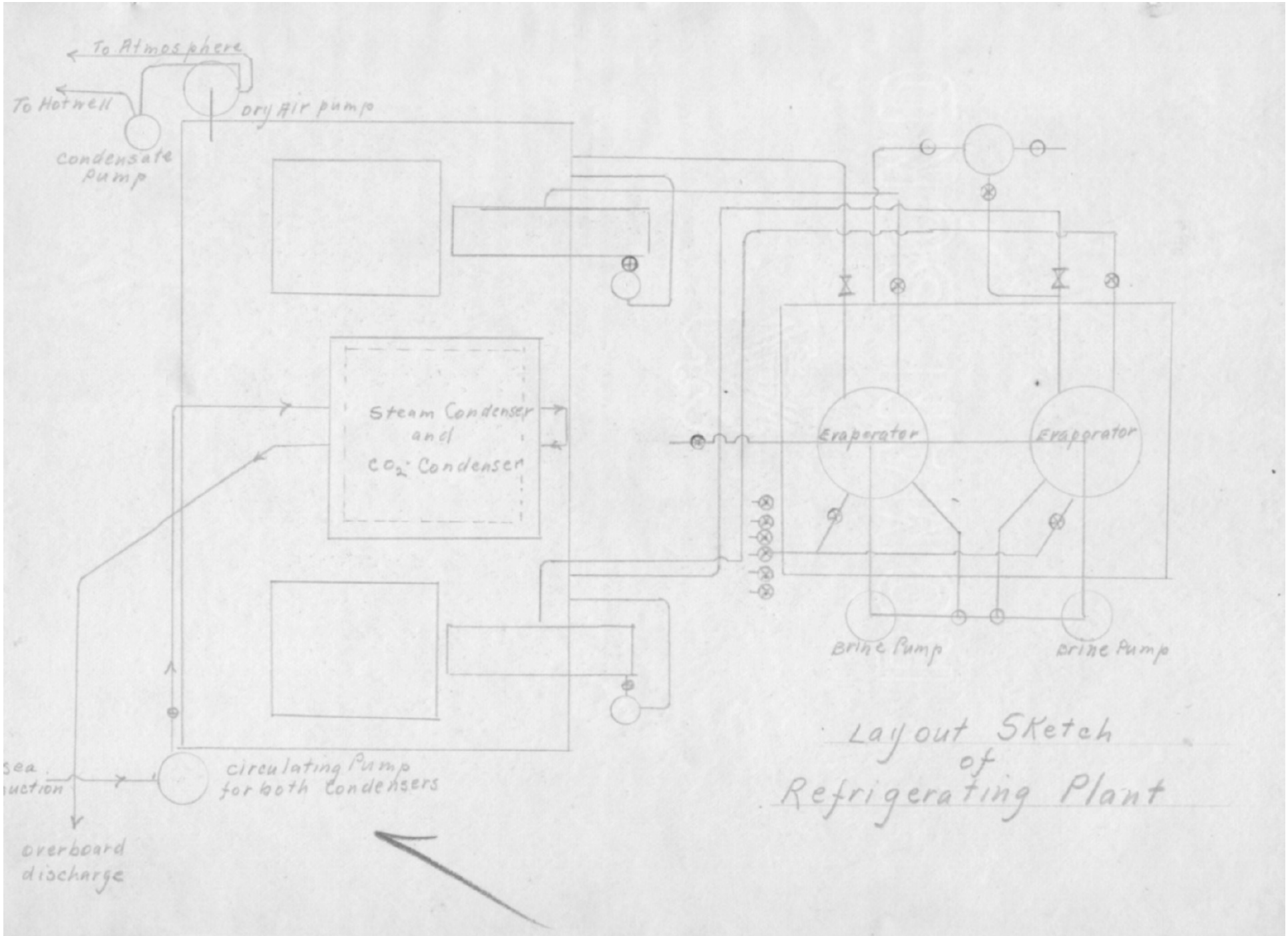
This reduction of pressure causes the the CO_2 to boil. The heat required for vaporization is taken from the brine which surrounds the evaporater coils.

In this manner the brine is cooled. It is circulated through the system by two duplex pumps. The vaporized CO_2 is returned to the compressor through a stop valve and used again.

There is an oil separater on the discharge side of the compressor this keeps the oil out of the CO_2.

The compressor is of the cross-compound type and uses a built-in steam condenser between the cylinders.

The CO_2 condenser is built under the compressor. The circulater is driven by an eccentric on the H.P. end of the crank shaft.



Layout Sketch of Refrigerating Plant

The wet and dry air pumps for the steam condenser are driven by an eccentric from the L.P. end of the crank shaft.

The one circulator furnishes cooling water to both condensers. The water passes first through the CO_2 condenser and then through the steam condenser.

(3) Since carbon dioxide is non-poisonous no safety measures are provided in case of leaks. Small leaks are detected by the application of soap suds. If the leak is in a gland, the nuts are set up or the gland repacked if necessary.

(4) The brine pumps are kept running at all times regardless of whether the compressor is operating or not.

Before starting the compressor the drains and the exhaust valve are opened. The steam valve is cracked and the cylinders are warmed up.

The expansion valves and the stop valves on the discharge side of the evaporators are opened, the former being regulated by experience.

When the engine is warm the lubrication is turned on, the drains are closed and the steam valve is opened.

The CO_2 valves are then regulated so that the circulating water injection temperature is about 10° F below the temperature corresponding to the high pressure gage reading, and after 15 minutes of operation the valves are set so that the brine temperature is 10° or 15° F above the temperature corresponding to the low pressure gage reading.

4 (cont)

The ice machine is secured by shutting the steam valve and stopping the lubrication.

The drains and the exhaust are left open, as are the CO_2 valves.

The brine pumps are allowed to continue in operation. This is a very simple way of securing and it leaves the machine ready for starting at any time on short notice.

(5) Normal operating data:-

2 Brine pumps in operation.
2 Evaporators " "

CO_2 Condenser pressure (std) = 48.8 atmos (53.5°F)
" " " (int) = 45.0 " (47.5°F)
Evaporator " (std) = 21.0 " (-5.8F.)
" " 21.3 " (-4.5°F.)
Brine pressure No. 1 pump = 24.4 #/in²
" " No 2 " = 23.9 #/in²

Brine temperature = 16.5°F.

Condenser Injection Pressure Temperature = 44°F.

Steam Condenser vacuum = 25.4" Hg.

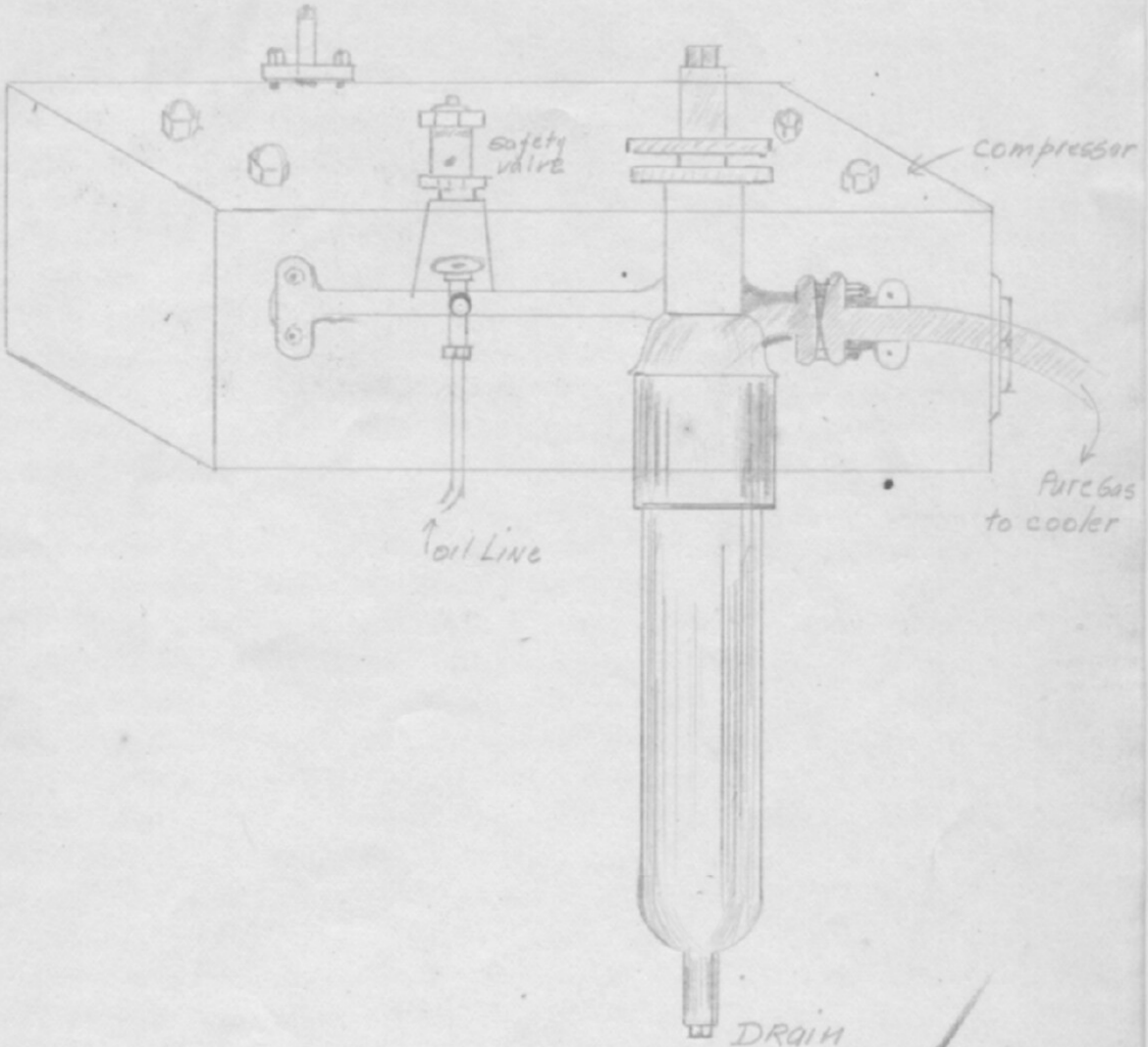
The rated output is 36 tons per 24 hrs.

(6) Serious leaks are made up by charging the machine with a few flasks of CO_2.

(7) Sketch is attached.

Oil Separator

Corse



Note:
Use "Spica" Oil.

⑧ "Anti-freeze," "Artic", or Spica, "Spica" oil is used. Each are practically the same.
They contain 60% glycerine and freeze at a very low temperature. It is necessary to use this low freezing oil on account of the low temperatures attained in parts of the cycle.

⑨ Spare CO_2 drums are stored in the starboard shaft alley. Empty drums are stored in the port shaft alley.
The only precautions necessary in storing is to see that the drums are kept cool and that they are not dropped.
In charging it is the practice on this ship to immerse the drums in boiling water so as to drive more gas out.
Care must be taken in doing this, for if a full drum is placed in hot water and the discharge line becomes stopped up, the drum is apt to explode. This has occured in this ships with fatal results.

⑩ The chief objection to ammonia machines is the danger caused by leaks. If such a machine were installed it would be almost necessary to have a separate compartment for it.
It would occupy more space than the CO_2 machine which would be another disadvantage.
The dense air machine would be more efficient and more satisfactory than the CO_2 plant, but it would require more skilled attention.
However there are twelve engineer officers aboard, so it is reasonable to assume that the more complicated dense air machine could be easily taken care of.
The use of air as a refrigerant does away with the necessity of having to carry flasks.

The CO_2 plant however is very satisfactory nevertheless I believe the dense air machine would even be better fitted for this ships.

OVERSEAS CRUISE

WEEK "P"

SIXTH DAY - For all ships -

1. Describe fully the manner in which the daily engine room inspection is carried out. Explain what things are looked for and why; who is responsible, to whom does he report; what check is made to see that he does his work properly. Repeat for weekly inspection, and compare with requirements of Navy Regulations.

2. What reports are made each watch by each man, Petty Officer and Engineer Officer? To whom are these made? Suggest any possible improvements that could be made in this part of the organization.

3. At what time and what entries are made in the rough steam log? Explain the items called for. How are these transcribed to the smooth log? By whom are these written up? If a copy of a sample log sheet is available fill in and attach it to your notebook; if not, make up a complete sample sheet.

4. Make out a complete watch bill for the Engineer force as actually carried out, giving rating and duties of each man. Make any suggestions which would improve this organization.

5. Discuss the military organization of the Engineer Department as you find it.

6. When, how and for what reason is bag inspection carried out?

7. How is the repair book kept? Reproduce a sample page with all entries. If no book is kept how would you make one?

8. Who regulates the watches? How is it done and how are men notified? How is liberty run? Can you suggest any improvement, either as to the plan used, or as to method of carrying it out?

Week P Sixth Day

Q. The first assist. Engineer officer is responsible for the daily engine room inspection, and he makes it in person.

He main engines are inspected, looking especially for hot eccentrics, crossheads, guides, piston rods, and valve stems, for leaky glands and for knocks.

He inspects the shaft alleys, the spring bearings, the stern tubes and the thrust bearings, paying especial attention to their temperature.

He inspects the dynamos for hot bearings, hot windings and correct voltage.

He notes the pressures and temperature of the feed heater.

He looks at the water service lines to see that they are not clogged up.

He inspects the sanitary system to be sure that the proper tanks are filled and that the pumps are taking suction from the proper tank and discharging as desired.

He inspects the fresh water tanks and also to see that they are pressed up for purposes of ballast.

He notes the temperature of the water in the bilges.

He inspects all pumps, looking for knocks, leaky glands, excessive pressure, hot valve stems and hot piston rods.

After making this inspection he reports to chief engineer officer. No check is made to see that he does his work properly, since he is considered competent.

No weekly inspection is made by the engineer officers, but the commanding officer inspects the engine room once a week.

Since he is unfamiliar with power plants, he confines his attention to the floor plates and rails, both of which must be free of grease and oil. There is no check of this work.

Navy Regulations require inspection of the machinery to be made by the senior engineer officer every day.

(2) Two reports are made each watch. One is made by the C. M. M. and the other by the engineer officer in charge of the watch.

The report of the officer is merely a verification of the report of the C. M. M. Both reports are made out side by side on the back of the rough log. They tell what boilers, pumps, and dynamos are in operation, what tanks, and bilges are pumped, what valves are opened and closed, what casualties occur, how many fires are cleaned, number of buckets of ashes hoisted, how long the ice machine is operated, and how long extra fuel is opened.

These reports are very brief and pertinent. The system is free from needless duplication, for nothing like these reports can be found elsewhere, in the log. There is apparently little room for improvement.

(3) Entries in Rough steam log.

The following entries are made hourly:- R.P.M. of main engines, receiver pressure, boiler pressure in fire room and in engine room, vacuum, auxiliary exhaust pressure, dynamo steam pressure, voltage, current, barrows of coal used, and temperatures of main injection, discharge, fuel tank and boiler feed from heater.

Every two hours the average R.P.M. of all pumps is recorded.

Every watch the cut off, gallons of oil and buckets of ashes are recorded.

Each watch officer records the auxiliaries in operation and the time of starting and stopping all auxiliaries.

Explanation of following items.

R.P.M. This is computed hourly from readings of continuous counters on each engine. The average of both engines is also computed and recorded.

Barrows of coal.- From this record the tons are computed assuming a barrow equal to 175 pounds.

R.P.M. of all pumps- In case of direct acting pumps, the number of double strokes is recorded.

Cut-off - This is shown in inches on a scale on the link motion mechanism.

The items in the rough log are transferred to the smooth log after summaries and averages have been made.

The work is done by a yeoman under the supervision of a warrant machinist.

Sample log sheet attached.

(4) Complete watch bill for the engineer force for fireroom watch bill see page

The steaming watch bill is as follows:- Names are omitted.

(1) Rating	(2) Rating	(3) Rating	Station
C.M.M.	C.M.M.	C.M.M.	Starboard Throttle.
M.M.2	M.M.2	M.M.	Port "
M.M.2	Oiler	F.	Starboard bearings & pumps
Engr	Engr	Engr	Port " "
M.M.2	M.M.2	Engr	Starboard engine platform.
M.M.2	Oiler	Engr	Port " "
Oiler	M.M.2	M.M.2	Blowers and steering engine.
Engr	Engr	F.	Ice machine, dynamo, shaft alleys.

With the exception of the throttlemen the duties have previously been explained, and are evident from the name of the station.

The starboard throttle man has general supervision over the oilers and machinist mates. Before taking the watch, he puts all bearings to be sure they are not running hot. During the watch he puts all bearings at certain intervals. In case of a heavy sea running he stands by the starboard throttle to prevent racing of the engine.

The port throttleman takes all pressures, temperatures, and speeds and records them on the rough log sheet. He also reads the continuous counters, on the main

engines and computes the R.P.M. He answers the speaking tube and transmits hourly data to the bridge. In case of a heavy sea he stands by the port throttle to prevent racing of the engine.

At present the engineer force is well run and organized and there is little to improve upon along this particular line. However there is an insufficient number of men. For instance it is too much work for one man to attend to the ice machine the dynamos, and the shaft alleys. The lack of men is apparant whenever there is a casualty. It also seems reasonable to say that the firemen, being used in the engine room, should be replaced by machinist mates or enginemen.

(5) The engineer department is composed of the usual three divisions, fire room, engine room, and electrical divisions. Each division is headed by a divisional officer. For an unknown reason the officer of the seventh division is a deck officer.

There is a long chain of responsibility which runs from the chief engineer officer all the way down to the last third class fireman.

The most striking feature of the military organization is the excellent discipline. Every man seems to understand his duties well and performs them without any forcing. The response to orders is invariably prompt and cheerful. The spirit among the men is of the best, and there is a marked absence of shirking duty.

The military organization is excellent in every respect.

⑥ Bag inspection is held once a month. The crew formed on the top side with bags ready for inspection. Each man empties his bag and places all its contents on top of the empty bag which is placed on the deck. The divisional officers make the inspection.

Bag inspection is made for:-

① To see that each man has sufficient clothing
② To " " all clothing is clean and orderly.
③ " " " no one has clothes which are not his own.

⑦ The repair Book is kept by the First assistant engineer officer. He considers it a strictly private matter and allows, no one except his superior, to inspect it. The only data obtainable concerning this repair book is that it shows all repairs which have been made and the ones that are to be made. The repairs to be made are compiled from observation of all the engineer officers and suggestions of the men.

⑧ The chief engineer officer regulates the watches.

The available gang work from 8 A.M. until 4.30 A.M. All others stand two watches of four hours each except when the ship is in port, at which times most men work during the entire day.

Men are notified of their watch duty by means of lists in the engine room.

Each man is called upon by the messenger in turn for his watch.

Liberty is run according to watches. All men are placed either in the starboard or port watch. The port watch gets liberty one day and the starboard watch the following day.

Liberty begins at 4. P.M. and expires promptly at 7 P.M.

The method of granting liberty is the one which has been used for years in the regular Navy. It is simple and proves satisfactory to the men and to the Officers.