OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

RESTRICTED

DP/ID/SER.A/997
7 April 1988
ENGLISH

16799

ASSISTANCE TO CHITTAGONG DRY DOCKS AND HEAVY STEEL STRUCTURE WORKS

DP/BGD/84/018

BANGLADESH

Technical report: Completion of the first phase of the subcontract*

Prepared for the Government of Bangladesh
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Keppel Shipyard Ltd., Subcontractors

Backstopping officer: Anatoli Assabine,
Industrial Management and Rehabilitation Branch

United Nations Industrial Development Organization
Vienna

*This document has been reproduced without formal editing.

V.88-23737
4542T

CONTENTS	PAGE

INTRODUCTION

Keppel Shipyard, a Division of Keppel Corporation Ltd, was awarded the Contract to provide technical services to Chittagong Dry Dock and Heavy Steel Structure Works to upgrade its operations. The Contract aimed to:-

(a) strengthen the operations of the Drydock
(b) provide training to the workers
(c) widen the range of jobs
(d) provide skills to operate equipment
(e) collect time-records
(f) implement an efficient maintenance service
(g) install and commission plant and equipment

An initial team of three engineers from Keppel Shipyard spent a month in Chittagong Drydock studying its operations to assess its training needs. The team also prepared the foundation for the Foreman team to function in the Project Area.

The Foreman team of six members commenced their assignments in the Drydock from 4 August 1986. The seventh member joined the project area on 17 November 1986. The team fulfilled its assignment and left Chittagong on 15 October 1987.

The team members and their respective functional areas are as follows:-

Chan Chong Heng (Leader)	Engine & Marine Equipment
Ng Hian Tong	Engine & Marine Equipment
Chan Chong Toon	Machine Shop
Chua Chee Wah	Plant & Maintenance
King Thian Kiong	Welding
Lee Wooi Sing	Safety
Khoo Kuan Yean	Hydraulics

As a condition of the Contract, Keppel Shipyard submitted bi-monthly work progress reports to UNIDO. Five progress reports covering period from August 1986 to May 1987 were submitted.

This final report summarises all the activities carried out by Keppel from August 1986 to October 1987.

The report is divided into four main areas and the format is as follows:-

- Operation
- Plant & Maintenance
- Functional Areas
- General Management

The operation section covers all vessels repaired at the Drydock and in Chittagong Port. It also covers vessels which were not repaired but were, however, advised upon by the Keppel Team Members.

The Plant & Maintenance section covers all repairs and maintenance to Dry dock equipment, plant and machineries.

The functional areas section deals with work performed by members of the Keppel Team in their respective functions. It covers non-marine jobs, lectures conducted, recommendations offered to CDD, and sketches for manufacture of jigs and tools. The six main areas are:

- Engine and Marine Equipment
- Plant and Maintenance
- Machine Shop
- Welding
- Fire & Safety
- Hydraulic

The general management section covers areas common to all the functions as well as areas not covered by any of the individual functions. It also mentions areas of general progress.

SUMMARY

OPERATION SECTION

A total of 77 vessels were attended to during the presence of the project team in CDD from Aug 86 to Oct 87. Rudders and rudder stocks from the Bangladesh Navy were not included.

The vessels included fishing trawlers, cargo vessels, dredgers, research vessels, tankers, naval ships, tugs, barges and pontoons.

The ships were mainly from the national fleet, local private owners and the navy. The largest vessels repaired during the period was the M.V. Banglar Maya, a cargo ship which has a GRT of 12,193.

Altogether 45 vessels were repaired in dock during the contract period. The total numbers of days in dock was 478. The average repair period was therefore 10 days.

The period included the repair of some barges which were in dock for considerable time. Also all public holidays were included. The average repair period still compared favourably with the 16 days stated in the Terms of Reference in the Contract document.

Total dock occupancy for the period from August 86 to July 87 was 278 days. The expected occupancy was 140-150 days per year in the Terms of Reference.

PLANT & MAINTENANCE

Repair and Maintenance were carried out to a large variety of drydock equipment, plant and machineries.

PLANT & MAINTENANCE (cont..)

Machineries repaired, overhauled and tested included high pressure pumps, fresh water pumps, air compressors, vehicles, standby generators, lathes, hydraulic presses, forklifts, tower cranes, mobile cranes, drydock penstock etc.

Preventive maintenance schedules were drawn up and regular inspection and greasing of all cranes and machineries were carried out to minimise downtime of the machines.

A proper maintenance record of all plant and machineries was implemented to facilitate follow-up repair and maintenance.

Catalogues for machines and equipment were compiled and spare parts lists were prepared for easy reference and stock inventory.

A checklist for the inspection of monotower cranes was designed for easy implementation.

FUNCTIONAL AREAS

(A) Engine & Marine Equipment

Numerous jigs and tools were designed and manufactured to facilitate shiprepair operations.

Hydraulic and pneumatic tools which were kept in the Drydock stores were commissioned and put into use to improve operational efficiency.

Enlarged workscope included the repair and renewal of pipings, overhauling of pumps, anchor windlasses, cargo blocks, heat exchanges, engine turbo-chargers and repair of damaged propellers.

(A) Engine & Marine Equipment (cont..)

New and more efficient methods of work were taught to CDD's engineers and workers.

Lectures were conducted on the repair of propellers, tailshafts and rudders, turbochargers, heat exchangers, main engine, pumps, air compressors, valves, deck machineries and controllable pitch propellers.

(B) Plant & Maintenance

A proposal was submitted to the Management of CDD for the setting up of a effective maintenance system to cut down on breakdown of machineries.

Daily progress meeting was introduced to improve communication and awareness of the status of the daily maintenance jobs.

Scheduling of maintenance jobs for the next day was implemented to reduce waiting time and better utilisation of manpower.

Preventive maintenance programmes were drawn up for the machine shop, plate shop, pumproom and cranes.

Introduced two full-time greasers whose jobs were mainly to grease all the cranes.

Conducted lectures on preventive maintenance and greasing of cranes.

Involved in the investigation of the collapse of the 40 Ton Metalna crane's jib and its subsequent fabricacion and installations.

(C) Machine Shop

Performed non marine jobs such as the auto-rickshaw Engine conversion, fabrication of trolley and rails, store gate, modification of sliding doors, motor covers, hydraulic piston, gear-box housing, valve chest , pumps sprocket wheel, fan rotor, worm wheel and turbine rotor shaft etc.

Manufactured numerous jigs and tools to facilitate the machining processes.

Conducted lectures on machining of chrome liners, rudders, tail-shaft, propellers, engine cylinder head valves, turbochargers and pumps.

Commissioned the nozzle grinding machine and drill bit grinding machine. Commissioning of the horizontal boring machine was withheld because of lack spares and technical information

(D) Welding

Performed non-marine steel structure jobs such as the fabrication of chimneys, 'I' beams, steel-bridge, steel-pipe pillars, and steel racks.

Performed welding on propellers, rudders lathes and landing pontoon.

Commissioned and trained CDD personnel in the use of the submerged arc welding machine, Tungsten Inert gas welding machine and carbon arc-air gouging.

Trained welders in down-hand and vertical positions welding on butt and T-fillet welds.

Conducted lectures on shipyard practices and welding process.

(D) Welding (cont..)

Improved the workshop layout of the plate shop for better work flow and easy housekeeping.

Involved in the quality control of the fabrication and welding of the 40 Ton Metalna crane's jib.

(E) Fire & Safety

Proposals were submitted to CDD for the setting up of a Fire & Safety Department and the implementation of safety policy for the Drydock.

Introduced standard safety signs, safety rules and safety cartoons to increase awareness and improve safety in the Drydock.

Conducted safety inspection of vessels, cranes, workshop, pumprooms and men at work and environment.

Suggested improvements in safety in tower gangways, transportation of gas cylinders and the use of life-times.

Conducted lectures on Fire fighting with extinguishers, artificial resuscitation, fire and explosion hazards on tankers, and wire rope maintenance.

(F) Hydraulic

Performed repairs on 500 Ton hydraulic power press, the Drydock penstock and other hydraulic equipment. Also attended to hydraulic equipment on vessels.

Conducted lectures on the hydraulic bilge block eystem in the dock, the power presses, hydraulics, hydraulic valves and the maintenance of hydraulic equipment.

GENERAL MANAGEMENT

Many meetings were held with CDD top management and numerous suggestions on improvements to the Drydock were offered.

Suggestions ranged from topics concerning the whole Drydock to very specific ones involving work in a section or trade. Some suggestions were accepted and implemented while others were not because of political reasons.

Suggestions included the implementation of bar charts for scheduling and controlling repairs on vessels, stemming meetings to co-ordinate work, regular progress meeting, changes in work systems, new areas of work, safety, and general improvements.

OPERATION SECTION

AL SAYESTHA

The tiller of the steering gear had dropped and touched the hydraulic ram.

Found that inside surface of tiller had worn and could not grip rudder stock. Recommended to remove the two halves of the tiller and machine the flanges. In this way the tiller would be able to grip the stock again when tightened.

As a temporary measure to overcome the tight schedule of the vessel, shims were added between stock and tiller.

MAHISHOWAR I, MAHISHOWAR II, FRIENDSHIP I AND FRIENDSHIP II

The four fishing trawlers MAHISHOWAR I, MAHISHOWAR II, FRIENDSHIP I and FRIENDSHIP II were docked for routine work. Clearances of rudders and tailshafts were checked. Sea valves were overhauled, sea gratings removed, zinc anodes renewed. All vessels were cleaned and painted.

F.V. SHAHJALAL I

Attended sea trial of vessel. Heard sharp metal rubber noise coming from shaft tunnel. Learnt that vessel was in Drydock before when bigger propeller was fitted. Propeller was heavier by 10 kg. Also aft sterntube was turned 180 degrees and clearance was 4.2 mm.

Noise was caused by excessive clearance in the sterntube and the tailshaft wiping the tube. The additional weight of the propeller had cause excessive wear in the tube. Recommended to dock vessel for repair.

Vessel was in Drydock for repair after fishing trip. Sterntube clearance was measured to be 6.1 mm. Tailshaft withdrawn for skimming, fitting of proper size propeller, remetalling of neck bush and rewooding of aft sterntube.

MEENHAR I, MEENHAR II

Both vessels docked for normal repair. Clearance of tailshaft and rudder checked, sea valves overhauled, sea gratings removed, zinc anodes renewed and ships painted.

Additional jobs on MEENHAR I were overhauling of controllable pitch propeller (CPP), rewooding of sterntube bush, skimming of shaft, rudder repair and some plate renewal.

Both vessels' rudders were removed from vessels and had their pintle bushes and dolly washers renewed.

Removal of sterntube of MEENHAR I was difficult as it was very tight. Advised Drydock to weld brackets on sterntube, fabricate strongback and then jack out hydraulically from both sides. Sterntube removed easily.

MIRABELLA

Jumbo Ship MIRABELLA had problem in the removal of the pinion gear of the hydraulic winch. The gear was jammed tight. Advised on the design and fabrication of a heavy strongback and puller system for the job in the confined space. With ship's 25 ton hydraulic jack and the system, the pinion gear was removed with ease.

MITA, BANDHAN

Both fishing vessels had similar repairs. Rudders and propellers were removed for access. Kort nozzles were sent to workshop for renewal of pintle bronze liners and welding up of pitting in kort nozzles.

Machined new bronze pintle sleeves. Heated sleeves in electric oven to expand. Dressed and polished kort nozzle pintles. Shrunk fit sleeves onto pintles.

JONTHA UDYAM

Propeller was removed and tailshaft drawn out for renewal of cutless bearings. Unable to procure the appropriate cutless bearings. With approval from vessel's Chief Engineer, the sterntube bush was modified from cutless bearing to lignum vitae bearing.

JONTHA UDYAM (cont..)

Shaft journals were skimmed and shaft in way of packing journals was polished.

Repairs on rudder were the machining of steady bearing journal, spigot collar and the machining of new keyway on the steady bearing journal.

MEGHNA

Port and Starboard propellers were entangled with fish nets. Starboard propeller was turning loose on the shaft taper. Sterntube bush and 'A' bracket bush clearances were all excessive. Both rudder palm bolts were loose. Rope guards and propeller cones were missing.

Rudders shafts and propellers were sent to workshop for repair. All bushes were rewooded. Port shaft skimmed and propeller repaired and fitted. Starboard shaft skimmed, taper machined and keyway dressed. A new key was machined.

Starboard propeller taper was built up by bronze welding, machined and fitted. Propeller nut was renewed.

Both propeller cones and rope guards were fabricated and renewed. Rudder palm bolts were built up by welding and machined to fit.

BANGLAR MAYA

Vessel was in dock from 21 to 30 September. She remained alongside wharf after docking for three days for cargo hold painting. While in dock, keyless tailshaft was withdrawn for survey. 35 sea valves, eight storm valves and four sanitary valves were opened up for survey and overhauling.

During dry docking of the vessel, the following was done :

- checking of propeller push-up
- overhauling of simplex seals
- taking sterntube wear
- centring of propeller for drawing in and out tailshaft
- holding of chrome liner to prevent dropping, and
- magnaflux testing of keyless tailshaft

FRIENDSHIP II

The vessel went to CDD for emergency dry docking. The propeller was damaged and was removed to the machine shops for repair. Propeller blades were distorted. The blades were faired, dents brazed and ground smooth. CDD Engineers were taught the methods of checking propeller pitch by trammel method.

FISHER I

The Fishing vessel was in dock for normal hull cleaning and painting jobs.

BANGLAR KAKOLI

Vessel was berthed at Chittagong Port. The problem was the seized cylinder cover of the main engine. Adviced to apply a coupled moment on the cover to loosen it.

FEDERAL FRASER

The vessel was berthed at Cement Silo Wharf. Adviced on the repair and renewal of piping jobs.

SONAR NAU

Vessel was docked for bottom survey by NKK Classification Society. Hull condition was very bad with deep pittings. Some parts of the bottom were rusted through. About 90% of bottom plates would require renewal. The kort nozzles and rudders were corroded and required partial renewal. Both sterntube seals were missing and the sterntube bearings had clearances of more than two inches. The 'A' bracket bearings were completely wiped out. The vessel was beyond economic repair and the owner decided to put doublers on the bottom for undocking and scrapped the vessel.

F.V. AHM I

The vessel was docked for normal jobs and pipework repair. Nine sea valves were overhauled.

It was the first occassion of pipework repair in CDD. A total of 29 pipes of varying lengths were renewed. The largest pipe was of 100mm bore.

SAMUDRA RAJ

During docking the vessel had her hull cleaned, chipped and painted. 14 sea valves were overhauled and repaired. Three pipes were renewed and two of them had bulkhead penetration.

Tailshaft and rudder clearances were taken. The bottom pintle was found to have dropped by approximately 30 mm. Rudder access was made for checking. The pintle nut was slack and there was clearance between the taper fittings. Due to tight schedule and owner's instruction, pintle was jacked back to position and pintle nut tightened. Tailshaft packing was renewed, propeller polished and ropeguard repaired.

Major steelwork jobs were renewal of steel plate at chain locker, renewal of shell frames at cargo holds and fitting and welding of stanchion supports and stiffeners for holding timber on main deck.

HEGGE THREE

The main jobs for this cargo vessel were rudder and tailshaft. The tailshaft was drawn out for survey. Both the inboard and outboard lignum vitae bushes were renewed. Boring of the bushes were done in situ. Tailshaft was assemblied with new packing.

The rudder was dismantled. Clearances on the pintle bush and stock steady bearing were excessive. The rudder stock was dismantled and the journal space was skimmed. The rudder steady bearing was removed and a new gunmetal sleeve was machined and fitted. The rudder bottom pintle bush was renewed.

Three sea suction valves and four scupper valves were overhauled. One scupper valve was renewed.

HEGGE THREE (cont..)

Both damaged gangways were removed to shop for repair. Roller pins were renewed. Damaged parts of the gangway were cropped off, replaced by new parts and welded. Electric driven winches and gearboxes were completely overhauled. Damaged worm gears were renewed. The worm gears were machined in the machine shops. The gangways and winches were load tested.

K.P.M. BARGES 1 & 2

Both barges were docked for inspection of bottom steel plates. Because of the conditions of the platings, it was decided to renew the complete bottom and sides. The total amount of steel estimated was 25 tons per barge. The barge were cut into three sections each and lifted up onto the dockside for plate renewal.

Due to the collapse of the 40T dockside crane There was no facilities to lower the three sections of the repaired barges into the dock.

The barges were cut into six sections each and lowered into the dock for joining up. All sections were fitted, welded, hose tested and painted. Total plate renewed was 56 tons.

C.U.F.L. (LAUNCH)

The launch was lifted out of the water and put onto the wharf side for repair. Rudder and stock was removed due to excessive clearances on the bushes. Rudder bottom pintle was build up by welding and machined, rudder stock palm face was skimmed and all palm bolts renewed.

Propeller with tailshaft was removed. Sterntube outboard casing was removed and rubber ring renewed. The propeller, after repairing in the shop together with the tailshaft was boxed up onboard.

Main engine fuel oil and lub. oil filters were opened up for cleaning. Main engine cooling pump was overhauled and rubber impeller renewed. Engine room bilge pump and two handpumps were overhauled. Generator lub. oil and fuel oil filters were renewed. Cracks on the main engine exhaust pipe were repaired. Rudder skeg was partially renewed, rudder alignment checked, rudder with stock boxed up and repacked.

C.U.F.L. (LAUNCH) (cont..)

Some shellplates, keelplates and shipside fenders were renewed. Other jobs done were renewal of portholes, shipside railings, carpentry jobs and painting of hull.

BANGLAR MITA

Vessel docked for withdrawal of tailshaft and overhauling of main engine turbocharger for survey.

During the removal of tailshaft coupling bolts, problems were encountered in removing 2 coupling bolts. Service bolts were machined and used to overcome the problems. During the overhauling of simplex seal, the outboard seal chrome liner was found to have worn down and the floating ring had excessive clearances. The chrome liner was sent to shop for skimming and floating ring for remetalling then machined to the recommended clearances. B.S.C. workshop did the job themself with our assistance.

Overhauling the main engine turbocharges 'Brown Boveri VTR 630' wass carried out. Inspection report, clearances chart and work report on the overhauling of turbocharger were made. The turbocharger was surveyed.

Other jobs were overhauling of 23 sea suction/overboard valves and 4 scupper valves for survey. Rudder clearances were checked, doubler plates fitted and air tested for survey. Anchor chain and chain lockers were cleaned. Forepeak bottom plate was partially renewed. Sea grating removed and fitted. Zinc anodes renewed and ship painted.

During the bottom survey a hole was found punctured into the forepeak tank. A thorough inspection was conducted inside the tank. Recommended to cut an insert plate 5ft x 28in x 3/4in thick at bottom of the stem shoe for renewal which was agreed by the Owner's Superintendent and Surveyor.

Rudder area P & S were found badly corroded and pitted. Recommended to the surveyor and Supt. to put doubler plates right across at P & S rudder leading. Sizes are 20ft x 2ft x 3/8in thick x 2 sides. Pitted areas which were more than 6mm deep were built up by welding. More zinc anodes were fitted on rudder.

AL-REZA

The vessel was docked for normal sea valves overhauling, rudder and tailshaft clearances jobs. During bottom survey it was found that the propeller was caught with fishing nets and cracks about 200 mm long were found running across the propeller blades from the leading edge on all the five blades. Decision from owners and classification to change the propeller with the ship spare. (This vessel was built with a semi-balanced rudder). Shifted out the propeller by just turning the rudder hard starboard to gain more excess room for manoeuvring.

The spare propeller was polished and dye checked. Hairline crack on one of the blade tip was arrested by drilling hole as recommended by the Surveyor. Outboard Simplex Seal was recommended for overhauling but it was not carried out as vessel did not have the spare parts. The shaft nut was found to be tight while removing. Rope guard was renewed, rudder clearances checked, rudder pressure tested, missing pintle closing plates fitted, total four main suction and discharge sea valves and five scupper valves overhauled. Biggest size being 320 mm. Other jobs included anchor chains, and chain locker plates renewal, welding of draft and plimsol marks. Hull chipping and painting, fitting of sounding pipe striking plates and building up of bottom plate holes.

AL-SWAMRUZ

Vessel came alongside the pier to carry out repair on the damaged propeller afloat.

Vessel was trimmed so that the propeller blade had a maximum clearance above the sea-water level. The dented area of the propeller blade was heated evenly for relieving the residual stresses and was faired by heating torch to max 600°C.

After fairing the blade, visual inspection was carried out on the surface of blade for any defect. The repaired area was stress relieved to 200°C. The area was covered with asbestos cloth for 4 hours. Damaged area was dye checked for defect and found satisfactory.

M.V. JOUTHA UDYAM

The fishing vessel went to Chittagong Drydock for emergency drydocking. A hole was found at the bottom in way of the engine room. Bilge was patched up with a doubler plate.

K.P.M. BARGE NO. 20 & 22

The two flat top barges were docked for bottom, side shell plates, angle bar stiffeners and ship side fenders renewal.

Total steelwork renewal was 52 Tons for two barges.

F.V. MOITRI - S

The trawler was docked for hull cleaning and painting. Eight sea valves valves were overhauled, biggest size being 100mm bore. Propeller cone plug was renewed, locking wire fitted and propeller cone cemented. Propeller blade was faired up in place. Rudder palm bolts cemented. Hull and rudder zinc anodes renewed. Doubler plates fitted and welded at starboard stern end. Sea gratings were removed and fitted for cleaning and painting.

BANGLAR SAMPAD

During the survey on the propeller blades, it was found that all four blades were badly dented and bent and some portions were torn off.

After discussion with Ship Owner and Class Surveyor, it was decided to cut and trim round the edges of the propeller blades in way of the damaged areas.

The following procedures were adopted:

- Fair the blades
- Cut the blades
- Weld the Fractures

Thirty-five sea valves and scupper valves were overhauled, the biggest size being 300mm. Corroded valve lids was recommended for renewal and the sealing face build up by stainless steel welding and machined. The landing face of the valve covers and chest were build up by low hydrogen electrode and machined.

Other docking jobs include sea gratings, checking clearances of rudder and shaft, renewal of zinc anodes, anchor chains calibration, hull cleaning and painting. Rudder was pressure tested with water.

KHULNA

The vessel was docked for normal docking and removal of tailshaft for survey. Rudder was removed for access. Rudder doubler plates were found corroded and recommended for renewal. Rudder king-post (big end) taper was corroded and recommended for building up and grinding. Echo sounder was renewed and installed. 49 sea valves, scupper valves, intermediate valves and overboard valves were overhauled, biggest size being 6" bore. Anchor chain studs were built up by welding, link taper pins renewed and sealed with lead. Chain lockers cleaned and painted. Anchors and chain cleaned, high pressure washed and painted. Propeller was polished, dents faired up and dye-checked for survey. Sea chests opened up for cleaning and painting. Zinc anodes renewed. Ship hull was cleaned and painted.

During bottom survey of vessel, a hole of one inch diameter was found at the aft starboard bottom plate between Engine Room double bottom fuel oil tank and No. 4 Centre double bottom tank.

It was decided to weld a spigot plate of size 2"I.D. X 4"O.D. X 7/8" thick on the damaged hole so that hot work are away from the fuel oil tank.

CHANDANA

Order was received from the Owners of the fishing trawler F.V. CHANDANA of Blue Bay Ltd. for machining new keys and key ways onto the new propeller and coupling to suit the existing tailshaft.

New key-way on 4-blade new manganese bronze propeller of 1460mm diameter was marked. Propeller mounted and aligned on slotting machine. Key-way was slotted. Two new forged steel keys 175mm x 32 mm x 17mm were machined. Tailshaft was fitted on the propeller. Later tailshaft, 177mm diameter x 3460mm length was mounted and aligned on milling machine. Keyways were milled deeper to suit the new keys.

AL-AMANAT

Vessel was berthed at the Port. Order was to rectify the hand hydraulic steering gear system.

AL-AMANAT (cont..)

Checked and found that cup-seals of telemotor transmitter's plungers at the wheelhouse were leaking. This affected the operation of the steering system. Dismantled telemotor transmitter to remove the defective seals. Original seals were obtained and telemotor re-assembled. System was bleeded of air thoroughly.

DENISH

Assistance was given to determine the suitable NDT (Non-Destructive Test) on the Mast-House derrick boom lifting eyes (10 locations) on vessel 'DENISH' berthed at Cement Silo Wharf.

Inspected the lifting eyes with CDD personnel and ship officer.

The following work procedures were recommended:

- Remove derrick blocks and shackles for visual inspection.
- Grind and polish the weldments.
- NDT by dye-penetrant.

The recommendations were accepted by Owners and Surveyor and all the lifting eyes were checked for defects by dye-penetrant test.

LANDING PONTOON

A new landing pontoon of size 50ft long 25ft wide and 5ft high was fabricated by the Drydock. The total amount of steel used was 32 tons and it took 30 days to complete the fabrication.

JAMUNA & BURMAH EASTERN

The two landing pontoons belonging to the oil companies Jamuna Oil Ltd and Burmah Eastern Ltd, respectively, were docked on 1 Apr 87. During the survey with owner representatives, both landing pontoon bottoms and side platings were found with holes and pittings. It was decided to renew the bottom and side plates as marked.

JAMUNA & BURMAH EASTERN (cont..)

The weight of steel plate renewed for Jamuna was 12 tons and for Burmah Eastern was 6 1/2 tons. The cutting, fitting and welding of both pontoons were completed at the same time and were undocked on 21.4.87.

Burmah Eastern though had less plates renewed than Jamuna, took a longer time for the following reasons:-

- Most steel plates renewed were at the port and starboard curve bilge areas which require more bending and pressing of plates in the shop.

- Pontoon was built of rivet construction and during the repairs, the angle bar stiffeners had to be trimed off to suit the edges for welding.

M.T. DOEL

The tanker was docked on 21 April 1987 for normal docking jobs such as hull cleaning and painting, sea chests and gratings cleaning and painting zinc anodes renewal, sea valves overhauling. Total 29 sea valves were repaired. Rudder clearance was checked and bottom pintle bush renewed. Tailshaft was drawn out for survey, both inboard and outboard sterntube bushes rewooded. The uneven wear on the tailshaft bronze liner was skimed and propeller polished. The design of this vessel has a short length of shafting inside the engine room, so tailshaft has to be drawn outward. The rudder was removed and shifted aside for access.

Portside forward section of bilge was found missing. A new flat plate was fitted and welded. Starboard side midship section of bilge keel with slight dent was faired to its original shape. Forward P & S bottom seams which were badly corroded were welded.

R.V. ANUSANDHANI

The research vessel was docked on 21 April 1987 for tailshaft survey. The propeller was of the controllable pitch type and the engineers and workers were taught the procedure of removing the servomotor piston, and the slackening of the SKF coupling to disengage the tailshaft from the pitch unit.

R.V. ANUSANDHANI (cont..)

On the job training was conducted and the trainees were taught how to check C.P.P. spare parts from drawings, spare parts book and actual spares. Sterntube seals were recommended for renewal and outboard chrome liner worn with deep grooves in way of the seals was advised to be skimed. Due to non-availability of sterntube seals the vessel was blanked for undocking. Other jobs were hull cleaning and painting. Sea chest and gratings cleaned and painted. Zinc anodes renewed, and rudder removed for access for withdrawal of C.P.P. shaft.

R.V. MACHHRANGA

The research vessel was docked on 21 April mainly for hull cleaning and painting. Shafts and rudders clearances were checked. Sea chests and gratings were removed, cleaned and painted. Zinc anodes were renewed. 10 sea valves were overhauled biggest size being 2" bore.

Aft starboard kort nozzle inner surface in way of propeller was found corroded. It was built up by electrode arc welding.

K.P.M. BARGES NO. 16 & NO. 24

Both the flat top barges came into the Drydock with an estimated steel renewal of 50 Tons. They were put into the dock for four days and were each cut into eight sections. Each section was then lifted on to the dockside for steel renewal.

M.T. BANGLAR JYOTI

The above new tanker was docked on 12 May 1987 for handling over to the new owner Bangladesh Shipping Corporation. Bottom survey was carried out, damaged paint work touched up and painted. Sea gratings opened up for inspection and refitted. Both C.P.P. shafts wear down pocker gauge readings were taken. Both "Becker" rudder with sub-rudder clearances were taken. CDDL engineers and workers were taught how to check this type of rudder clearances. Additional zinc anodes were fitted and forward and aft fenders installed. Tank ullage pipes supoorts were modified and fitted.

M.T. BANGLAR JYOTI (cont..)

Gas-free inspection at the cargo oil tanks for the purpose of entry for ullage pipes modification works which required burning and welding was carried out. A total of 7 tanks were inspected with the aid of a "Riken" oxygen/hydro-carbons gas meter.

M.V. AL SANA

The vessel was docked on 18 May for normal docking jobs. Tailshaft clearances was found to be excessive. Rewooding of sterntube was recommended. Tailshaft journal in way of the inboard bush was found to have worn down by 25 to 30mm.

Pneumatic disc sander used to grind down the overhang of the tailshaft. Intermediate shaft shifted aside. Rudder was removed for access for setting up the machine for boring the stern bush.

Leaking area on the rudder was welded and doubler plate fitted. Rudder was pressure tested and found satisfactory. Tailshaft was magnaflux tested on the taper end, propeller polished and dye checked for survey. Rope guard was renewed.

Total 24 sea valves and 6 scupper valves were overhauled for survey. Zinc anodes were renewed. Hull was cleaned and painted.

Bottom keel plate in way of forward deep tank was found heavily corroded and thickness gauging had shown below half of original plate thickness. After discussion with the classification it was decided to renew the plate 11'-0 x 6'-0 x 3/4" thick.

Forward port and starboard sides welding seam which was badly corroded was marked and welded by m.s. electrode 36' long x 3/4" width.

BNS SHAMEED RUHUL AMIN - A 511

The above ship came in for emergency docking on 18 May with a broken tailshaft. Major jobs were removing the rudder for access and withdrawing the tailshaft and were done by ship's crew. The hull was cleaned and painted.

The aft bottom keel was pitted and a doubling plate of 19' x 2' x 3/8" thick was fitted.

ALI

Received order from Chittagong Port Authority to overhaul the pumps of the pressure compensating system on the hydraulically operated buoy lifting vessel.

The pumps were unable to deliver sufficient working pressure. The pumps were of the axial piston swash plate design.

NAVAL DOCKYARD

The Bangladesh Navy sent a total of nine rudders and stocks for repair and two tailshafts for checking straightness.

BNS ABU BAKR

The ship was docked for generators renewal. The new 656 HP Caterpillar engine 3508 with electrical generator was installed. Some shell plates and bottom plates were renewed. Hull cleaning and painting were carried out. Zinc anodes renewed.

BNT KHADEM

The tug was docked for hull cleaning and painting

M.V. BANGLAR MONI

The vessel was docked on 13.6.87. During bottom inspection, found that fishing nets were caught in between the outbaord stern tube seals and chrome liner.

Tailshaft fitted with S.K.F. coupling. Tailshaft drawn out, both taper ends and keyways were magnaflux checked for cracks. Propeller polished and dye checked for cracks. Inboard and outboard seals were overhauled. Outboard chrome liner found with deep pitting holes in way of seal areas. Recommended for renewal. Inboard chrome liner skimmed and polished.

M.V. BANGLAR MONI (cont..)

Nine sea valves, ten overboard valves, eight scupper valves and eighteen intermediate valves were overhauled. Two main engine jacket fresh water coolers and one main engine piston water cooler were overhauled.

Air-condition sea water pump housing was skimmed and both neck bushed renewed. Domestic fridge cooling pump housings were skimmed, impeller machined and new wear rings shrunk-fit onto the impeller. One strainer was repaired and one new strainer fabricated. Three pieces generator sea water cooling pipes were renewed. One piece branch pipe was fabricated and fitted to drain condensate water to boiler feed tank.

Port windlass and all derrick blocks were overhauled.

Bulkhead in way of fore-peak and chain locker was torn off by anchor chain. The damage area was croped off and a new insert plate was fitted and welded. Aft port bilge keel was dented and repaired.

M.T. PASMARINI

Received order to check the truthness of one of the connecting rod of Deutz Marine Engine.

The connecting rod was put on the surface table supported by cast iron square blocks. At the bearing and gudgeon pin sides both end surfaces are checked with try-square for right angle to the surface plate. It was found that the centres of the two holes for the securing bolts of the bottom end bearing were not in line and out by 0.5mm. The connecting rod was twisted.

M.V. AL SALMA

Complained of rudder noise when travelling with deep draft. Inspection onboard ship was carried out. Recommended to send diver to check the rudder pintle.

M.V. BANGLAR KIRON

Seventeen pieces of pipes were renewed. The sizes vary from 1 1/2" to 6" in diameter and length of 3ft to 24ft. One of the pipes was set and fitted onboard.

BANGLAR SWAPNA

A job order was received for rectification of Mac-Gregor hydraulic hatch covers, on an emergency basis. Attended to the vessel at the anchorage.

One of the hatch covers had its rollers fallen off the tracks which were worn out. The tracks were trimmed in way of rollers by oxy-acetylene burner to allow cover to be lifted up onto the tracks. The hatch managed to close up.

M.T. JAMUNA

The tanker was docked for hull cleaning and painting. Anchors and chains were calibrated, surveyed and painted. Port and starboard rudders removed for access to propeller job. Both port and starboard tailshafts clearances taken, damaged propellers were removed and faired. Sea gratings were removed and sea chest cleaned. Zinc anodes renewed. Sixteen sea valves and 4 storm valves were overhauled. Sounding pipes to all the cargo tanks were modified.

Bottom plates welding seam was badly corroded and welded. New pipe guards were fitted on the port and starboard sides of the bottom hull around the propellers about 36ft in length to prevent fish nets entangling the propellers.

All cargo tanks were gas freed for hot work.

M.V. DACCA

The vessel was docked for normal docking jobs and tailshaft survey. Tailshaft and rudder clearances were taken and rudder removed for access. Tailshaft drawn out for survey. Thirty-six sea valves and seven storm valves were overhauled. Other jobs included the survey of tanks, anchors, anchor chains, chain lockers and sea gratings. Zinc anodes were renewed. Hull cleaned and painted.

AL AMANAT

The vessel was at Chittagong Port. Sea water was leaking through the steady bearings of the port and starboard rudders. Suspected rudder stock bushes were slack. For temporary repair suggested to trim vessel till the rudder stock packing boxes were above water level and pack them with oversize packings.

Starboard telemotor hydraulic system could not respond well to the command. There were some leak at the gland of receiver at steering flat.

PLANT AND MAINTENANCE

PORTABLE HIGH PRESSURE PUMP

The pump was jerking and delivering only 200 bar pressure instead of the expected 400 bar.

Opened up valve seats and pressure regulator for checking. Pressure regulator was satisfactory. Valve seats '0' rings were all damaged, wall of valve seatings were worn off. Replaced '0' rings. For wall of the valve seatings, built with steel putty.

Wall of valves seatings was thoroughly cleaned before application of steel putty. Pump repaired satisfactorily and delivering 400 bar pressure.

NO. 1 FRESH WATER PUMP

The motor was reported to be vibrating violently.

Visual inspection showed that vibration was due to slackened bushes and damaged drive couplings of the pump. Vibration was not caused by the motor. Delivery pressure dropped from 120 kg/cm2 to 80 kg/cm2.

Opened up whole pump for overhauling. All bushes were worn off, ball-bearing damaged and drive couplings also damaged. Replaced all damaged parts.

Pump was tested after assembly. Vibration had gone, working pressure remained at 80 kg/cm2. Re-opened up pump for further inspection. New bushes which were machined by the machine shop were slack. Two new bushes were machined. When pump was ready, tested again. Pressure found satisfactory at 115 kg/cm2.

500 TON HYDRAULIC PRESS

Gave out very loud noise when the main ram was being lowered or lifted. Sound came from the supporting cylinders of the hydraulic ram trolley. While operating the cylinders were unable to hold the pressure thus causing the whole ram to jerk and giving out loud noises.

500 TON HYDRAULIC PRESS (cont..)

The supporting cylinders were opened up and the seals were found to be damaged because of incorrect size. The correct seals were replaced and the supporting cylinders were boxed up. The press was tried out and found to operate satisfactorily.

MOTOR VEHICLE DAHKA - 7646

Water was coming out from exhaust pipe of vehicle.

Removed the cylinder head to check. The cooling space at the cylinder head was badly corroded and worn, causing water to seep into combusting chamber. Managed to procure a re-conditioned cylinder head to replace.

Engine tried out satisfactorily.

OVERHEAD CRANE ELECTRICAL BUS-BAR

The bus-bars which were made of mild steel were rusted. Two solutions were offered. Solution one, and the cheaper of the two, was to fix copper strips on bus-bars to provide better conduction. Solution two was to modify bus-bar system to the enclosed type. The Drydock, however, accepted neither and instead just polish the bus-bar.

PLANT & MAINTENANCE INSPECTION

Inspection was carried out on the following plant & equipment.

(1) Metalna 40 Ton Monotower Crane

(2) No. 2 Grove Hydraulic Mobile Crane

(3) Pumproom

The recommendations were as follows:-

PLANT & MAINTENANCE INSPECTION (cont..)

(1) Metalna Crane

Travelling bogies giving out noises. To grease all bushes.

Hoisting and luffing wire ropes were very dry. To grease thoroughly.

Roller & shaft of auxiliary hoisting wire rope guide badly worn and causing wear to wire rope. To renew.

Dip-stick of slew gear-box missing. To replace immediately.

Parts of crane corroded. To chip and paint to prevent further corrosion.

To grease all grease points to prevent seizure in moving parts.

Auxiliary gear-box oil contaminated. To change immediately.

(2) Hydraulic Mobil Crane

Main and auxiliary hoisting wire rope were very dry. To grease thoroughly with correct grease immediately. Delay might result in rope bursting during operation.

All greasing points were dry. To grease immediately.

(3) Pumproom

Both fire pump pressure gauges were faulty. Unable to determine whether pumps were running efficiently as pressure could not be read. To replace immediately.

All three inlet cast iron pipes from the sea were not properly supported. When pumps were running, vibrations could cause cracks in the cast pipes. The consequence would be serious as the pump room would be flooded and rendered inoperational. It would paralyse the whole Drydock. To solidly support pipes immediately.

(3) Pumproom (cont..)

It was also recommended to install control valves on the cast iron pipes near the wall where the pipes enter the pumproom. Water could easily shut off should the pipe break.

INSPECTION OF CRANES

The following three monotower cranes were inspected and the observations made and recommendations were as follows :-

MANSKY 15 Ton

Observation	Recommendation
Radius and load indicator found faulty.	May overload without indications. To repair immediately.
All wire ropes were dry and there were signs of wear.	To grease immediately all wire rope.
All greasing points were dry.	To grease all points.
Corrosion on various parts of crane body.	All corrosions to be treated and painted.
All greasing point dry.	To grease all points.
Wire ropes dry and signs of wear.	All wire ropes to be thoroughly greased.
Few strands of luffing rope damaged.	To check regularly. Replace rope if further damaged.
Radius and load indicator faulty.	To repair to avoid overloading.
Handrails at aft-counter weight damaged.	Dangerous for greaser. To repair.
Travelling limit switch jammed.	To repair.
Corrosion at various parts of structure.	Inspection doors to be fitted.

INSPECTION OF CRANES (cont..)

DIA 50 Ton

Observation	Recommendation
Wire ropes dry and signs of wear	To grease all ropes immediately.
All greasing points dry	To grease all points.
Corrosion at various parts of structure	To treat and paint.

No. 3 Forklift

The forklift was giving out unusual noise. Noise coming from the back left wheel. Suspected that wheel bearing was damaged.

On removal of wheel, confirmed that bearing was damaged. Back right wheel was similarly removed for checking. Likewise bearing was damaged. Both bearings were replaced and forklift operated satisfactorily.

NO. 4 PORTABLE AIR COMPRESSOR

The compressor had overheating problem causing the engine to trip. On checking, found that engine was running with excessive RPM.

Adjustment was made to the linkage of the fuel pump. RPM was reduced from 1800 to 1500. Radiator was cleaned. After adjustment and cleaning, engine was running normally.

NO. 2 STAND BY GENERATOR

The enhaust pipe of the generator was reported to be 'red hot' when running at 75% load. Tried out the generator without load and found that temperature at the enhaust was normal.

Further, a thermometer was fixed at the enhaust and the temperature was measured at five minutes intervals when the generator was on 75% load. The temperatures were recorded at around 515°C; within the allowable limits.

COLLAPSE OF 40 TON METALNA CRANE'S JIB

The crane jib's wire rope snapped and the jib fell forward hitting the ground. The jib was badly damaged, distorted and twisted at several places.

A committee was set up to investigate the accident.

After thorough investigation, inspections and interviewing the crane driver and his helper, the committee concluded that the cause was the wire rope snapping. The rope slipped off its position and got stuck in between the pulley and the sharp end of the opening of the tower structure. When the jib was hoisted, the wire rope sheered off and the jib fell.

Removal of Damaged Jib

The removal of the damaged jib was carried out as follows:-

- Lashed up the fork-end of the jib with two 10T chain blocks to prevent the jib from falling.
- Arranged for proper supporting of jib for dismantling and cutting of damaged portions.
- Cut and removed all wire ropes after obtaining wire ropes arrangement ment drawings. Also removed free pulley block.
- Cropped off sections of jib starting from tail end. Jib suspended by grove mobile crane.
- Removed steel pins at job hinges.
- Removed part of crane counter weight with help of 15 Ton wharf crane.

Jib Fabrication

The main hoisting hook was straightened on a hydraulic press and sent to Chittagong Steel Mill for stress-relieving.

Jib Fabrication (cont..)

The existing gun-metal bushes of the fork-end of the job was extracted. In setting up the boring tool for boring, it was ensured that the axis of the boring bar was perpendicular to the axis of the jib. The assistance of the theodolite was used. Two new gun-metal bushes for fitting into the fork-end of the jib were casted at Chittagong Steel Mill.

The Mill certificates were finally received.

Welding Procedure Qualification test was conducted. Six test-pieces were made from excess plates and sent to Chittagong Steel Mill for test. The tests are for tensile strength, face bend and root bend. The results were satisfactory to American Welding Society requirements.

Twelve critical areas of butt weldings were marked for radiographs. The results showed four areas requiring repair.

The bolt-holes at the fork-ends of the jib were dye-checked and no visible cracks were seen.

Ultrasonic readings were taken on the steel plates to check for lamellar tearings.

INSPECTION REPORT ON MAN-KSY 15-TON CRANE

The crane was visually inspected and the wire rope were calibrated as follows:-

	Original Diameter	Calibrated Diameter	Reduction
Luffing wire rope	20mm	18mm	10%
Hoisting wire rope	28mm	27.5mm	1.78%

The followings were recommended.

1. Luffing wire ropes to be renewed immediately.
2. A load test with a 15-ton ballast weight to be carried out after renewal of the luffing wire rope.
3. All wire ropes to be thoroughly greased.

INSPECTION REPORT ON METALNA 15 TON CRANE (cont..)

The crane was visually inspected and the wire ropes were calibrated as follows:-

	Original Diameter	Calibrated Diameter	Reduction
Luffing Wire Rope	22mm	21mm	4.54%
Hoisting Wire Rope	22mm	20mm	9.09%

The following defects were observed and action recommended.

1. Luffing and Hoisting wire ropes to be renewed immediately.

2. Radius and load indicator still faulty and advised to make good immediately.

3. Hand-rails on the aft counter balance weight to be repaired.

4. Corrosion on various parts of the crane to be chipped and touched up with Anti-corrosion paint.

5. The minimum working radius is found to be at 18.5 metres instead of 8.5 metres as stated in the drawings and instruction manual. To investigate immediately.

INSPECTION REPORT ON DIA 50 TON CRANE

The crane was visually inspected and the wire ropes were calibrated as follows:-

	Original Diameter	Calibrated Diameter	Reduction
Luffing Wire Rope	28mm	27.8mm	0.71%
Hoisting Wire Rope	25mm	24.8mm	0.8 %
Auxiliary Hoisting Wire Rope	20mm	19.2mm	4 %

INSPECTION REPORT ON DIA 50 TON CRANE (cont..)

The following defects were observed and actions recommended:-

1. Auxiliary Hoisting wire rope to be renewed.
2. All wire ropes to be thoroughly greased.
3. Corrosion on various parts of the crane to be chipped and touched up with Anti-corrosion paint.
4. The electrical panels in the machinery house not covered. To cover up.
5. A load-test to be carried out after renewal of Auxiliary hoisting wire rope.

LOAD-TESTING OF 15-TON MAN KSY CRANE

The crane was load tested on 6 December 1986.

The following were done:-

1. Test-load of approximately 16.5 tons was lifted at radius of 30.5 metres. During lifting, hoisting brake was found to be effective.

2. The upper hoisting limits, minimum and maximum limits of the working radius were checked, adjusted and set accordingly.

3. The Over-load was not working. Recommended to check and make good the load-cell.

STANDBY GENERATOR NO. 1

Engine speed and the lubricating oil pressure were dropping.

The generator was run without load for about half an hour and the engine speed and lubricating oil pressure were constant. Subsequently the generator was put on load to about 100KW, and the engine speed and lubricating oil pressure were dropping slowly. Changed the engine lubricating oil and filter.

The generator engine was started again and when put on load to about 100 KW, the engine speed and the lubricating oil pressure remained constant.

DRYDOCK PORT PENSTOCK VALVE

The port penstock valve of the drydock was unable to remain open and was closing gradually under its own gravity.

During inspection it was found that the hydraulic oil level in the reservoir had dropped to a low level. The hydraulic rod's seals were leaking. Removed the hydraulic cylinder of the penstock valve for repair. Procedures were as follow:-

- Use crane to lift up grating at entrance of penstock valve;
- Send divers to clean up place where blank is to be seated;
- Lift blank into entrance of the penstock valve to prevent water from rushing into the dry-dock if penstock valve is accidently lifted up.

Hydraulic cylinders were removed and sent to workshop for dismantling of the hydraulic rod. The seals were damaged and the chroming was badly eroded and shaft badly pitted.

Recommended to dress up the hydraulic rod which is about 93" long, and to hard-chrome it. Alternative such as fixing stainless steel or brass sleeves onto the hydraulic rod were also recommended.

INSTALLATION OF VALVES IN PUMPROOM

Three cast steel valves were fitted to the three cast iron suction pipes of the fire pumps, as per earlier recommendation. It was to prevent flooding of the pumproom in the event of a leak. The used valves were completely overhauled before installation.

Procedures of fitting the cast steel valves to the suction pipes were as follows:-

- with a crane, lift grating at suction end of fire-pumps
- divers to clean up suction end of fire-pumps
- lower blank into suction end of fire-pumps
- pump out water in chamber between blank and suction end
- remove the suction pipes
- fit cast steel valves
- alter suction pipes
- fill chamber between blank and suction end with water
- finally lift up blank and lower grating back into suction end

PURCHASE OF CRANE WIRE ROPES

A recommendation was made to purchase crane wire ropes for stock as there was no more spare.

A meeting was convened to work out the types, sizes, construction, length and quantity of the wire ropes for each respective Monotower crane. It was emphasised that the wire rope certificates must be supplied.

PUMPROOM'S FIRE-PUMP

One of the fire pumps was reported to be running with a low discharge pressure. Inspected the fire pump. Noticed that the discharge pressure was about 50 p.s.i. It should be 100 p.s.i.

Sent a diver to check the suction pipes and gratings. Diver reported that the inlet pipe gratings was damaged and covered with clothes and ropes, thus restricting the water inlet to the fire pumps. Recommended to renew the inlet pipe gratings with stainless steel material. Due to difficulty in obtaining stainless steel grating in the market, mild steel grating was used. Grating was coated with epoxy paint.

Procedures for renewing gratings were as follows:

- Use crane to lift up main grating.
- Divers to clean up the suction end.
- Use crane to lower blank into suction end.
- Drain out water in chamber between the blank suction end.
- Remove inlet pipe grating.
- Fit new inlet pipe gratings.
- Fill chamber with water.
- Finally lift up blank and lower main grating into the suction end.

DRY-DOCK PORT PENSTOCK

For the repair of the penstock, a stainless steel rod of size 4"Ø by 9ft. was used. The rod was found to be twisted. The stainless steel rod was machined to size and polished. Machining was intricate as shaft was only 1.5mm oversize and bent.

DRY-DOCK PORT PENSTOCK (cont..)

Procedures of assembling and installing the hydraulic cylinder to the penstock were as follow:

- Assemble hydraulic rod to piston and cylinder with new seals.
- Test complete hydraulic cylinder with compressed air for leakages.
- With the Mobile Crane, lower the hydraulic cylinder to the penstock valve.
- Join up the hydraulic cylinder to the valve by fitting the connecting pin.
- Top-covers of the penstock tightened up.
- Limit switches of the penstock fitted back.
- Hydraulic oil in penstock pumps' reservoir renewed as oil was contaminated.
- Start penstock pump and test the penstock at full open and close position a number of times.
- Put penstock at full open position for at least 2 hours to ascertain any hydraulic oil leakages.
- Remove the blank with the assistance of mobile crane and diver.
- Lower the steel grating back to its position.

WATER TREATMENT PLANT PUMP

The pump of the water treatment plant was running with excessive vibration and noise. An inspection of the pump was made.

It was found that the gap at the coupling of the pump and motor was uneven. The misalignment could be seen with the naked eye. The pump and motor was re-aligned and tested satisfactorily.

INSPECTION OF DRYDOCK STARBOARD PENSTOCK

An inspection was carried out on the drydock starboard penstock. The following observations and recommendations were made:-

INSPECTION OF DRYDOCK STARBOARD PENSTOCK (cont..)

1. The hydraulic rod was found to be badly pitted and slight hydraulic oil leakages could be seen. Recommend to repair or replace the hydraulic rod and to renew all the seals in the hydraulic cylinder.

2. The hydraulic oil in the penstock pump reservoir was found to be contaminated. Recommend to change the hydraulic oil in the penstock pump reservoir.

MAN-KSY 15 TON CRANE

1. Hoisting Motor Overheating

The hoisting motor was overheated. Electrical systems were found o.k.

An inspection was carried out. The crane driver was instructed to operate the hoisting motor. It was observed that the hoisting electro-mechanical brake was not adjusted satisfactorily thus causing one side of the brake linings to rub on the brake drum. The brake drum was very hot. The heat was transmitted to the hoisting motor. The hoisting brake was adjusted.

A load test was done to ensure the effectiveness of the hoisting brake. The crane was put into operation and was monitored for a week. The problem was resolved.

2. Inspection and Load Testing

An inspection and load-testing were carried out on 2 May 1987. The following were done and observed during the testing.

(a) Test-load of approximate 12.7tons consisted of the side fork-lift (approx. 10.5tons) and 1 piece of sheet pile (approx. 2.2tons) were lifted at a radius of 27 metres. During the lifting, the hoisting brake was found to be effective.

(B) Wire ropes were calibrated and the readings were as follows:-

Original Dia	Calibrated Dia	Red. %
Hoisting wire ropes	28 mm 26.5 mm	5.3
Luffing wire ropes	20 mm 19.5 mm	2.5

MAN KSY 15 TON CRANE

(B) Inspection and Load Testing (cont..)

The 'wear-down' in the hoisting wire ropes were found to be excessive. It was advised to renew the hoisting wire ropes, Kuplex shackles and the chains as soon as possible. All the wire ropes were to be thoroughly greased.

STAND-BY NO. 1 GENERATOR VIBRATING

There was a vibration problem in the No. 1 Generator after overhauling.

Inspected the generator. Requested CDD personnel to narrate what they had done during the overhaul. Was told that while trying to fit the alternator to the engine, they encountered problem putting the alternator in position as the alternator's rubber mounting studs were in way. They cut off all the studs so that they could bring the alternator into position to couple with the engine. Subsequently they drilled holes on all the rubber mountings so that they could fasten the the alternator to the generator's skid.

It was explained to them that what they did was wrong. By cutting off the studs on the rubber mountings and fastening the alternator directly to the generator's skid would meant that the rubber mountings had lost its purpose. Thus vibration occurred when the generator was running.

They were advised to fit bushes with thread to both ends in all the rubber mountings so that they could fit studs onto them. When the alternator was in position for fastening to the generator's skid it was emphasised that both bushes in the rubber mounting must not touch i.e. leaving the middle of the mounting cleared. Method of fastening the bushes to the rubber mounting was also advised to them.

The generator was tested and found to run steadily. The vibration had gone.

500 TON PRESS

The hydraulic jacks for clamping the press block were again malfunctioning. Checked and found that the piston seals were defective. These seals were manufactured sub-standard in a local workshop. Highly recommended to use original seals.

400 TON PRESS

Checked and found that the main cylinders piston seals were defective due to deterioration. Recommended to procure and use only original seals.

BILGE PUMP

The No. 4 bilge pump in the pumproom was vibrating vigorously. A fishing net was entangled with the impeller and shaft of the pump. The pump's impeller and the shaft's bushes were badly worn off. The pump was removed and sent to Machine Shop to machine new bushes and impeller. The inlet gratings was repaired.

LATHE MACHINE

Lathe machine No. 32 in the Machine Shop was scheduled for preventive maintenance. On the 3rd of June all parts were checked, inspected and lubricated.

INSPECTION OF MAIN DE-WATERING PUMPS

CDD was concerned with the slower de-watering rate of the main dewatering pumps. An inspection was to be done. The mud and debris in the dock's sump must be cleared for access.

The mud and debris was about 12" high.

A man with a life line was sent into the sump to ascertain the actual amount of mud and debris.

While removing the mud and debris in the sump, all the drains in the dock-bottom, were sealed off. Portable pumps were installed in the drains.

FUNCTIONAL AREAS SECTION

(A) ENGINE & MARINE EQUIPMENT

Portable Handpump

A suggestion was made for the procurement of a small portable hydraulic handpump for connection to hydraulic jacks instead of using bulky electric driven pumps.

Static Balancing of Propellers

Proposal for the fabrication of a pedestal bearing and support for the static balancing of propellers was submitted to CDD. Lectures were conducted on the procedure for balancing three and four blade propellers, flywheels and pump impellers for. Demonstrations on balancing were carried out.

Portable Engine-Driven Ballast Pumps

CDD personnel were taught the operation and running test of portable engine-driven pumps. The overhauling procedures of the pumps were also explained.

Lectures on Propeller, Tailshaft and Rudder Repair

Lectures were conducted on the method of repair of propeller, tailshaft and rudder. Emphasis was placed on planning of work manpower distribution and safety aspects. The following recommendations were made:-

- Protective plates to wrap around the edges of propeller blades in way of lashing wires to prevent damage to edge of blades.
- Eye-plates to be welded onto both sides of the rudder and at the stern area along the centre line of the tailshaft for easy removal
- All necessary tools and equipment to be prepared, tested and brought to the site of repair instead of having to hunt for them.

Lectures on Propeller, Tailshaft and Rudder Repair (cont..)

- A checklist for the withdrawal of tailshaft for survey and the procedure for the removal of rudder were given to CDD.

Lecture on Turbocharger

A lecture was conducted on the operation and maintenance of the turbocharger. The function of the turbocharger and its relation to the engine was explained. Also, its parts and the special tools required for overhauling were explained.

Lecture on Heat Exchangers

Lecture on various kind of heat exchangers onboard the ship was taught. Heat exchangers like coolers, heaters, evaporators, condensers and exhaust gas economisers were explained. Functions of each type of heat exchangers and their construction were highlighted. Taught on how to repair, including retubing and testing of each type of heat exchangers. Various kind of tools like tube expander, drill and drift punch were explained.

Planning and Organising of Jobs

A meeting was conducted on the planning and organising of jobs prior to ship arrival. Topics covered were planning, organising of work, manpower, tools and equipment. The use bar charts was recommended.

Main Engine Repair

Lectures were held on main engine repair. Topics covered planning and organising of work, systematic procedure of overhauling each part of the engine, usage of special tools and lifting jigs and Safety precautions.

The lectures also covered the 2 stroke and 4 storke engines, crankshaft deflection, tracing faults and preparing engine for starting.

Lectures on Pumps

The following topics were covered:-

- Various Types of Pumps and Their Parts
- Function of the Different Types of Pumps
- Machinery Used to Run the Pump
- Critical Parts to Check
- Dismantling, Assembling, Preparing for Survey and Repair
- Alignment of Pumps
- Testing and Troubleshooting

Lecture on Air Compressor

The following topics were covered:-

- Description of Various Types of Air Compressors
- Usage of Air Compressor Onboard Ship
- The Principles of Operation of One, Two and Three Stages
- Safety Factors in Air Compressor and Air Receiver
- Repair of Air Compressor
- How to Prepare and Start Compressor

Lectures on Valves, Strainers, Stuffing Boxes

Lectures were conducted on:-

- Overhaul and Repair of Various Types of Valves and Strainers
- The Construction and Functions.

Lecture on Deck Machineries

Lectures on deck machineries were conducted. Machineries such as anchor windlass, deck winches and capstan were taught.

The following topics were covered:

- Description of Various Parts of the Machineries.
- Function of Each Type of Machinery.
- How to Prepare the Machineries for Survey.
- Procedure for Overhaul and Repair of the Machineries.
- Safety Aspects During Overhauling and Repair.
- Aspects to Meet Class Requirements.

Lecture on Controllable Pitch Propeller (CPP)

Lecture was conducted for CDD personnel on Controllable Pitch Propeller. The functions and the procedure for overhaul of the equipment was explained.

Forced Draft Fan

The F.D. fan shaft was renewed but the shaft was sized tight. Welded stays to the fan bass and using hydraulic with strong back and heating the boss removed the shaft.

Jigs and Tools

The following jigs and tools complete with drawings were submitted to CDD for fabrication.

1. Dummy shaft for the static balancing of propellers.
2. A ring jack for propeller and rudder jobs.
3. A multi-purpose strong-back for jacking of propellers, couplings, gears, etc.
4. A jig for the pressure testing of rudders.
5. A turbocharger rotor stand.

(B) PLANT & MAINTENANCE

Preventive Maintenance

Preventive maintenance schedules were drawn up for :-

- the regular inspection and greasing of all cranes in COD.

- the regular inspection and greasing of all machineries and equipment in the Machine Shop.

The objective of the schedules was to allow maintenance personnel to plan for the systematic maintenance of all plant and machineries in the Drydock to minimise breakdown.

Maintenance Record

A proper record of all machines and equipment and the maintenance work performed on each of the equipment was being introduced and slowly implemented in the section.

Machine Catalogue

Machine instruction manual and parts references were being arranged and organised and put in catalogue for easy reference.

Proposal for an Effective Maintenance Management

A write-up on the requirements for the setting up of a effective maintenance management was submitted to the Drydock for consideration.

Crane Check List

Three sets of crane check lists for the inspection of Monotower Crane, EOTC and Mobile Crane were given. The check lists are to be filled up by the Maintenance Officer while inspecting the cranes every quarterly. All defects observed during inspection must be duly filled in.

Maintenance of 'AMIN' Weigh Bridge

CDD took over the maintenance of the 20 ton 'Amin' weigh bridge. The bridge was contracted to a local agent who came once a month to maintain the machine. Agent only clean and grease the mechanism.

Proposed Ballast Pump System

Presently there is no ballast pump. The fire-pumps are used as ballast pumps. The motors are not continuously rated. Two proposals are as follows:-

1. Procure a continuously-rated motor driven centrifugal pump with a pumping capacity of 100 to 200 tons per hour at a head of 60ft. The impeller of the pump is preferred to be of stainless steel material. The suction of the ballast pump could be taken from the existing inlet manifold of the fire-pumps and the discharge lines could be joined to the existing discharge manifold of the fire-pumps.

2. The ballast pump is the same as in proposal (1). The suction of the ballast pump is also taken from the existing inlet manifold of the fire-pumps but the discharge line is to be separate.

Lecture on Crane Greasing

A lecture was conducted on Importance of Crane Greasing Programme.

The following topics were covered:-

- Use of Right Lubricant
- Application at the Right Time
- Right Quantity
- Care of Lubricant
- Objective of Greasing

(C) MACHINE SHOP

Nozzle Grinding Machine

Taught the correct operation of the portable fuel valve nozzle grinding machine. Also demonstrated on the grinding of valve lid.

Worm Wheel

Demonstrated the procedure and method of machining a worm wheel. Discussed the calculation of gear pitch.

Drill Bit Grinding Machine

Comissioned the TDP - 1000 Drill Bit Grinding Machine. Machine was in-operational and required servicing and adjustment. After commissioning, demonstrated and instructed on correct usage.

Horizontal Boring & Milling Machine

The KBT 1353 horizontal boring and milling machine which was installed a few years ago was not hitherto commissioned. Some parts were missing and Electrical Engineer not ready to turn on electric power. As machine was complex, Drydock management delibrating whether to call in the manufacturer.

Training on Simplex Seals and Sea Valves

While the vessel Banglar Maya was in dock undergoing tailshaft survey, the opportunity was taken to train CDD personnel on the overhaul of simplex seals and the repair of sea valves. The procedure of repair was taught and demonstration was made.

Fabrication of Trolley and Track Rails

Fabricated of a trolley and track rails for the oven for baking of electric motors and switchgears. The electric oven was converted from a furnace.

Auto-rickshaw Engine Conversion

The project was to replace the engine of the 'Lombardini' rickshaw by the Bangladesh Deutz engine. A new rickshaw was used for experiment.

The Deutz engine was not of the same physical dimension as the original engine and the following modifications were necessary :

- A mild steel distant piece of 20 mm thick to couple the engine and gear box.
- A new extended 250mm length drive shaft was machined to fit.
- Adjustment of engine seating for shaft alignment and fastening.

Modifications were also made to the exhaust system for passenger comfort.

Fabrication of Auto-Rickshaw Frames & Parts

After having successfully experimented and tested the new auto-rickshaw with the Bangladesh 'Deutz' engine. Orders were received to fabricate auto-rickshaw chassis body complete with bonnet frame work.

The job which include the fabrication of steel structure and the machining and drilling of parts was handled by Plater Shop and Machine Shop respectively.

Lecture on Machining Chrome Liners

A lecture on the function, overhauling and machining of chrome liners on the AFT & FORD simplex sterntube seals was conducted.

The topic covered were :-

- Various Types of Seals
- The Method of Overhauling, Machining and Polishing
- Method of Checking Wear on Chrome Liners
- Proper Recording Sheet
- Remetalling of Guide Ring
- Tolerance for Machining of Liners
- Spring Adjustment

Fabrication of Store Gate

A 42" high mild steel gate complete with a top-counter at tool store entrance was fabricated.

The gate, made of mild steel angle bars, rods, 'S'-shaped flat bars and completed with hinges was fabricated and installed onto the existing wooden door frame.

Modification of Workshop Sliding Door

All sliding doors at Machine Shop and Plater Shop with rollers fitted at the top section of the door were modified as they were badly seized and unable to close properly. The doors were modified to run on rollers on the bottom instead.

Lecture on Rudders

Lecture on rudders was conducted. The function of various types of rudders like Simplex Rudder, Hinged Rudder, Hanging Rudder and Spade Rudder was explained. Alignment of rudder complete with the rudder stock on the surface table was illustrated with photographs and Sketches Methods of checking clearances on the bushes were explained. Taught the procedure of repairing excessive wear on the journal of the rudder stock by welding. Re-sleeve on the king post journal of Simplex Rudder and shrunk fit of new sleeve onto rudder pintle for the Hinged Rudder was explained.

Lecture on Machining and Repairing of Tailshaft and Propeller

Lecture was conducted on the functions and differences between various types of tailshaft such as solid coupling tailshaft and loose coupling tailshaft. The procedure for Board of Trade and Classification Rules for shafting was explained.

Magnaflux testing of tailshaft taper in way of critical areas such as key-way, end of the gun-metal sleeve and also at the forward end where heavy corrosion would take place were pointed out. Ways to identify the cracks and their seriousness were shown by photographs. Explained the correct thickness of gun metal liners required to be fitted on tailshaft and proper machining procedure were taught.

Rollers

Order was received to fabricate and machine 25 rollers for conveyor belt system.

The following are carried out:

- The central shafts of the rollers were machined to sizes Owner's drawing from mild steel bars.
- New mild steel pipes of 90mm outside diameter were cut to length.
- The internal bore at both ends of the pipes were machined to size to suit the new cast iron bushes which were forced fited onto both ends of the pipe. New ball bearings were fitted into these cast iron bushes into position.

Lecture on Machining and Repairing of Main Engine and Auxilary Engine Cylinder Head Inlet and Exhaust Valves

The following topics were covered during the lecture:-

- Various types of engine cylinder head with inlet and exhaust valves
- Method of checking clearances between valve spindle and guide bush
- Method of repairing, removing and shrunk fitting of guide bush
- Checking and skimming of valve seats
- Method of modification and tolerance machining of exhaust valve seat
- Method of skimming and grinding inlet and exhaust valve spindle
- Method of grinding inlet and exhaust valve seats
- Method of lapping inlet and exhaust valves and seats
- Method to clean up cylinder head in way of water space and hydro-testing for any defects or blow holes.

Lecture on Machining and Repairing Engine/Exhaust Gas Turbo-Charger

The following topics were covered during the lecture:-

- Various Types of Engine Exhaust Gas Turbo-charger
- Checking Clearances between Rotor Shaft and the Guide Bush, Sealing Bushes and Shaft Protecting Sleeve

cont...

Lecture on Machining and Repairing Engine/Exhaust Gas Turbo-Charger

- Checking Clearances between Turbine Blade and the Fixed Nozzle ring
- Renewing the Gas Sealing Rings and the Final Machining Works
- Removing and Shrunk Fit of Rotor Shaft Impeller
- Install in Position and Final Clearances

Lecture on Repairing Salt Water/Fresh Water Centrifugal Cooling Pumps

The following topics were covered:-

- Various Types of Centrifugal Pumps
- Checking Clearances between the Impeller Sealing Rings and Wearing Rings on the Pump Casing.
- Machining new Wearing Rings and on the Pump Casings and Shrunk Fitting of Wear Ring into Position.
- Method of machining new impeller sealing rings and shrunk fitted onto the pump impeller.
- Machining of New Insert Sleeves to be Force Fitted onto the Pump Casing in Way of the Ball Bearing.
- Assembling Pumps and Final Hydro-test for Checking Leakages

Motor Cover

Order was received for the repairing and machining of electric motor end cover. The sleeve which was slack was removed. The bore on end cover was polished and calibrated. A new cast iron sleeve was machined and force fitted onto the cover and secured by stopper screws. New ball bearing was fitted.

Machining Hydraulic Piston for Grove Crane Outriggers

Three hydraulic rams of 695mm length x 79.5mm rod x 99mm piston were modified at the Machine Shop. The hydraulic system was set on the lathe. Both the seal grooves were machined deeper to suit the new seals. New seals were mounted onto the ring grooves and checked.

Machining of Tail-Axle Crown Differential Gear Box

One tail-axle crown gear box housing was repaired in the Machine Shop.

Special tools were made to do the job. One new arbor extension boring bar was fabricated for mounting the cutting tool.

The tail-axle crown gear box housing was mounted and aligned onto the milling machine. Wear down area were bored. New mild steel insert bush was machined and force fitted onto the housing and secured by stopping screws. Ball bearing was fitted into position and tested satisfactory.

Modification of Valve Chest

A suction and delivery valve block of the high pressure hull cleaning machine was reconditioned.

The machine was unable to deliver a pressure of 500Kg/cm2. The block was badly pitted in way of the seat landing due to contamination by sea water.

Machined away the pitted areas in way of the suction and delivery valve landings. New stainless steel seat rings were machined and forced fitted. Seat rings were secured by tack welding. The suction and delivery valves were skimmed on the outside to suit the new seat rings.

The spacer rings between the suction and delivery valves were machined to keep the valves in their proper position. The valve chest was boxed up and the machine tested satisfactory to a pressure of 500 Kg/cm2.

Machining of Bilge Pump

One 4" bore bilge pump was repaired.

The cast-iron pump impeller with heavy damaged was renewed. Pump shaft was set on lathe machine and aligned. Due to uneven wear, the bush journals were machined. A new lignum vitae steady bush was machined to suit the shaft journal.

The pump casing was machined. A new gun-metal wearing ring was machined to size and force fitted onto the pump casing to replace the worn-out ring.

Idler Roller

Fabricated and machined 70 new steel rollers for belt conveyor system of cement factory.

Sprocket Wheel

Machined one new forge steel triplex sprocket chain wheel for conveyor system of cement factory.

Dockyard Equipment : No. 2 High Pressure Hull Cleaning Machine

Modified suction and delivery valve block (triple valve type) of the No. 2 high pressure water jet cleaning machine. The required pressure of 500kgc/m2 was achieved.

Fan Rotor

Machined and renewed the rotor shaft of one of the forced draft fan for the boiler for a paper mill.

New Heat Exchanger

Fabricated and renewed the complete heat exchanger for Chittagong Steel Mill. Machine Shop cut all the cooling tubes and drilled the tube plates. Plater Shop did the rest of the fabrication works.

Repair of Gas Turbine Rotor Shaft

A gas turbine rotor shaft was repaired.

One end of the rotor shaft snapped off. The broken shaft driving the motor was machined flat with a spigot and flange holes drilled and tapped at the end. The other end of the shaft was renewed.

Jigs & Tools

Drawings for the manufacture of jigs and tools were submitted to the Drydock. The following tools were submitted : -

1. Vee Blocks
2. Rectangular Block
3. Steel Clamp
4. Steel Shores
5. Cast Iron Face Plate
6. Cast Iron Steady Bushes
7. Cast Iron Square Chocks
8. Angled Shores
9. Mild Steel End-centres
10. Foreged Steel Boring Bar
11. Tools for Vertical Boring Machine

(D) WELDING

Fabrication of Chimneys

The quality of welding on the chimneys was poor. The causes were attributed to three main factors. First the quality of electrode used was poor and unsuitable. Second the current setting was wrong and third the welders lack the skills and knowledge.

The faults noted on the job were:-

(1) uneven fillet weld (leg length)

(2) no standard root gap

(3) improper bevel butt-weld

(4) no uniform distance between stiffeners on flanges

(5) no temporary supports to prevent distortions

All the faults were pointed out to the welders. Corrections were carried out by the welders to improve the job.

Fabrication Of "I" Beams

During the inspection of the welding on the "I" beam job, similar weaknesses of the welder as for the chimney job were observed. The welder lacked proper techniques and weld sequence. Again faults were pointed out and corrections made.

Fabrication Of Steel Bridge

Welding on the deck of the steel bridge and railings were also of poor quality. The welding was uneven and appearance was poor with no dressing.

Proposed Workshop Layout

A proposed workshop layout for good housekeeping and safe work practice was submitted to the Dy. Chief Engineer of the Steelwork Shop. The proposal was accepted and the workshop was being reorganised according to the plan.

Submerged-arc Welding Machine

The submerged arc welding machines was set up and commissioned. Demonstrations on its used were made.

Training on the use of submerged-arc machine were carried out. However the training was limited due to the lack of welding flux and wires.

Welding of Propeller

Demonstrated the welding procedure on the welding of the propeller. Explained the proper current setting, the preheating and peeling, and supervised the welders in carrying out the welding.

Welding Of Rudder Plates And Cracks

Demonstrated and supervised the welding of a rudder plate and rudder cracks. The jobs were all satisfactorily completed.

Training of Welders

A plan was drawn up to train 30 welders on the down-hand and vertical positions welding. The Welders would be trained two at a time for one week off the job at the workshop.

The training in the two positions would be on Butt Weld and Fillet Weld. Knowledge on weld leg length, root penetration, bevelangle and root face would also be imparted to the trainees.

Welding Inspection

The following areas were highlighted:-

- The maximum allowable leg length according to plate thickness to prevent excess of weld and reduce distortion.
- Distance of intermittent welds to be marked on fabrication panel to prevent excess welds and wastages.
- Ending of welds to be rounded up at the corners to prevent cracks.
- Slags to be chipped immediately after welding so that weld defect could be rectified immediately.

Welding of Lathe

The crack on the body was repaired by manual arc-welding and the procedure were as follows:-

- Drilled hole to arrest the crack.
- Ground 'V' on crack and cleaned surface.
- Preheated to between 100°C and 150°C.
- Used 3.2 mm size electrode and bead welding technique.
- Peeled by hammer
- Wrapped up with asbestos covering and left to cool for four hours.
- Performed dye check.

Repair of High Pressure Pipes

Advice was given to the local Steel Mill on the repair of some heavy schedule high pressure pipes. The pipes were for the pressure lines at the production shop.

The pipes were badly corroded and was beyond repair by welding. The recommendation was to renew the pipes but to reuse the flanges which were still in good condition.

Carbon Arc-Air Gouging

A carbon arc-air gouging demonstration and briefing was conducted.

The following topics were covered;

- Process
- Advantages
- Materials Required
- Components

Welding Procedure for Steel-Pipe Pillars

The following methods were proposed;

1. Due to size limitation, pipes were butt jointed. Only one seam is allowed along the circumference.

2. Plates were prepared with 30° bevel for welding.

3. Bevel edges were faced inside.

4. Root gap and root face were maintained at a maximum of 3mm. No tacking allowed along joints to prevent weld defects. Pieces of strong back placed intermittently along the butt and seam joint to reduce distortion.

5. 10g electrodes used for first run. 8g electrodes used for second run and final run.

Welding Procedure for Steel-Pipe Pillars (cont..)

6. Inside the pipe root passes welded, chipped, cleaned and the toe of the weld grinded smooth to prevent weld defects.

7. Gouging and grinding carried out on the outside of the pipe.

8. Remove excess fusion and slag inclusion and maintain 3mm deep of clean groove along joints for etter welding.

9. Final run carried out along the joints.

10. Spatters, scars, undercut on the surface of the pipes ground off.

11. Final check on diameter on both ends of the pipes.

12. Location of welded joints marked for NDT.

Fabrication of Landing Pontoon

The following procedures were introduced;

- Due to limited size of plates in the market, plates were joined together by welding. Sequence of welding (backward welding) were taught to the welders to reduce distortion.

- Side plates, bottom plates, bulkhead plates and deck plates were fabricated in a panel with stiffeners, girders and welded before assemble to save time.

- During the assemble, bottom plates were laid on blocks, then bulkhead panels and side shell panels were fitted togather to the bottom plates.

Lathe Machine Body Fractures

The following welding procedures were used to arrest and repair the fractures of the lathe machine.

- Dismantle and remove the accessories.

- Dye check the area to locate the extend of the cracks.

Lathe Machine Body Fractures (cont..)

- Drill holes at the end of the cracks.
- Grind V-groves on the cracks to a depth of half the wall thickness on both sides.
- Preheat the area before welding to about 150°C to release the stresses.
- Use 3.2mm diameter, 90% nicket content electrodes.
- Peen the weld metal after each bead of weld.
- After welding cover the weld with asbestos cloth for 2-3 hours.
- After cooling, dye check again for any weld defects.

Commissioning of the TIG (Tungsten Inert Gas) Welding

The commissioning of the TIG machine was followed by demonstration and briefing to personnel of the Plater Shop.

The notes on the principles and operation of the TIG machine were given to CDD personnel attending the demonstration.

Lectures on Shipyard Practices & Welding Processes

A lecture was conducted on the above subjects.

The topics covered were as follows:

1. Indication of the code : AWS E6013 and E7018

   AWS meant 'American Welding Society

   'E' designates Arc Welding Electrode

   The first two digits indicate minimum tensile strength
   E 60XX : 60,000 psi min
   E 70XX : 70,000 psi min

   The third digit indicates position
   E XX1X : All position
   E XX2X : Flat position and horizontal fillets

Combination of last two digits indicate the type of current and type of covering on the electrode.

E XX13 : AC or DC Rutile
E XX18 : AC or DC low hydrogen and iron powder
E XX16 : AC or DC low hydrogen
E XX24 : AC or DC Rutile and iron powder

2. Low hydrogen electrodes are used to reduce the danger of moisture content, porosity and defects in the welds, but to produce excellent notch toughness, high ductility, welds in alloy requiring a strength of 70,000 psi or more and X-ray quality welds.

3. The preheat and interpass temperature should be minimum 15°C to 200°C for welding on weldable cast-iron. copper and its alloy. Peening each deposited weld metal lightly before it has a chance to cool and contract. This causes the weld metal to stretch and reduce residual stresses.

Store Racks

Fabricated 260 angle bar store racks for a fertilizer plant.

Overall Dimensions are 4000 x 1800 x 600mm per rack. Total steel weight.

(E) FIRE & SAFETY

Observation

An observation of the Drydock to assess its standard of safety was made. The impression was that the standard of safety was inadequate.

Safety Gears

Safety helmets and safety shoes were issued to workers. The shoes were, however, found to be safety hazards in themselves as the nail heads protruding at the sole could produce sparks and cause explosions in confined and explosive atmosphere such as in oil tanks. The toe caps which were tapered, made wearing very uncomfortable.

Proposals

Two proposals were submitted to the Drydock for improving safety at work. Proposal I was for the setting up of a Fire & Safety Department while Proposal II gave the guideline for drawing up the Safety Policy and the associated Duties & Responsibilities for the Departmental Head, Sectional Head and the Safety Officer.

Safety Stock

There were fire extinguishers and fire suits. There were also sufficient fire points around the Drydock. However, there were inadequate fire hoses and also the fire hydrant couplings were found to be unsuitable as they could not withstand the necessary pressure.

Explosimeter

The Drydock has a 'Riken' explosimeter set which has never been commissioned. The alarm calibration was out and made the necessary adjustments. A demonstration was performed on board a vessel to check the gas content in a fuel oil compartment.

Tower Gangway

The tower gangways used at dock bottom for shipside work were unsafe. A drawing for modification was made. The modifications took into consideration the proper openings for assess to vessels, proper handrails and platforms and the need for rubber packings at the edge of the staircase openings.

Transportation of Gas Cylinders

There was no proper facilities for transporting gas cylinders around the work place. Submitted drawings for the fabrication of a cradle for the carrying of bottles at the dock bottom and a trolley for the workshop.

Use of Life-lines

After two months of service at the Drydock observed that the workers working at the shipside were supplied with life-lines.

Inspection

Safety inspection was carried out jointly with the Maintenance personnel on the pumproom and on the overhead travelling cranes.

Opening Of Man-hole Covers

Two dummy barges were in the Drydock for repair. Advice on the safety precautions to be taken in the opening of man-hole covers were explained.

Standard Safety Signs

Twelve internationally accepted safety signs were introduced for adoption. The signs were : No Naked Flame, Poisonous/Toxic substances, Emergency Exit, Flammable Substances, Fixed Co_2 Fire Fighting System, Noisy Area, Explosive Substances, No Smoking, Fire Extinguisher, Safety Helmet Area, Electrical Hazards and Radio-active Substances.

The recommendation was to display them around the drydock at strategic positions. A lecture was conducted on the safety signs.

Safety Rules

Fourteen sets of Safety Rules from Rule 1 to Rule 14 were given to CDD for their consideration and implementation. The objective of introducing the rules was to improve the safety standard in CDD.

Safety Cartoons

Sixteen safety cartoons were displaced on notice boards to convey safety messages to the general workforce.

Check and Servicing Fire Extinguishers

The CDD had in their possession three types of fire entinguishers. They were : Foam type, Carbon Dioxide type and Dry Chemical Power type.

Servicing was carried out on 16 foam and six carbon dioxide extinguishers.

Demonstration was made on the servicing of the Dry Chemical Powder extinguisher.

Lecture : Basic Fire Fighting with Fire Extinguishers

A lecture and demonstration was conducted. The topic was "Basic Fire Fighting with Fire Extinguishers" and the syllabus included were;

1. Triangle of Combustion;
2. Methods of Extinguishing Fires;
3. Types and use of Fire Extinguishers; and
4. Procedure in Case of Fire.

Lecture : Artificial Resuscitation

A lecture cum demonstration on artificial resuscitation was conducted. The topics were:-

1. Mouth-to-Mouth Resuscitation;
2. Holger Nielson Method;
3. Silvester Method;
4. External Heart Compression; and
5. Large Arm Sling.

Technique on how to detect pulse rate, breathing and application of artificial resuscitation was taught and demonstrated.

Gas-Free Inspection on vessel "Banglar Mita"

The first inspection was at centre tank No. 5 D.B. fuel oil tank for men to gain entry for tank cleaning.

The second gas-free inspection was in the engine room. The job was to burn off all bolts and nuts of a sea chest.

Safety Inspection on "Banglar Mita"

The following items were pointed out;

1. Scaffolding for ship side chipping

   The upper-most level of the scaffolding were not fenced up with railings. Workers were not provided with safety belts.

2. Joining of Life-Lines

   Workers were provided with life-lines anchored at the ship side bulwark. However, most of the life-lines were joined to provide required length. Essential to check and ensure that all life-lines are correctly joined.

Safety Inspection

A yard and workshop safety inspection was carried out.

The following unsafe environments were noted:

Civil Works - Two pieces of concrete slaps covering the drains were removed for access for work. The holes were left uncovered at the end of the workshift and between breaks.

Jetty No. 1 - The jetty beside the Dock entrance was damaged by tidal errosion.

Jetty & Dock Entrance - Along the jetty there were no life-buoys.

Safety Inspection (cont..)

Workshop - Wood cutting circular saw without its guard and riving blade.

Dock-Gate Area - The port and starboard unfenced dockside area immediately after the dockgate posed a risk in 'fall-to-different-level' accident.

Lecture on Oil Tanker - Fire & Explosion Hazards

A lecture was conducted on fire and explosion risk when working onboard an oil tanker.

The topics for the lecture were as follows:

1) Characteristics of flammable liquids
2) Possible sources of flammables on a vessel.
3) Sources of ignition.
4) Detection of combustible gases and vapours.
5) Preventive measures.

Lecture on Wire Ropes Maintenance

A lecture on wire ropes - general maintenance, inspection and safe-uses was conducted.

Environment

An observation was made at the site where the barges were under repair and the recommendation were as follows:

1. An open drain immediately at the front of the railings/square stools must be covered.

2. Loose rocks and other materials scattered in and around the worksite should be removed.

3. About 90% of the ground area was overgrown with grass and was a fire hazard in the event of hot-work.

(F) HYDRAULIC

Hydraulic Penstock

The hydraulic circuitry was discussed. Details of the hydraulic components used and its operation in the circuit was explained. The symbols used in the diagram were made known. The following components were explained:

1. Check Valve
2. Pressure Relief Valve
3 Directional Control Valve
4. Pilot Control Check Valve
5. Variable Return Orifice Check Valve
6. Actuator

500-Ton Press

The top crown block was shaking severely during operation. The hydraulic clamping of jib block was not working effectively. Four clamps were removed and cup seals renewed. Pressure checked and found working satisfactorily. After a few days, checked and found hydraulic clamp seals were again damaged. These seals were of inferior material. Suggested that original seals from manufacturer be obtained.

Overhauling Of Hydraulic Cylinder

The following procedures were recommended:

1. Dismantle the cylinder in a clean location. Drain all the oil from the cylinder.
2. Clean each part. Coat metal parts with good preservative and keep in proper storage.
3. Check piston for straightness.
4. Examine the piston rod for scratches, scores, indentations and others blemishes.
5. In reassembling a cylinder, suggested that all the seals and gasket be replaced.
6. Always tighten cover bolts evenly.

Overhauling Of Hydraulic Cylinder (cont..)

7. After a cylinder has been assembled, test at low operating pressure first. Then increase the pressure slowly ;to its full operating range, and check for both internal and external leakage.

8. When returning a cylinder to a fixture, make certain that it is securely mounted.

Briefing on Hydraulic Bilge Block System

Briefing was conducted on the operation of the hydraulic bilge blocks system. The system consisted of a pump unit of 2 gear pumps, 3 safety valves, 2 check valves, 1 restriction check valve and 2 pressure switches. Also in the system was a battery bank of 3 accumulators. The operation of the bladder accumulators was also discussed.

Control panel which served to control sequence and speed of cylinders and to block them in the end positions was explained. The automatic operation of pump auto-start and auto-stop by pressure switches and the electrical interlock of operating the system were also discussed.

Briefing on Hydraulic Presses

Briefing was conducted on 400 Ton and 500 Ton presses. The various hydraulic components used, functions and behaviour in the system was discussed.

A list of spare parts for the presses was prepared for their procurement.

Lecture on Hydraulics

A lecture was conducted on the Basics of Hydraulics, the advantages and disadvantages and the basic physical Laws of Hydraulics.

Lecture on Hydraulic Valves

A lecture on hydraulic valves was conducted.

The lecture covered the various types of hydraulic valves and their functions.

GENERAL MANAGEMENT

The following proposals were submitted to the Drydock to improve operational efficiency:

Bar Charts

It was suggested to the Drydock to draw up bar charts for controlling the schedule of repair of vessels. The charts would be extremely useful to both the owners and the Drydock in monitoring the progress of repair.

The use of bar charts was adopted. The charts were used for repairs of vessels Banglar Mita and Al-Reza . The charts assisted the Drydock in identifying critical areas in meeting the repair schedule.

Stemming Meetings

Stemming meetings was proposed to the Drydock to be held every morning. The meeting should be held with all the Sectional Heads and Engineers present. The meeting should be chaired by a senior manager and discuss issues such as the priority of jobs to meet schedule, the manpower required for each job and the amount of overtime to be worked.

Progress Meeting

Progress meetings were implemented in the shiprepair and maintenance sections. The objective of the meetings was to improve communication and operational efficiency.

Checking of Tools

Conducted a thorough check of all the tools and equipment kept in the store. Comprehensive lists of the equipment and tools were submitted to the various section heads. The uses of the tools were explained to the heads and their men.

Work System

A proposal was made to CDD to modifty the system of work in the Machine Shop. The current practice was that Shiprepair Section would bring work such as simplex seals, propellers and tailshafts into Machine Shop and would continue to carry out repair work in the shop. The proposal was to assign such work to personnel of Machine Shop. This would overcome the excessive work load of the shiprepair section and would add work to Machine Shop which was slack most of the time.

Cargo Gear Testing

CDD consulted on the possibility of carrying out cargo gear testing on vessel May Sky. The recommendation was positive with provisions of equipment such as ballast weights, test clocks and wire and cargo blocks testing machine being available. The men would have to be trained. Also the rules governing such testing must be available.

The rules and regulation were submitted to CDD. Given also were some photographs of cargo gear testing machines taken in Keppel Shipyard. A complete list of rigging gears was submitted as well.

Grit Blasting and Painting

Instruction manuals on grit blasting and painting were given CDD. Currently CDD was still employing the manual chipping method. The method was primitive, labour intensive and time consuming. Besides, the quality of finish would not have the same standard as those of the abbrasive blast cleaning method.

Remetalling Bearing

The detailed procedure for the remetalling of whitemetal bearings was submitted to CDD for their study and consideration.

Meeting with CDD Management

Meetings were held with the top management of CDD with a view to improve the operation of the Drydock. Topics of discussion included the following:

Meeting with CDO Management (cont..)

- Ways of improving the transfer of skills and knowledge to CDO.
- The setting up of a repair team specializing in the repair of propellers.
- Manpower problems.
- Proposal and fabrication of jigs and tools to improve the operating efficiency of CDO.
- Securing engine and hydraulic jobs for on-the-job training of CDO personnel.
- The feasibility of shifting the responsibility of maintaining the essential drydock equipment from the shiprepair to the Plant & Maintenance Department.

The meeting also discussed the following:-

- High Pressure Jetting Machine
- Drydock Main Pump
- Generator
- Fire Pump
- Forklift
- Diesel Generator
- Grove Crane
- Compressors
- 15 Ton Man-Ksy Crane
- Repair of 40 Ton Metalna Crane
- Bilge Blocks
- Crane Track-Line
- Maintenance of Chain Blocks

Safety Committee

For the overall improvement of safety in the Drydock, the setting up of a Safety Committee was proposed. The function and composition of the Committee are as follows:

- the detection and remedy of unsafe conditions and practices; and
- the observation and correction of unsafe acts.

CONCLUSION AND RECOMMENDATION

The project can be considered a success in spite of all the constrains in the Country. It has achieved nearly all the aims and objectives that were set out.

Improvements can be seen all round. The Drydock workers are now more disciplined than before. They are more punctual at work and there are less idling.

The impact of the project team who were always well and properly attired and punctual at work must have had their influence on the local workforce.

There are general improvements in the morale of the workers. Work environment has improved and the workers feel that the management is now more concerned of their safety and well being.

The Drydock has greater confidence in the work having the support and backing of the specialist team who work side by side with them. The nett result is a faster turnaround of ships.

New methods of work were imparted to the Drydock workforce during on-the-job training. The understanding of the job was enhanced by the complementary lectures conducted by the specialists.

New jobs not previously accepted by the Drydock were successfully carried out to the satisfaction of ship owners and the Drydock.

The operational efficiency is enhanced through the introduction of many new jigs and tools. The tools are designed and manufactured in the Drydock.

Idle machine tools were commissioned and put into use and workers were trained in their operations and maintenance.

The Plant and Maintenance Section was revamped and changes were made to improve its services. There are now less breakdowns and maintenance work now is much more systematic.

The achievement in the short span of one year is commendable for the Drydock in view of the constrain in the Country. There were frequent disruptions to work due to power failure, worker strikes and the poor infrastructure.

Basically the Chittagong Drydock has all the necessary equipment and skills to operate profitably. What is lacking seriously is the experience and exposure of the mid-level management staff to modern shiprepair operations.

Another area wanting is the leadership and management skills of the Foremen and Engineers.

The workers generally are a good lot of people. However, there are needs for more incentives to motivate them to give off their best.

The level of skills and knowledge of the Drydock in shiprepairing, though has improved, is still at the elementary stage. Further assistance in shipyard management and technical expertise will definitely enhance the operation of the Drydock.

Further guidance and onjob training in the areas of Engine, Welding, Maintenance and Hydraulic in the immediate term and Automation in the longer term is desirable for the Drydock.

This would enable the Drydock to take on additional and new jobs such as the repair of main and auxiliary engines, deck machineries, hydraulic deck cranes and steering gear systems.

The expertise in hydraulic system would also enable the Drydock to repair some of the newly acquired vessels of Bangladesh national fleet which are modern and have many hydraulically operated systems.

The expertise in maintenance would provide the skills to maintain the drydock facilities including the sophisticated pumproom equipment, caisson and hydraulic keel blocks.

The Welding expert would provide further training in Metal Inert Gas (MIG), Tungsten Inert Gas (TIG), submerged arc welding as well as ensure welding qualitites.

The duration of expert assistance for the Drydock is difficult to estimate as it depends on many factors. The desire to learn, the availibility of ships to provide onjob training, the system of work and the infrastructure all affect the duration. A rough estimate is a period of two to five years.

There is no urgent need to provide any expertise in the area of automation and non-destructive testing.

It will be quite some time before the Drydock could take on any automation jobs which are normally quite advanced and specialised.

Non-destructive testing in the form of Magnetic Particles Inspection and Dye Penetrant Crack Detection are available in the Drydock and are being performed satisfactorily. X-Ray requirements are not often and specialist services are available in the city.

On the commissioning of equipment, most of them have already been carried out by the Keppel experts except for machineries still waiting for parts.

It is recommended that the Drydock install a compressed air manifold system for the yard. This will facilitate the utilization of many pneumatic tools available in the Drydock.

Collection of Time-records is not critical at the present stage. Improvement in work quality is more crucial. Collecting Time-records of repaired jobs is rather difficult. Jobs differ greatly in shiprepair and even similiar jobs may require very different amount of time to repair.

Inconsistency of repair speed also make collection of records difficult. Different level of skills in workers, different category of workers such as casual or permanent and frequent interruptions of work due to external factors affect accuracy of time collection.

It is more important for the Drydock to emphasise on quality of work and efficiency of planning work at this juncture. The formation of the workforce into small groups to improve quality of work is most useful. More training should be provided to the workers to enhance their skills. A skills certification system will certainly be very useful in the future to ensure work standards.

The engagement of experts to assist the Drydock in their operations and to provide onjob training to their workers is a useful way to upgrade the Drydock to international competitiveness.

The effectiveness of the experts in carrying out their mission depends to a great extend on their position power in the Drydock. With and without executive power makes a lot of difference to the outcome of their assignments.

While technical and managerial assistance are being provided to the Drydock, they must also consider the following additional recommendations to make the Drydock more viable.

Adopt a more aggressive marketing strategy. The shiprepair industry is extremely competitive internationally. With more ships in the Drydock, not only will revenue increase but also the opportunity to gain more expertise and experience.

Send middle managers overseas to well established shipyards for training. Constant upgrading of skills and knowledge is essential to staying ahead and survive in the industry.

Improve management skills in leading, motivating and controlling workers. Proper utilization of labour is very crucial to achieve higher productivity and better performance.

Establish better methods of planning and coordinating work. This will improve efficiency and save time.

Provide incentives to increase worker loyalty and committment. The Drydock engages approximately 70% casual workers in its work-force. These workers are employed on a much more inferior terms of employment then the permanent workers. It was observed that they were the people who contributed most to the work load. The Management should review the reward system for both the casual and permanent workers.

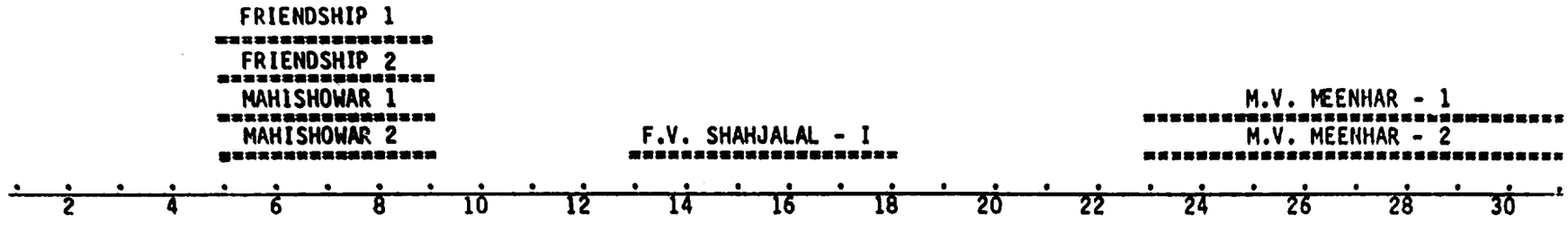
Establish more contacts with overseas suppliers and manufacturers for spare parts and materials. Non availability of spare parts is a serious problem in the Drydock and the delay in the procurement of parts often cause delays to repair schedule.

VESSELS IN DOCK

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

MONTH : August 1986

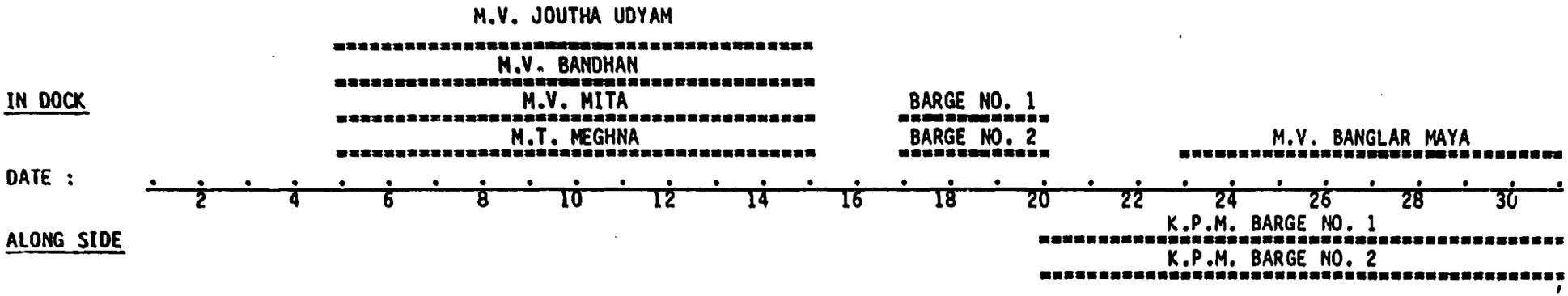


VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
Friendship I] Friendship II]	Fishing Trawler	132	23.4m x 6.4m x 3.5m	]	Normal Hull Cleaning and Painting.
Mahishowar 1] Mahishowar 2]	Trawler	160	27.5m x 6.4m x 3.5m	]	
F.V. Shahjalal-I	Fishing Trawler	120	23.4m x 6.4m x 3.5m	N.K.K.	EMERGENCY DOCKING - Propeller problem - Tailshaft drawn. Bronze liner on tailshaft skimmed stern bush rewooded. Stern tube inboard neck bush remetalled and machined. Tailshaft fitted with spare propeller.
M.V. Meenhar-1	Trawler	160	27.5m x 6.4m x 3.5m		Rudder removed for access. Bush at skeg renewed. Emergency carrier clearances adjusted by adding shims on dolly washer. Controllable pitch propeller complete with tailshaft drawn out. Bronze liner skimmed. C.P.P overhauled. New sliding blocks for C.P.P. made and machined to suit C.P.P. Boxed up with new propeller blades and seals stern tube inboard and outboard bushes rewooded. Hull cleaned and painted.
M.V. Meenhar-2	Trawler	160	27.5m x 6.4m x 3.5m		Rudder removed. Bush at skeg renewed. Emergency carrier clearances adjusted by adding shims on the dolly washer. Hull cleaned and painted.

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

MONTH : September 1986



VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
M.V.Joutha Udyam]] M.V. Bandhan]] M.V. Mita]	Fishing Trawler	191.72	31.85m x 7.2m x 3.4m	N.K.K.	M.V. JOUTHA UDYAM TAILSHAFT - Tailshaft and propeller removed bronze liner skimmed inboard and outboard stern bushes rewooded. Knort nozzle rudder and stock removed. New rudder stock modified. M.V. BANDHAN] Knort nozzle rudder removed. Rudder pintle bronze M.V. MITA] nozzle rudder removed, rudder pintle bronze sleeve
M.T. MEGHNA	Tanker	741	55.64m x 9.15m x 1.72m	A.B.S.	Port and stbd rudder removed for access. Rudder coupling bolts built up by welding and machined to suit. Port and stbd propellers and tailshaft removed for access. Bushed on A bracket rewooded. Inboard and outboard stern bushes rewooded. Tailshaft bronde liner skimmed. Taper bore of propeller built up by welding and machine to fit.
K.P.M.-Barge No.1 K.P.M.-Barge No.2			39.64m x 9.15m x 1.72m		Barges docked for inspection of bottom steel plate. Cut into 3 sections and lifted onto wharf side for renewal of steel plate. About 25 Tons of steel on each barge.
M.V. Banglar Maya	Cargo	12,193	154.149m x 22.2m x 13m	L.R.	Tailshaft drawn for survey. Sea valves, storm valves and sanitary valves surveyed and overhauled. Hull cleaned and painted. Painting in cargo holds.

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

MONTH : October 1986

IN DOCK

M.V. FRIENDSHIP II
F.V. FISHER 1
M.T. SONAR NAU
F.V. AHM NO. 1
M.V. SAMUDRA RAJ

DATE :

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

ALONG SIDE

K.P.M. BARGE NO. 1
K.P.M. BARGE NO. 2

VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
M.V.Friendship II	Fishing Trawler	132	23.4m x 6.4m x 3.5m	-	EMERGENCY DOCKING - Damaged propeller removed. Distroted propeller blades faired and brazed and ground smooth. Pitch on propeller checked.
F.V. Fisher 1	Fishing Trawler	159.28	38m x 6.5m x 3m	-	Normal Hull Cleaning and Painting.
M.T. Sonar Nau	Tanker	600	-	-	Vessel Docked for bottom survey. Hull condition very bad. Deep pittings all over bottom and some already punctured through. Both rudders and stern bushes condition were bad. Owner and surveyor decided to scrap vessel. All holes at bottom pateched up by doublers for undocking.
F.V. Ahm No. 1	-	224.92	44.57m x 7.6m x 2.95m		Hull cleaned and painted. Sea valves overhauled. 29 lengths of steel pipes renewed. (Largest size - 4 "bore)
M.V. Samudra Raj	-	5327	110m x 18.6m x 9.4m	ABS	Hull cleaned, rusty areas chipped and painted. Sea valves over-hauled and stern gland repacked, rudder bottom pintle dropped down about 30mm. As per owner's instruction jacked back to position and pintle nut hardened up. Isolated shell frames in way of cargo holds renewed. Doubles fitted in way of chain locker, minor deck steel works carried out.
K.P.M.-Barge No.1 K.P.M.-Barge No.2			39.64m x 9.15m x 1.72m		Continue renewing steel plates.

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

MONTH : November 1986

IN DOCK

M.V. SAMUDRA RAJ — M.V. HEGGE THREE

DATE : 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

ALONG SIDE — K.P.M. BARGE NO. 1

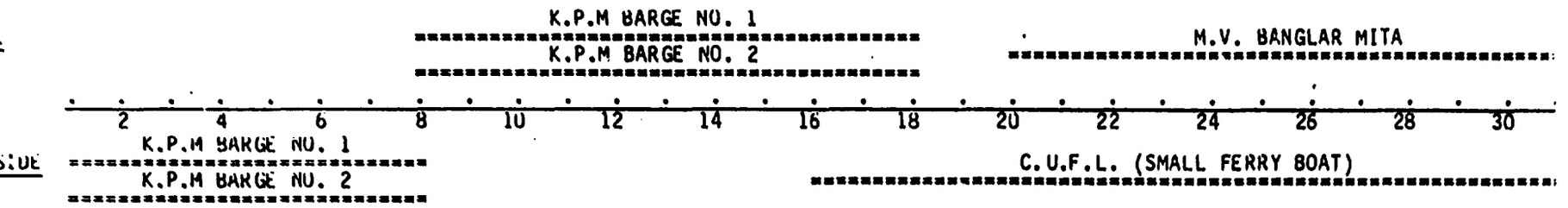
K.P.M. BARGE NO. 2

VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
Hegge Three	Cargo	2906	105.5m x 17.2m x 13.3m	N.K.K.	TAILSHAFT - drawn for survey. Inboard and outboard ugnlim-vitae stern bushes renewed. Boring tools set up and both stern bushes bored in place to suit tailshaft. Tailshaft boxed up with new packings. RUDDER - Removed. Excessive clearances on pintle bush and at stock steady bearing. Rudder stock removed and journal space skimmed. Rudder steady bearing removed and re-sleeved with new gun-metal sleeve. Rudder bottom pintle lignum-vitae bush renewed. SEA VALVES - 3 sea suction valves and 4 scupper valves overhauled. (Largest size 100mm Bore). One 100mm scupper valve renewed. GANGWAYS - Both damaged gangways removed to shop. Roller pins renewed. Damaged area cropped, new piece fitted and welded. Both winches and gearboxes completely overhauled and worm gears renewed.
K.P.M.-Barge No.1 K.P.M.-Barge No.2			39.64m x 9.15m x 1.72m		Renewal of steel plates at bottom and sides of barges completed. Waiting for crane to lift into Dock for joining up.

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

MONTH : December 1986

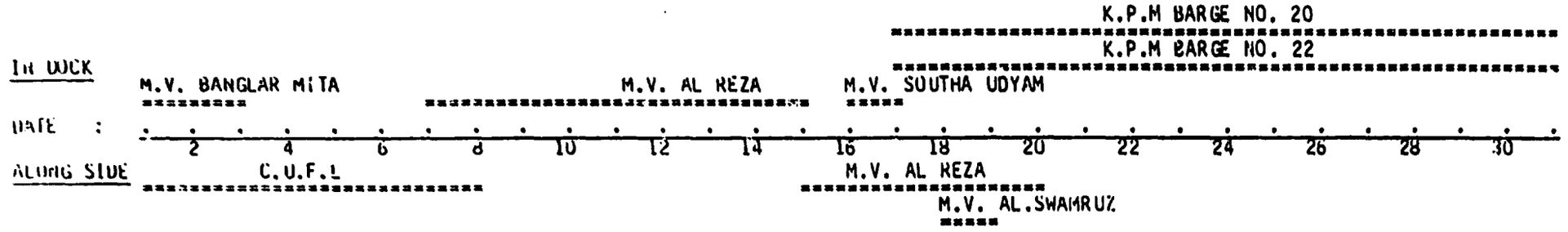


VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
KPM BARGE NO. 1] KPM BARGE NO. 2]					Total steel renewal on bottom and side shell amounted to 56 tons. Duration of repair 3 months.
C.U.F.L	Ferry				Ferry boat (29 Ton) lifted onto land for repair. Propeller, tail-shaft and rudder removed. Propeller repaired. Leaking sterntube rectified and aligned. Rudder and stock aligned and bushes renewed. Minor steelworks renewed on hull and side fenders. Normal cleaning and painting. Cooling pumps, bilge pumps and hand pumps overhauled.
MV BANGLAR MITA	Cargo	10663.20	156.14m x 21.34m x 13.11m	LLOYD	Tailshaft drawn for survey. Sterntube simplex seal overhauled. 23 sea suction valves and 4 scupper valves overhauled for survey. Main engine FWD Turbo-charger overhauled and surveyed. Doubling plates fitted and welded onto rudder. Minor steelworks carried out in way of fore-peak tank. Normal hull cleaning, chipping and painting.

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

MONTH : January 1987

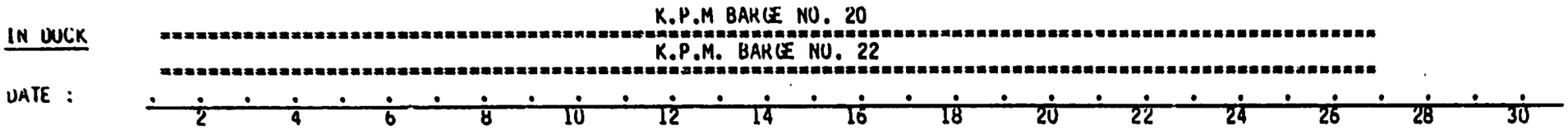


VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
MV BANGLAR MITA					Vessel undocked sea trial on 3 Jan 87.
C.U.F.L	Ferry				Underwater job and hull painting completed on 8 Jan 87.
MV AL REZA	Cargo	9565.08	144.76m x 20.65m x 12.73m	LLOYD	Extensive cracks found on all 5 propeller blades and some 200mm long. Decision from owners and surveyor to renew propeller. Vessel fitted with semi-balanced rudder. Damaged propeller removed without removing tailshaft and rudder and spare propeller bedded in place. 4 sea valves and 5 scupper valves overhauled. Vessel undocked and went alongside wharf for steelworks renewal in chain locker. Normal hull cleaning and painting.
MV JOUTHA ADYAM	Fishing Trawler	191.72	31.85m x 7.2m x 3.4m	N.K.K	Vessel came for emergency docking. Hole at bottom in way of engine room. Bilge was patched up with doubler 2ft x 2ft square.
MV AL-SWAMRUZ	Cargo	8522	143.5m x 21m x 11m	N.K.	Vessel came into yard for emergency repair of damaged propeller. Job carried out afloat. Vessel trimed so that propeller blade was above sea level. Propeller blade heated and faired up.
KPM BARGE NO.20] KPM BARGE NO.22]			39.64m x 9.15m x 1.72m		Barges docked for inspection of bottom steel plates. Mud inside ballast tanks cleaned for inspection. Bottom and sides steel plates marked for renewal. Estimated about 50 Tons.

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

MUNTH : February 1987



VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
KPM BARGE NO.20] KPM BARGE NO.22]	Flat-Top-Barges		39.64m x 9.15m x 1.72m		Both barges docked for steel renewal. Complete bottom and vertical shell plates on both barges were renewed. Damaged angle-bar stiffeners were marked, cropped and renewed inside the ballast tanks. A total of 52 Tons of steel were used. After steel works were completed, internal of ballast tanks were painted. The external hulls of both barges were cleaned and painted. Steel fenders of 6" half-round pipes were completely renewed on both barges. (Barges undocked on the 27 February 1987).

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

MONTH : March 1987

IN DOCK

F.V. MOITRI-S — M.V. BANGLAR SAMPAD — M.V. KHULNA

DATE :

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

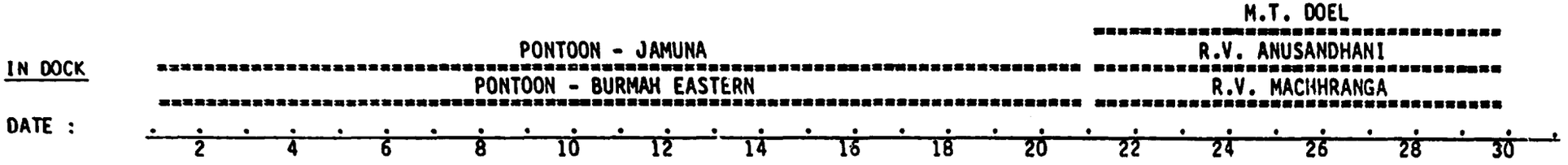
ALONG SIDE

VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
F.V. MOITRI-S	Fishing Trawler	148.23	36.4m x 7.25m x 5.1m		Docked for tailshaft and rudder clearances, sea valves overhauling, hull cleaning and painting. Eight sea valves overhauled, one propeller blade bent at the tip. Faired in place. Sea gratings removed and fitted after cleaning and painting.
M.V. BANGLAR SAMPAD	Cargo	5121.35	153.9m x 19.45m x 11.9m	Lloyd	Emergency docking - damaged propeller. Leading edges of the propeller blades. Two badly bent. One had a portion of 120mm missing and other with 125mm at the edge chipped off. Cracks seen along the edges of the blades. Bent blades faired and damaged areas trimmed. Edges ground to proper profile. Cracks ground and vee welded, dye-checked satisfactory. Pitch of propeller re-checked. 35 valves overhauled. Tailshaft and rudder clearances recorded. Zinc anodes renewed, anchor chains calibrated, hull cleaned and painted.
M.V. KHULNA	CARGO	1248	74.5m x 11.32m x 5.33m	Lloyd	Tailshaft and sea valves surveyed. Rudder removed for access work. 49 valves overhauled. Minor steelwork on hull and rudder. Cleaning and painting on the hull.

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

MONTH : APRIL 1987

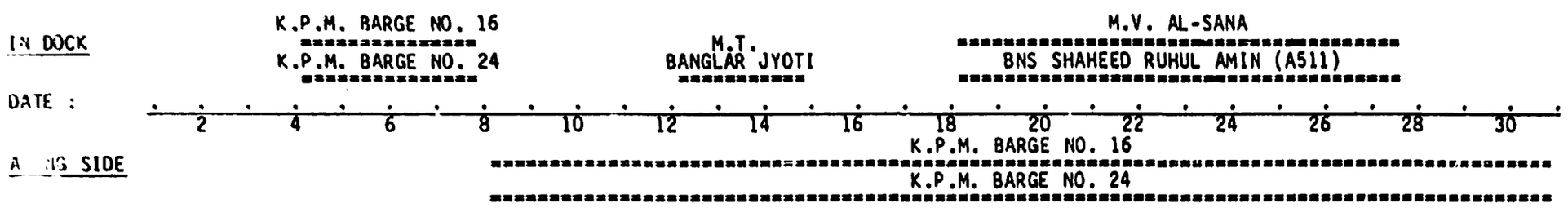


VESSEL NAME	TYPE	SIZE GRT	DIMENSION	CLASS	MAIN JOBS
PONTOON "JAMUNA"			64'x27'x5'		Steel plates on complete bottom and from bottom to half vertical height all round were renewed. Total steel renewed is 12 Tons.
PONTOON "BURMAH EASTERN"			100'x22'6" x6'4"		Most of steel plates renewed were at port and starboard curve bilge areas. Badly corroded bottom and deck plates were renewed at affected areas. Total steel renewed is 6 1/2 Tons.
M.T. DOEL	Tanker	899T	63.55mx9.6m x4.83m	NKK	Tailshaft drawn outward, surveyed and skimmed. Stern bushes rewooded. Rudder removed for access and bottom pintle bush renewed. 29 sea valves overhauled. Minor steelworks done on the hull. Gratings for sea chests removed, cleaned and painted.
M.V. ANUSANDHANI	Research Vessel	226.16T	32.4mx7.5m x3.3m	NKK	Controllable pitch propeller and tailshaft drawn out and surveyed. Rudder removed for access. Zinc anodes renewed. Sea chests and gratings cleaned and painted. Stern seals overhauled with outboard chrome liner machined. Vessel was blanked and undocked.
R.V. MACHHRANGA	Research Vessel	87.28T	22.4mx5.5m x2.4m	LR	Tailshafts and rudders clearances taken. Zinc anodes renewed. 10 sea valves overhauled. Corroded area on starboard kort nozzle built up by welding.

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

MONTH : MAY 1987

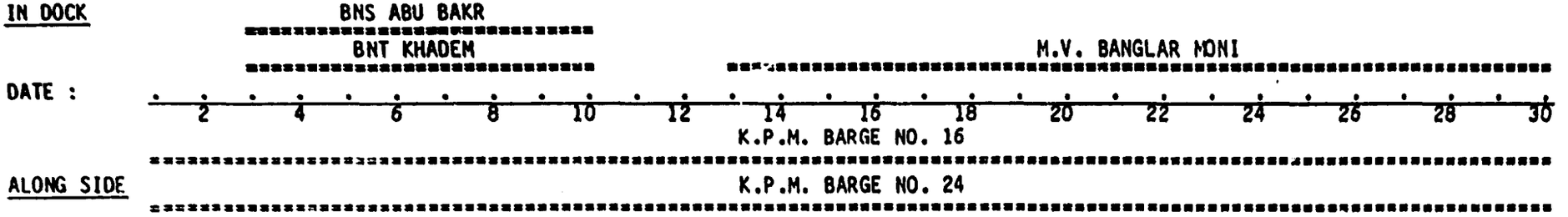


VESSEL NAME	TYPE	SIZE GRT	DIMENSION	CLASS	MAIN JOBS
KPM BARGE NO. 16) KPM BARGE NO. 24)	Flat-Top Barges		39.64mx 9.15mx1.72m		Barges came with an estimated 50 Tons steel plates renewal. In dock for 4 days and each were cut into 8 sections. Lifted onto dockside for repair.
MT BANGLAR JYOTI	Tanker	8,672	138mx22.9m x9.65m	LR	Tanker was docked for delivery to B.S.C. Additional zinc anode fitted and cargo tank ullage pipe supports modified. Tailshafts and rudders clearances taken.
MV AL-SANA	Cargo	5423.21	124mx17m x9m	NKK	Vessel docked for normal cleaning and painting. Excessive clearances found on stern bush. Tailshaft drawn for survey. Stern bush rewooded. Rudder removed for access. Stern bush bored. Leakages on rudder repaired. 24 sea valves and 6 scupper valves overhauled. Zinc anodes renewed. Corroded keel plates renewed.
BNS SHAHEED RUHUL AMIN(A511)	Navy Ship		154'10"x 30'x10'		Emergency docking. Broken tailshaft and damaged stern bush removed. Rudder shifted for access. Stern tube blanked for undocking of vessel. (Work carried out by Naval personnel). Fitting of doubling plate carried out by CDDL.

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

MONTH : June 1987

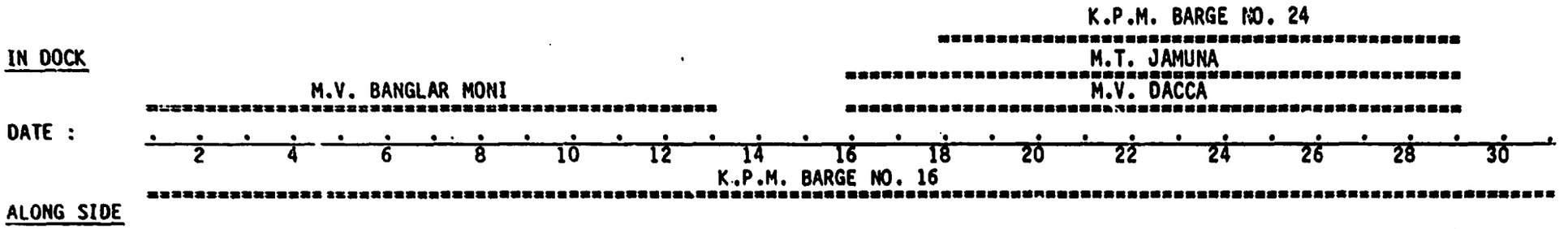


VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
KPM BARGE NO. 16]	Flat-Top		39.64m x 9.15m x 1.72m		Damaged bottom and vertical shell plates renewed. 40% were done.
KPM BARGE NO. 24]	Barges				Complete bottom, vertical shell plates and steel side fenders renewed. Ready to be lifted into dock for joining up.
BNS ABU BAKR	Naval Frigate		103.62m x 12.2m x 3.46m		Docked for hull cleaning, painting and renewal of 2 sets of electrical generators complete with engines. Starboard side plate cut for access for removal and replacing of generators. Corroded shell plates in way of port side steering room renewed. Zinc anodes renewed.
BNT KHADEM	Naval Tug		60.22m x 11.6m x 3.65m		Hull cleaned and painted.
MV BANGLAR MONI	General Cargo	8687.02	150.17m x 21.05m x 11m	Lloyd	Docked for normal hull cleaning, painting, sea valves and tailshaft survey. Tailshaft drawn outward and rudder removed for access. Waiting for spares.

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

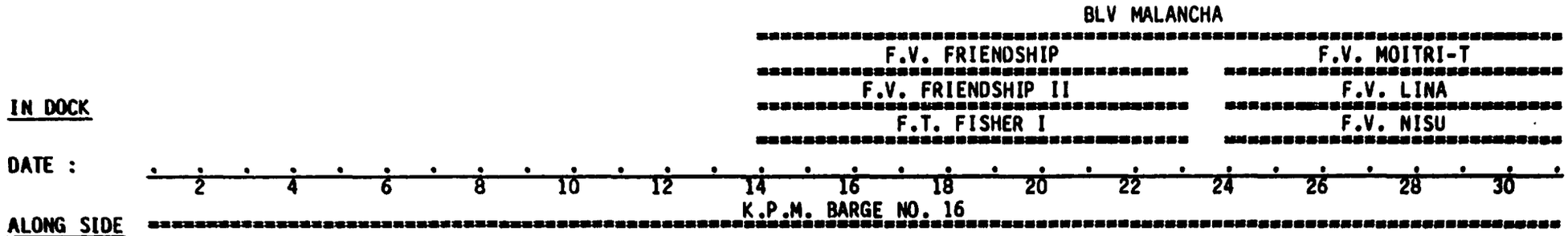
MONTH : July 1987



VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
MV BANGLAR MONI	General Cargo	8687.02	150.17m x 21.05m x 11m	Lloyd	Continue from last month spares arrived. Propeller and tailshaft boxed up and stern tube seals tested. Rudder boxed back. Intermediate and sea valves boxed up. Minor steelworks carried out inside cain lockers and at bilge keel. Overhauled pumps, anchor windlass, heat exchangers, derricks cargo blocks and pipeworks.
MV DACCA	Cargo	1153	74.5m x 11.2m x 5.2m	Lloyd	Tailshaft and rudder clearances recorded. Tailshaft drawn out for survey and rudder removed for access. 36 sea valves and 7 storm valves overhauled and surveyed. Zinc anodes renewed. Hull cleaned and painted.
MT JAMUNA	Tanker Tug	720	65.53m x 10.67m x 3.3m	A.B.S	Tailshaft and rudders clearances recorded. Rudders removed for access and both damaged propellers removed, repaired and boxed back. Pipe guards fitted around both propellers. 16 sea valves and 4 storm valves overhauled and surveyed. Sounding pipes in 8 cargo tanks modified. Hull cleaned and painted.
KPM BARGE NO. 24]	Flat-Top Barges		39.64m x 9.15m x 1.72m		26 Tons of steel plates renewed on bottom and ship sides.
]					
KPM BARGE NO. 16]					To be joined up next month.

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK MONTH : August 1987



VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
FV FRIENDSHIP I	Fishing Trawler	132	23.4m x 6.4m x 3.5m		Tailshaft and rudder clearances recorded. Propeller removed for checking. Stern packing renewed. 12 sea valves overhauled. 34 lengths of pipes renewed. Hull cleaned and painted. Zinc anodes renewed.
FV FRIENDSHIP II	Fishing Trawler	132	23.4m x 6.4m x 3.5m		Tailshaft and rudder clearances recorded. Stern packing renewed. 12 sea valves overhauled. 3 lengths of pipes renewed. Hull cleaned and painted. Zinc anodes renewed.
FT FISHER I	Fishing Trawler	159.28	38m x 6.5m x 3m		Tailshaft and rudder clearances recorded. Stern packing renewed. 9 sea valves overhauled. Approx 1 ton of bottom shell plates renewed. Zinc anodes renewed. Hull cleaned and painted.
BLV MALANCHA	Buoy Laying Vessel	556	46.6m x 12m x 4m		Port and starboard tailshafts drawn for survey. Tailshafts bronze bushes renewed. Cutlass bearings in sterntubes and 'A' brackets renewed. New cooling system fitted onto the bushes of the stern tubes and 'A' brackets. Zinc anodes renewed. Hull cleaned and painted.

cont...

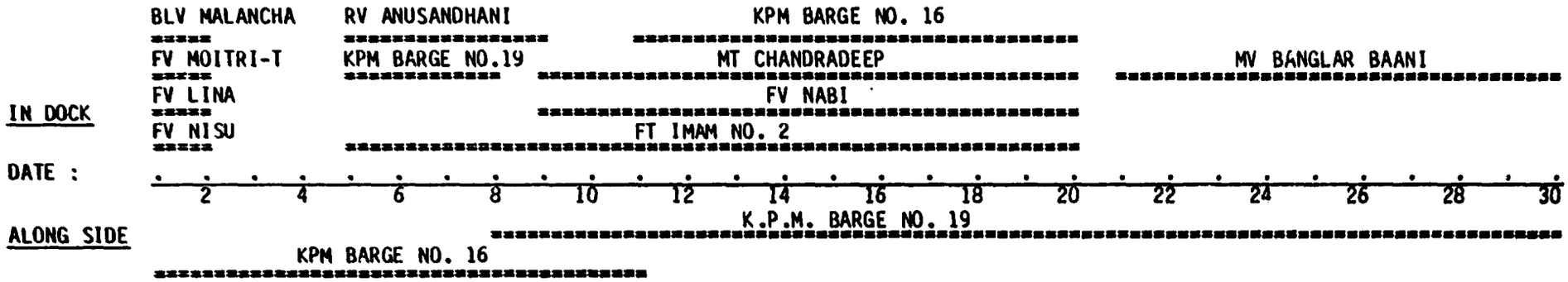
MONTH : August 1987

VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
FV MOITRI-T	Fish-in Trawler	287.22	48.3m x 7.8m x 4m		Rudder removed and pintle bush renewed. Tailshaft drawn for survey. Stern bush rewooded. Tailshaft bronze bush skimmed down. 21 sea valves overhauled. Vibration on port generator rectified. Zinc anodes renewed. Hull cleaned and painted.
FV LINA	Fish-ing Trawler	160	27m x 7m x 3m		Tailshaft drawn out for survey. Tailshaft bronze liner renewed. 11 sea valves overhauled. 7 lengths of pipes renewed. Zinc anodes renewed. Hull cleaned and painted.
FV NISU	Fish-ing Trawler	160	27m x 7m x 3m		Tailshaft drawn out for survey. Tailshaft bronze liner renewed. 10 sea valves overhauled. 4 lengths of pipes renewed. Zinc anodes renewed. Hull cleaned and painted.
PM BARGE NO. 16	Flat-Top Barge		39.64m x 9.15m x 1.72m		Steel plates renewal completed. To be joined up inside dock next month.

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

MONTH : September 1987



VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
KPM BARGE NO.19	Flat-Top Barge		39.64m x 9.15m x 1.72m		Cut into 8 sections and lifted out onto dockside for bottom and side shell plates renewal.
RV ANUSANDHANI	Re-search Vessel	226.16	32.4m x 7.5m 3.3m	NKK	Redocked for boxing up controllable pitch propeller and stern tube seals. Hull cleaned and painted.
FT IMAM NO. 2	Fish-ing Trawler	184.94	23.3m x 6.5m x 3.99m		Emergency docking. 3 damaged propeller blades, guide blocks, seals, pilot tube collar nut on CPP renewed. Tailshaft bronze liner renewed. Stern tube rewooded.
FV NABI	Fish-ing Trawler	227	34.28m x 6.3m 2.85m		Emergency docking. Seized rudder and stock remeoved. Rudder stock checked and clearances adjusted on bush. Rudder boxed up and tested.

cont...

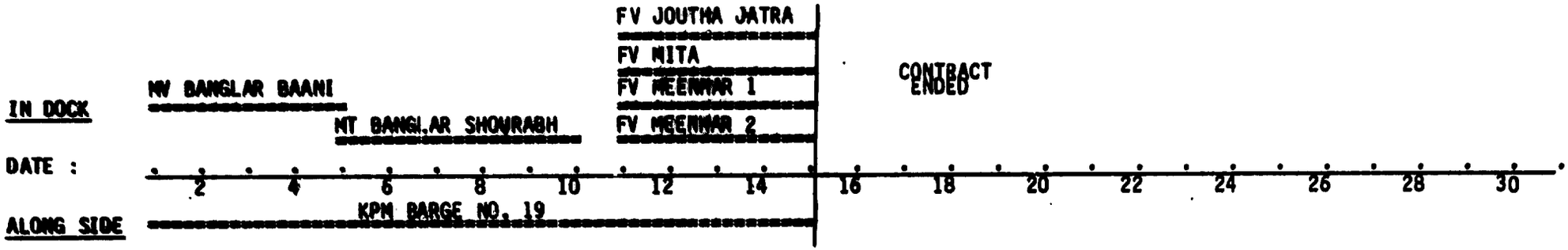
MONTH : September 1987

VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
MT CHANDRADEEP	Oil Tanker	600	49m x 9m x 4.5m		Rudder and stock removed. Rudder stock steady bearing and bottom pintle bush renewed. Tailshaft removed for survey. Liners renewed. Stern tube rewooded. 7 sea valves and 4 storm valves overhauled. 3 pipes renewed. Hull cleaned and painted.
KPN BARGE NO. 16	Flat-Top Barge		39.64m x 9.15m x 1.72m		All 8 sections joined up inside dock. Total 26 tons of steel plates renewed.
MV BANGLAR BAANI	General Cargo	9345.51	140.99m x 20.42m x 10.6m	LR	Tailshaft draw for survey. Stern tube seals renewed. Rudder bushes rewooded. Rudder stock steady bearing renewed. 24 sea valves overhauled. Minor steel works carried out in forepeak tank and rudder. Hull cleaned and painted.

CHITTAGONG DRY DOCK LIMITTED

VESSEL IN DOCK

MONTH : October 1987



VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
MT BANGLAR SHOURABH	Tanker	8673	138m x 22.9m x 9.65m	LR	New tanker docked for final inspection and deliver. One blade of port side controllable pitch propeller replaced due to oil leakages.
FV JOUTH JATRA	Fishing Trawler	192.72	31.85m x 7.2m x 3.4m		Docked for hull cleaning and painting. Tailshaft and rudder clearances recorded.
FV MITA	Fishing Trawler	192.72	31.85m x 7.2m x 3.4m		Tailshaft drawn for survey. Knort nozzle renewed. Zinc anodes renewed. Hull cleaned and painted.
FV MEENNAR 1	Fishing Trawler	199.24	36.2m x 7.2m 2.6m		Rudder and tailshaft removed. Rudder stock steady bearing renewed. Stern bush rewooded. Controllable pitch propeller overhauled and blades renewed. 19 sea valves overhauled. Hull cleaned and painted.

cont...

MONTH : October 1987

VESSEL NAME	TYPE	SIZE GRT	DIEMENSION	CLASS	MAIN JOBS
FV MEEMAR 2	Fishing Trawler	191.23	36.4m x 7.25m x 2.56m		Rudder and tailshaft removed. Rudder stock steady bearing renewed. Stern bush rewooded. 29 sea valves overhauled. Zinc anodes renewed. Hull cleaned and painted.
KPM BARGE NO. 19	Flat-Top Barge		39.64m x 9.15m x 1.72m		As at 15.10.87 40% corroded plates cropped, 20% new plated fitted and 10% new plates welded.

LECTURE NOTES

ENGINE & MARINE EQUIPMENT

MAIN ENGINE REPAIR

Before starting work, get engineer to shut down the system. Drain off cooling water, lubrication oil, isolate fuel oil system and shut air starting master valve. Get instruction manual from engineer in order to know the exact clearances, weight of each component and special tools for the jobs. Arrange compressed air for pneumatic equipment and lights for working inside engine. Arrange necessary tools and equipment e.g. hydraulic pump, jacks, impact wrench, lifting gears etc.

(A) Cylinder Covers

1. Remove all attached pipes.

2. Slacken and remove all cover nuts by jacks or impact wrench. Send cylinder cover to shop for overhauling.

3. Remove all attached valves and overhaul i.e. exhaust valve, relief valve, fuel injectors, air starting valve and test clock.

4. Remove cylinder cover cooling space inspection covers, chemical clean cooling space and renew inspection covers zinc anodes.

5. De-carbonise cylinder cover, polish and dye check for crack.

6. Hydro-test cylinder cover for leak.

7. Grind and lap all valve and cylinder landing surfaces with grinding jig.

(B) Piston

When engine cool down, crankcase door should be opened and ventilated before entering engine crankcase. Arrange planks for working in engine crankcase.

1. Turn piston to bottom dead centre. Slacken nut by hydraulic jack (special tool).

2. Remove stuffing box housing bolts and fix clamp to prevent from dropping.

3. Remove piston rod nut and turn piston to top dead centre. Fix lifting gear and lift out piston to shop for overhauling.

4. Dismantle piston and cleaned.

5. Remove piston rings and check ring grooves sizes with feeler gauge.

6. Cheak piston crown wear down with special gauge. Polish and dye check.

7. Check piston skirt wear down renew wear ring if necessary.

8. Check piston rod wear and skim or chrome as necessary.

9. Dismantle stuffing box, clean and check clearances and fitting of rings to piston rod. Adjust ring gap as require.

10. Assemble piston and air-test with testing gear.

11. Check piston ring gap to cylinder liner to ascertain they are within the allowable clearances before putting back into piston.

(C) Cross-Head Bearings

1. Turn piston to bottom dead centre.

2. Check clearances of bearings and guide shoes.

3. Remove lub oil pipes.

4. Slacken bearing nuts with jacks.

5. Jam all bearing bolts.

6. Remove nuts and shift out top half bearings.

7. Turn piston to top dead centre.

8. Stop cross-head pin with stopper.

9. Hook up chain blocks and support con-rod.

10. Turn piston down slowly and adjust chain blocks accordingly until bottom half bearings are visible for inspection.

11. If bearings need to remetal, turn engine till crankpin is at bottom dead centre, adjust con-rod until it is in a vertical position.

12. Slack jam bolts and remove bearing bolts and set pins.

13. Shift out bottom half bearings.
    N.B. Bearings need to remetal in set.
    Do not remetal only one half.

14. After remetaling make sure all lub oil holes are clear.

(D) Cylinder Liner

1. Clean and calibrate cylinder bore to check extend of wear.

2. Dye check for crack.

3. Grind off ridges, horn cylinder bore if require.

4. If cylinder liner need renewal, remove attached cooling pipes and oil quills.

5. Hook up special lifting tools and jack loose cylinder liner.

6. If cylinder liner does not come loose, check for any obstruction. Do not force out by engine room crane.

7. Cylinder liner can be repaired by hard chroming the bore to original size.

8. Grind and lap cylinder landing surfaces.

9. Wire brush and paint water cooling space with Apexior No. 3 paint.

10. Renew all 'O' rings, oil quills copper gaskets.

11. Check all lub oil holes for clear passage.

12. Apply soft soap on rubber rings before putting back liner.

13. Jack in cylinder liner by cylinder cover studs and special tools.

14 Hydro test for leaks.

(E) Bottom End Bearings

1. Check bearing clearances.
2. Turn bearing to bottom dead centre.
3. Slacken bearing nuts with hydraulic jacks.
4. Jam bearing bolts with setpins.
5. Hook up chain blocks and support bottom half bearing.
6. Remove bearing nuts and lower bottom half bearing to crankcase bottom.
7. Turn crankpin to port or starboard side.
8. Shift out bottom half bearing.
9. Turn crankpin to about top dead centre and stop cross-head with stopper.
10. Turn crankpin down slowly and adjust con rod with chainblock until top half bearing is visible for inspection.

Note : Latest bottom end bearings are normally shell type. If excessive wear, renewal is recommended and old bearings send to maker for reconditioning.

(F) Main Bearing

1. Take crankshaft deflection and bearing clearances.

2. Turn crankpin position to either port or starboard.

3. Remove oil pipe, slacken bearing nuts with jacks.

4. Hook up special tools and shift out bearing keep and top half bearings.

5. Using special tools roll out bottom half.
   Note : In some engine it is required to jack up the crankshaft before the bottom half bearings can be rolled out.

6. If more bearings are required to open out, it should be done alternately and bottom half bearing clamp down with wood by bearing studs.

7. Counter check all bearings clearances and crankshaft deflection after assembling.

8. Oil holes and pipes are to be cleaned before putting back.

(G) Crankshaft Deflection

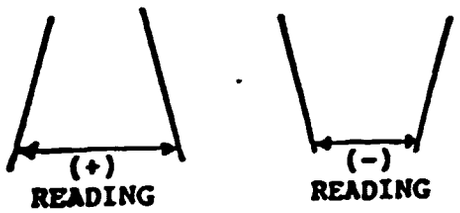
1. Open crankcase door and ventilate.

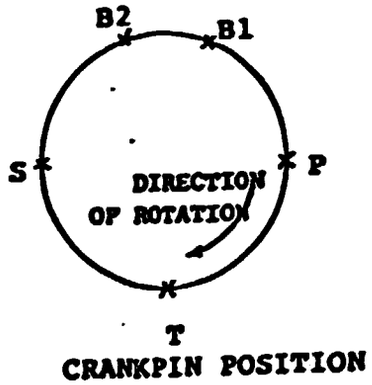
2. Clean crankweb, look for manufacturer position for deflection gauge centre punch mark. Open all indicator cocks.

3. Turn crankpin position to bottom.

4. Position deflection guage onto centre punch mark and adjust reading to zero.

5. Take crankshaft deflection of each unit as indicated in the diagram and table.





	POSITION OF CRANKPIN				
CYCL. UNIT	B1	P	T	S	B2
1					
2					
3					
4					
5					
6					

(H) Bearing Bridge Gauge

Bearing bridge gauge is used to check the bearing weardown without removing or partially remove the bearing in order to save time.

1. Remove oil pipe and nipple of main bearing.

2. Instal bearing bridge gauge and check reading with vernier or micro-depth guage as shown in Fig. 1.

3. The reference reading is stamped on the bridge gauge frame.

4. If the reading is more than the reference reading that mean the bearing have worn out.

5. Some old engine it is required to remove the top half bearing before checking.

6. The reading is check by feeler gauge between the main journal top and bridge gauge reference surface as shown in Fig. 2.

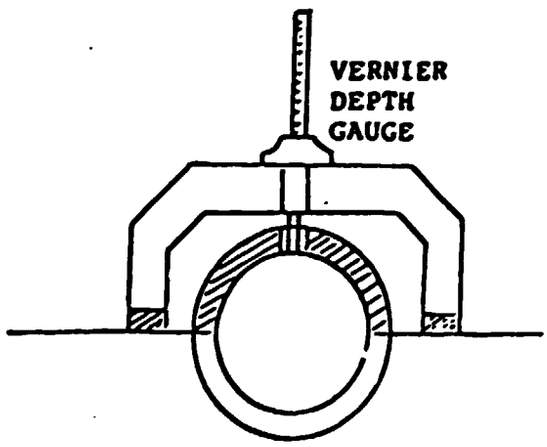


FIG. 1

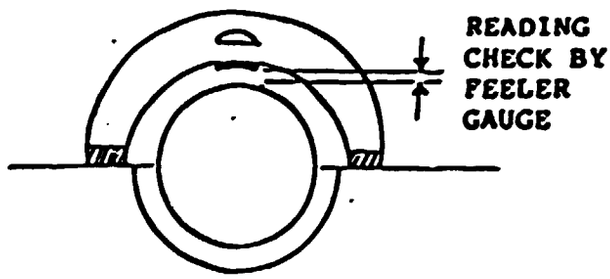


FIG. 2

(I) TWO STROKE ENGINE

Two stroke engine consist of power stroke and compression stroke.

1. Power Stroke

Piston move down until it uncover the scavenge pot, fresh air rush in and pushes the exhaust gas out through the exhaust valve or pot which is opened by now.

2. Compression Stroke

Piston move upward until it cover the scavenge pot, compression commence. Now the exhaust valve is closed. Fuel injection commences before top dead centre.

FOUR STROKE ENGINE

1. Air Intake

Piston move downward inlet valve open, exhaust valve close, fresh air enter the cylinder.

2. Compression

Piston move upward, inlet and exhaust valves close. Fuel injection commences 27° before top dead centre.

3. Power/Firing Stroke

Piston move downward.

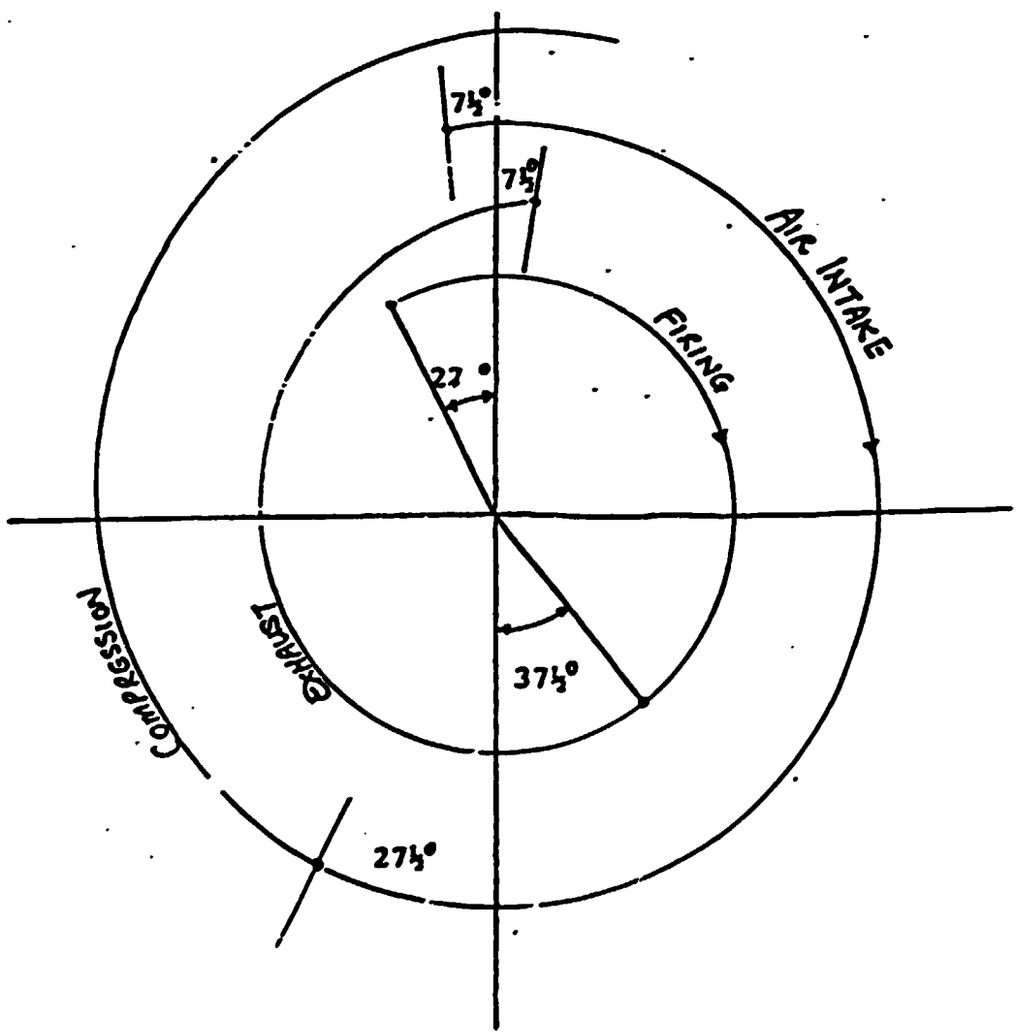
4. Exhaust

Piston move upward, inlet valve close, exhaust valve open. Exhaust gas is pushed out by the piston and the fresh air (at 7 1/2 ° B.T.D.C. inlet valve open). See valve timing diagram.

VALVE TIMING DIAGRAM

Valve Timing

Inlet valves opens	7 1/2 ° B.T.D.C.
Inlet valves closes	27 1/2 ° A.B.D.C.
Exhaust valve opens	37 1/2 ° B.B.D.C.
Exhaust valve closes	7 1/2 ° A.T.D.C.
Fuel injection commences	27 ° B.T.D.C.



(J) TRACING FAULTS

1. Difficulty Starting

a) Fuel system not prime through to the nozzles.

b) Starting air pressure too low.

c) Water in the fuel.

d) Air intake filter choked.

e) Timing out.

2. Poor compression due to any of the following causes:-

a) Exhaust valve seats in bad condition.

b) Exhaust valve spindle sticking.

c) Starting air valve sticking.

d) Piston rings stuck or liners badly worn.

3. Engine running unsteadily or hunting

a) Sticky fuel pump control racks or linkage.

b) Fuel injection pump delivery valves sticky.

c) Overload or governor fault.

4. Smoky exhaust

a) Check fuel pump timing.

b) Check maximum firing pressure and exhaust temperature.

c) Injectors may be sticking or sprayer holes choked or enlarged.

d) Injector spring screwed down too tight.

e) Overload or unsuitable fuel oil.

(K) PREPARE ENGINE FOR STARTING

1. Lub Oil System

Run lub oil pump, make sure lub oil reaches all parts by looking at the sight glass and into the crank-case. Check lub oil pressure on pressure gauges if the difference in pressure before filt and after filter are beyond the engine manufacturer recommendation, clean up the filters. Make sure governor is filled with oil. If turbocharger lub oil system is seperate, make sure both end bearings oil level is sufficient.

2. Cooling Water System

Run cooling water pumps (fresh water and sea water). Check expansion tank water level. Check water flow through sight glass and drain cocks at cooler discharge end. Check water pressure on pressure gauges. Use auxiliary boiler steam to heat expansion tank water or bypass from generator cooling system to warm up engine.

3. Fuel Oil System

Prime system by running fuel oil priming pump. Check the pressure before filter and after filter. If the difference is beyond the manufacturer recommendation, filter to be cleaned. Check fuel rack and lingkages for free movement. Set fuel level to starting position. If engine is running on heavy fuel oil, make sure steam reaches the fuel oil heater and booster pump working, ready for change over.

4. Air Starting System

Make sure starting air pressure is sufficient and compressor switched 'on' for auto starting.

5. Disengage turning gear and inspect all parts visually for obstruction. Check all alarms and indicators lights. Set governor to manoeuvering speed as a minimum. Open all indicators cocks and blow through all units with air. Close indicators cocks, engine ready for starting.

(L) SAFETY PRECAUTION DURING MAIN ENGINE REPAIR

1. When dismantling the engine, engage the turning gear.

2. Cool of the engine before work commences.

3. Do not open the crankcase cover when the engine is hot. Allow at least 10 minutes after engine shutdown.

4. Cut the supply of all high pressure fluids such as starting air, cooling water, fuel oil and lub oil to the engine before any repair work is attempted. Open all indicator cocks to drain the high pressure fluids.

5. Disconnect all pipelines attached to the engine so that they do not obstruct removal of components.

6. Precautions when using hydraulic jacks:-
   - Secure all jacks;
   - Ensure good hose connections;
   - Beware of spring-back of jacking lever.

7. Take special care to avoid hand injuries while positioning the locating pins in the lug holes in the cylinder cover. Hands could be sandwiched between the cylinder head and cylinder cover.

8. Use a working platform when working inside the crankcase to prevent slips and falls. Frequent cleaning is necessary. Provide adequate lighting.

9. Use expanders or pliers when replacing piston rings. Avoid using bare hands as the rings are under tension and could cause hand injury.

10. Screw supporting brackets onto the cross head guides in such a way that the weight of cross head is distributed evenly. As this work involves the turning of the gear, the con rod and cross head should be adequately supported to prevent them swining of dropping onto workers.

(L) SAFETY PRECAUTION DURING MAIN ENGINE REPAIR (cont..)

11. Beware of dangers posed during re-assembly of cross head bearing without removal of piston. Adopt the correct sequence of operation and securing the con rod to prevent the slings slipping out. A shift in the con rod could be hazardous to those working in the crankcase.

12. Support lower half of the crank pin bearing before taking out the bolts joining the two halves otherwise the lower bearing would drop down once the bolts are removed. Lower the crank pin bearing by the adjustment of the chain blocks.

CENTRIFUGAL PUMPS-IMPELLER TYPE

The impeller type of pumps are normally driven by motor, engine or steam turbine. It can be used to pump any kind of liquid depending on the material of the pumps, e.g. cast bronze impeller and casings for pumping water and oil; stainless steel components for pumping chemical and edible oil, etc.

In order to prevent the liquid under pressure in the volute from returning to the suction, the impeller clearances must be maintained at its original clearance. This can be done by renewing the wear rings. The shaft should be carefully examined, especially the part at the stuffing-box. If excessive wear it should be renewed as for small shaft, build up by welding or resleeved as for bigger diameter shaft. Bushes and bearings to be renewed if found to have excessive clearances. The quality of the packing and gasket as specified in the pamphlets should be used during renewal.

A) Trouble Shooting

1. Failure to Build up Pressure

Make sure pump is primed. Air is expelled through vent cocks and all valves in the suction line are opened. Make sure that pump runs at normal speed and there are no leaks.

2. Bearing Hot

Ensure the pump is properly aligned, and correct lubricant used. The pump should not be running over speed.

3. Noisy

Bearings worn or some part loose and rub against the casings.

4. Vibration

Make sure pump alignment is correct and foundation bolts secured. If still vibrates, maybe impeller is out of balance, bearing worn or shaft bent.

5. Pump Cannot Turn

Either packing is too tight or impeller fitted tight to the casings.

(B) Rotary Displacement Pumps-Gear Type

These pumps are normally driven by motor and use to pump oil. It is a positive displacement pumps, self-priming and capable of producing a high vacumm.

The pump is basically comprised of gear-wheels having a special form of tooth profile to minimise noise and oil trapping between the teeth. The pumps are suitable for running at relatively high speeds and are normally confined to handling oil, because the lubricating qualities of the oil reduce wear of the moving parts. When wear take place, the parts like bearings and gear-wheels are normally renewed. If wear is on the shaft, it can be repaired by welding, metal spray or resleeved.

AIR COMPRESSOR

Compressors onboard ship are used for engine starting, operating pneumatic tools, machinery, automatic control and cleaning. They are normally motor or engine driven and may be in one, two or three stages as of piston type. For general use, the pressure varies from 7 to 10 kg/cm2 but for diesel starting, pressures of 25 to 45kg/cm2 are common or even higher.

The cycle of operation of an air compressor of the piston and cylinder form is briefly as follows:-

A) Compression Stroke

The piston compresses the air until the pressure rises to the discharge pressure, that open the discharge valve and the remainder stroke will be the delivery of the compressed air through the discharge valve.

B) Suction Stroke

The piston move down allowing first the air cushion in the cylinder. At the end of the stroke, the suction valve closes and the piston is ready for another compression stroke.

When air is compressed, work is done, and changed from mechanical energy into heat energy resulting in a quick rise in the temperature of the Compressed air. The heat, if not removed, means a greater volume of air for a given pressure which is meconomical. The heat also increases the danger of an explosion if oil vapour or combustible dust is present. Consequently water jackets are often built around the air cylinders to absorb partially the heat of compression. Except on smaller compressors it is water cooled by intercoolers.

Before starting air compressor, ensure the air line valve is open so that pressure will not be built up in the compressor cylinder. Open the valve of the cooling water jackets. Check lubrication, then start compressor. When it has attained maximum speed, close air blow cocks.

OVERHAULING VALVES, STRAINERS, STUFFING BOXES

A) Globe Valves

Mark cover to body. Screw the spindle up a few turns to open the valve, so as to drain the liquid in the system and prevents unnecessary load on the valve cover nuts. Loosen and remove the nuts of the valve cover and lift the cover off the body. Remove the handwheel from the valve stem or spindle. Loosen the stuffing box gland, turn the spindle out of the valve cover and the packings in the stuffing box. Loosen valve disc locking nut and disconnect the valve disc from the spindle. Clean valve body, valve seat, disc, spindle and cover. Grind the disc onto the valve seat until the seat is fully in contact with the disc. If the disc is deeply grooved, send for machining. After machining lap the disc to the seat and check the disc for contact again. Valve is ready survey.

Inspect the cover, studs, bolts and nuts, make easy and ready for use, renew them if necessary. Supply and cut new gland packing. Make new rubber cover joints. Make use of the divider and scissors to cut the joints. Not to knock the joints over the cover. Cut the inside diameter slightly bigger than the spigot, this will prevent mistake in assembling and eventually leaking.

Fix back valve disc to spindle with a new lock washer, screw spindle back to the cover and replace the handwheel. Replace cover with a new joint. Check that it rest evenly on the cover, screw the spindle up a few turns to make certain that the disc is lifted off the seat before the cover is tighten down. Repack gland with new packing.

B) Gate Valve

The procedure of overhauling is the same, except that instead of grinding the disc onto the valve seat, it is done by blue fitting using scraper. If the valve wedge drop below the seat rings, renew the valve or seat rings depending on which is more economical.

C) Safety Valve, Relief Valve and Pressure Reducing Valve

The procedure of overhauling is the same as globe valve, after overhauling the valve is tested in the workshop, to adjust the required pressure and then again tested in-situ. Safety valve and relief valve are spring loaded, pressure reducing valve is fitted with diaphragm and is controlled by spring tension or compressed air.

D) Strainers

Strainers are fitted in the pipe lines where there is danger of foreign matter which may obstruct valves or piping or damage machinery.

Strainers should be cleaned frequently, at least once every day or before starting machinery.

Double strainers are installed for change-over while system is still in use. The flow of water is diverted by positioning the sliding valve disc, operated by the screwed spindles and external handwheel. To overhaul strainers, mark cover to housing, loosen cover nuts and remove cover. Draw out strainer basket, clean and check all parts. If strainer basket is corroded renew by fabricating out of perforated plate. All parts should be painted with anti-corrosive paints. Cover joints should be renewed and vent cock overhauled. To check for leak after overhauling, open inlet valve, close outlet valve of strainer, open vent cock until water rushes out, close vent cock and check. If no leak the strainer is ready to be put in use.

Auto-klean strainer, the oil, etc, is passed through a series of fine slots in the wall of a cylindrical cartridge. This cartridge is formed by a pile of circular discs mounted on a central spindle and interleaved by thin washers. The dirt or suspended matter is intercepted by the edges of the discs. To clean them the handle on the top or end of the strainer is given one turn. This revolves the discs which are keyed to the spindle attached to the handle against a series of stationary cleaning blades, slightly thinner than the washers. The dirt settles and collects in a large sump, thus the strainer can be cleaned whilst in use. To overhaul, remove cover with cartridge, clean strainer housing, clean cartridge with compressed air and turn handle several times at various position, look for damages, renew rubber 'O' ring and box up. If cartridge is damaged renew them.

E) Stuffing-Boxes

As the life of the shaft depends to a very great extent on the quality and treatment of the packing, it pays to maintain the stuffing-box in good order and re-pack with new packing from time to time, especially where there is grit in the water. It is advantageous in all cases to run the set with a full stuffing-box, as by this means the intensity of pressure on the packing is reduced and consequently the frictional resistance and wear on the shaft at this point.

In re-packing a stuffing-box, see that the packing is installed in such a manner as to give uniform thickness all around the shaft sleeves. An excess of packing on one side of the shaft will result in deflection of the shaft and frequently in shaft breakage. In installing new packing, the stuffing-box should be packed loosely and the packing gland set up lightly, allowing a liberal leakage in the case of stuffing-boxes subject to pressure above atmosphere. Then, with the pump in operation, tighten the gland in steps so as to avoid excessive heating and possible scoring of shafts or shaft sleeves.

A slight drip is necessary from the gland in order to provide lubrication for the packing. Excessive pressure should not be applied to the glands to prevent excessive leakage. If it is found that leakage from the gland is excessive, the correct procedure is to repack the stuffing-box at the earliest opportunity.

F) Re-packing of Stuffing-Boxes

- Completely remove the old packing from the stuffing-box and clean the rod or shaft on which the packing is to be fitted.

- The packing rings, cut to the correct size, are split at one point with a scarf joint, and when fitted over the shaft, the ends should be adjusted to form a perfect ring.

- Each ring should enter the stuffing-box freely, be installed separately and caulked home individually, using wooden strips which are a good fit in the stuffing-box.

Re-packing of Stuffing-Boxes (cont..)

- Tamp each ring into the stuffing-box, rotating the shaft slightly after each ring has been tamped back until the stuffing-box is entirely filled.

- When the stuffing-box is full, apply the gland and compress the entire set until it feels solid, add an additonal ring if it is necessary, then release and re-set lightly.

- Place the unit on load and adjust the gland if necessary, keeping the gland well set up so that no movement of the packing is possible. It is advisible to stop the unit while the packing adjustments are made.

- Care should be taken to see that any clearance on the neck bush, lantern ring or gland is not excessive.

- The dipping of each ring in lubricating oil before installation will help the packing life.

ANCHOR WINDLASS, DECK WINCHES AND CAPSTAN

Anchor windlass is normally driven by electric motor, hydraulic motor or in older ship steam driven.

The main purpose of a ship's windlass is to lift the anchor and for warping. It is a class requirement that the ship's windlass should be in good condition before going out to open sea.

To prepare the windlass for survey the anchor chain should be lowered and lifted out of the gypsy, while in dock. If alongside the wharf, it can be done by lashing up the anchor chain with the chain stopper in lock position then lift the anchor chain aside. Check gypsy snugs for cracks and wear down. If excessive wear it should be built up by welding, grind to the original profile and dye check for cracks. Pinion and gear wheel should also be checked for wear and cracks, if found it should be renewed. Brake bends should be removed for inspection, if excessive wear on the linings, it should be renewed. All brake bends pins to check for wear and grease hole clear. All bearings and bushes clearances to be checked, if excessive to be renewed. After marking, with the consent of the Surveyor alternate bearings keep can be opened for survey. If bearing clearance is slightly excessive, it can be reduced by removing the shimes. Bearing grease hole should be cleared and grease nipple renewed if damaged. If bearing journal on shaft wear down, it can be skimmed and new bearing machined to original clearances. Clutch jaws should be check for wear. If excessive it should be built by welding and grind to shape in situ. For major repair it should be machined. Carry out visual inspection of other parts for corrosion and hammer test on foundation bolts for tightness. After overhauling all parts exposed to weather to be painted and all moving parts greased.

Deck winches are used principally for handling cargo, with warping as a subsidiary duty. Instead of a gypsy as in anchor windlass it is substitute by a wire drum. Other parts are almost identical and they are driven by the same type of prime mover. Overhauling of deck winches are the same as anchor windlass. Load test should be carried out after overhauling.

Capstan is generally used for warping or pulling objects in a horizontal direction. It is normally driven by electric motor, hydraulic motor or in small ship by hand with ratchet pawls.

CONTROLLABLE PITCH PROPELLER

Advantages of the controllable pitch propeller are that it can be used in a uni-directional prime-mover, thus eliminates the necesity for an astern section in the turbine/engine with consequent increase in overall efficiency. It increases the manoeuvrability of the vessel, the speed and direction ahead and astern can be controlled instantly from the bridge. It is possible to alter the pitch of this type of propeller to suit the conditions, the change in pitch is affected by rotating the blades about its vertical axis, this movement usually being carried out by hydraulic or mechanical means. In the unlikely event of electrical of hydraulic failure, a spring moves the blades into full ahead pitch. Controllable pitch propellers propellers are normally used by tugs, trawlers, ice-breakers, ferries and other ships that require the above advantages.

To overhaul the controllable pitch propeller, first of all you must have the instruction manual to start with, then check the spares and special tools. When the vessel is in dock, get engineer to start the hydraulic pump and operate the CPP. This will facilitate the fault finding and thus expedite the repair. Most part of the CPP are made of stainless steel or bronze, being resistance to corrosion in sea water. The stoppers can be removed by gouging or grinding away the welds, special care should be taken to prevent damaging the sealing surfaces and threaded areas. All parts should be properly cleaned, clearances checked, and dye check for cracks. Pay special attention on the sealing surfaces, propeller blade roots, threaded holes and bolts for defect. If clearances exceed the recommended value it should be renewed. If threaded parts is damaged or parts crack, same to be renewed. All seals and 'O' rings to be renewed.

During assembling all bolts to be tightened to recommended torque. Special care should be taken when welding stoppers, after testing.

CHECKLIST FOR WITHDRAWAL OF TAILSHAFT FOR SURVEY

1. On arrival of vessel, propeller, tailshaft, stern bush drawings from ship should be obtained.

2. Check size of drawing stays from the drawing for removing propeller.

3. Check whether lignum Vitae or white metal bushes. If white metal bush, ask Chief Engineer or Superintendent for any spare simplex seal and chrome liner. If there is no spares on board, ask Superintendent whether Yard to order or owner to order.

4. Obtain simplex seal poker gu·ge and check last docking reading.

5. Check from drawing the weight of the propeller and type; whether key type or keyless type or pilgrim nut type.

6. Check from drawing or go down personally to shaft compartment to check whether it is S.K.F., loose or muff couplings on intermediate shaft. If tailshaft to be withdrawn from aft, allow sufficient space for withdrawal of tailshaft before vessel is docked. Prepare for removal of Rudder for access.

7. Confirm whether left hand or right hand screw.

8. Obtain necessary tools from the ship. (Special tools for keyless propeller or controllable pitch propeller).

9. Meeting with the Engineer, Foreman and Supervisor to prepare drawing stays, hydraulic jacks, hydraulic prmps, service bolts, staging, hand chain blocks, propeller lifting, wire slings, eye-plates etc.

10. Ensure shaft compartment is gas free for hot work if required.

11. Arrange for burner and welder for cutting rope guard, heating coupling bolts, welding eye plates and weld nuts on coupling bolts if required.

12. Inform ship engineer to engage the turning gear and switch on power to turn the engine for removing coupling bolts.

13. Inform Chief Engineer to drain out the oil from stern tube.

14. Prepare magna flux unit and inform wireman to connect wire and switch on power for surveying of tailshaft. Test magna flux machine before surveyor arrives.

WORK PROCEDURE FOR REMOVAL OF RUDDER

A. Preparation

1. Find out the weight of the rudder from drawings supplied by owners.

B. Tool and Equipment

1. Hydraulic lifting jacks.
2. Purchase blocks (40T, 60T, 80T, or 120T).
3. Eye plates.
4. Chain blocks and sling wires.
5. Stopper plates.
6. Wooden blocks for resting rudder.

C. Procedure

1. Support rudder by placing lifting jacks and blocks under it.
2. Weld eye plates on both side of rudder.
3. Rig up purchase blocks with its accessories on both sides at position between the two eye plates.
4. Pass wire rope from the purchase blocks through the snatch blocks and connect at winch.
5. Use shackles and sling wires to connect purchase blocks to eye plates.
6. Weld another set of eye plates.
7. Have two chain blocks on the eye plates for holding rudder in a stable position when the 2 service bolts (temporary bolts) at rudder stork are removed.
8. Tension up the chain blocks.

Procedure (cont..)

9. Weld two stopper plates on each side of rudder.

10. Remove top and bottom pintles from rudder.

11. Remove two stock palm bolts, one from each side of rudder and replace them with two service bolts.

12. Remove all other remaining stock palm bolts.

13. Control winches at both side of the dock until weight of rudder is taken by purchase blocks.

14. Remove the 4 stopper plates.

15. Remove the service bolts.

16. Lift up rudder stock until it is cleared from rudder palm.

17. Remove jacks at bottom of the rudder.

18. Release slowly chain blocks on both side of rudder.

19. Remove chain hooks from eye plates on rudder.

20. Control winches for purchase blocks until weight of rudder is taken fully by one side of purchase blocks.

21. Disconnect sling wire from the other side of purchase blocks.

22. Transfer load from purchase blocks to dockside crane so that it can be transported to its destination.

23. Using another crane, rest rudder horizontally on blocks.

D) Safety Precaution

1. The jacks used must be able to hold the weight of the rudder.

2. Position the jacks at the frame and also in a suitable position so that it can support the weight of the rudder.

3. Protecting plates between the rudder and jacks must be put.

4. Ensure that rudder is gas-free before welding eye plates.

5. Use correct size eye plates.

6. Ensure that location of eye plates are slightly at top half of rudder and at equal distance from the centre line of the rudder.

7. Eye plates are to be located on frames and dye-checked upon completion of welding.

8. Use correct capacity purchase blocks and lifting equipment.

IMPORTANCE OF CRANE GREASING PROGRAMME

Proper greasing is the essence of any good crane maintenance system. If thoroughly analysed, the causes of most of the cranes break-down will be traced to failure of greasing programme.

Proper greasing means:-

A) Use of the Right Lubricant.

B) Application of the Lubricant at the Right Time.

C) Use of the Right Quantity of Lubricant Each Time.

D) Proper Care of Lubricants to Prevent their Contaminations.

A) Use of the Right Lubricant

Such occurances are not uncommon, where wrong lubricants are advertently or inadvertently applied and they happen because of the following reasons:

1. Mixing grease and heavy grease oil with kerosene to make it dilute. This will leads to seizure of shaft and bearings.

2. Use of wrong lubricant because of mix-up. One of the possibilities is failure to identify the right lubricants from among many kept in the stores.

B) Application of Lubricant at the Right Times

Failures of cranes also happen because of not applying the lubricant with the desired frequency.

C) Use of the Right Quantity of Lubricant Each Time

Excessive use of oil can be as dangerous as its shortage. In some modern cranes, for example, clutches are provided at a certain height in the gear boxes and level of the oil is poured into the sight glases. If excessive oil is poured in such cases then these clutches are submerged in oil. The 'dry-type' of clutches will slip causing excessive damage to the clutch disc and the 'wet-type' clutches will churn oil causing fuming and consequent heating of oil. Quantity of lubricant per occasion should be determined on the basis of experience and measurement.

D) Proper Care of Lubricant to Prevent their Contamination

Contamination of lubricants by dirt, water, dust and by other lubricants is an important feature of controlled crane greasing. For this purpose it is necessary to:

1. store lubricants in clean and dry surroundings

2. maintain a cover on the storage tank or drum

3. use, to the extend if possible, one dispensing equipment for each type of lubricant. In case, where the same dispensing equipment is used for different types of lubricant, it is to clean the equipment thoroughly before filling it with a different lubricant.

OBJECTIVE OF CRANE GREASING

1. To keep cranes running smoothly i.e. prevent cranes breakdown and emergency shut down for repair.

2. To prevent corrosion on crane's parts.

3. To reduce wear and tear on crane elements that must be lubricated such as wire ropes, bearings, gears, bushes etc. When the crane elements wear too much, a crane can no longer do it's job and must be repaired. Replacement of parts - labour and materials - can be costly but this cost can be minor compared to the cost of lost production. If a crane has to be immobolised because of lack of greasing. Not only is production lost from the crane itself, but lack of this crane may cause other equipment or even the whole operation department - machines and employees to be idle.

CARBON ARC-AIR GOUGING

It is a metal removal process, electric energy forms an arc between a carbon electrode and the base metal. A stream of compressed air from the torch head then blows away molten metal as it melts under the arc.

A) Advantages

1. Saves time and costs
2. Reducing downtime and repair costs.
3. It gives clean and bright surface after gouging.
4. Lower heat input than oxygen cutting.
5. Less effect on the characteristics of the base metal or alloy.

B) Material Require

1. A gouging torch
2. Carbon electrode
3. A source of compressed air
4. Electric power supply

C) Functions

1. Electric power and air are supplied to the torch through an air cooled power cable.

2. Electrode : Arc gouging electrode are a special formulation of carbon and graphite for metal removal and carbon arc welding applications. Carbon provide better heat and arc energy for melting.

3. Compressed Air : Centralise or portable compressor air is satisfactory for arc gouging. Air pressure between 60 psi to 100 psi are normally used to blow away molten metal.

Functions (cont..)

4. Electrical Power : Constant current welding power sources are commonly used for the arc gouging process. An open circuit voltage of at least 60V is required.

The current (Amps) are dependent on the thickness of the base metal, size of gouging rod, size and length of the supply cables. The range of current are 300 Amps to 1500 Amps. The current form an arc or heat to melt the base metal to a molten pool.

D) Operation

1. Switch on the welding machine, grip the carbon rod (electrode) so that a maximum of 6 inches extend from the gouging holder's hand.

2. Turn on the button at the holder for air stream.

3. Hold the electrode at angle of 30° to 40° to plate surface and slop away from the direction of travel with the air blast behind the electrode. The air stream will sweep through the arc between the work and electrode end, then remove all molten metal.

4. Strike arc by lightly touching electrode to work. To move forward reason is to blow molten metal away from the arc. (Do not draw electrode back once arc is established).

5. Progress in the direction of cut to maintain a short arc length and at a rate equivalent to metal removal. The steadiness of progression controls the smoothness of the resulting groove.

SUBMERGED ARC AUTOMATIC WELDING

Submerged arc welding is a process that a blanket of fusible materials called flux is used for shielding the arc and the molten metal.

The arc is struck between the workpiece and a bare wire electrode of which is submerged in the flux. The arc is not visible and is run without the flash, spatter and sparks as different from the open arc process.

The natural of flux will only emit little smoke or visible flame.

The material of the flux combination with electrode wire are to be used equivalent to the tensil strength and chemical composition of the base metal.

The range of the welding amperes determines the rate of the electrode melted, the depth of penetration and the size of the welds.

The voltages influence the shape of the weld cross-section and appearance of the weld.

The travel speed of the feeder unit is used primarily control the bead size and the depth of fusion which corresponding to the welding current.

The distance between the point end of electrode contact and the electrode nozzle tip is called "stick out" is to determine the amount of heat input and melting rate to the depth of penetration.

The preparation of plates are to be free from scale, rust and oil. Joint surface to be clean and grind before welding.

Bevel edges and root is not required for plate thickness less than 15mm, as the high current and deep penetration of the subarc process, of which will produce fusion welds when welding on both sides.

TIG WELDING

TIG is an arc welding process wherein coalescence is produced by heating with an arc between a tungsten electrode and the work.

Essentially, the nonconsumable tungsten electrode is a 'torch' as a heating device. Under the protective gas shield, metals to be joined may be heated above their melting point so that material from one part coalesces with material from the other part. Upon solidification of the molten area, unification occurs. Welding in this manner requires no filler metal.

If the work is too heavy for the more fusing of abutting edges, such as butt joint or fillets, are required, filler metal must be added. This is supplied by a filler rod, manually feed into the puddle. Both the tip of the electrode and the filler rod are kept under the protective gas shield as welding progresses.

Usually the arc is started by a high-frequency, high voltage device that causes a spark to jump from the electrode to the work and initiate the welding current. Once the arc is started, the electrode is moved in small circles to develop a pool of molten metal. The filler rod, held at an angle to the surface of the work, is advanced into the weld puddle. When adequate filler metal has been added to the pool, the rod with drawn and the torch moved forward. The cycle is then repeated.

Shielding gases for the welding are either argon, helium, or a mixture of the two, are commonly employed. Argon provides the advantage of easier arc starting, smoother arc action, superior resistance to draft, argon costless than helium and requires a lower arc voltage for comparable currents and arc length.

In the normal welding of thin material, argon is recommended because its lower arc voltage characteristic reduces the tendency for burn-through. Helium's higher arc voltage characteristic is desirable for thick material or metal with high heat conductivity.

The rate of welding and the quality of the welds are significantly affected by gas purity.

TIG WELDING (cont..)

One important characteristic of gas tungsten-arc welding is the ability to weld thin sheets or the first pass in the bottom of a groove with complete penetration and a uniform, continuous bead on the underside. E.g. the first bead in the root of a circumferental pipe joint can be fully penetrated, and a continuous small bead is laid on the inside of the pipe. This method has considerable advantage over using a back-up ring.

Electrode used for TIG welding are of three types, pure tungsten, 2% thoriated tungsten and 1/2 Zirconium-tungsten. Pure and Zirconium tungsten are mostly used for welding aluminuim and non-ferrous material. Thoriated tungsten are used for steel or ferrous material such as stainless steel. Filler materials used are to be equivalent to the chemical composition and mechanical properties requirements of the base or parent metal.

OIL TANKER - FIRE AND EXPLOSION HAZARDS

A) Introduction

In the course of shiprepair work especially on an oil tanker, fire and explosion hazards are the most dangerous hazards found in Shipyards. Once initiated, fire and explosion, particularly the latter are virtually out of control. Because of this, it is crucial that fire and explosion hazards be eliminated altogether. In order to appreciate the dangers associated with flammable liquids, it is necessary to know something about their characteristics.

B) Characteristics

Viscosity : Most flammable liquids are of low viscosity so that they can flow easily, enabling a small amount to cover a large area of ground, especially where there is a downward slope or a drop in level.

Volatility : Volatility is used for classifying petroleum and it determines the amount of vapour which could be formed. The more volatile the liquid, the more hazardous it could be. Petroleum with flash-point below 60°C are classified as volatile.

Flash-point : Flash point is the lowest temperature at which there is sufficient vapourisation of the substance to produce a vapour which will flash momentarily when a flame is applied.

Flammability : The flammable (explosive) range of a substance is that between the minimum and maximum concentration of hydro-carbon vapour in air which forms a flammable (explosive) mixture. The risk of ignition depends on the lower explosive limit (LEL) of flammability of the vapour, which is the lowest concentration in air which will burn with a flame when ignited, and is commonly expressed as a percentage by volume in air. There is not only a lower explosive limit (LEL) of flammability but an upper explosive limit (UEL) as well. If a mixture is too lean, below the LEL, or too rich, above the UEL, it will not support combustion.

		LEL	UEL
Limits of Flammability :	Petrol	1.4	7.6
	Acetylene	2.5	80.0
	Propane	2.2	9.5
	Methane	5.3	13.9

The LEL of petroleum liquids could vary between 1% vapour to 99% air and UEL could be as high as 10% vapour to 90% air by volume. Some petroleum could produce vapour concentrations within the explosive range and some above the UEL. Only non-volatile petroleums, vapour concentrations at ambient temperature are below the LEL and are too lean to support combustion. However it should not be presumed to be safe. Burning could occur when the oil temperature is raised to its flash-point. Similarily, petroleum products cannot be presumed to be pure substance of one type of hydro-carbon. Crude oil and petroleum are mixtures of a large variety of hydro-carbons.

Densities : Petroleum vapours pose certain dangers owing to the vast range of densities. E.g. Methane gas, the lightest hydro-carbon, found in crude oils, being much lighter than air could form a layer beneath the roof of compartments and could explode if ignited. On the other hand, LP Gas (Mixture of propane and butane) are about 2 times the weight of air tends to settle at the bottom of the tanks.

C) Possible Sources of Flammable Liquids

The most common place where flammable liquids or petroleum sludge is found are cargo tanks, bunker tanks and service tanks, pump rooms, engine room, and cargo lines.

Cargo Tanks : Sludge and oil residue tend to accumulate on the longitudinal members of frames, tie beams and the bottom of cargo tanks.

Possible Sources of Flammable Liquids (cont..)

Bunker/ Service Tanks : Bunker oil or heavy fuel oil are normally stored in the bunker tanks for vessel consumption. However some service tanks or day tanks contain high speed diesel oil or diesel fuel for use in the auxillary engines.

Pump Room : Leaks from pumps, valves, pipes, etc., would result in flammable liquids displaced at the bottom bilges.

Engine Room : Engine room and its bilges are places where fuel oil, lubrication oil and cleaning solvents tend to accumulate. There are also several double bottom tanks in the engine room for flammable liquids.

Cargo Lines : All cargo lines (pipelines) onboard the vessel are possible sources of petroleum.

D) Sources of Ignition

There are several common ignition sources by which flammable vapours of concentrations within their flammability range can be ignited. The first and most obvious ones are flame, heat and sparks from burning and welding processes. Smoking and the indiscriminate throwing of cigarette butts; sparking of a faulty switch or over-loaded circuit; use of non-explosive proof electrical equipment; static electricity; auto-ignition; etc., are all possible sources of ignition.

E) Detection of Combustible Gases and Vapours

A convenient means of detecting acetylene gas is by the sense of smell as acetylene gas smell of garlic. However there are 2 disadvantages in this means of detection. Firstly, the ability of the nose to sense an odour is of short duration and could result in the false interpretation that the gas which was initially detected was no more in the atmosphere when our sense of smell become less sensitive and eventually immune. The second draw-back which is very critical, is that certain gases (oxygen, carbon-monoxide, hydrogen, etc.) will not have an odour. A more scientific approach in gas detection would be the use of meters, e.g. M.S.A. Explosivemeter, Riken Oxygen/Hydrocarbon combination gas meter, and glass-tube gas detector for special gases, etc.

F) Prevention

Work System : By introducing a standard work procedure, fire and explosion hazards could be prevented. The Permit-to-Work system is an effective method in controlling hot work on board vessel. A daily gas free inspection programme and the constant up-dating of the Permit-to- Work chart is a necessity to effect the system. The introduction of "Hot Work Permit Application" system will provide the main line of defence in the prevention of fire and explosion.

Fire Watch : A fire watchman familiar in the use of fire extinguishers is the first line of defence in containing and extinguishing a fire. The watchman could be an assistant welder or a memeber of the work group.

G) Other Preventive Measures

1. Establish a work co-ordination system between Dockyard personnel and Ship's crews to ensure incompitable works are not carried out at the time/location.

2. Hot work tools and electrical equipment should be checked regularly to elimate a possibility of faulty equipment being used in hazardous atmosphere.

3. Adequate forced ventilation must be provided and maintained throughout for work conducted in confined spaces.

4. Observe all safety rules and regulations pertaining to hot-work.

Name of Shipyard:
Vessel:

PERMIT-TO-WORK CHART FOR TANKERS

	PORT TANKS										
	1	2	3	4	5	6	7	8	9	10	11

	CENTRE TANKS										
	1	2	3	4	5	6	7	8	9	10	11

	STARBOARD TANKS										
	1	2	3	4	5	6	7	8	9	10	11

	AFT. MAIN PUMP ROOM	FWD. MAIN PUMP ROOM	FWD. AFT. PUMP ROOM	ENGINE ROOM	BOWERS PORT.	BOWERS STARBOARD	FORE DEEP PORT	FORE DEEP STARBOARD	FWD'D PORT COFFERDAM	FWD'D STBD COFFERDAM	AFT. PORT COFFERDAM	AFT STBD COFFERDAM

⊖ — ENTRY PROHIBITED

RED — SAFE FOR MEN – NOT SAFE FOR HOT WORK

BLUE — SAFE FOR MEN – SAFE FOR HOT WORK

WIRE ROPES - GENERAL MAINTENANCE, INSPECTION & SAFE USES

A) Introduction

There are many different types of wire ropes, each having its own particular characteristics and constructions. Ensure that the correct one is used for the purpose and load for which it is designed.

B) Maintenance

Correct lubrication of wire ropes is necessary to ensure long life and good services. The wires in a rope bear against each other with considerable pressure when the rope is under tension or is bent over a pulley or drum. Therefore it is practical to maintain regularly a film of lubricant to reduce the internal friction of wire ropes for cranes, winches and other lifting appliances/equipment.

Wire ropes must be stores if possible under cover and in place with moderate temperature and adequate ventilation so as to prevent deterioration. It is a good practice to keep wire ropes off the ground by placing them on raised wooden platform.

When wire ropes are paid out from a reel or a coil, ensure that the surface is dry and clean, and they are laid in straight line and without slack in order to prevent kinking and disturbance of the lay.

C) Inspection

Check wire ropes for:-

Broken Wire Strands : A wire rope becomes unservicable when 5% or more broken wire are shown in any length of 10 dia.

Example: 12.7mm (1/2") dia. 6 x 19 rope

No. of wires = 6 x 19
= 114

Length of 10 diameters = 10 x 12.7mm (1/2")
= 127mm (5")

Replace any rope which has 6 or more wires broken along any length of 127mm (5").

Inspection (cont..)

Decrease in Diameter : Measure the diameter of a suspected wire rope and ensure that the decrease in diameter is not more than 7%. Example:

For 10mmØ not less than 9.4mmØ
20mmØ not less than 18.6mmØ

Safe Working Load : Normally the Safe Working Load (S.W.L) of any wire rope is indicated by the manufacturer. However, for simplicity and to ensure that an unknown (unmarked) piece of wire rope is within the S.W.L of an object, the equation is:

D(mm) x D(mm) x 7.7
where D is the diameter of wire rope

Others : A wire rope should be withdrawn from use when is is found to be badly kinked; deformed (bird cages); or abraded or corroded.

D) Safe Use

Wire ropes used for the purpose of lifting loads are normally spliced or socketed for its intended purposes. However, the use of bulldog grips to form an eye is not uncommon. It also provide a means of securing the ends of temporary wire ropes and wire ropes which may need adjustment of length. The first grip should be fitted as close to the thimble or eye as possible with the others having a spacing distance of 6 rope diameters. The number of bulldog grips required for various rope diameters are:

Up to and including 19.1mm (3/4").....3 grips
19.1mm (3/4") to 31.8mm (1 1/4").....4 grips
31.8mm (1 1/4") to 38.1mm (1 1/2").....5 grips
38.1mm (1 1/2") to 50.8mm (2").....6 grips
Over 50.8mm (2").....7 grips

Wire ropes are sometimes slinged over a load for lifting, must be protected by padding against sharp edges of the load.

Do not effect a lift if the angle formed by the bight (loop of rope) exceeds 120 degrees.

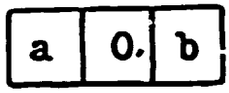
HYDRAULICS

(1)

Symbols are used to represent valves in circuit diagrams. They only indicate the functions of the valves and not the various types.

These symbols have been standardised in accordance with ISO 1219.

(2)



The moving parts of the valves can assume different positions or spool positions.

Each position is represented as a square. Fig. 1

Positions can be identified by means of letters. A valve with 3 positions (a-0-b) is shown, Fig. 2. The Centre position is designated '0'.

(3)

Within the squares, pipelines and flow directions are shown by lines and arrow heads respectively, Fig. 3.

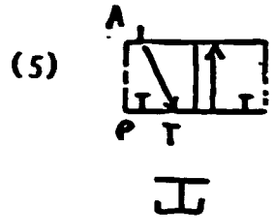
A Shut-off is indicated by a bar in the square, Fig. 4.

The controlled connections can each be identified by a capital letter:

(4)

Operating and cylinder supply lines - A,B,C
Inlet pressure - P
Outlet - R,S,T

The outlet and return flow in the reservoirs are identified by adding the reservoir symbol, Fig. 5.

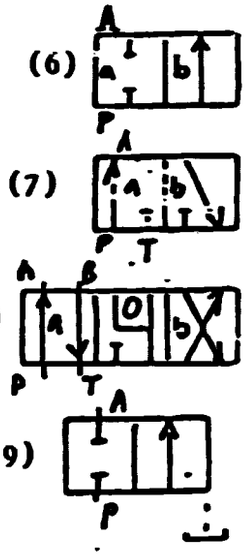


Examples of controlled connections (main connections).

2 controlled connections - Fig 6

3 controlled connections - Fig 7

4 controlled connections - Fig 8



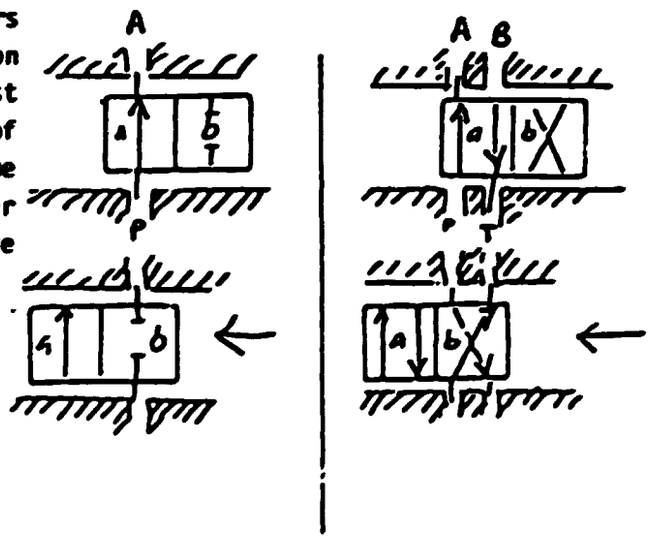
Leakage fluid is removed by means of a drain line, Fig. 9. For simplicity's sake, it is no longer shown in the symbols and circuit diagrams.

The drain and control line connections are not main connections.

Other positions are obtained by displacing the square blocks until the connections coincide with the lines of the other square (connections remain unchanged), Fig. 10.

Directional control valves control the fluid flow in certain directions.

(10)

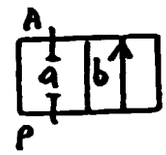


These valves are identified by numbers perfixing the designation designation 'direction control valve'. The first number indicates the number of connections (ways or directions), the second number referring to the number of positions. The two numbers are separated by a slash.

Examples

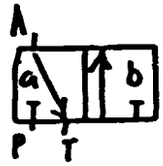
a) Simplest valve : Shut-off Valve
2 connections
2 positions (squares)
produces a 2/2-way directional control valve, Fig. 11.

(11)



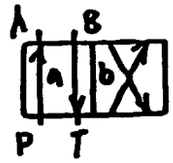
b) 3 connections
2 positions (squares)
produces a 3/2-way directional control valve, Fig. 12.

(12)



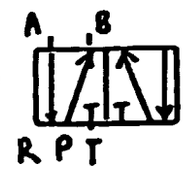
c) 4 connections
2 positions (squares)
produces a 4/2-way directional control valve, Fig 13.

(13)

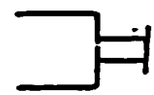


d) 5 connections
2 positions (square)
produces a 5/2-way directional control valve, Fig 14.

(14)



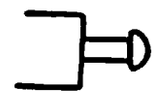
(15)



Types of actuation

Valve actuation is also represented by a symbol.

(16)



Manual actuation in general - Fig. 15

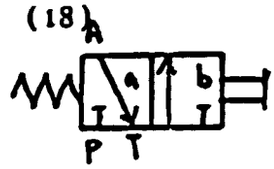
Manual actuation by means of push-button - Fig. 16

(17)

Mechanical actuation by means of built-in spring - Fig. 17

These actuating elements are shown at the the side of the squares of the positional symbols, Fig 18. This is an example of a 3/2-way directional control valve.

(18)



HYDRAULICS (cont..)

What is hydraulics?

Hydraulic is the transmission and control of forces and motions by fluid.

Hydraulic systems and equipment find wide spread applications in engineering e.g.

- Machine Tool Engineering
- Press Machine
- Process Equipment
- Vehicle Manufacture
- Air-craft Construction
- Shipbuilding/Repairing

The advantages of hydraulics are the ease of control, as well as the generation and transmission of large forces and power through the use of comparatively small units. Hydraulic cylinders and motor permit starting from rest with maximum torque. Quick reversals are made possible by the provision of suitable equipment is self-lubricating and has a long service life.

Disadvantages

The high fluid pressures involve dangers of accidents, so care must be taken that all connections are tight and do not leak.

Fluid friction and leakage oil reduce efficiency.

HYDRAULICS (cont..)

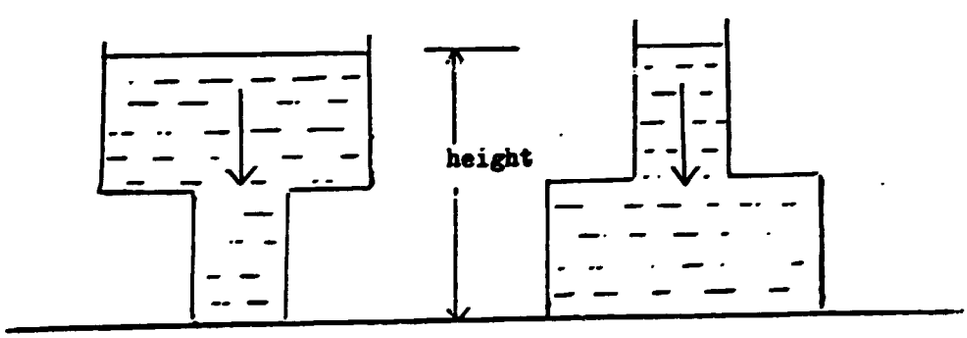
Hydraulics requires of the user;

- Knowledge of the basic physical laws of hydrostatics and hydrodynamics.
- Knowledge of the units and physical quantities in hydraulics.
- Knowledge of hydraulic equipment and its operation in hydraulic circuits.

BASIC PHYSICAL LAWS OF HYDRAULICS

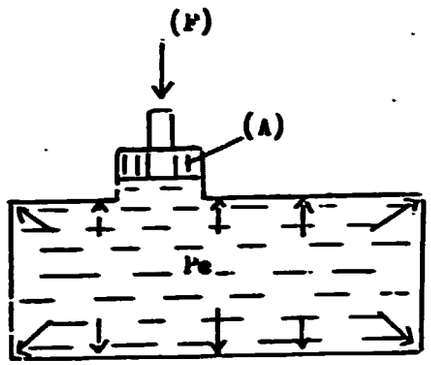
Hydrostatic (Fluid at rest)

The pressure (force over area) exerted by the fluid at bottom of the reservoirs as a result of its gravitional force is identical in two vessels. The hydrostatic pressure depends only on the height of the liquid column and not on the shape of the vessel.

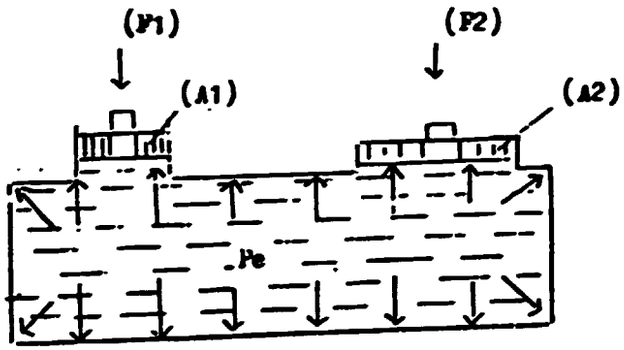


Hydrostatic (cont..)

If a force is applied to a fluid e.g. via piston area A, this force is transmitted equally throughout the fluid. Neglecting gravity, it generates a uniform pressure at the sides and bottom of the vessel.



The ratio of forces is the same as that of the piston area. If area A2 is 4 times that of A1 (i.e. when the piston ø is double) the force will also increase by a factor of four.

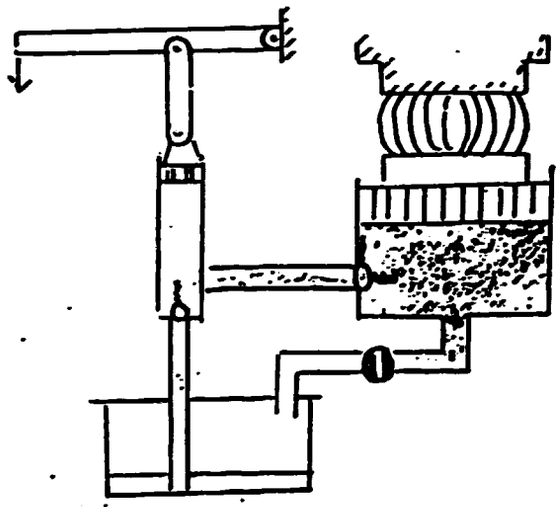


$$Pe = \frac{F1}{A1} \quad \text{or} \quad \frac{F2}{A2}$$

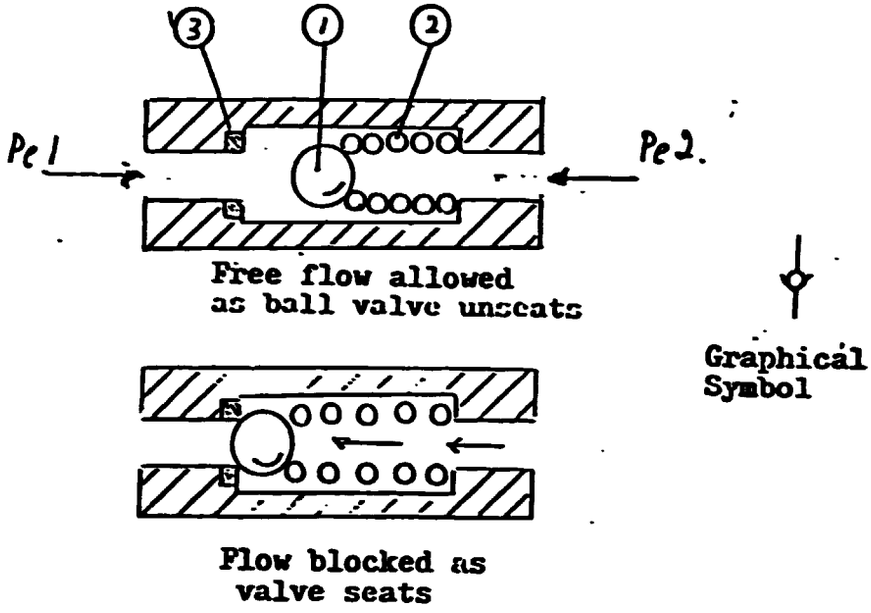
$$\text{Therefore,} \quad \frac{F1}{A1} = \frac{F2}{A2} \qquad \text{i.e.} \quad \frac{F1}{F2} = \frac{A1}{A2}$$

Hydraulic Press

This is the principle of the hydraulic press. An available pressure can produce a greater force by increasing the working piston area.



CHECK VALVE



A check valve is used to permit fluid flow in one direction and block the flow in the other.

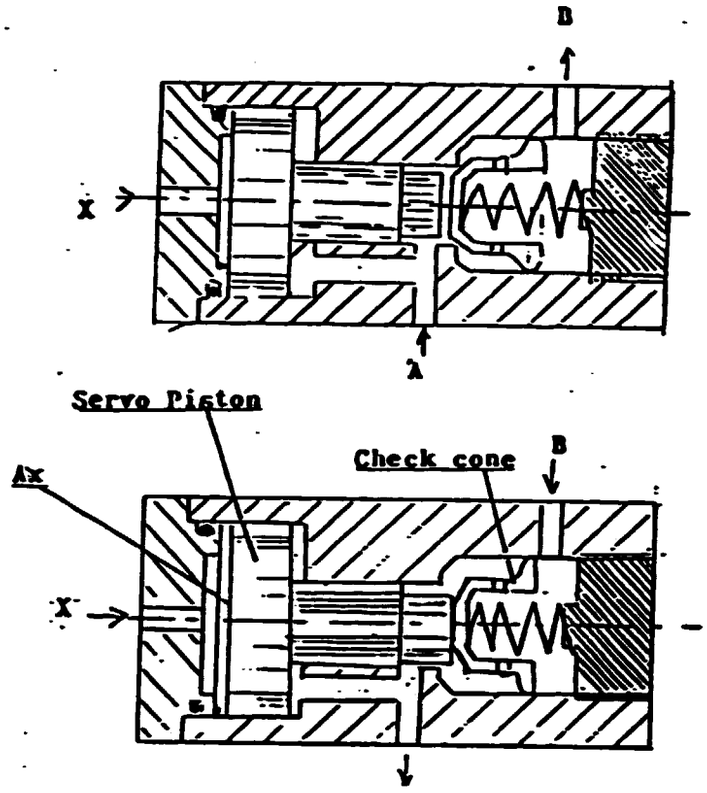
Pressure Pe1 acts upon ball valve (1) causing it to lift off from its seat (3) and permitting flow.

Pressure Pe1 must overcome the slight force exerted by compression spring (2).

If pressure Pe2 acts in the opposite direction, it adds to the spring force, causing the ball valve to be forced against its seat. The flow is blocked.

If pressures Pe1 and Pe2 act together, flow occurs when Pe1 greater than Pe2 + spring force.

PILOT CONTROLLED CHECK VALVE



Application

A pilot controlled check valve permits fluid flow in one direction, blocking it in the opposite direction. Fluid flow in the opposite direction is released by a control fluid, i.e. the check valve is released.

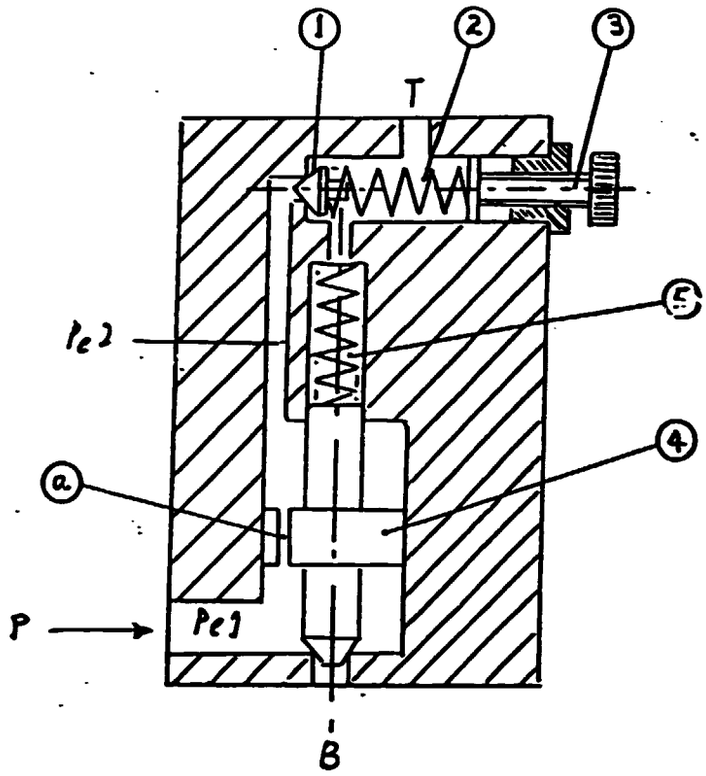
Operation

The fluid flows from A to B against a small resistance (check cone-spring). The servo piston assumes the left-hand position in the housing.

Flow from B to A is not possible since the check cone blocks the fluid flow.

If fluid flow from B to A is required, check cone must be lifted from its seat by pressuring servo piston via control line X. Servo piston lifts the check cone against the spring force and prevailing operating pressure. The greater force required is provided by the control pressure acting on Area Ax.

SEQUENCE VALVE (PRESSURE-DEPENDENT CONTROL)



The sequence valve opens when a specific adjustable pressure is reached and permits flow to another hydraulic system.

Operation

When the valve closed, the fluid flows at P into the inlet. Fluid flows through throttle bore (a) to pilot cone (1), which is held in its seat by the pre-tension of spring (2). This pre-tension and hence the opening pressure of the valve are determined by the setscrew (3).

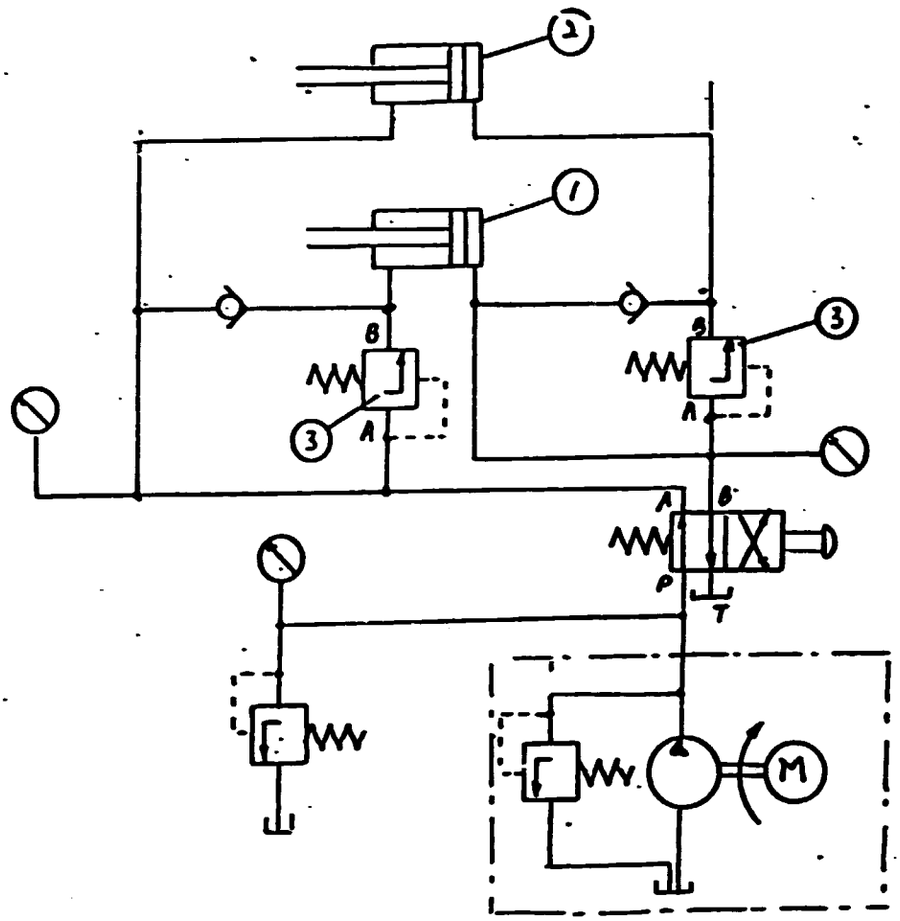
The fluid exerts pressure Pe1 on the inlet side of valve spool (4). A pressure Pe2, which is equal to Pe1 on account of the uniform pressure distribution, builds up via throttle bore (a) downstream of the valve spool and upstream of the pilot cone.

If as the pressure increases the force on pilot cone (1) exceeds the set spring force of compression spring (2), the pilot cone opens and fluid flows to reservoir via T. Opening of the pilot cone causes pressure Pe2 to drop. The quantity of fluid flowing via throttle bore no longer permits pressure compensation.

Thus a pressure difference p develops at the valve spool. The pressure difference increases further as Pe1 rises.

This increased pressure difference causes valve spool (4) to lift off from its seat against the spring force of compression spring (5). The fluid can now flow into another system via B.

SEQUENCE VALVE (PRESSURE-DEPENDENT CONTROL)



A hydraulic system for discussion, utilising sequence valves is shown in the circuit drawing above. In the hydraulic system, the clamping piston (2) should only move out after the transfer cylinder piston (1) has reached its end position.

Forward Motion

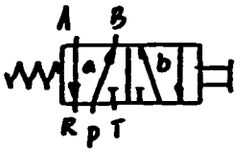
When the 4/2-way directional control valve is actuated, the transfer 3/4 piston (1) should first move out, then the clamping piston (2).

Return Motion

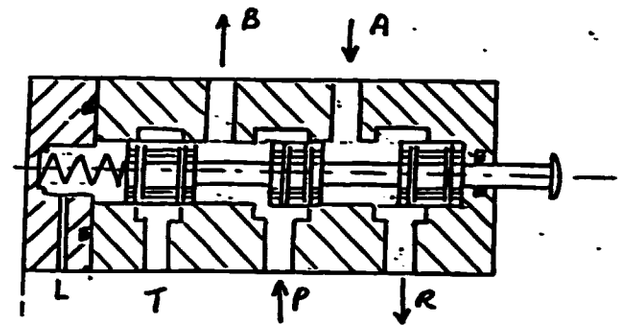
When the 4/2-way directional control valve is reset by the spring to its neutral position, clamping piston (2) should first return, then transfer piston.

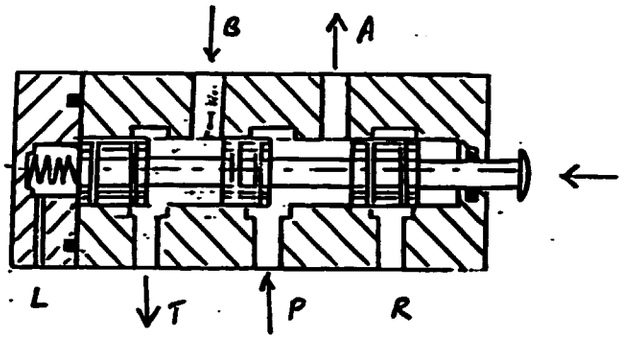
The abovementioned sequencing is made possible by the introduction of two sequence valves (3).

5/2-WAY DIRECTIONAL CONTROL VALVE



Graphical symbol



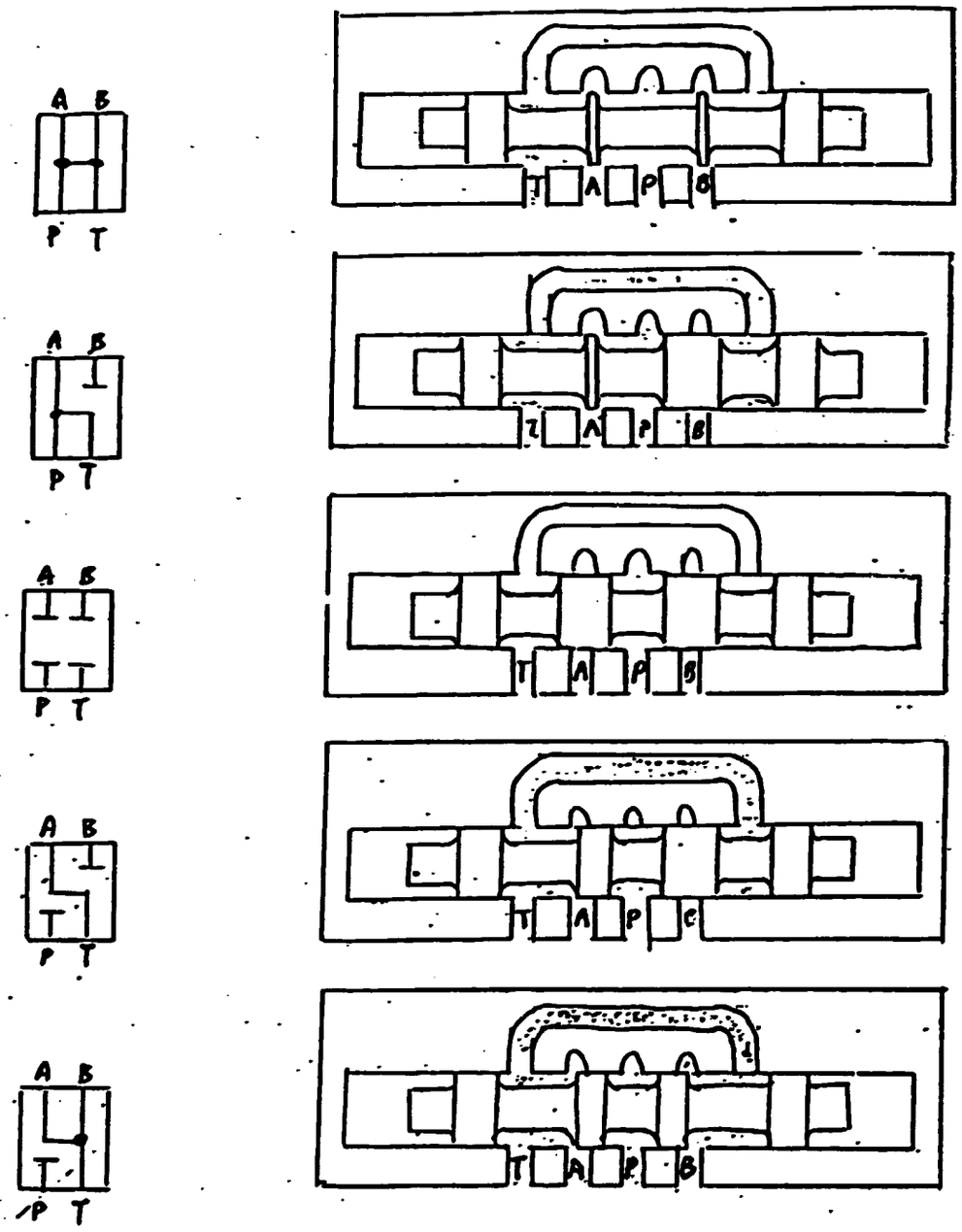


Operation

The sliding spool of the 5/2-way directional control valve (5 connections, 2 positions) releases the flow from P to B and A to R in the neutral position. Connection T is blocked.

When the lever is actuated, the sliding spool moves to the other end position, permitting flow from P to A and B to T. Connection R is blocked.

Once the lever has been released, the compression spring returns the sliding spool to the neutral position.



Various Centre Conditions for 4-way Valves

SAFETY RULES

SAFETY RULE NO. 1

GENERAL SAFETY

1. Be alert always to protect yourself.

2. Give proper advice and correct your subordinates or fellow workers on their unsafe practices.

3. Report all unsafe conditions/acts to your immediate superiors.

4. Obey all safety signs posted in the Yard.

5. Do not horseplay while at work.

6. Use the necessary personal protective equipment as required.

7. Never enter or work in any confined spaces unless authorised and there is adequate lightings and sufficient ventilation.

8. Report immediately to your superiors and get immediate treatment for all injuries, whether serious or not, from the Medical Centre.

SAFETY RULE NO. 2

HOUSEKEEPING

1. Clear your workplace at all times.

2. Gangways, passageways and demarcated lines should be kept free from obstructions.

3. Dispose all combustible materials in proper bins or containers.

4. Spilled liquids, paints, oil, etc., on the floor, deck, and working surrounding should be mopped up.

5. All materials, tools, equipment, etc., must be properly stacked and brought back to workshop or designated places after use.

6. All obstruction in access-ways and fire exits should be removed.

7. Cables, hoses and other service lines should be arranged in a tidy and orderly manner.

8. Toilets to be maintained and kept clean.

SAFETY RULE NO. 3

PERSONAL PROTECTIVE EQUIPMENT

A. Head Protection

1. Safety helmets must be worn at all times at operational areas.

B. Face and Eye Protection

1. Welding shields must be worn when performing welding. Welding lenses that are pitted or cracked must be replaced.

2. Fitters performing oxy-acetylene cutting should also wear goggles.

3. Goggles, safety spectacles or face shields must be worn during operations where foreign bodies, flying sparks, corrosive and glare are liable to injure the eyes/face.

C. Hand and Arms Protection

1. Hand gloves should be worn when handling sharp objects.

2. Suitable rubber gloves should be worn when handling chemicals, aromatic oils and electric appliances.

3. Heat resistence gloves should be worn when handling hot objects.

4. Arm sleeves (heat/flame retardant) should be worn when welding at close quarters or when handling molten metals.

D. Foot and Leg Protection

1. Safety shoes must be worn at all times while working.

2. Leggings or gaiters should be worn when handling molten metals.

3. Leggings or gaiters should be worn when welding.

4. Rubber boots should be worn when chemicals are handled.

SAFETY RULE NO. 3(cont..)

E. Body Protection

1. Aprons should be worn by welders when doing overhead welding at close quarters and by those handling chemicals.

2. Ear plugs or muffs must be used when working in noisy area (85 dBA).

3. Safety belts must be used when working at height (3 M. above ground or platform level).

4. Suitable respirators must be worn when working in contaminated atmosphere of gas, dust, vapour or fumes. (Read instructions carefully on cartridge before use).

SAFETY RULE NO. 4

HEALTH AND SANITATION

1. Get first aid treatment immediately when you sustained any injury whilst at work.

2. If you fall ill whilst working, do not continue to work but report to the Medical Officer for treatment. If the illness is cause by the work environment, warn the others, stop work and leave the area. Report immediately to your Supervisor and/or the Safety Officer.

3. Keep all toilets, washrooms and locker areas neat and clean.

4. Throw all food wrappers, plastic bags, etc., into dustbins provided throughout the worksite.

5. Wash yourself after comming into contact with any solvents or chemicals.

6. Never rub your eyes when particles get into them. Seek medical treatment.

SAFETY RULES NO. 5

HAND TOOLS

A. General Guidelines

1. Check all hand tools before using them. All defective tools must be replaced or repaired.
2. Always carry your hand tools in a tool box or proper container.
3. Never leave the tools scattered on the floor.
4. Use the right tools for the right job.

B. Hammers

1. Do not use the hammer if the head is chipped or badly worn.
2. Hammer head must be properly secured to the shaft - NO IMPROVISION IS ALLOWED.
3. Cracked or split hammer shaft should be replaced.
4. Hammer head should be kept free from oil or grease.

C. Chisels

1. Burred and mushroomed head chisels should not be used, such tools should be dressed.
2. Keep chisels head free from oil and grease.

D. Files

1. Do not use file without a handle.
2. Do not use a file for prying or levering.
3. Always grip the file firmly.
4. When filing burrs on a lathe, do not wrap rag or cloth around the file handle; do not wear long sleeves shirt; ensure length of file is suitable and safe for the job; and do not wear gloves.

SAFETY RULE NO. 5(cont..)

E. Spanners

1. Do not use splayed open-end spanner and box spanners showing signs of splitting.
2. Use rigid-jawed spanners in preference to adjustable spanners where possible.
3. Check monkey wrenches or adjustable spanners for free play and and spraying of the jaws.
4. Pull spanner towards yourself whenever possible.
5. Use the correct size spanner for the job.
6. Do not use spanner as a hammer.

F. Screw Drivers

1. Do not use the screw driver as a chisel.
2. Never grind the edge of a screw driver.
3. Use correct size screw driver for the job.
4. Avoid holding the job in the hand when using screw driver.
5. Repair a split handle.

G. Hacksaws

1. Do not twist the blade or apply too much pressure during sawing. The blade may brake and cause injury.
2. Pressure should always be applied on the downward stroke.

SAFETY RULE NO. 6

A. ELECTRICAL TOOLS

1. All electrical power tools must be effectively grounded.

2. Electrical cords must be inspected periodically and kept in good condition.

3. Socket outlets must always be used to provide electricity, never to receive it.

4. Damaged or cracked plugs or sockets must be removed immediately and replaced with good ones.

5. Proper wire or cable connectors must be used.

6. Electrical wire must be protected from sharp objects and corners, heat, oil or solvents that might damage the insulation.

7. Disconnect the power when moving the tools around.

8. Do not use unguarded tools or remove tool guards.

9. Do not use electrical power tools in an explosive atmosphere which has not been gasfreed.

10. Do not temper with any electrical connections or the tools. Seek an electrician to do the repairs.

11. When large power drills are used, small pieces of work must be clamped to prevent whipping.

12. Electrical circular saw should be started and stopped outside the work.

13. The guard protecting the blade should operate freely and enclose the unsafe portion of the blade when it is cutting.

14. Electrical grinders must be held correctly to prevent the wheel from touching the body.

15. Keep the wheel away from water, or oil so as not to affect its balance.

16. Grinders should be marked to indicate the maximum wheel size and speed.

SAFETY RULE NO. 6 (cont..)

B. Pneumatic Tools

1. Do not use air hose for removing dust from clothing.

2. Always suspend hoses over aisles or work areas to avoid tripping hazards.

3. Ensure that air hoses are tightly and properly connected to prevent whipping.

4. Do no squeeze the trigger until the tool is on the work.

5. Wear safety goggles when using pneumatic impact tools.

6. Always follow the manufacturer's instruction on the proper use of pneumatic tools.

7. Examine couplings in hose and hose connections to the tools to see that they are in good conditions.

8. When changing tools or connecting and disconnecting them to air hose, be sure that the air supply is turned off. Do not kink the hose to make connections.

SAFETY RULE NO. 7

1. All prime movers and transmission machinery parts must be securely fenced.

2. When practical, all dangerous of machinery must be properly guarded.

3. Before working, all guards must be checked for their correct positions and functions.

4. Never adjust guards when the machine running.

5. Report immediately to supervisors for any defect found or missing guard.

6. Do not temper with guards.

7. Replace all guards removed for purpose of maintenance or repair.

8. rning signs must be displayed on faulty machinery.

9. Never put on loose clothing and rings when working on and around machinery.

10. Never use a cracked or wear down grinding disc.

11. Operate jcnly on machine that you are trained and authorised.

12. Do not leave machine unattended.

13. Keep the floor around the machine clean, clear of scrap, swarf and metal chips.

14. In case of wood working machinery (circular saw), always use a push stick to feed the timber.

SAFETY RULES NO. 8

FALL OF PERSON

(A) Fall from Same Level

1. Practice good housekeeping to prevent tripping.
2. Report defective floor, slippery ground and obstacles.
3. Mop up oil spills.
4. Ensure sufficient lightings.
5. Use proper footwear.
6. Avoid walking into cloud of dust or steam which could obscure vision.

(B) Fall from Height

1. All ladders must be visibly inspected for defects.
2. Ladders must be properly pitched on sound foundation and secured.
3. Ladders should extend one meter above platforms or ledges to provide safe foot and hand hold.
4. Ladder rungs must be free from oily and slippery substances.
5. Wooden ladder must not be painted.
6. Use both hand whilst climbing a ladder. Do not carry objects in your hands.
7. Do not use boxes, drums or makeshift materials as a means of going aloft.
8. Anchor your safety belt when working at height.

SAFETY RULES NO. 8 (cont..)

9. When work is to be carried out on a scaffold/work platform, ensure the followings:-

   (a) access ladders are provided and secured;

   (b) the structure is rigid, free from defects and adequately secured

   (c) all open ends are railed.

10. When work is to be carried out on a Bosun's chair, ensure the followings:

   (a) life-line must be used;

   (b) gantline and life-line must be inspected before use; and

   (c) the stage is rigid, free from defects and correctly rigged.

11. Crawl boards, safety belts and life-lines must be used when working on fragile roofs.

12. All openings, pits, tranches, etc., should be fenced or covered with gratings.

13. During hours of darkness and in areas with insufficient lightings, all openings and means of access should be adequately illuminated.

14. Where a gangway leads on to a bulwark, a step platform should be provided for safe access to the deck.

SAFETY RULES NO. 9

MANUAL LIFTING/HANDLING

1. Do not handle sharp objects without adequate hand protection.

2. Do not attempt to lift objects in excess of your capacity - get help or utilise mechanical aids.

3. Wear safety shoes to avoid foot injury.

4. Use correct lifting method as follows:
   a) Keep the feet at shoulder-width apart;
   b) Keep the back straight;
   c) Tuck in your chin;
   d) Grip the load with the whole hand;
   e) Lift with legs and arms muscles;
   f) Always carry the load close to your body;
   g) Have a clear vision over the load.

5. Choose a suitable place for putting down your goods it is easier to place goods on a bench at waist height than on the floor.

6. When working in a team, pre-arranged signals should be well understood and only one person should give the orders.

SAFETY RULES NO. 10

MECHANICAL LIFTING

Forklift

1. Only authorised persons are allowed to drive forklifts.
2. Hands on steering wheel must not be oily.
3. Never overload forklifts.
4. Never overstack goods or materials to block your vision.
5. All goods and materials must be properly secured and balanced.
6. Keep a clear view of the path of travel. Do not speed.
7. Reduce speed when negotiating turns.
8. Avoid travelling on undulating ground.
9. Stop at blind corners or intersection to prevent collusion.
10. Never leave the suspended or elevated load unattended.

SAFETY RULES NO. 11

Mechanical Lifting (Cranes)

(A) Before starting the crane, check that:

1. There are no external damage to the crane.
2. Wires, hooks, hoist or jib are visibly in order.
3. All working liquids in automation are in correct level.
4. All control are in neutral.
5. All switches, alarms, and safe load indicators are working correctly.
6. Brakes are effective.
7. The ground/foundation is firm and level (mobile/crawler cranes)
8. When a mobile (telescopic) crane is used, ensure that the outriggers are tested in order.

(B) During operation, ensure that:

1. Any load to be lifted is within the safe working limit of the crane;
2. No obstruction to the working paths and movements of the crane;
3. Work only on the signals of the authorised signaller in full view, or where he cannot be seen, the intermediate signaller.
4. Always lift the load a few centimetres above ground level to test its stability before raising it fully.
5. Loads are straight lifted and not slewed over workers, load must be correctly sling, never 'snath-lift' a load.
6. Always ensure that the load is lifted and lowered slowly.
7. When lifting a load with a mobil (telescopic) crane, always use the shortest boom possible, and ensure the outriggers are fully extended and secured.
8. Comply with other instructions of the crane manufacturer.

SAFETY RULES NO. 12

Mechanical Lifting (Lifting and Lowering of Load)

1. Ensure correct capacity wire ropes and shackles are used for securing the load.

2. Check and ensure that the wire slings and shackles used are free from defects.

3. Select strong support points for lifting and ensure the load is properly secured.

4. All loose objects on the load must be removed or properly secured.

5. Slings must be protected by padding against sharp edges of the load.

6. All shackles pins must be fully fastened.

7. Do not effect a lift if the angle formed by the bight (loop of rope) exceeds 120°.

8. Ensure that the hoist line is directly over the centre of the load to prevent swinging.

9. Always keep hands and fingers away from pinch-points.

0. Maintain good position so as not to be trapped inbetween the moving load and its surrounding objects.

1. Use suitable stays or tag ropes to guide the load if necessary.

2. When lowering the load ensure that:
   (a) the ground is level and firm,
   (b) the ground is clear of obstruction and persons,
   (c) supports are used to rest the load, and
   (d) slings and its attachments are not to be removed before slings are slacken.

SAFETY RULES NO. 13

Electric Arc Welding (Tools and Equipment)

1. Check and ensure that all welding cables and connections are in good conditions.

2. Use only electric holders that are adequately insulated and free from defects.

3. Carry out regular inspections to ensure that the equipment are in good working condition. Report any defects or damages to your immediate supervisor.

4. Disconnect the electrode from the holder if it is to be left unused.

5. Disconnect the holder from the cable if the holder is to be left unattended.

6. Fit shock preventors (anti-shock device) to all AC supply welding transformers.

7. Effectively earth the metal frame of arc welding machines. Connect welding machine earthing lead close to the point of work.

8. Check earthing connections to determine whether they are machanically strong and electrically adequate for the required current.

9. Do not place welding machines in confined space.

SAFETY RULES NO. 14

Safety in Oxy-acetylene Gas Burning (Tools and Equipment)

1. All gas cylinders in use must be properly secured in an upright position.

2. Ensure correct pressure regulators are securely fitted to gas cylinders.

3. Use cradles, trolleys or other safe means to transport gas cylinders.

4. Do not use chain slings, hooks or magnets to lift gas cylinders, use proper rope slings, nets or cradles.

5. Gas cylinders must not be placed near sources of heat (in excess of 130°F/51.3°C), petroleum products, corrosive substances and electrical conductors.

6. Place gas cylinders in open and accessible areas. Do not place cylinders below deck or in confined spaces.

7. Use no grease on gas cylinders.

8. When handling gas cylinders, ensure that your gloves/hands are free from grease, oil and other waxy materials.

9. Use your gas hoses correctly;
   Blue/Green for oxygen and
   Red for acetylene

10. Check and ensure that there are no leaks at the torch, joints, valves and along the line.

11. Light torch with proper spark gun.

12. Use suitable injector pins to clean torch tip. Do not pressure (press) nozzle tip against solid object with the flame on. (It could give rise to backfire and explosion).

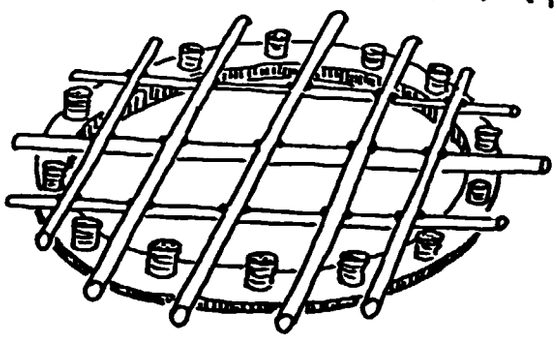
13. Use non-return valves for your burning tools.

14. When a job is to be left unattended, ensure that the valves are properly shut off at the torch and the gas cylinders.

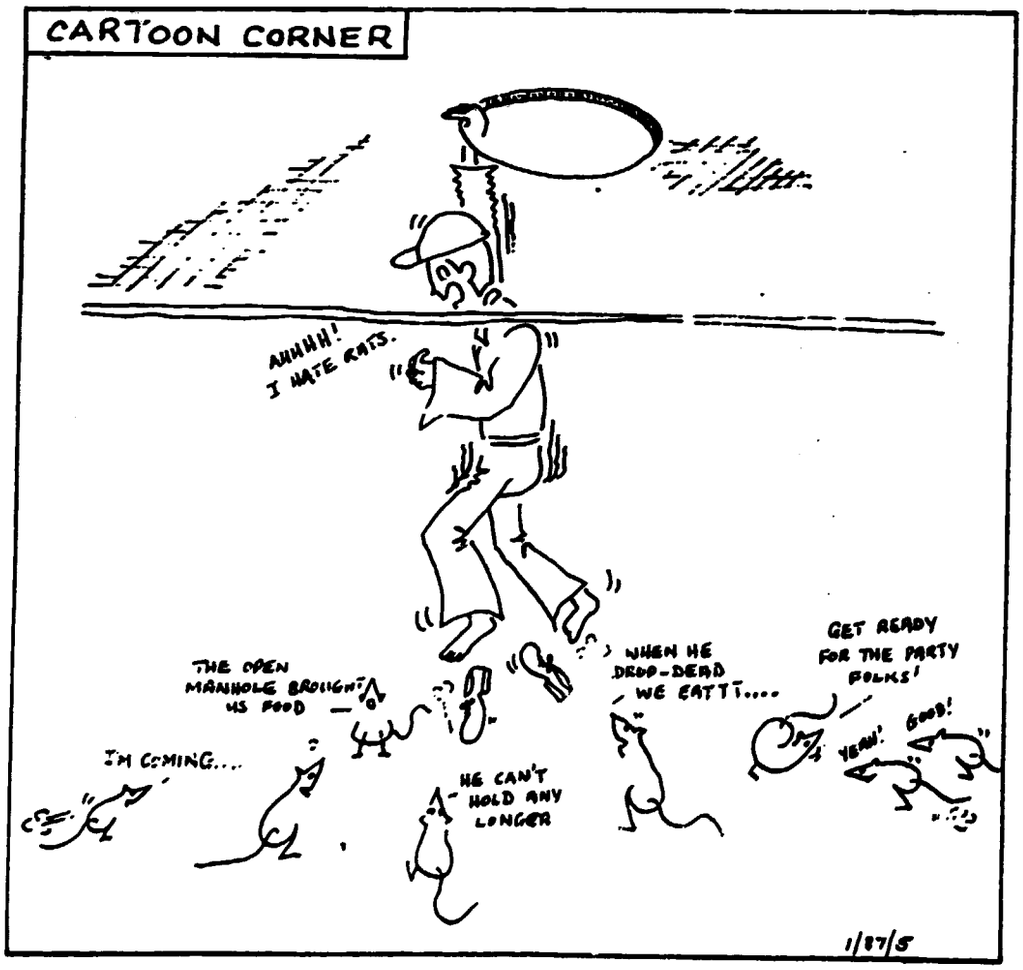
15. Do not leave gas hoses and cutting torch unattended in confined spaces.

CARTOONS

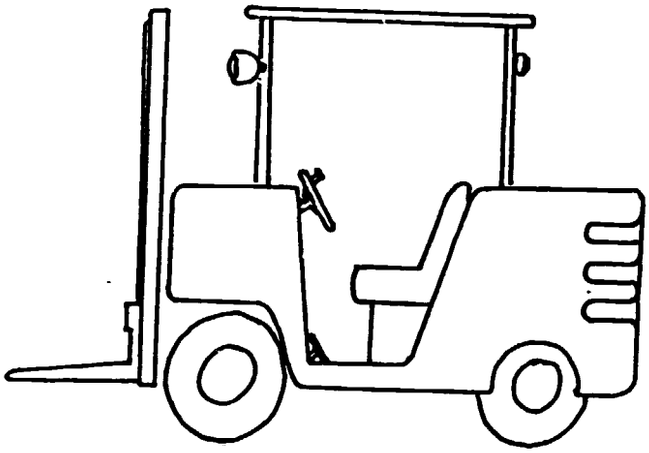
COVER OPEN MANHOLES



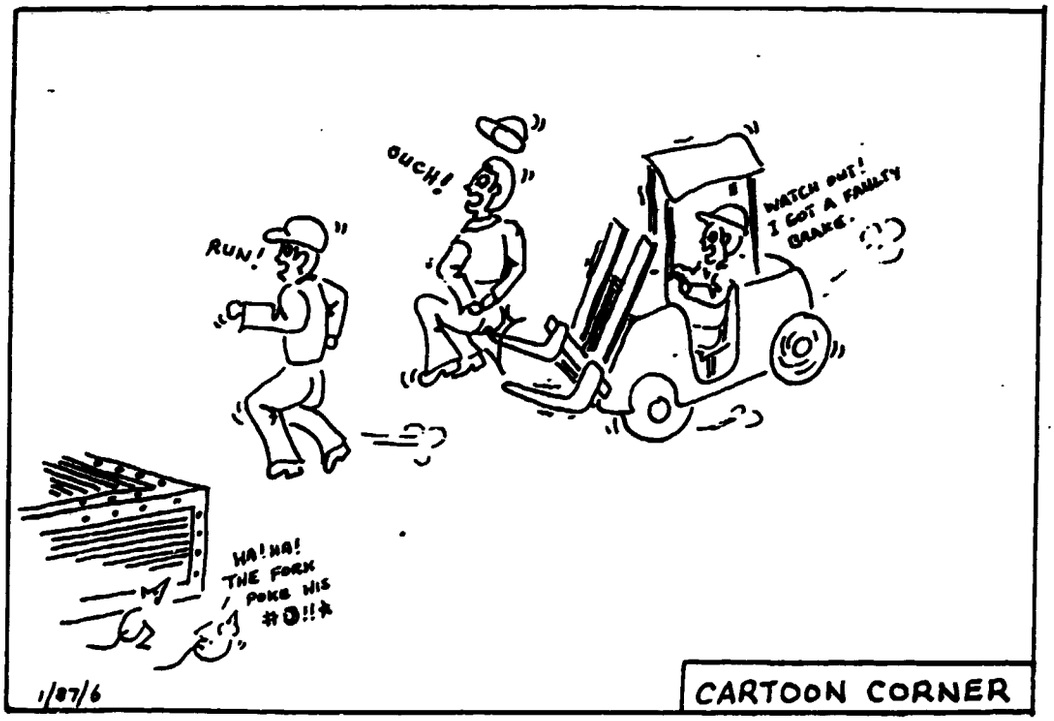
DON'T SET TRAPS

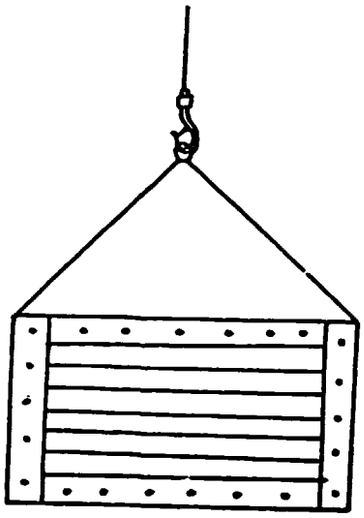


SERVE YOUR FORKLIFT TO SERVE YOU

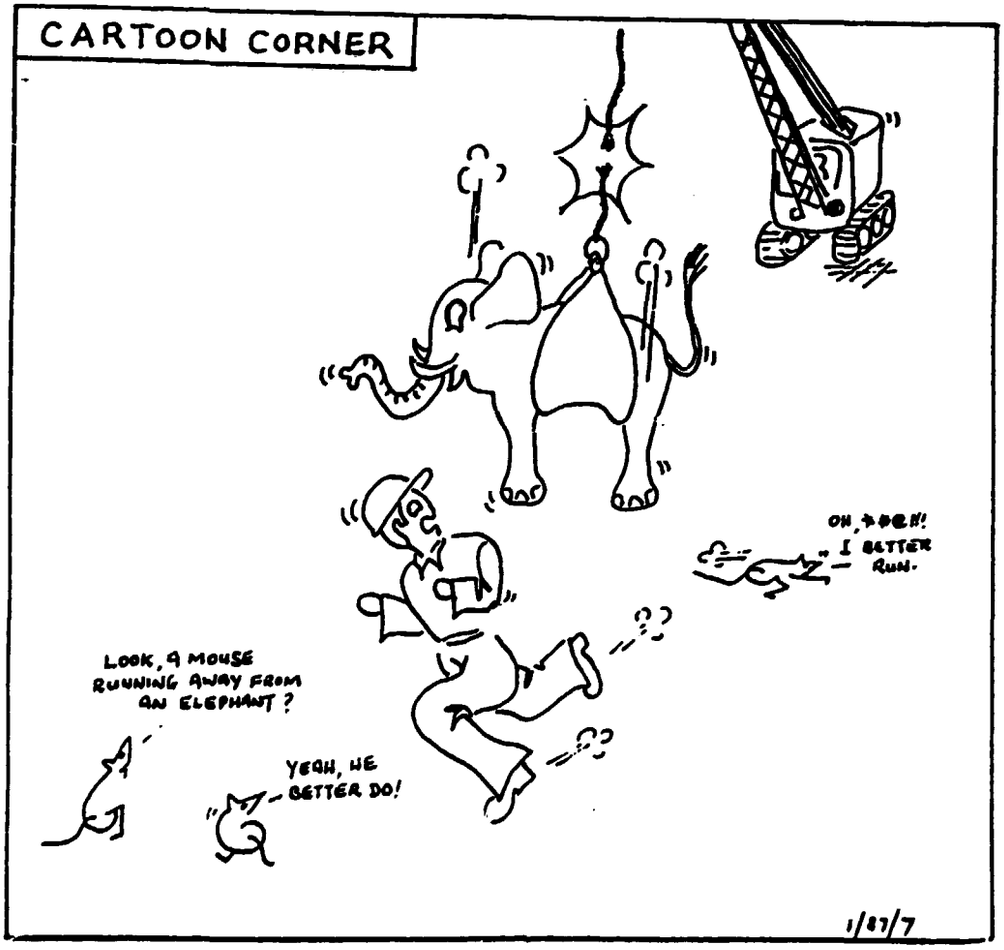


MAINTAIN YOUR FORKLIFT IN GOOD ORDER.

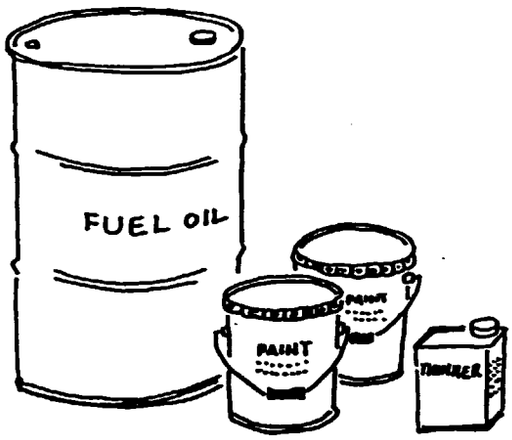




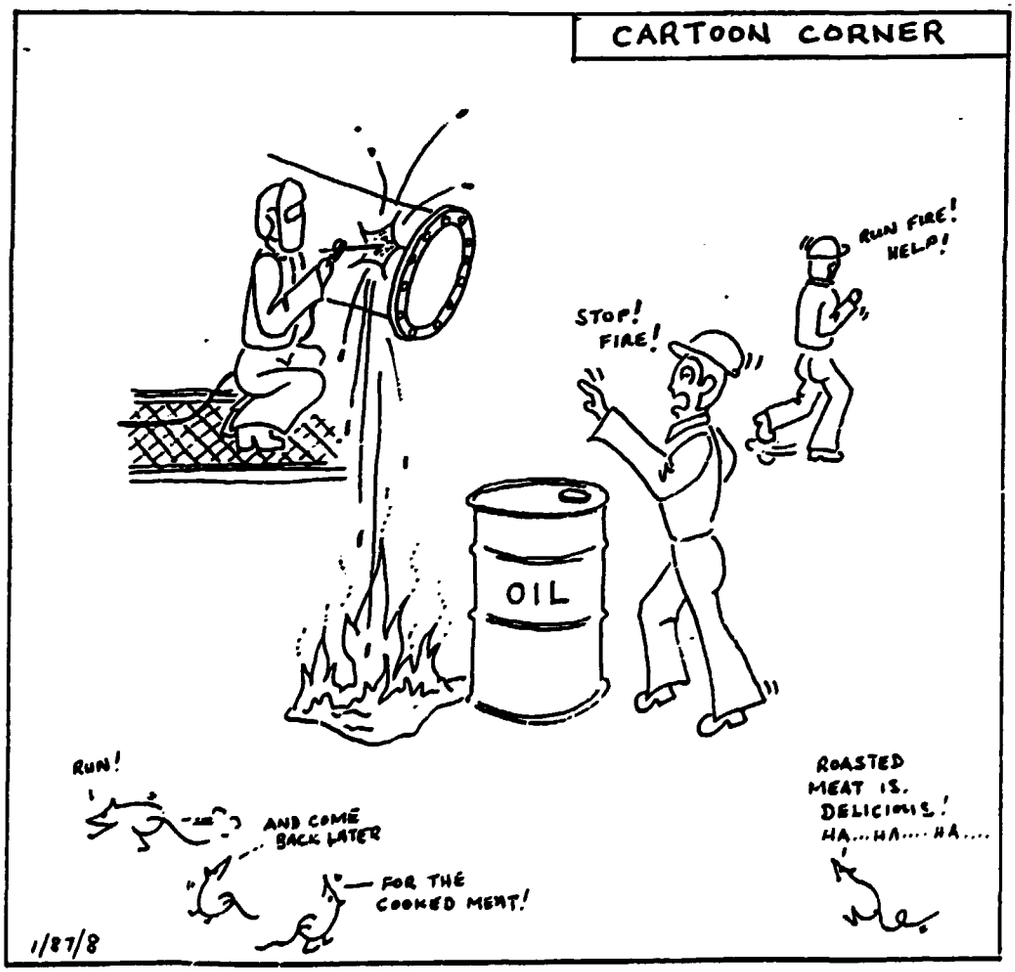
DON'T STAND UNDER
SUSPENDED
LOAD



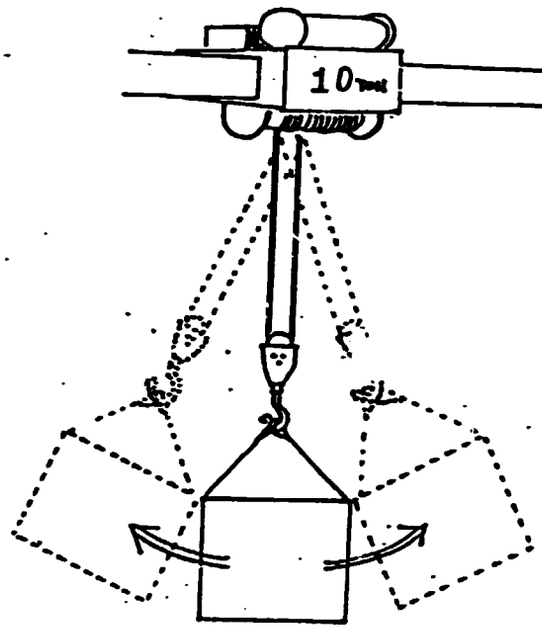
REMOVE ALL FLAMMABLE MATERIALS.....



.....BEFORE HOT WORK.

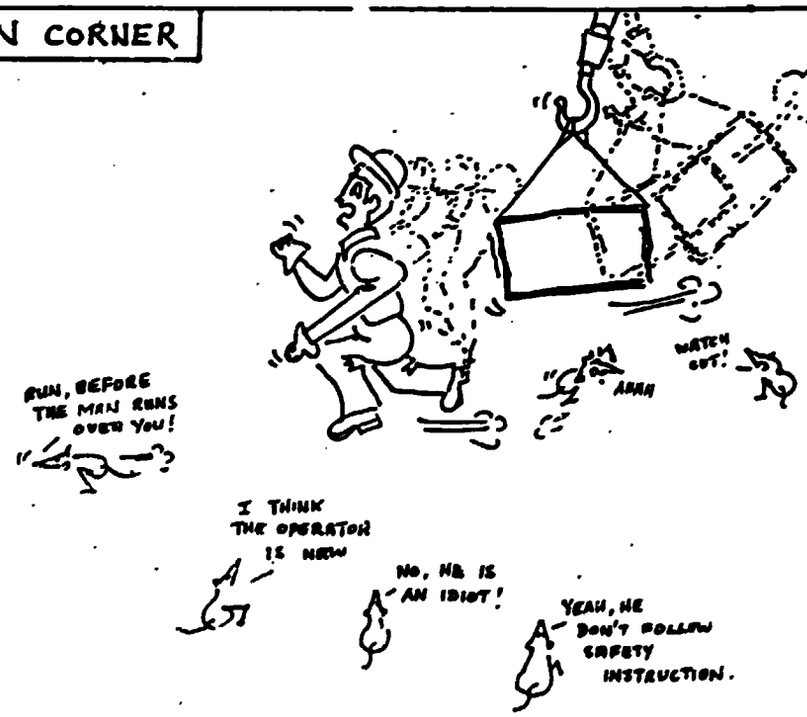


OVERHEAD CRANE



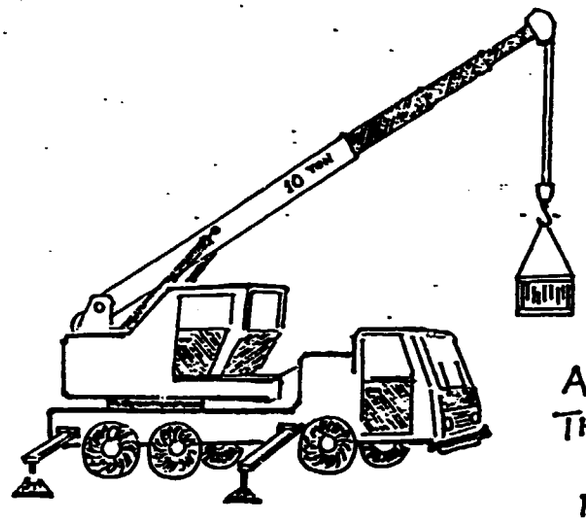
DO NOT ALLOW THE LOAD TO SWING.

CARTOON CORNER



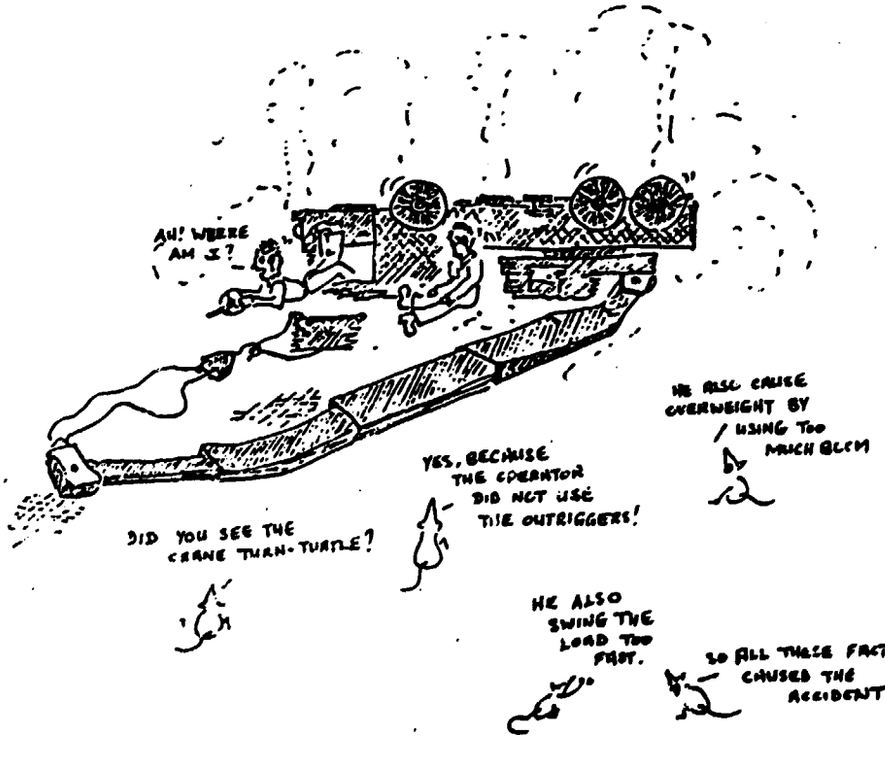
2/27/9

MOBILE CRANE



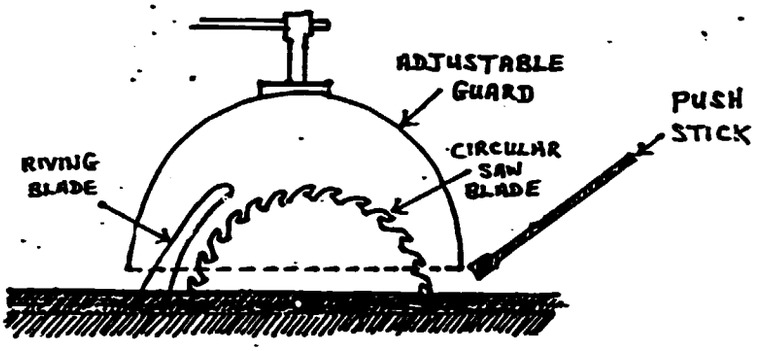
ALWAYS USE THE SHORTEST BOOM POSSIBLE

CARTOON CORNER



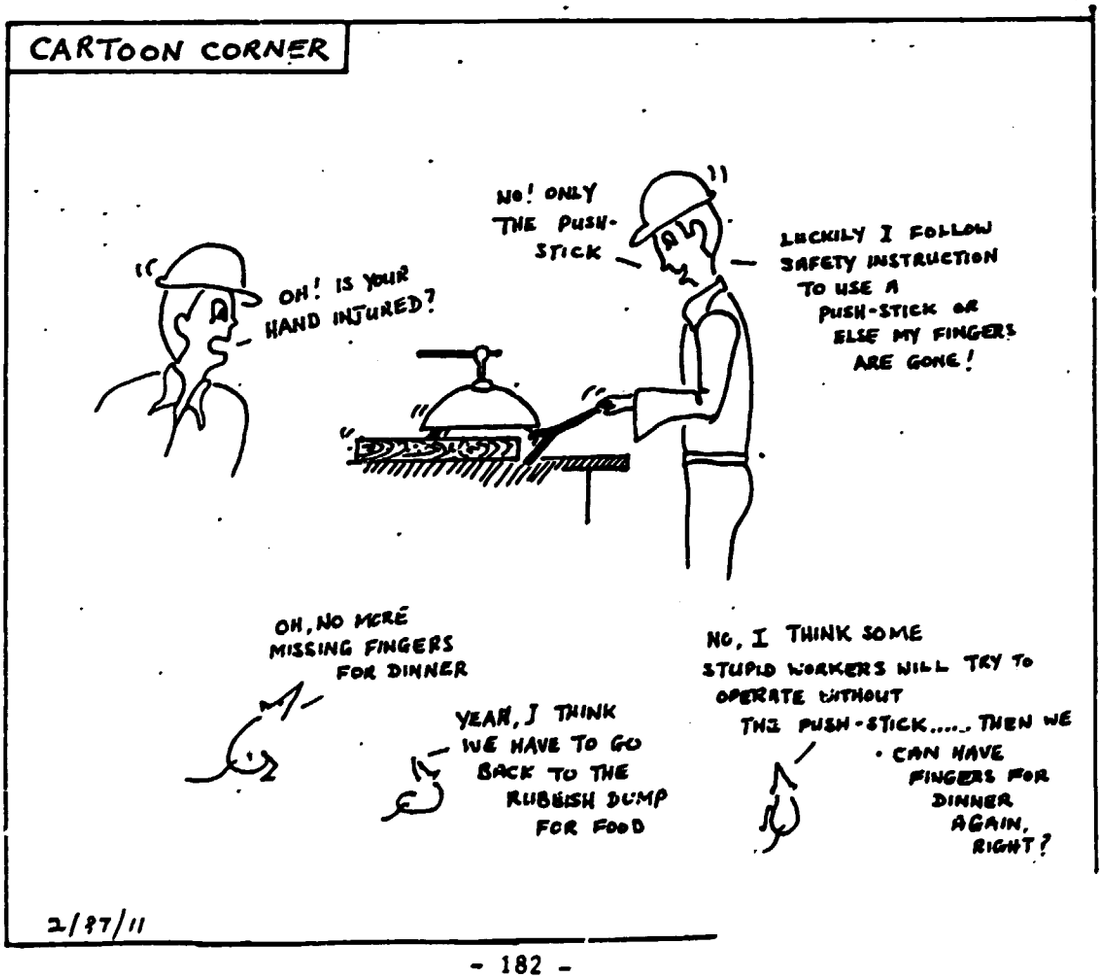
2/27/10

CIRCULAR SAW



GUARD DANGEROUS PARTS

USE PUSH-STICK TO FEED WOOD END

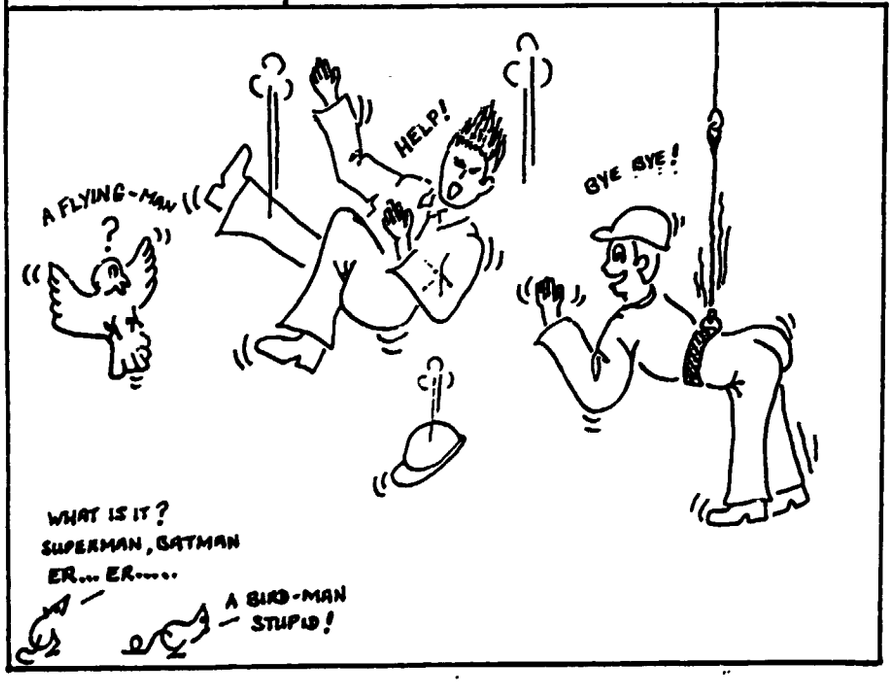


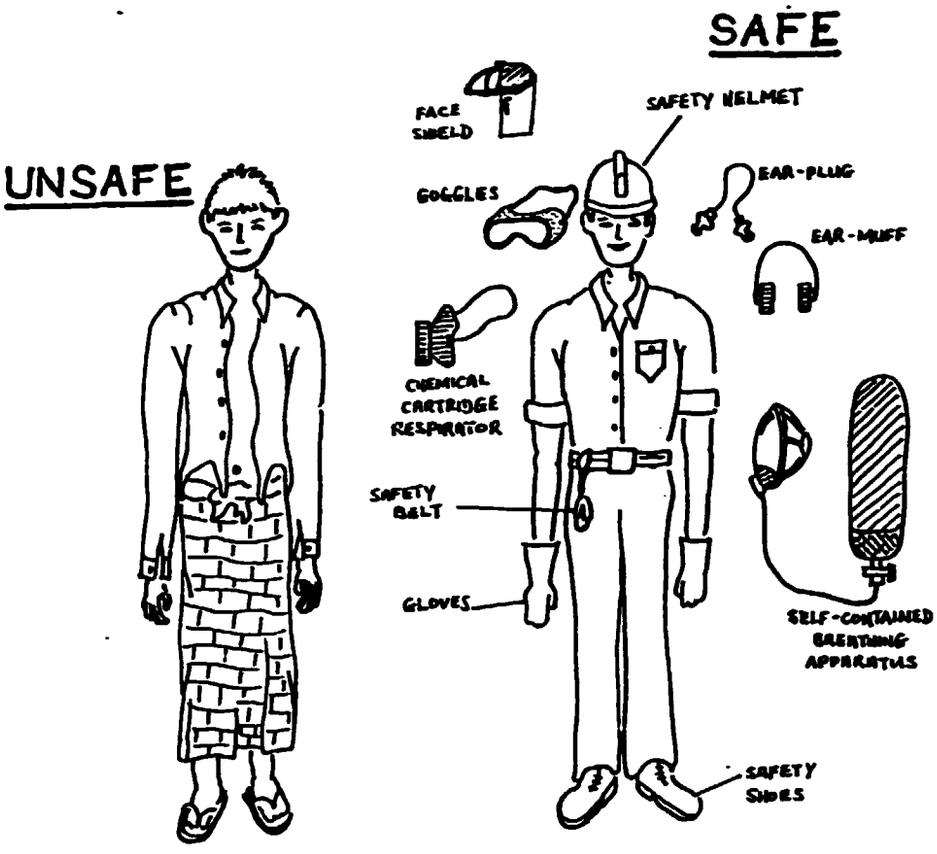
PREVENT FALLS

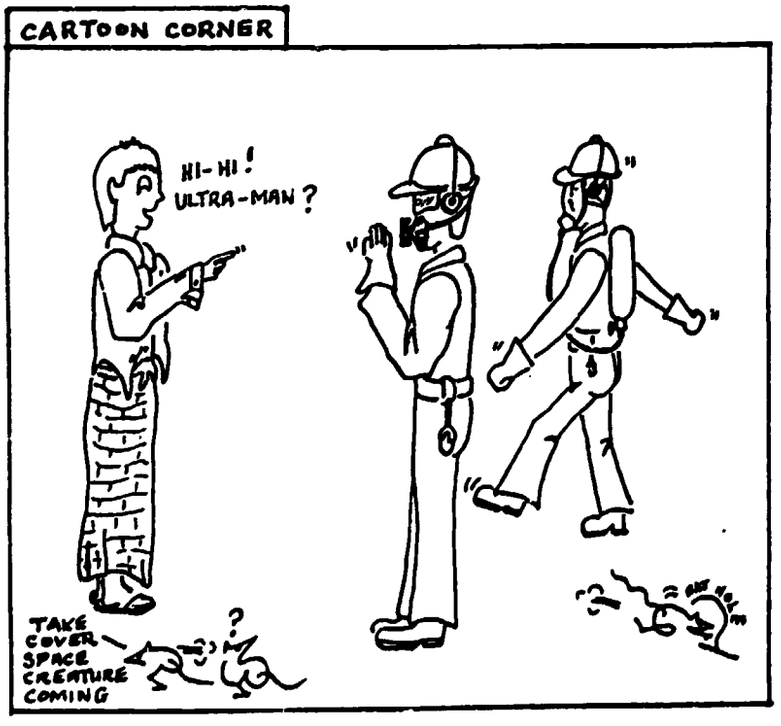
USE

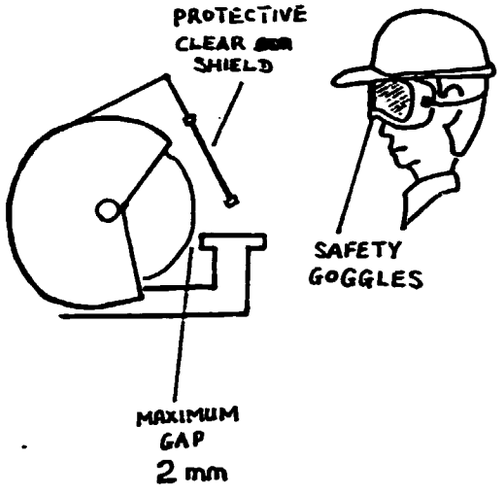
SAFETY BELT

CARTOON CORNER




SAFE
UNSAFE
FACE SHIELD
SAFETY HELMET
GOGGLES
EAR-PLUG
EAR-MUFF
CHEMICAL CARTRIDGE RESPIRATOR
SAFETY BELT
GLOVES
SELF-CONTAINED BREATHING APPARATUS
SAFETY SHOES


CARTOON CORNER
HI-HI! ULTRA-MAN?
TAKE COVER SPACE CREATURE COMING
?



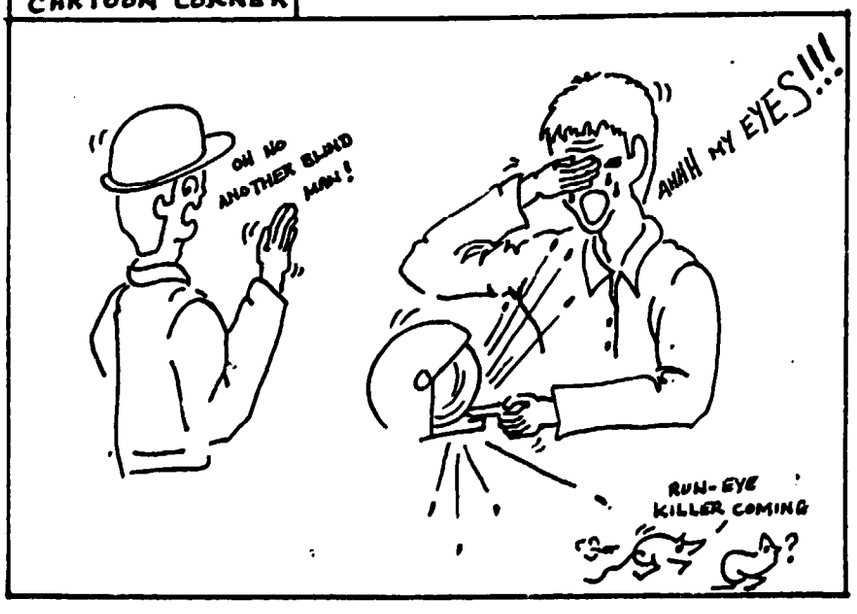
BENCH GRINDER

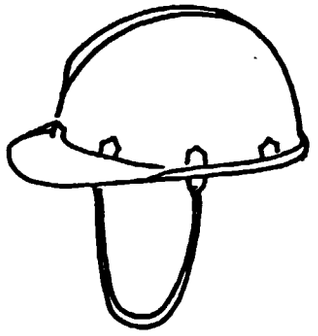
:CHECK GAP CLEARANCE

:MAINTAIN PROTECTIVE
CLEAR SHIELD

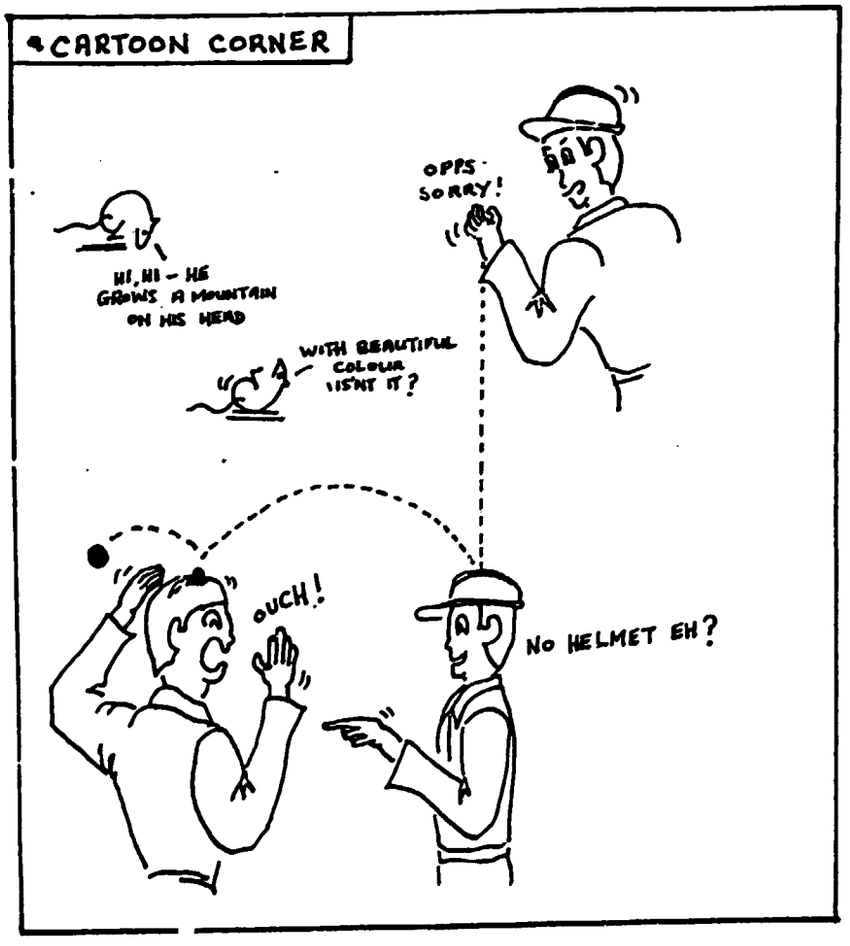
:WEAR SAFETY
GOGGLES

CARTOON CORNER

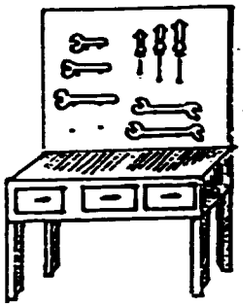


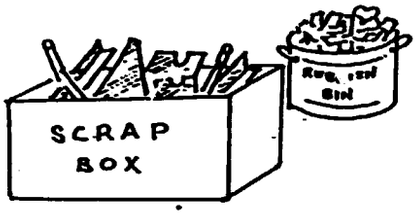


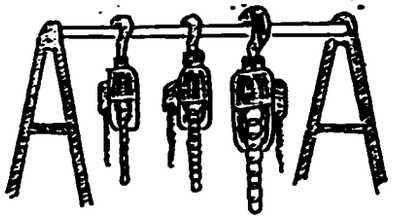
SAFETY HELMET PREVENTS HEAD INJURY



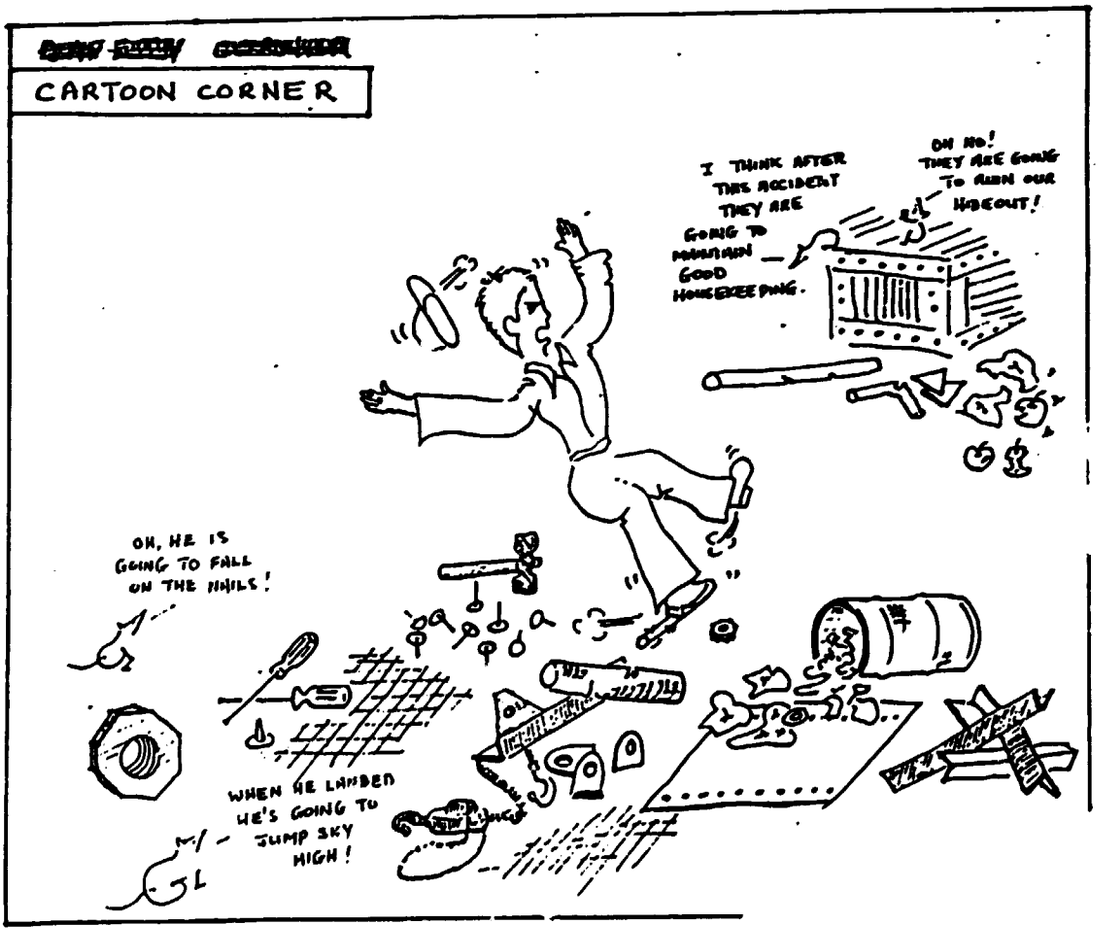
HOUSEKEEPING







MAINTAIN
GOOD
HOUSEKEEPING



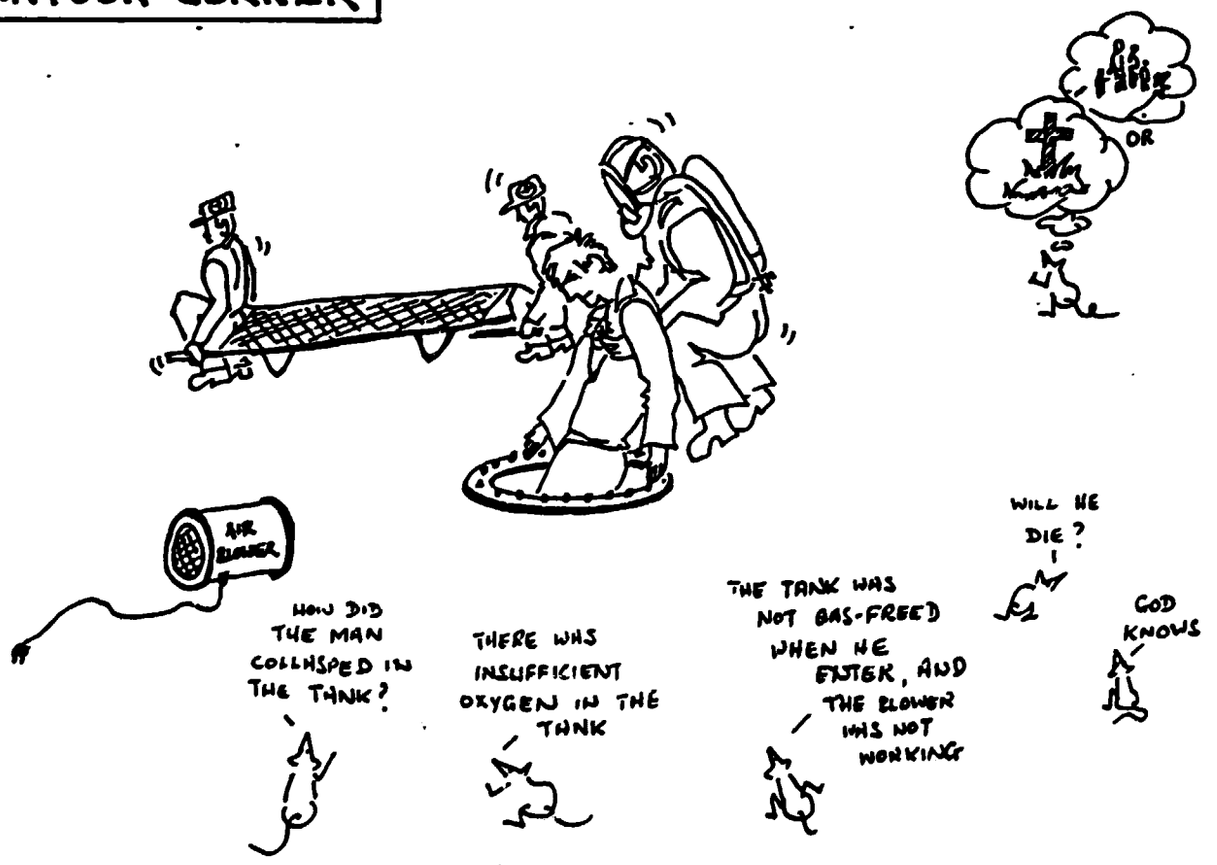
GAS - FREE CONFINED SPACES

CHECK:

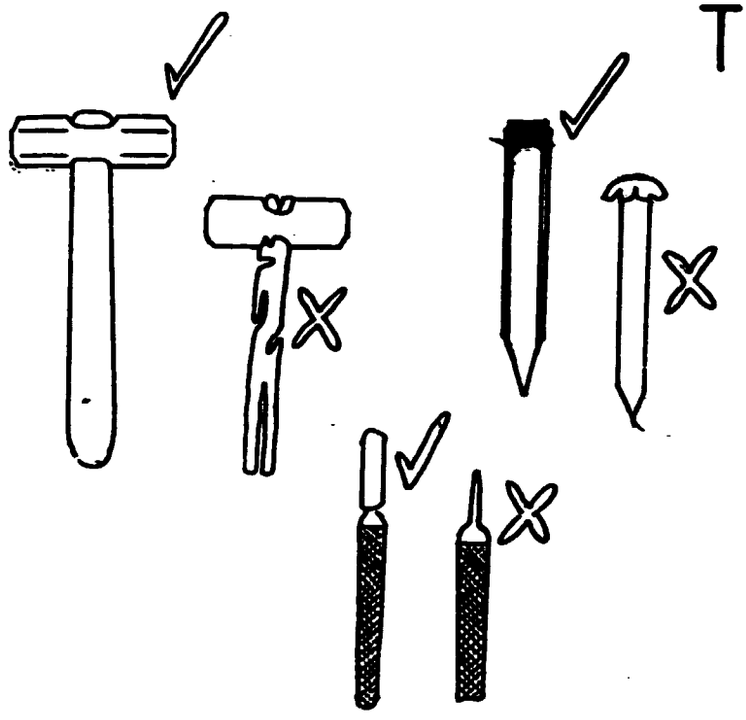
1. OXYGEN DEFICIENCY

2. EXPLOSIVE VAPOUR/GAS.

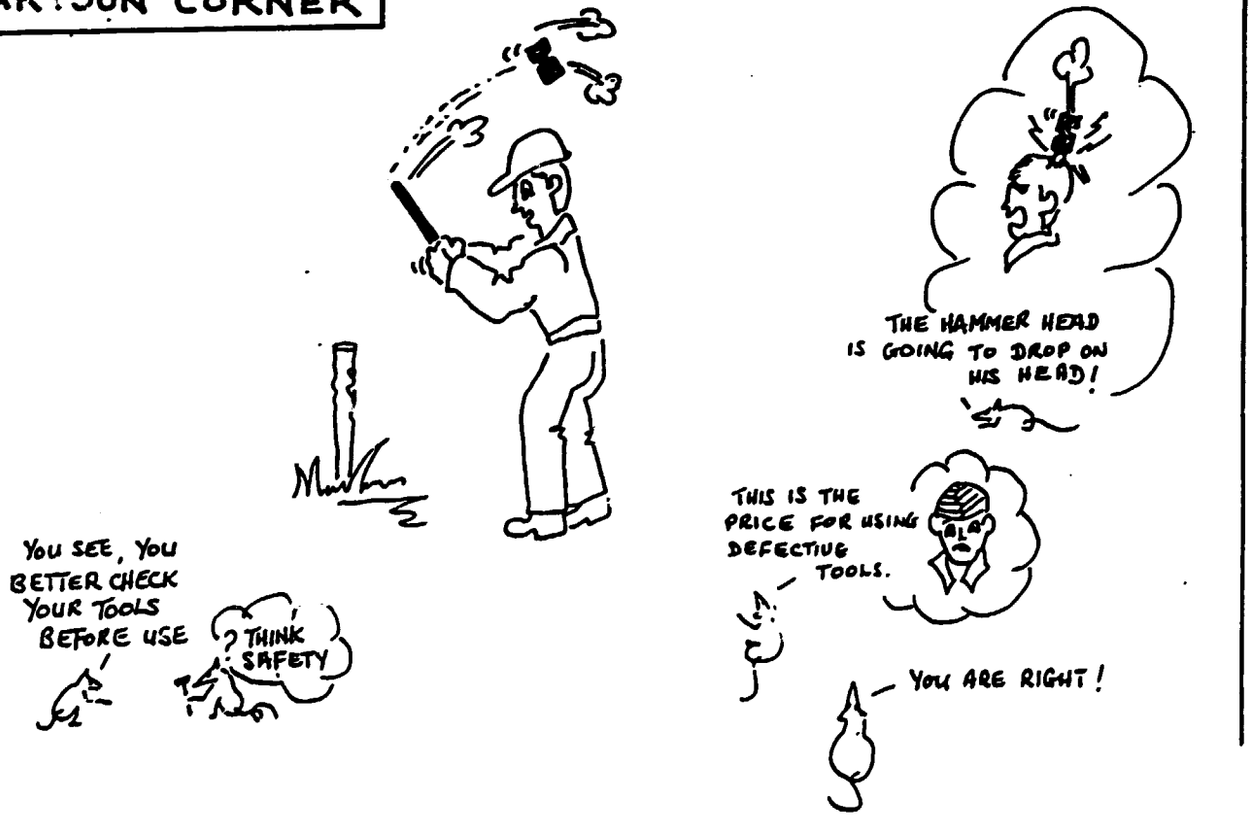
CARTOON CORNER

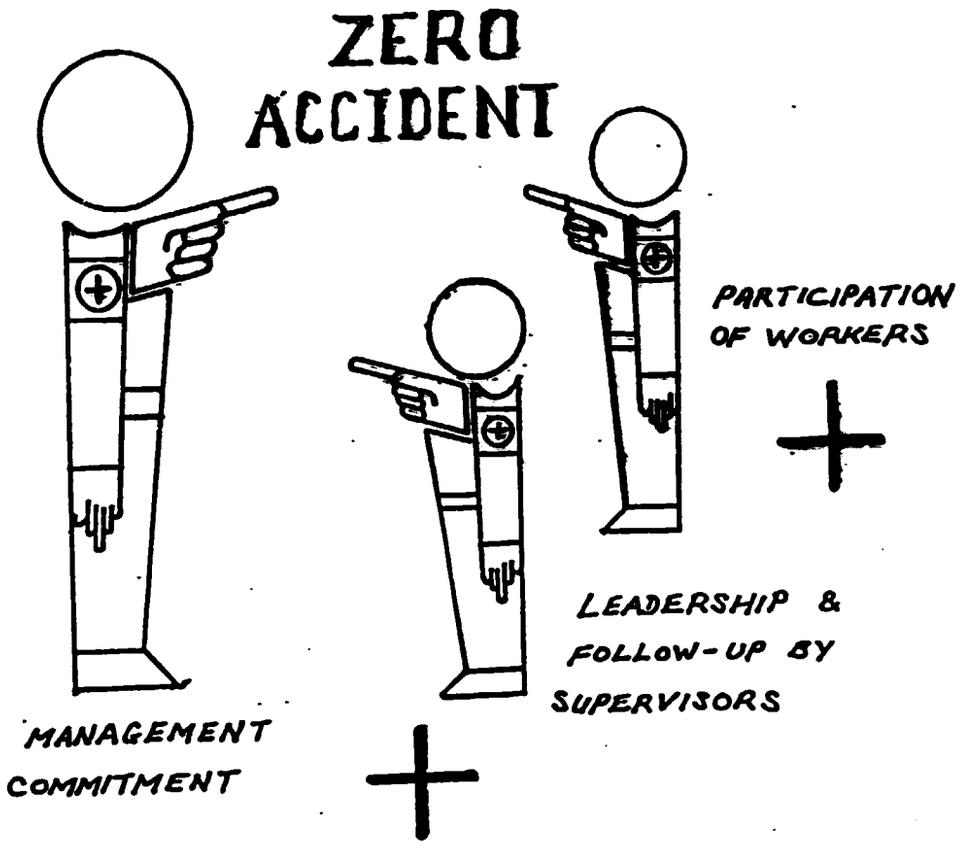


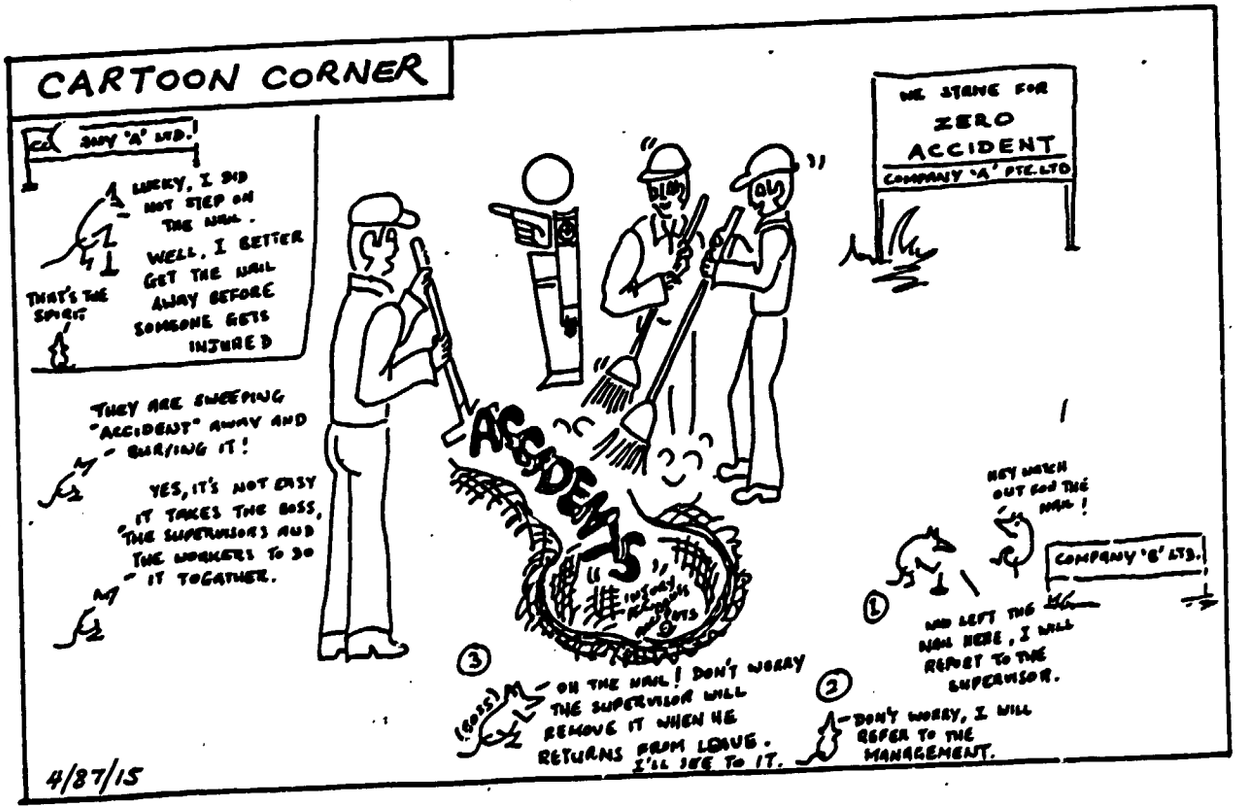
USE PROPER TOOLS



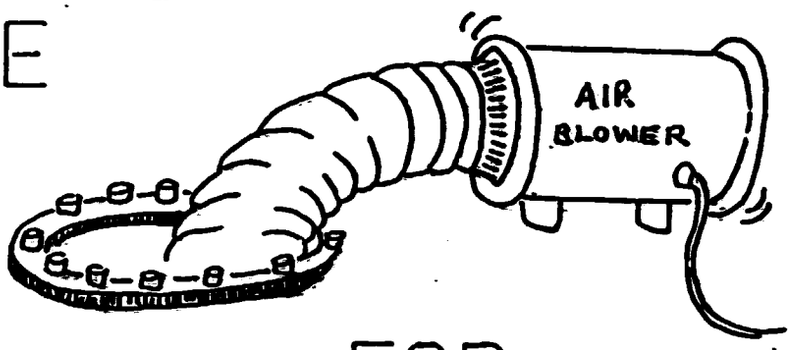
CARTOON CORNER



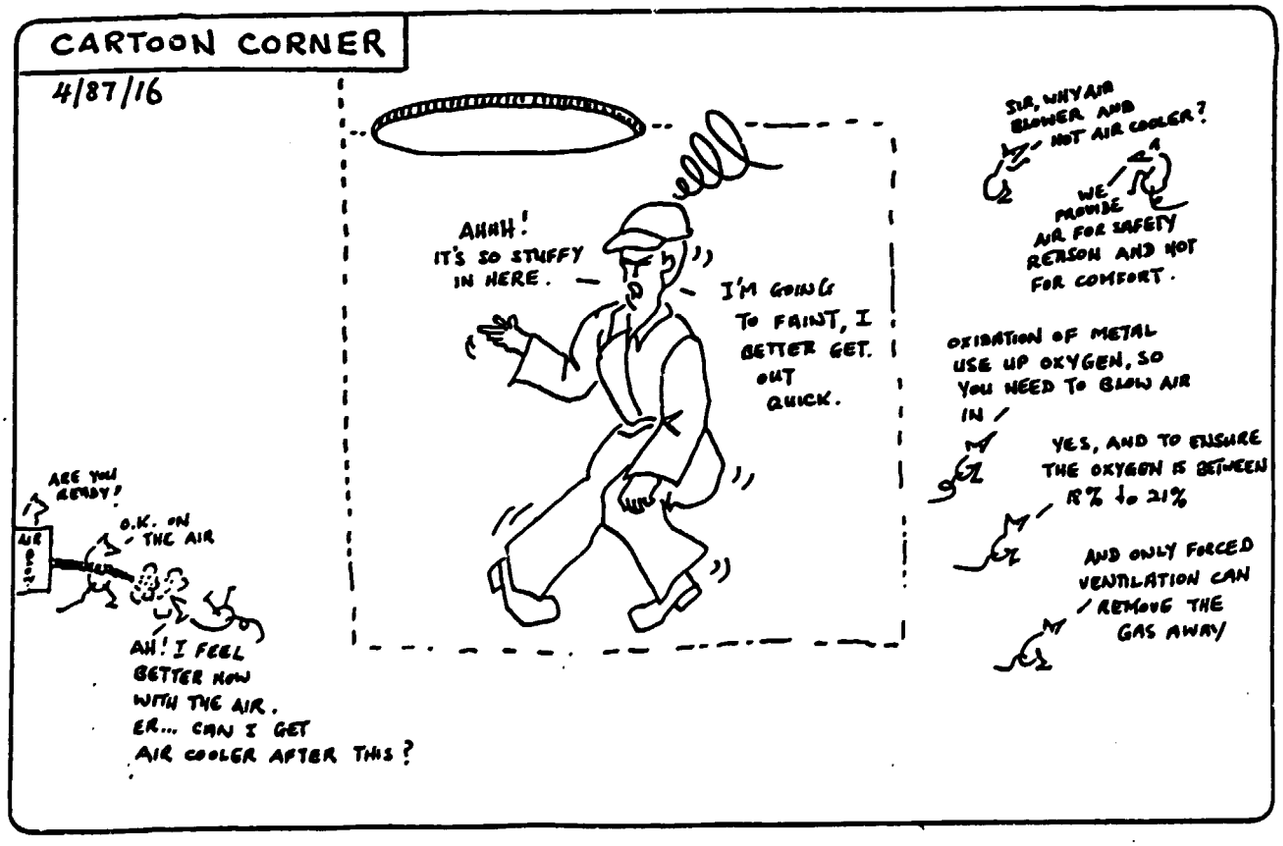

ZERO
ACCIDENT
PARTICIPATION
OF WORKERS
LEADERSHIP &
FOLLOW-UP BY
SUPERVISORS
MANAGEMENT
COMMITMENT


CARTOON CORNER
SHOP 'A' LTD.
LUCKY, I DID NOT STEP ON THE NAIL.
THAT'S THE SPIRIT
WELL, I BETTER GET THE NAIL AWAY BEFORE SOMEONE GETS INJURED
THEY ARE SWEEPING "ACCIDENT" AWAY AND BURYING IT!
YES, IT'S NOT EASY IT TAKES THE BOSS, THE SUPERVISORS AND THE WORKERS TO DO IT TOGETHER.
ACCIDENTS
ONE STONE FOR ZERO ACCIDENT
COMPANY 'A' PTE. LTD
HEY WATCH OUT FOR THE NAIL!
COMPANY 'B' LTD.
AND LEFT THE NAIL HERE, I WILL REPORT TO THE SUPERVISOR.
OH THE NAIL! DON'T WORRY THE SUPERVISOR WILL REMOVE IT WHEN HE RETURNS FROM LUNCH. I'LL SEE TO IT.
DON'T WORRY, I WILL REFER TO THE MANAGEMENT.
4/87/15

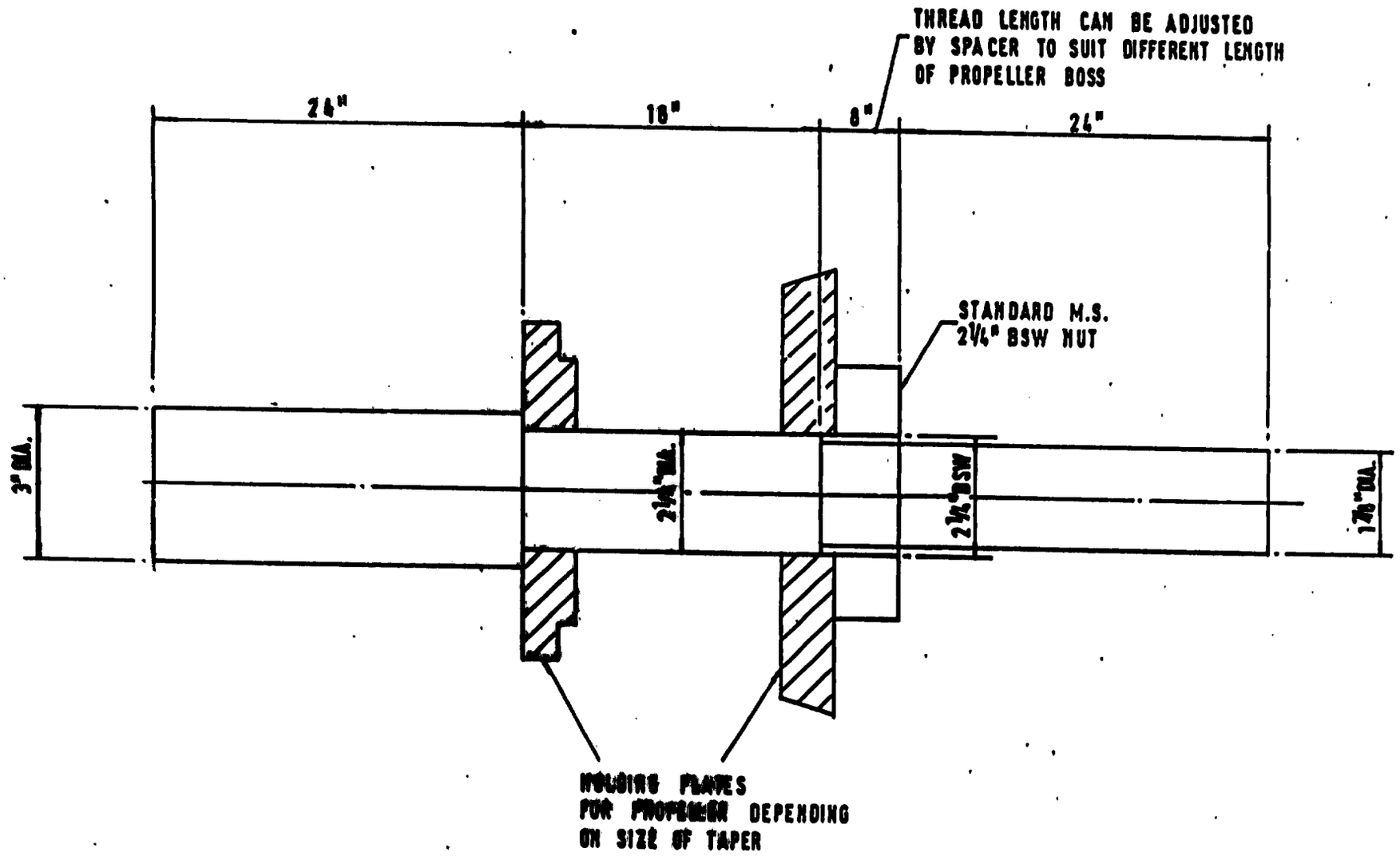
VENTILATE CONFINED SPACE



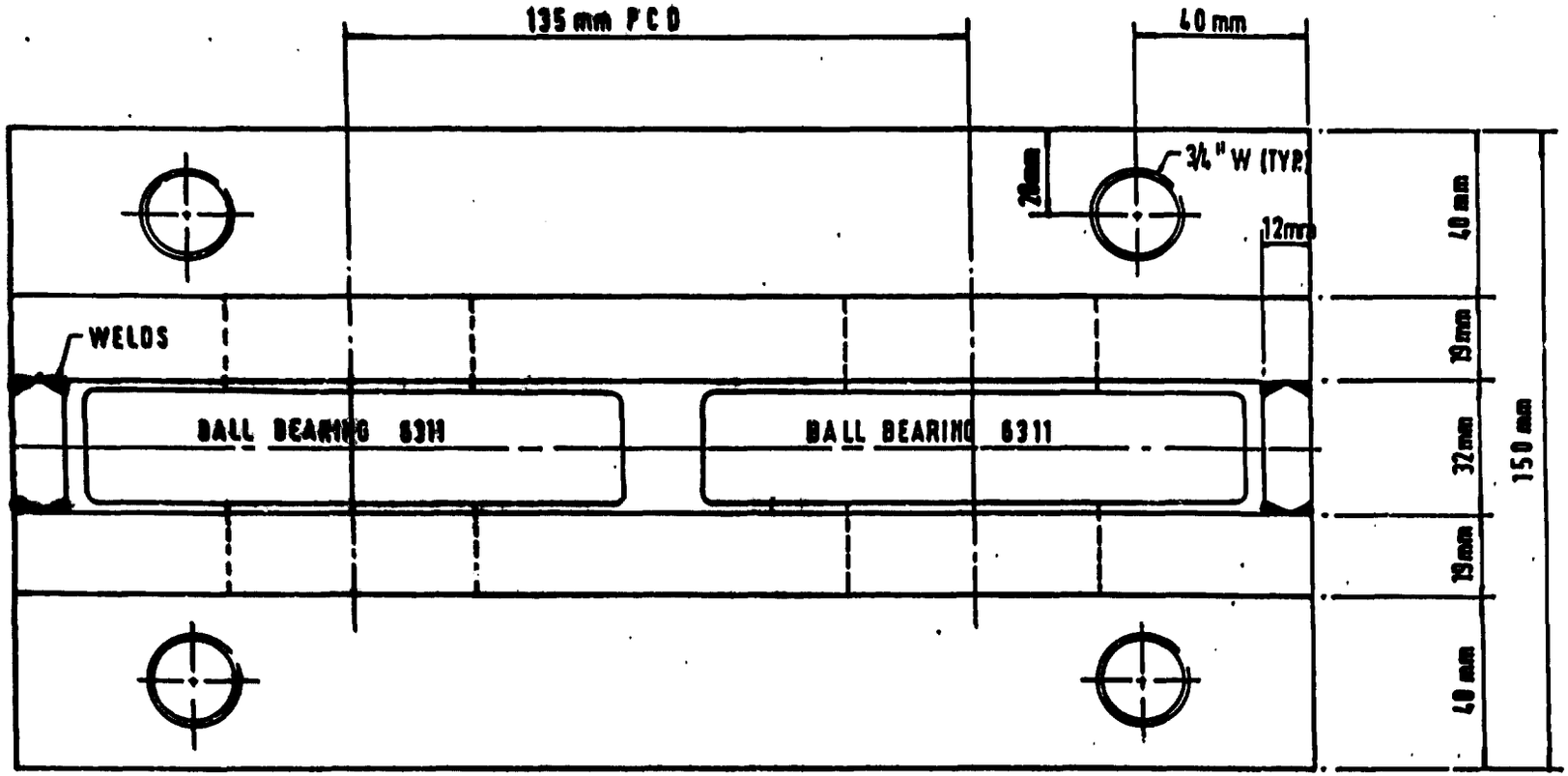
FOR ENTRY



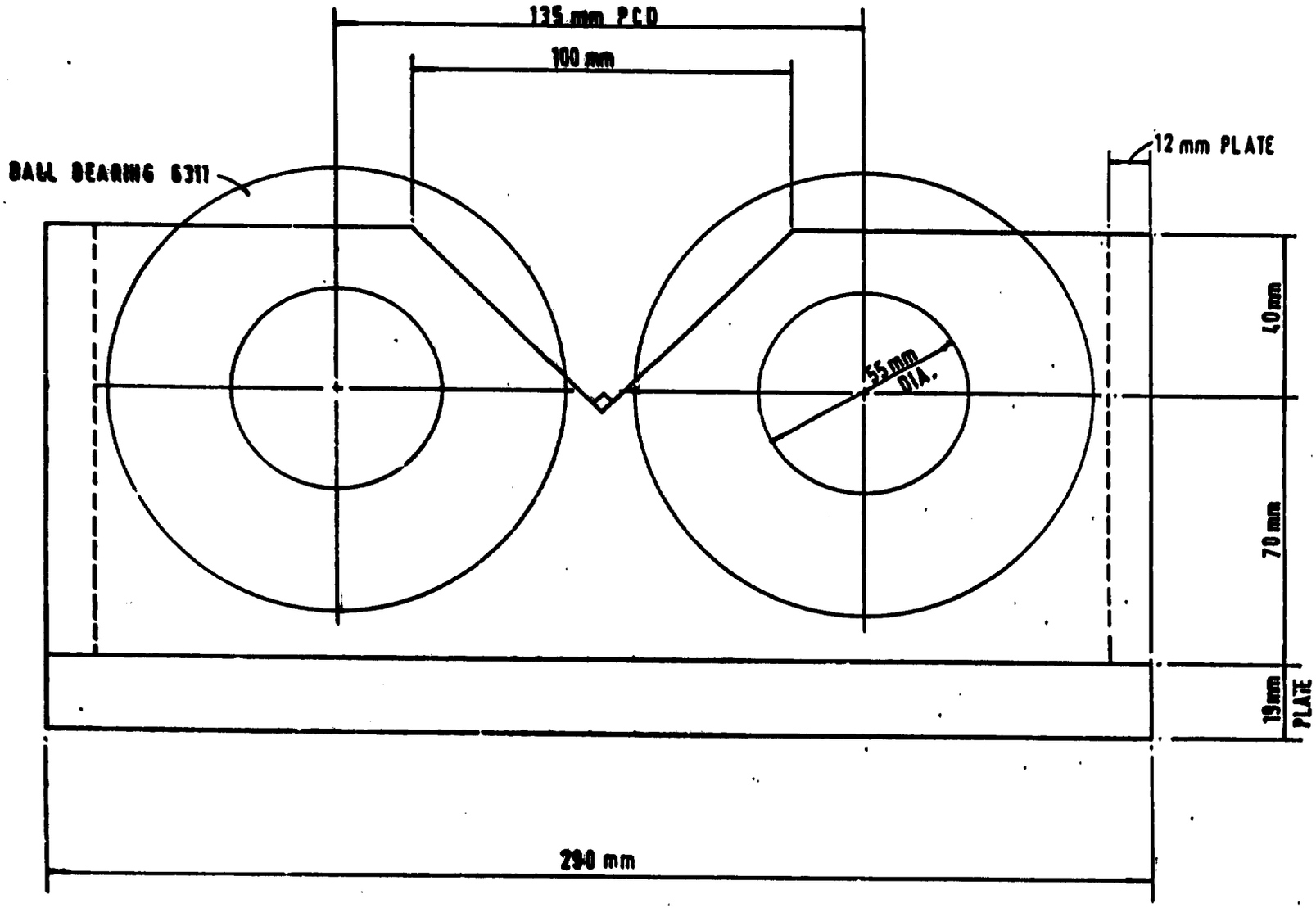
SKETCHES

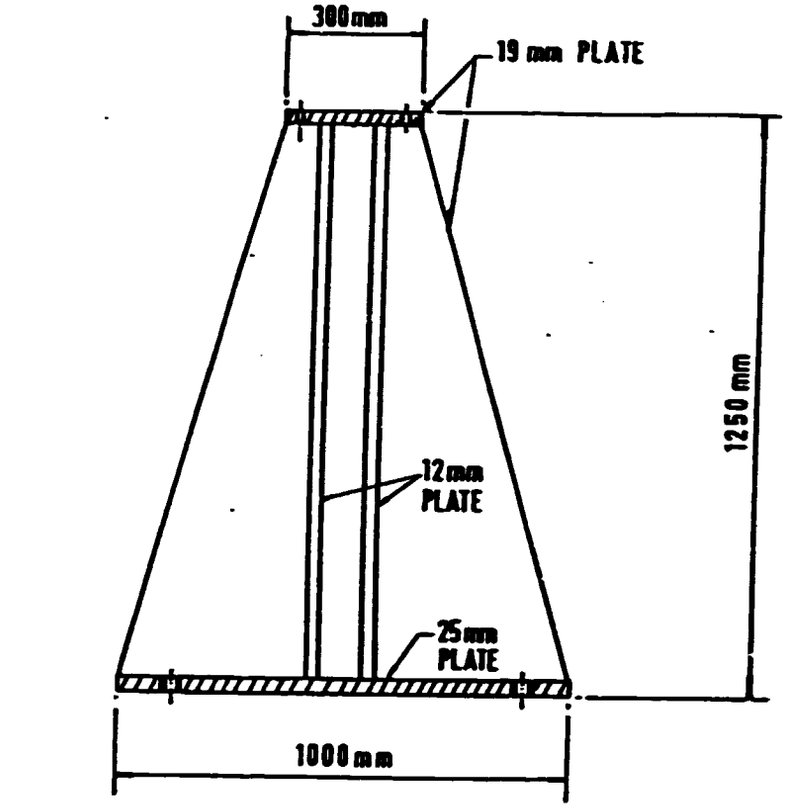


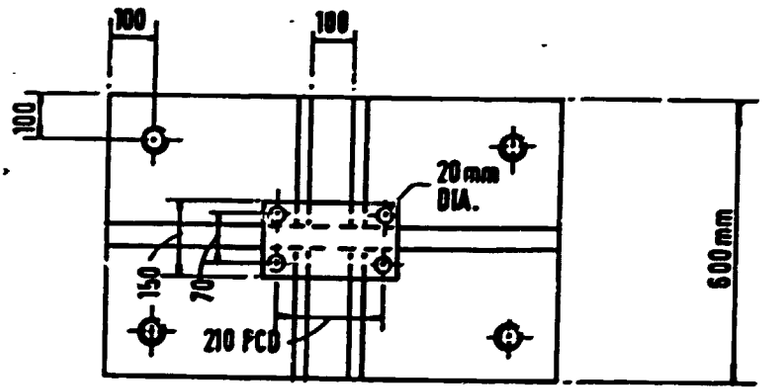
DUMMY SHAFT FOR STATIC BALANCING OF PROPELLERS



BEARING PEDESTAL BLOCK 1 SET (2 PCS)
FOR STATIC BALANCING OF PROPELLERS


135 mm P.C.D
100 mm
BALL BEARING 6311
12 mm PLATE
55 mm DIA.
40 mm
70 mm
19 mm PLATE
290 mm

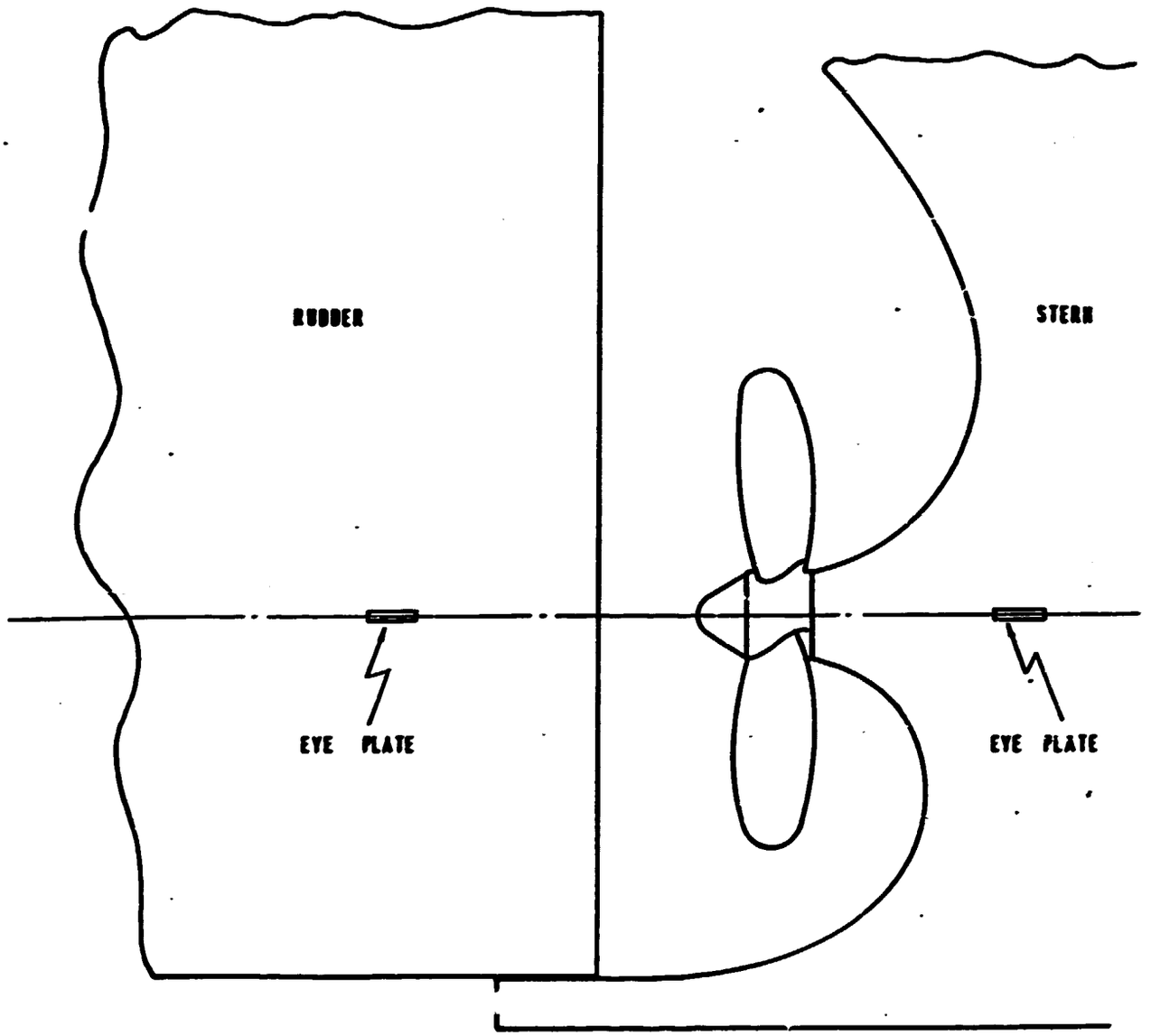


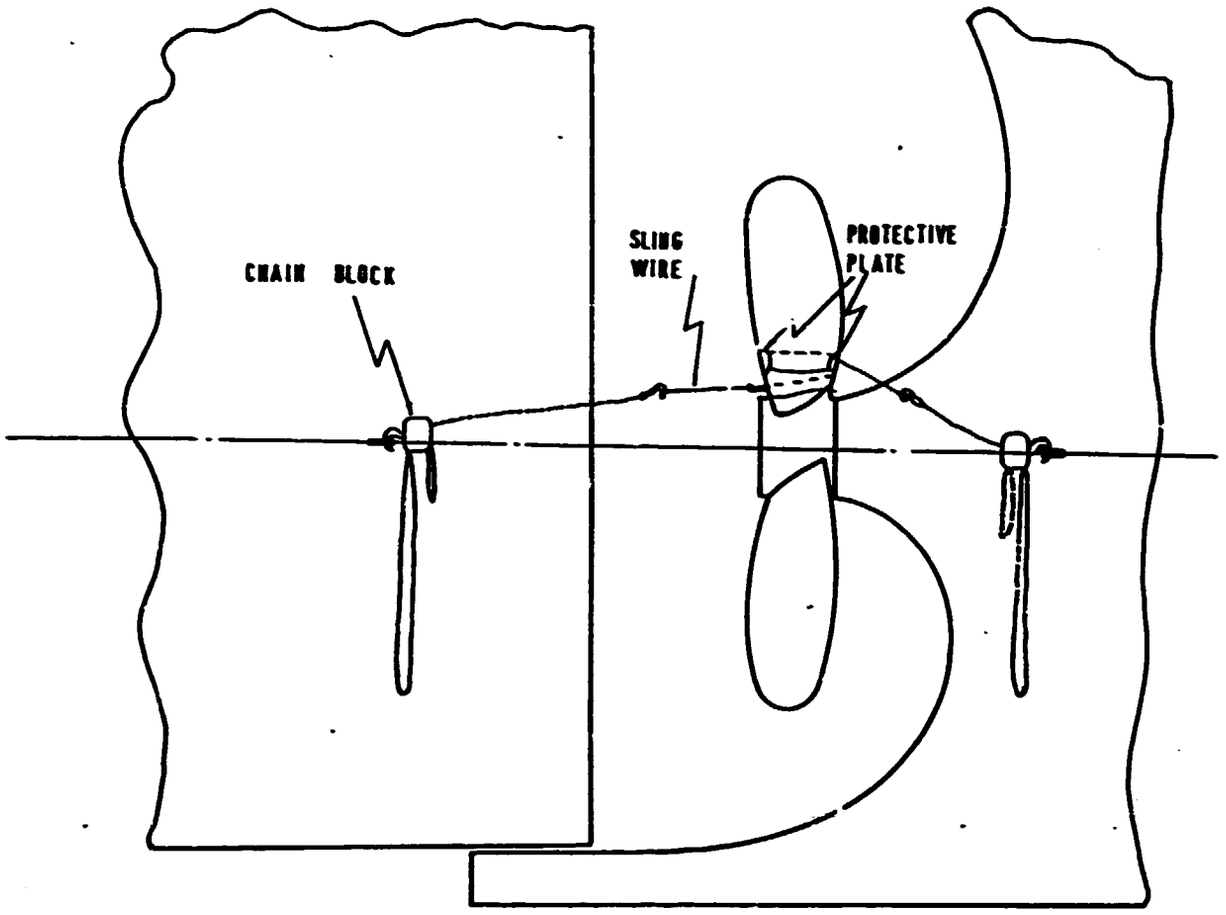


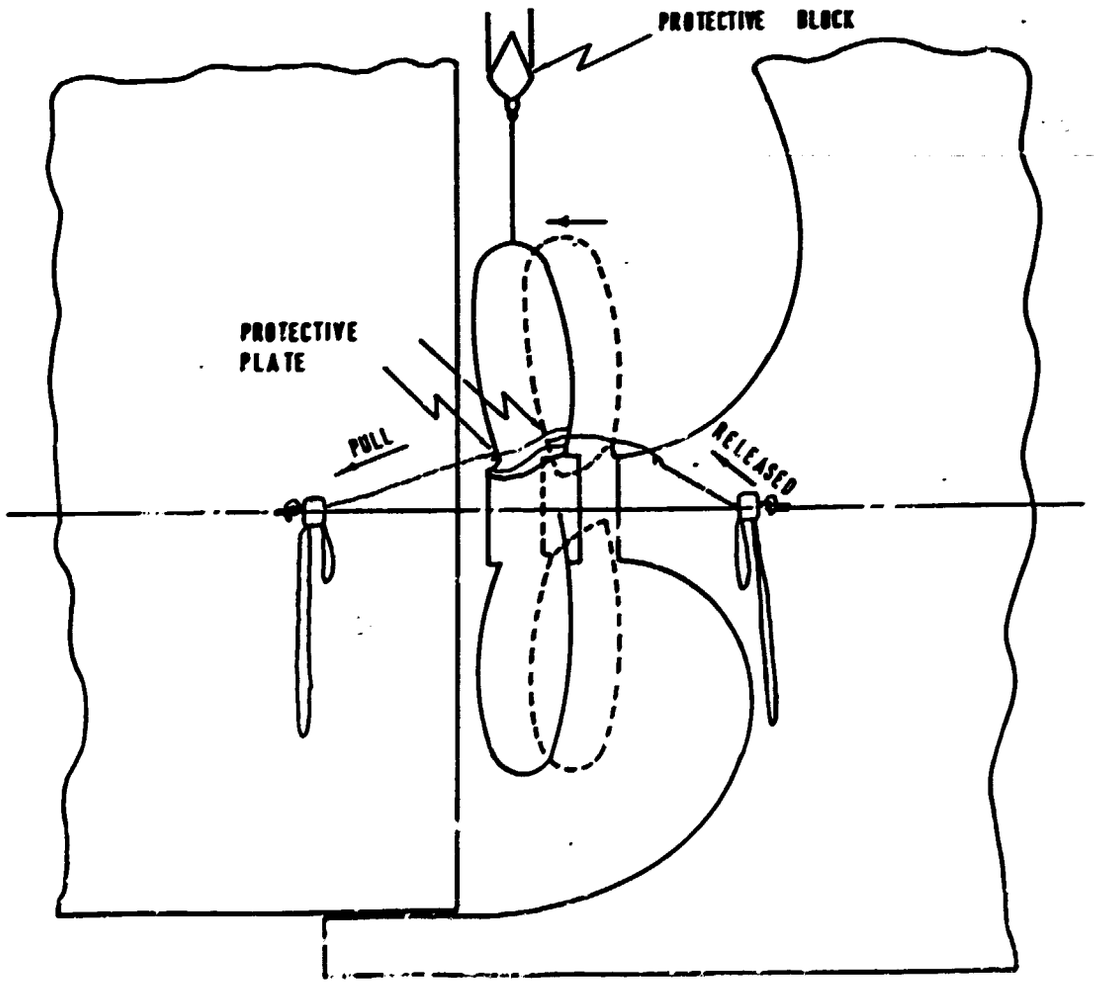
SUPPORT FOR STATIC BALANCING OF PROPELLERS

QTY. 2 PCS

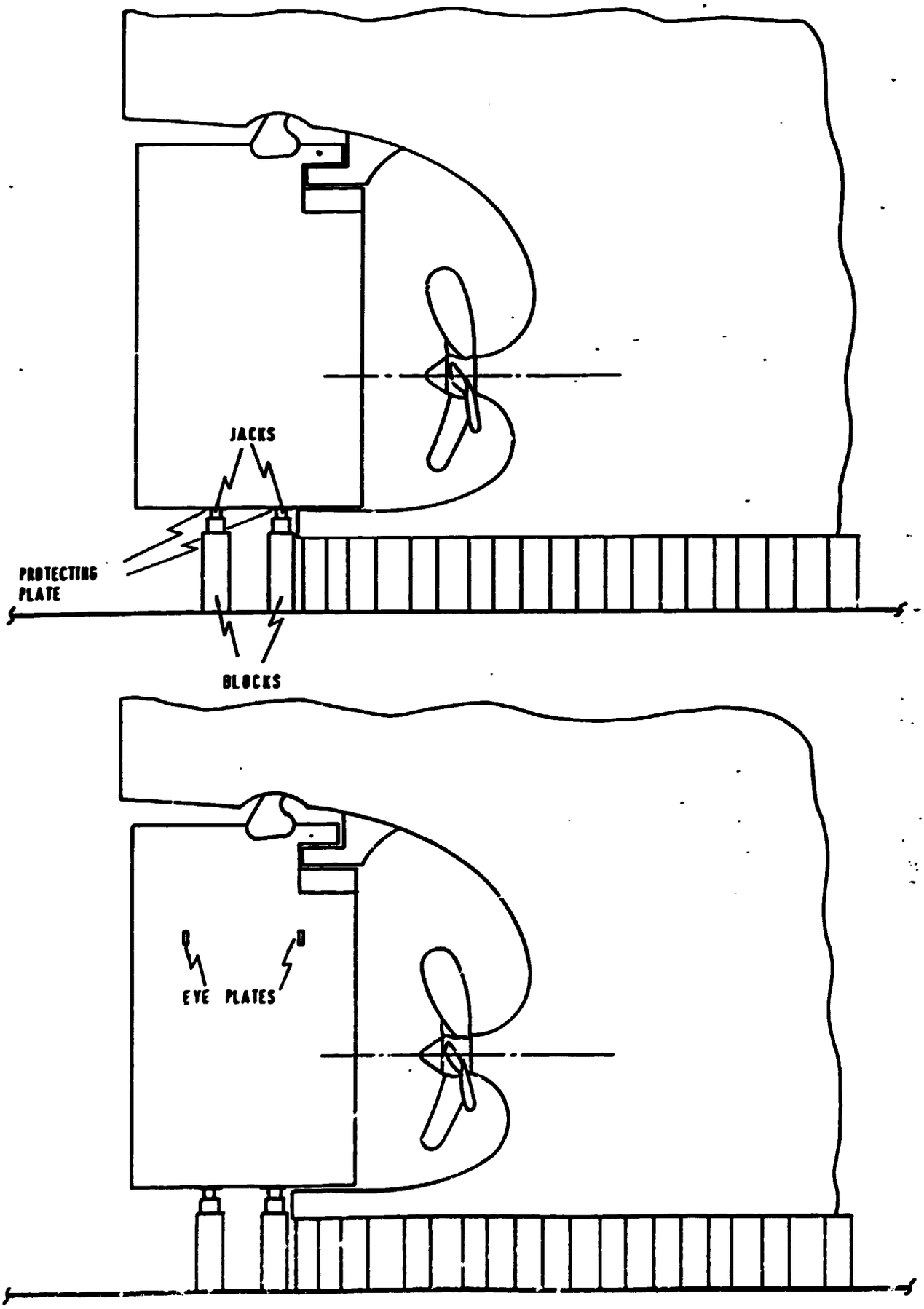
REMOVAL OF PROPELLER

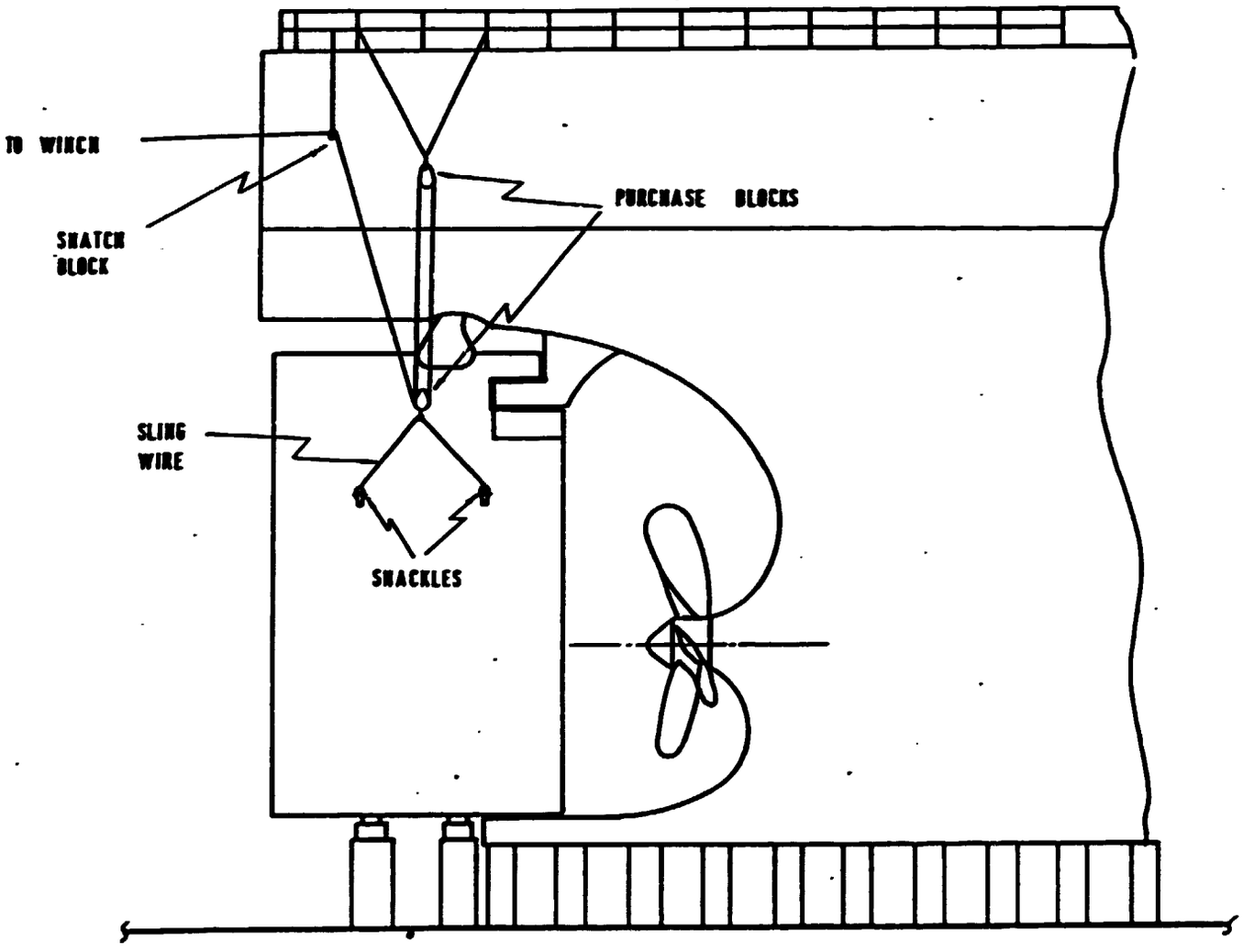


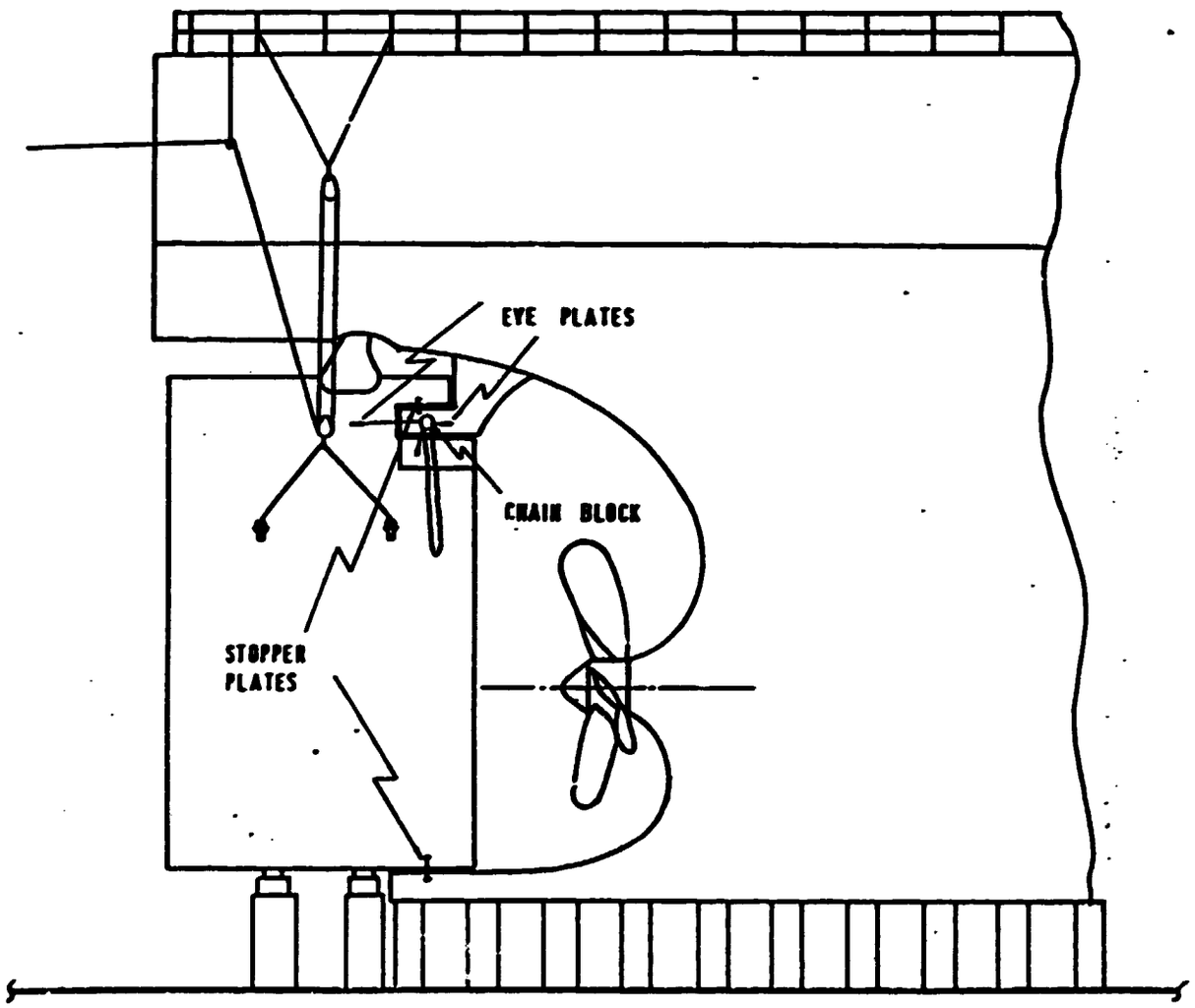

CHAIN BLOCK
SLING WIRE
PROTECTIVE PLATE

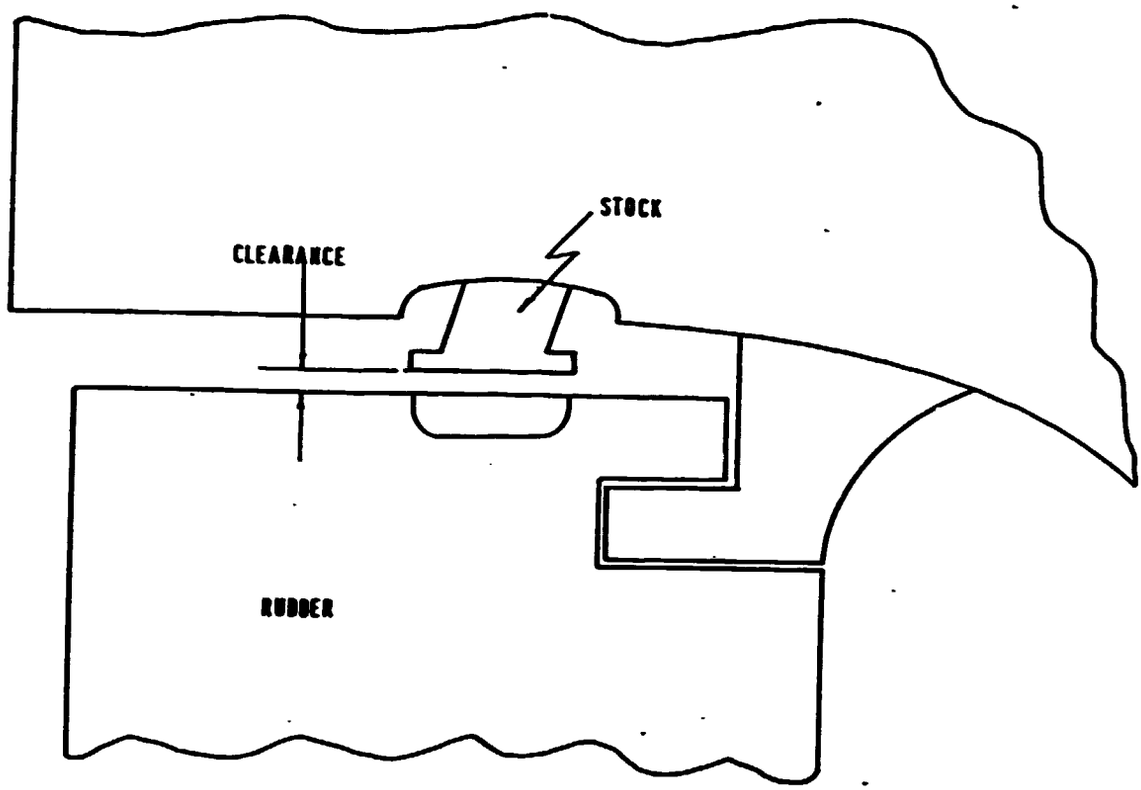

PROTECTIVE BLOCK
PROTECTIVE PLATE
PULL
RELEASED

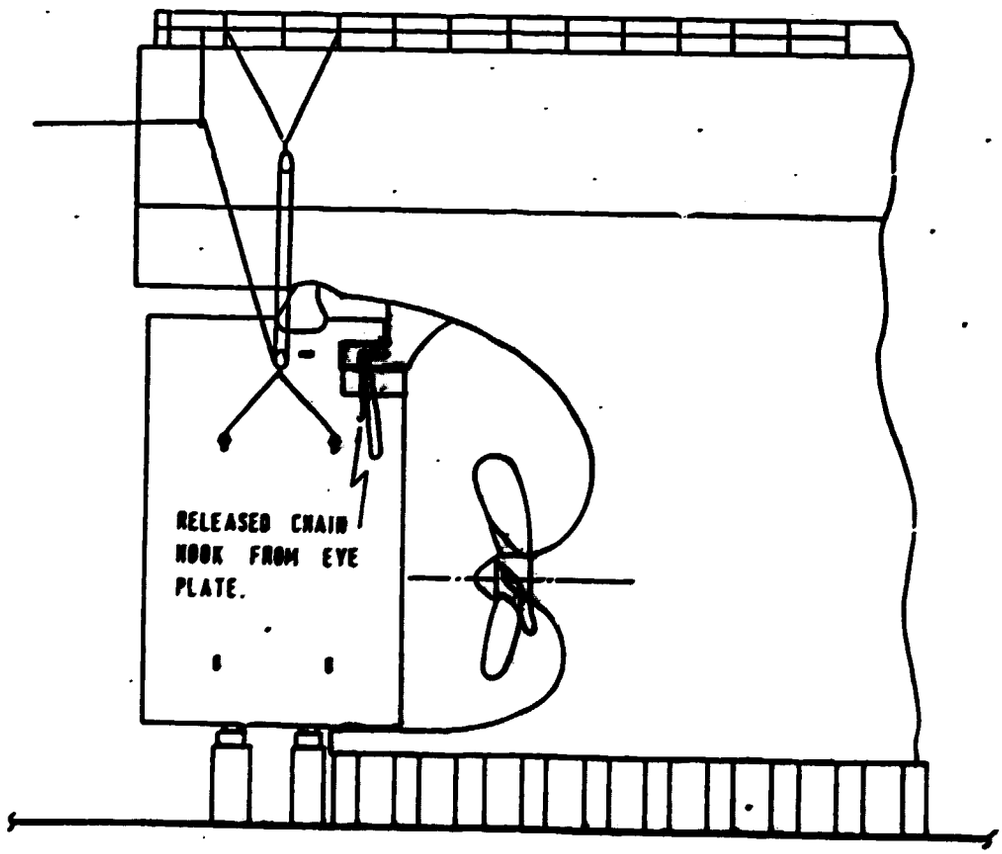
REMOVAL OF RUDDER

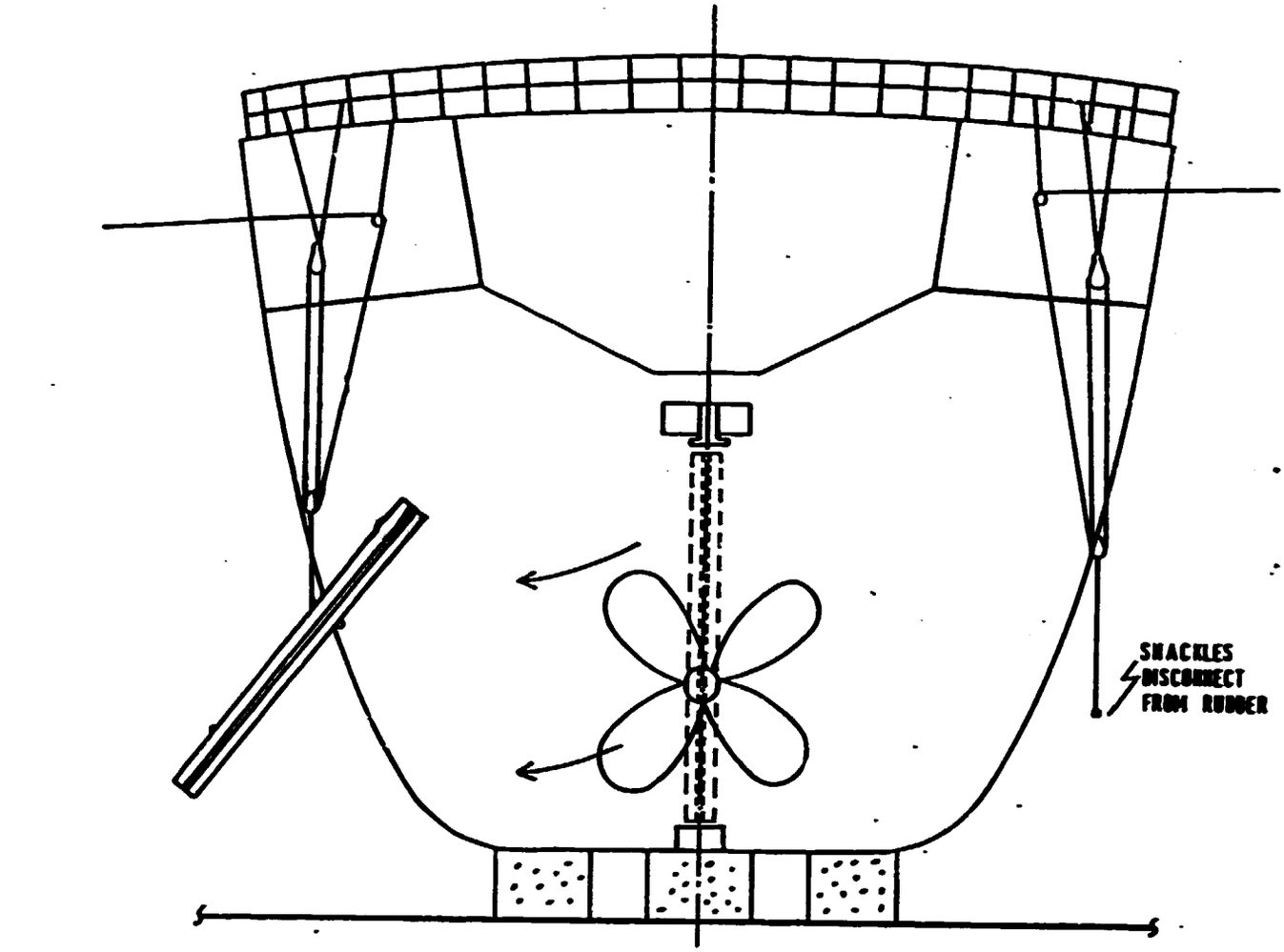


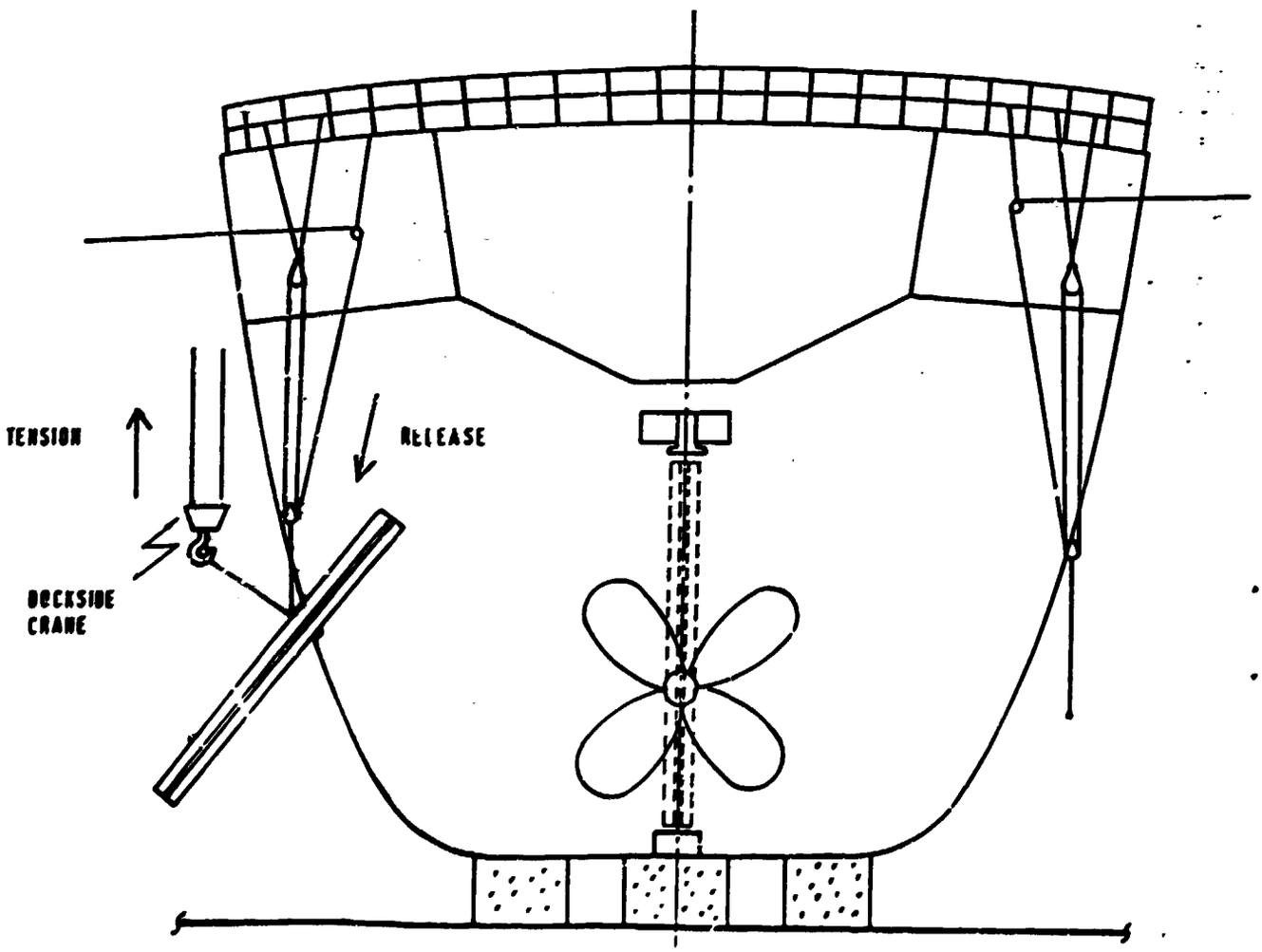

TO WINCH
SNATCH BLOCK
PURCHASE BLOCKS
SLING WIRE
SHACKLES

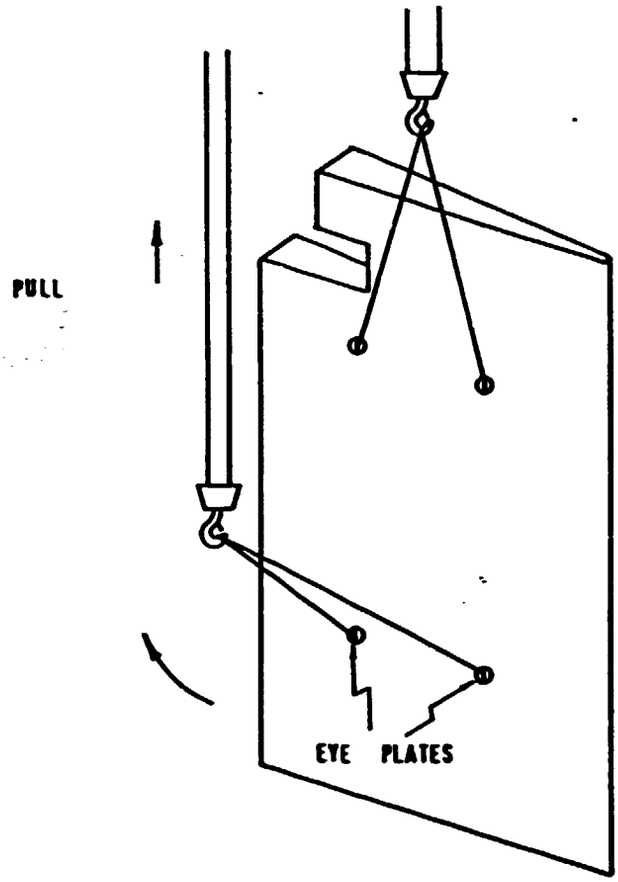

EYE PLATES
CHAIN BLOCK
STOPPER
PLATES

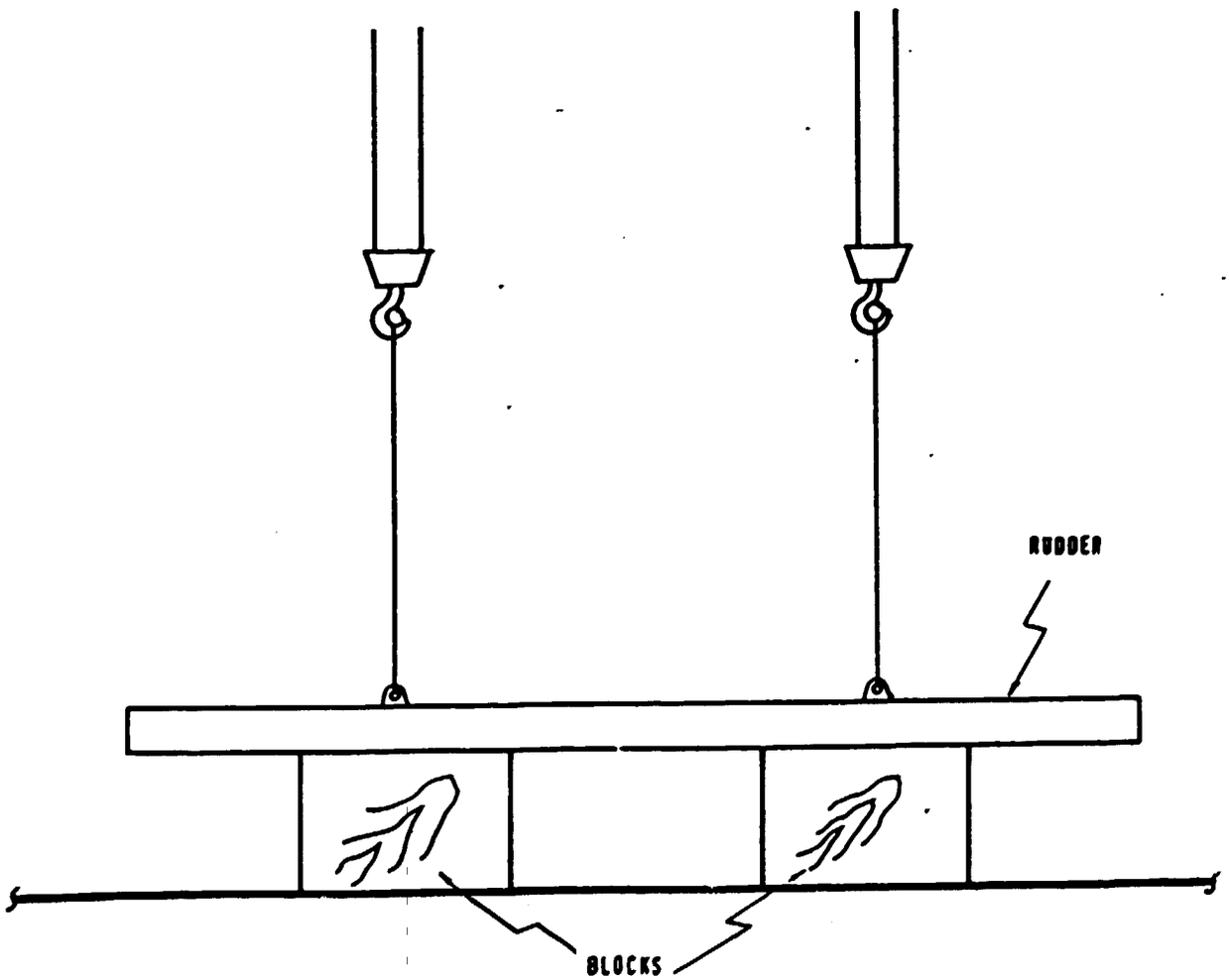

STOCK
CLEARANCE
RUBBER

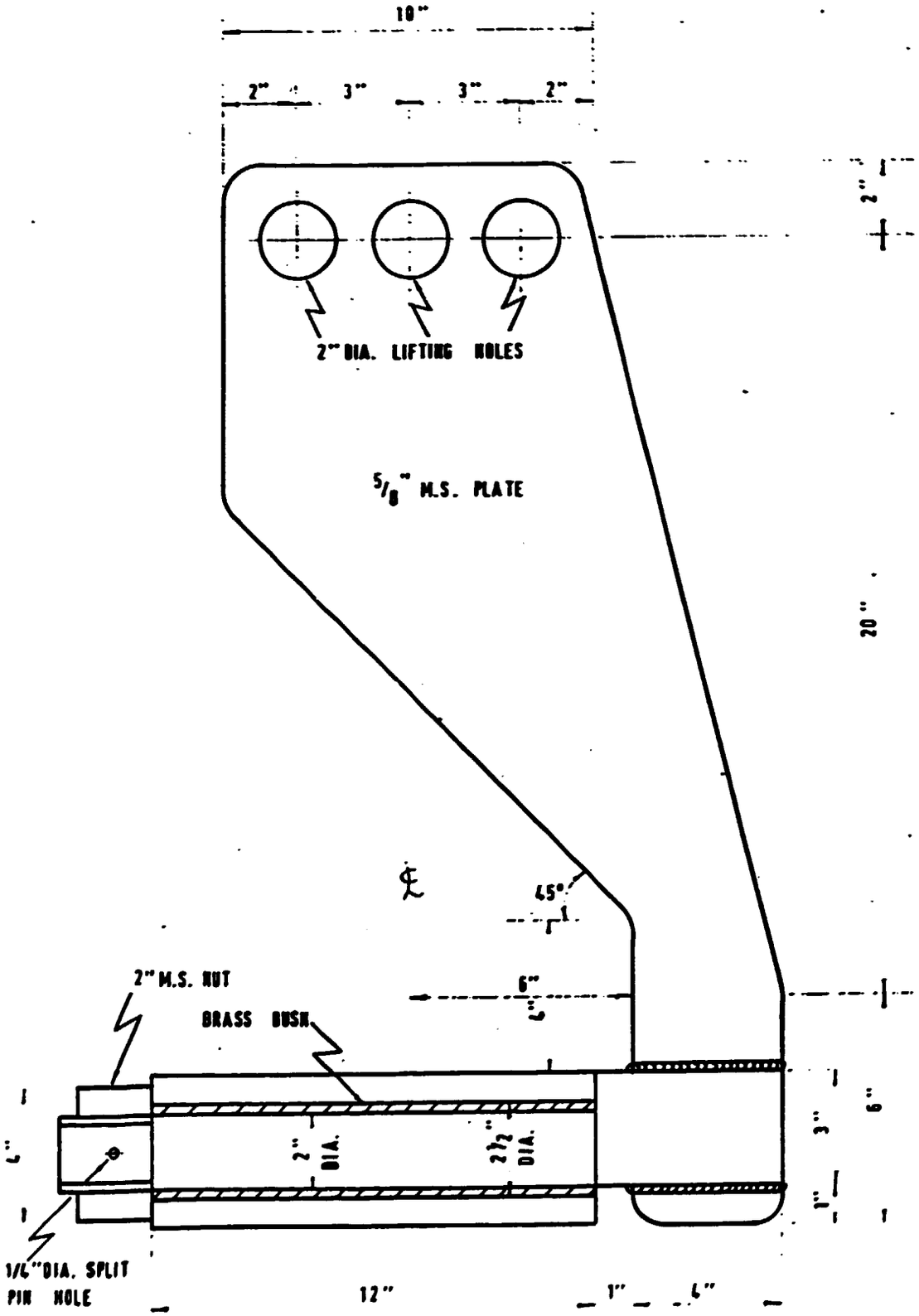

RELEASED CHAIN HOOK FROM EYE PLATE.


SHACKLES
DISCONNECT
FROM RUBBER

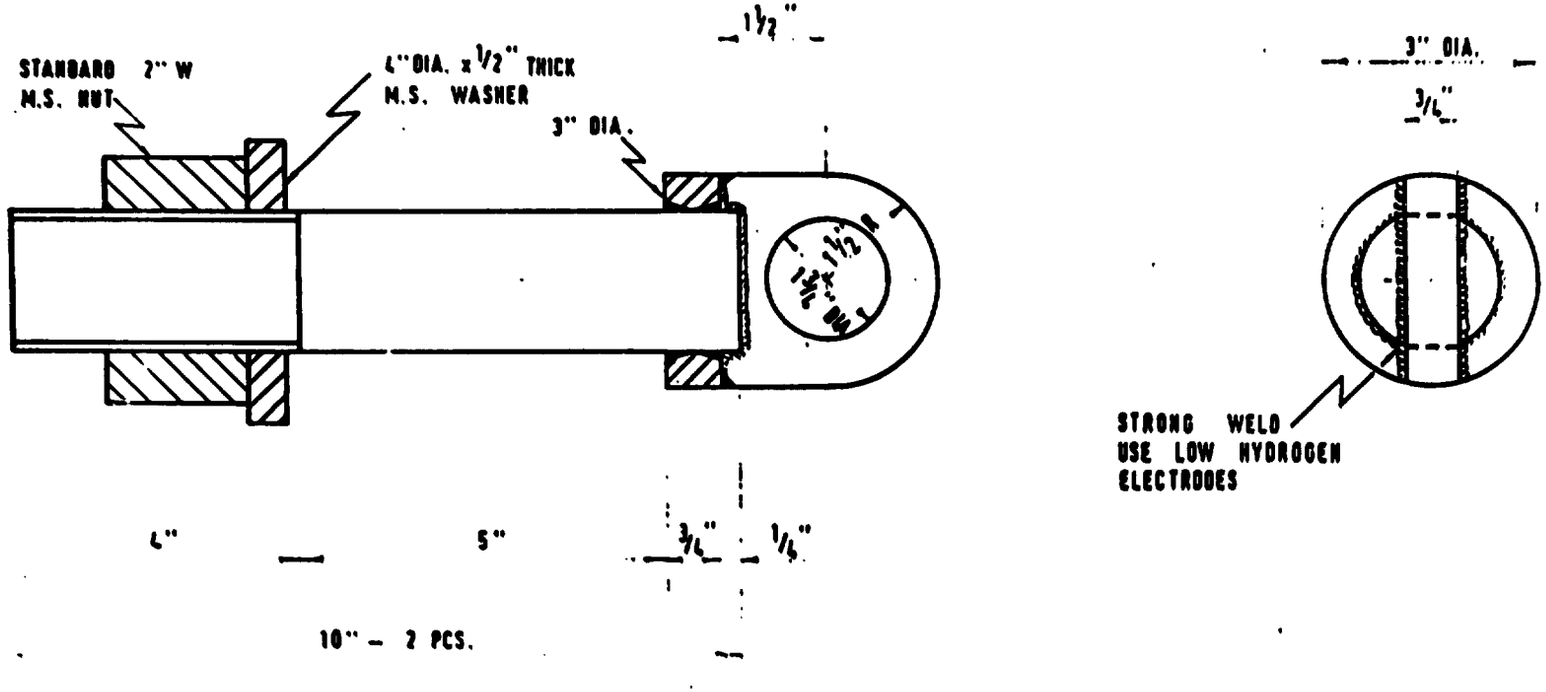

TENSION
RELEASE
DOCKSIDE
CRANE


PULL
EYE PLATES

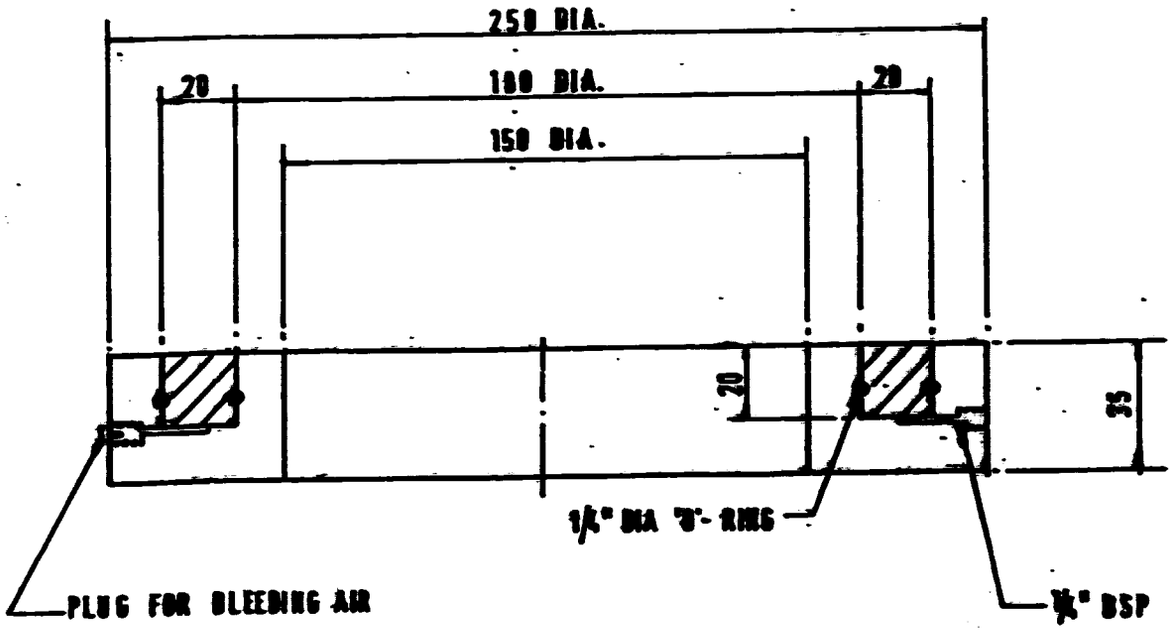

RUDDER
BLOCKS



LIFTING PLATE FOR REMOVING AND ASSEMBLING OF MEDIUM SIZE PROPELLER NUT.



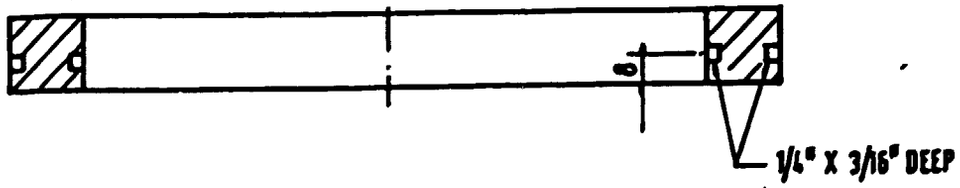
EYE - BOLTS FOR PULLING IN TAILSHAFT



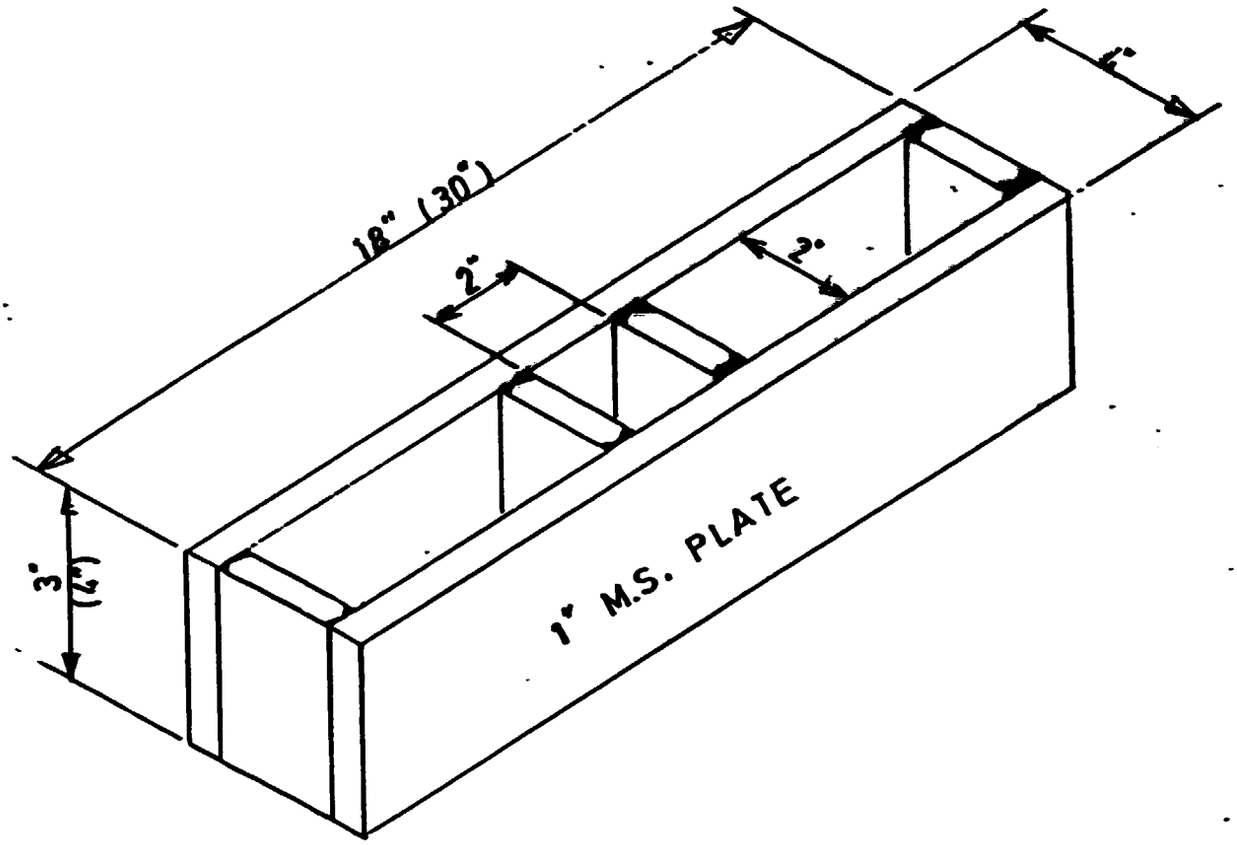
AREA = 125·68 CM^2

PRESSURE 100 KG/CM^2 = 12·5 TONS

RING JACK FOR JACKING IN PROPELLER →



NOTE: ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.

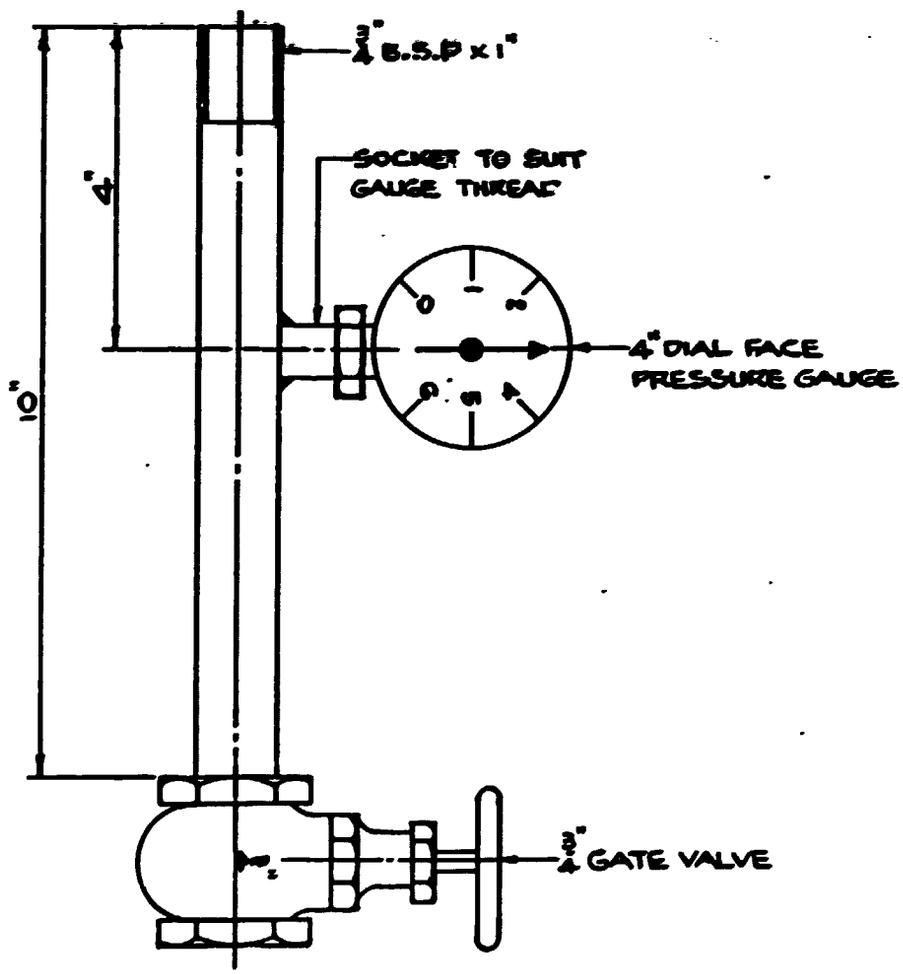


MULTI PURPOSE STRONG-BACK

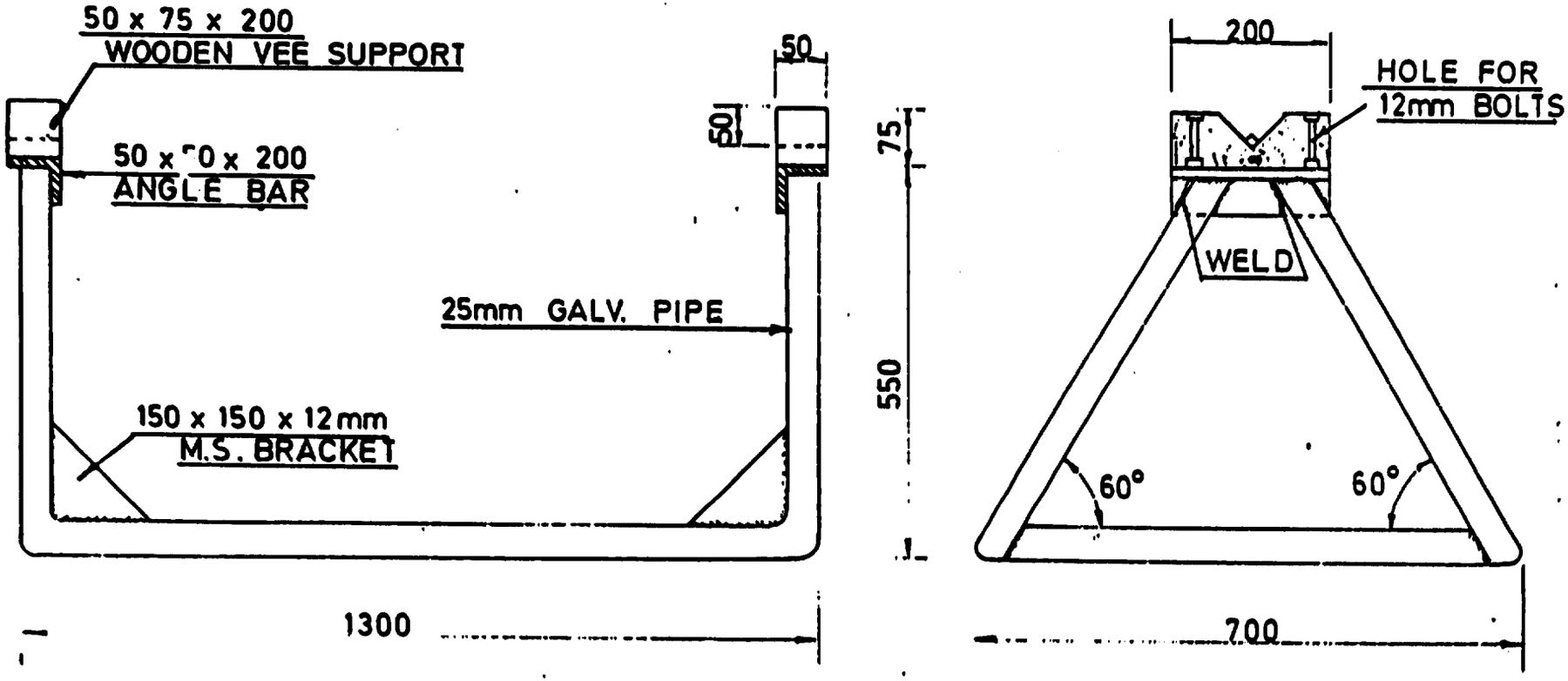
FOR JACKING OUT PROPELLERS, COUPLINGS, GEARS, ETC. WITH VARIOUS P.C.D.

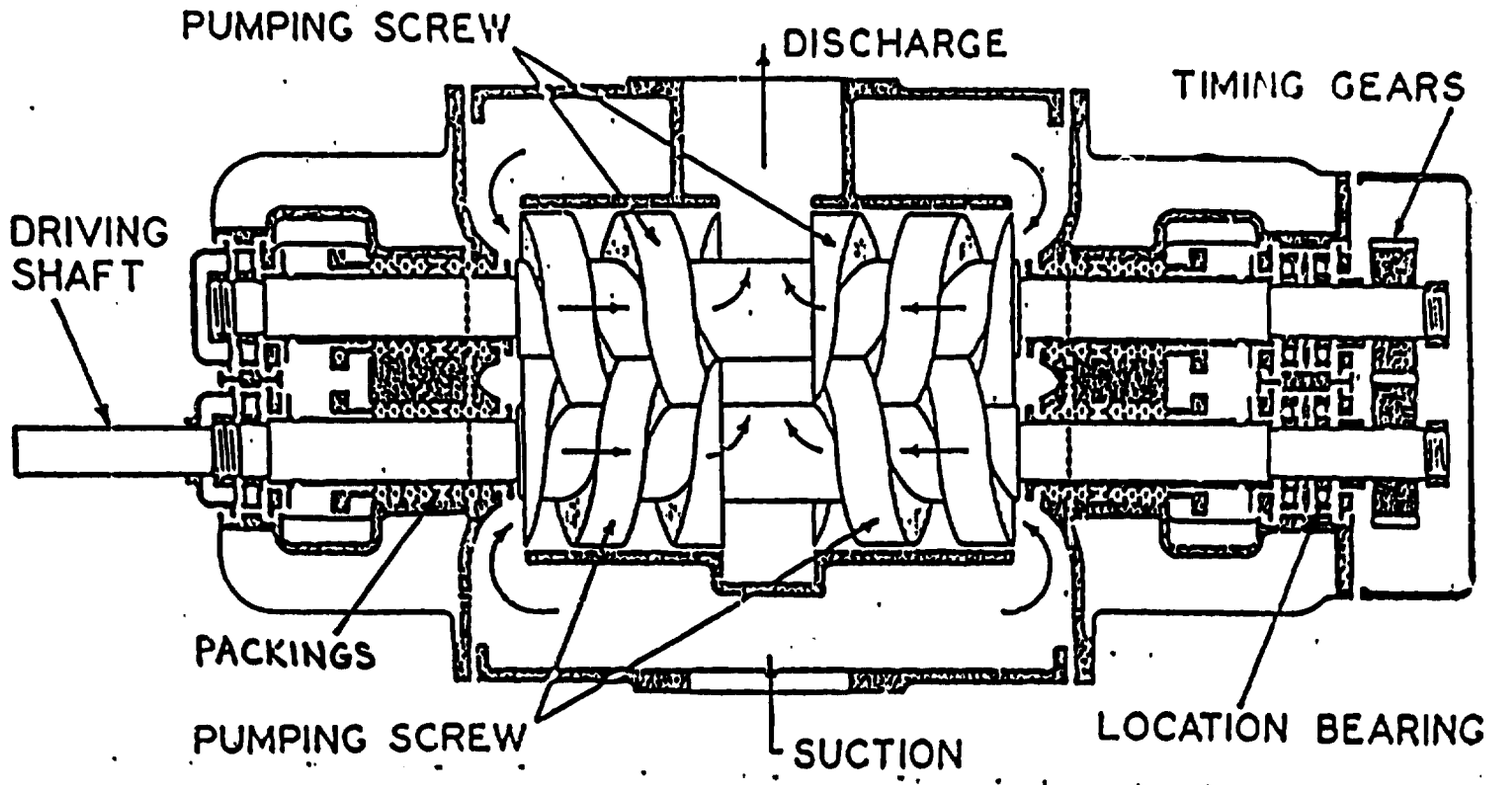
1 PC — 18" x 3" x 4"
1 PC — 30" x 4" x 4"

JIG FOR PRESSURE TESTING OF RUDDER

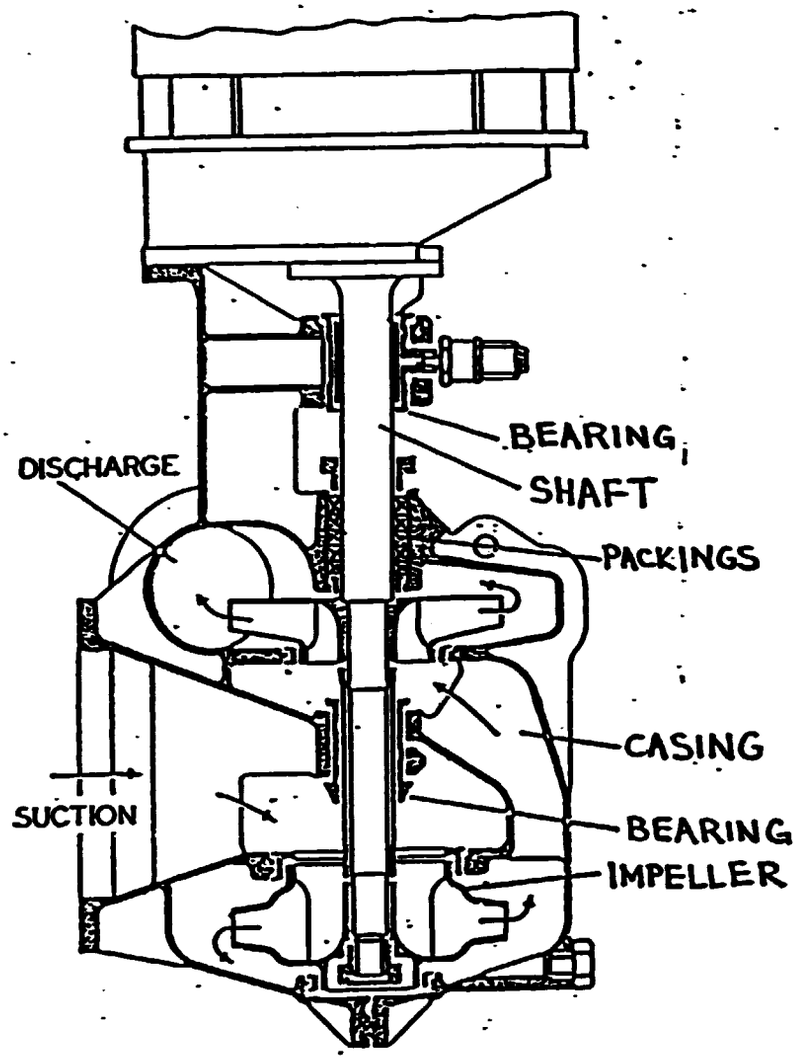


TURBOCHARGER ROTOR STAND

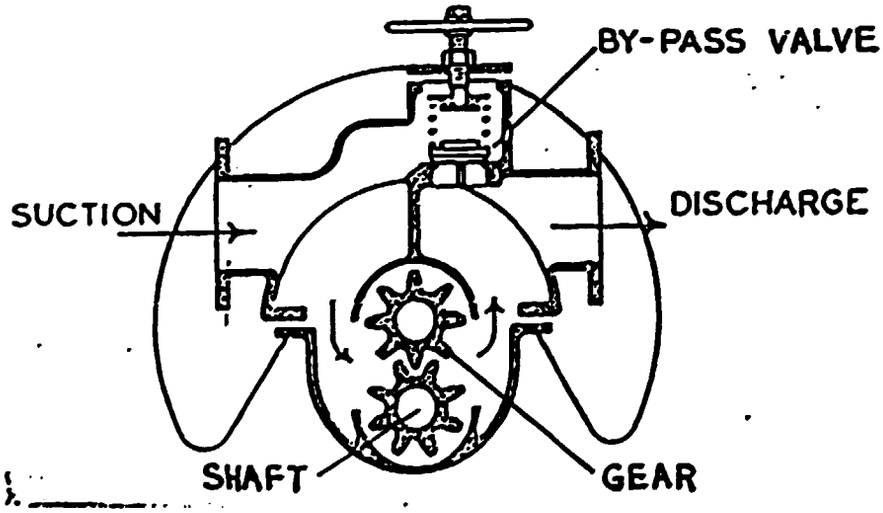




SCREW SHAFT PUMP.

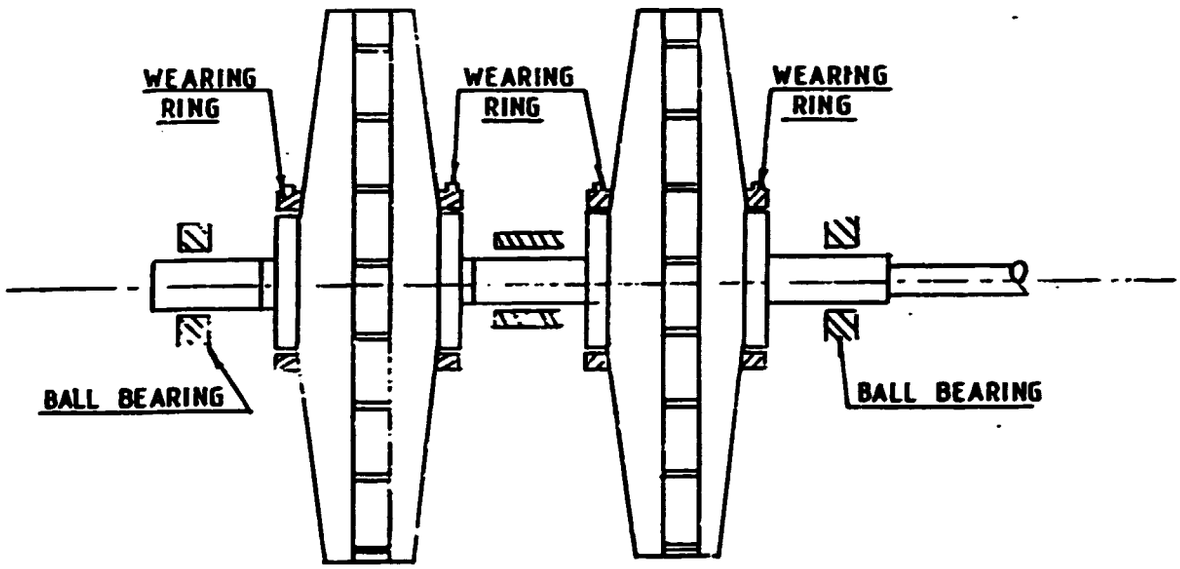


IMPELLER PUMP



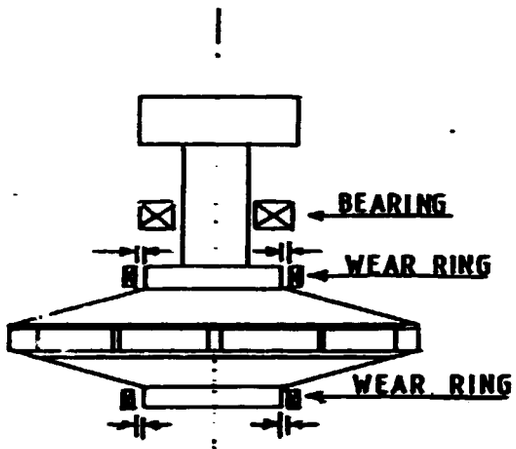
ROTARY GEAR PUMP.

CARGO PUMP


WEARING RING
WEARING RING
WEARING RING
BALL BEARING
BALL BEARING

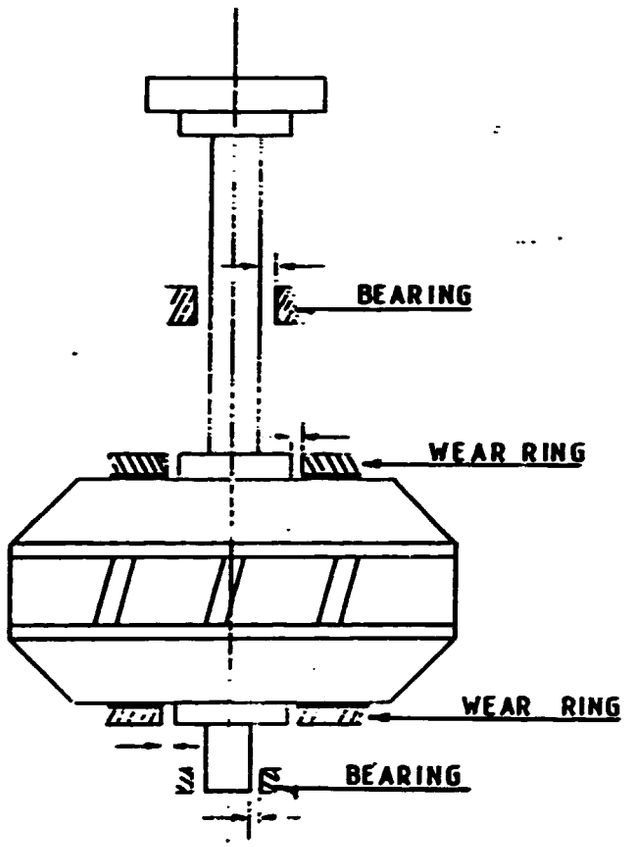
FIRE PUMP CALIBRATION

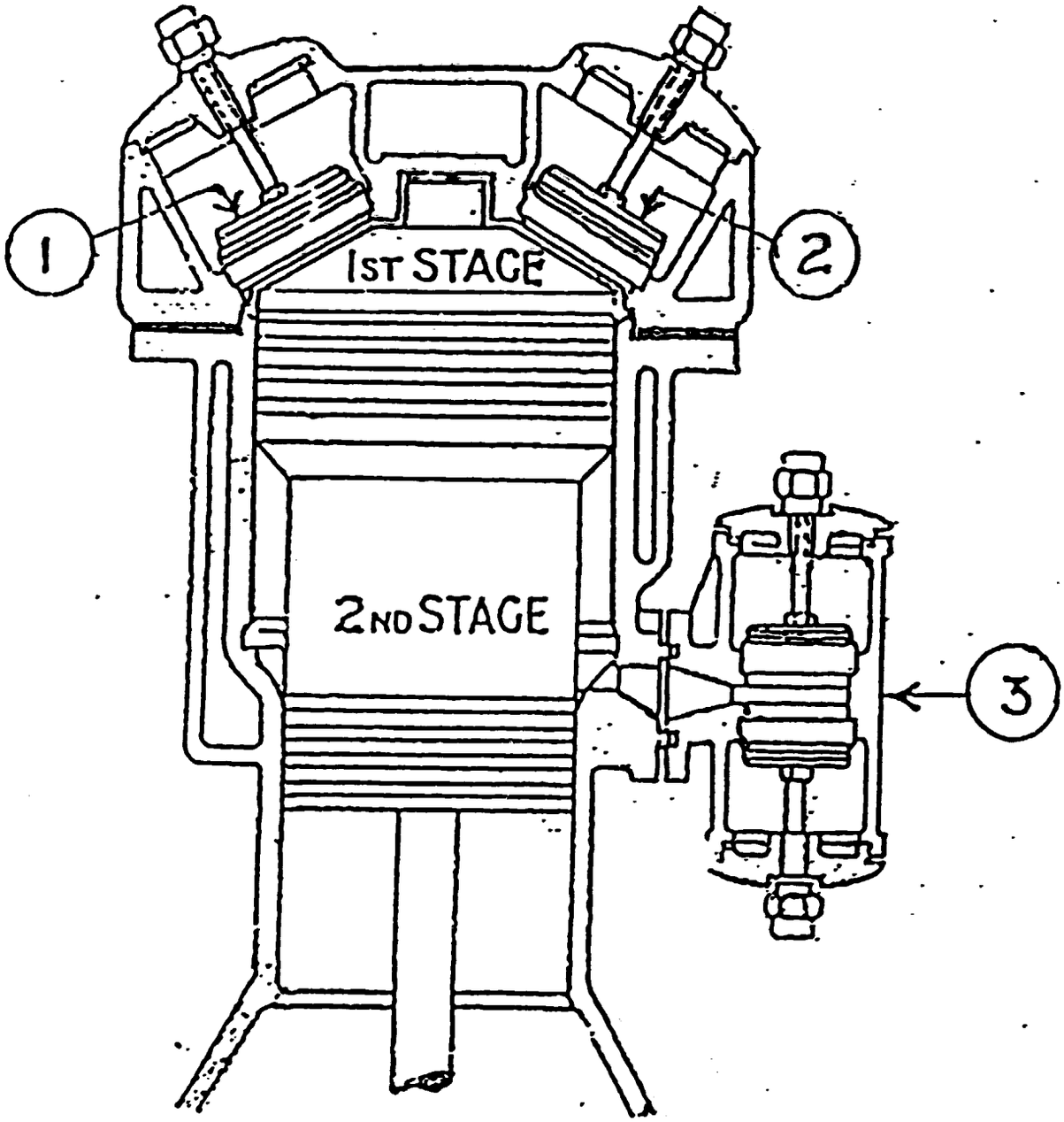
MEASUREMENT IN: _____



REMARKS :-

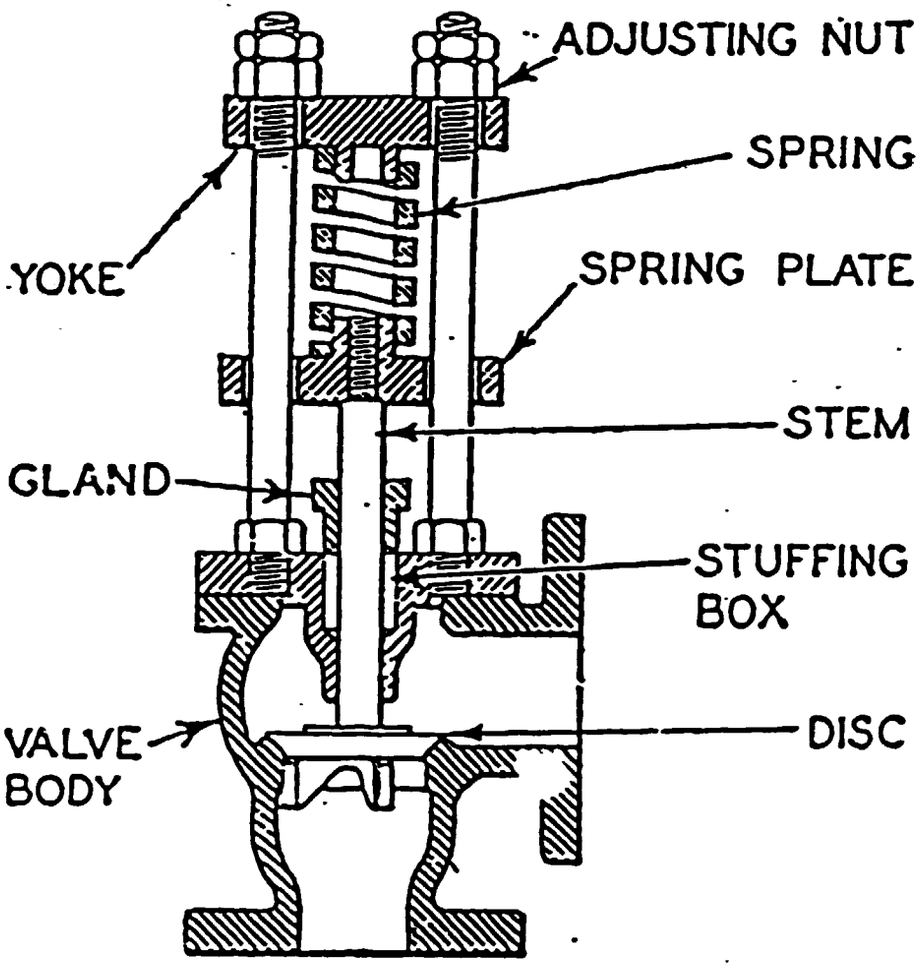
GENERAL SERVICE PUMP



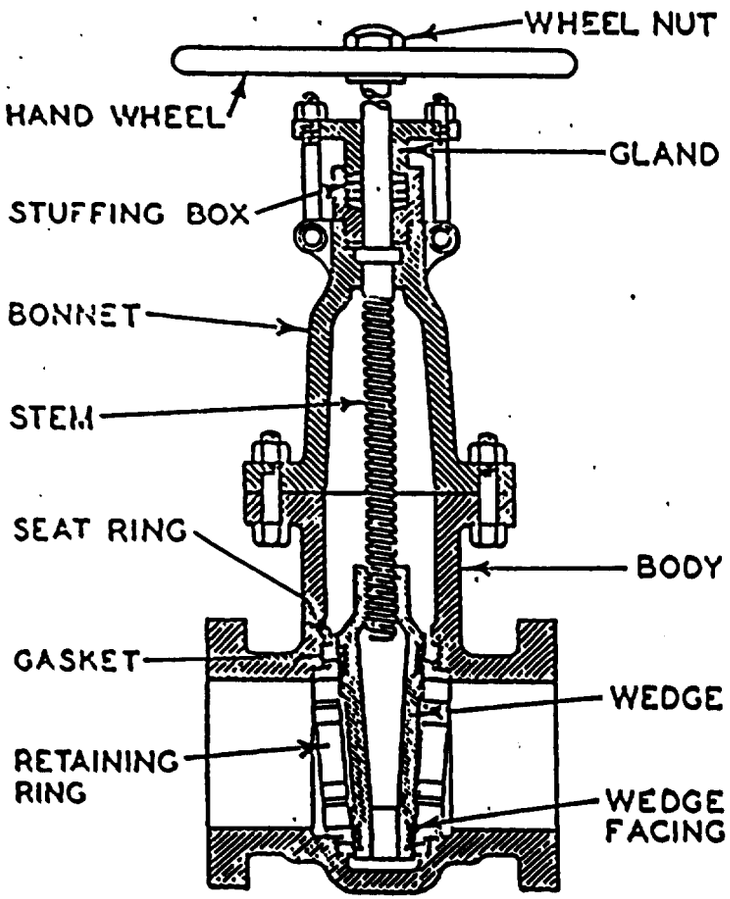


TWO-STAGE AIR COMPRESSOR.

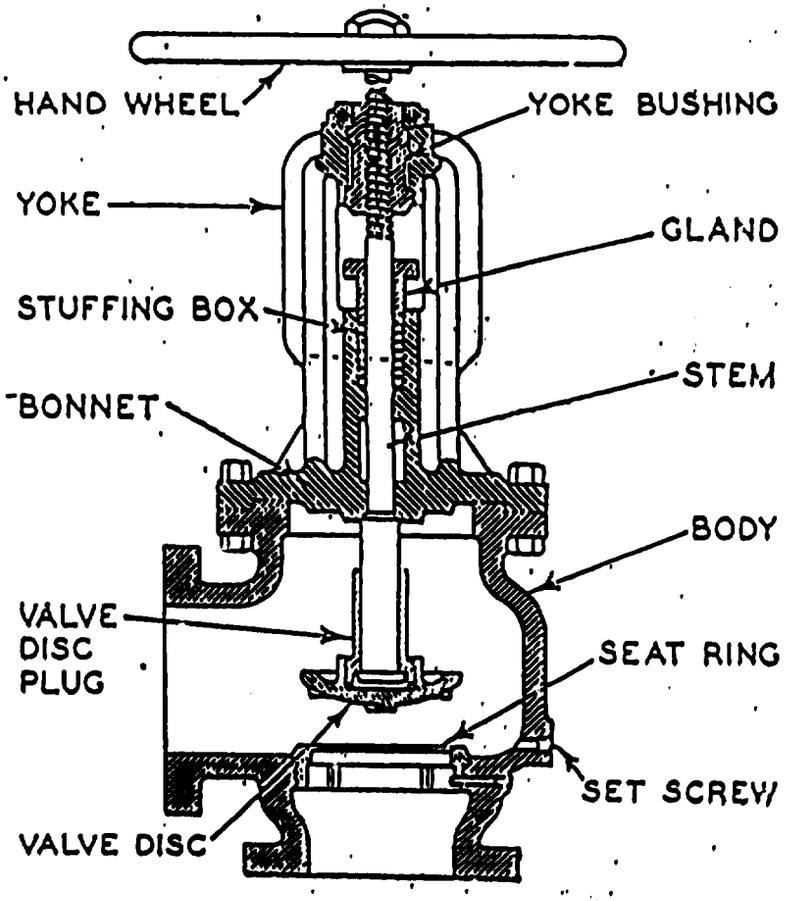
1. 1st stage (L.P.) suction valve.
2. ,, ,, (L.P.) delivery ,,
3. 2nd stage suction and delivery valve chest.



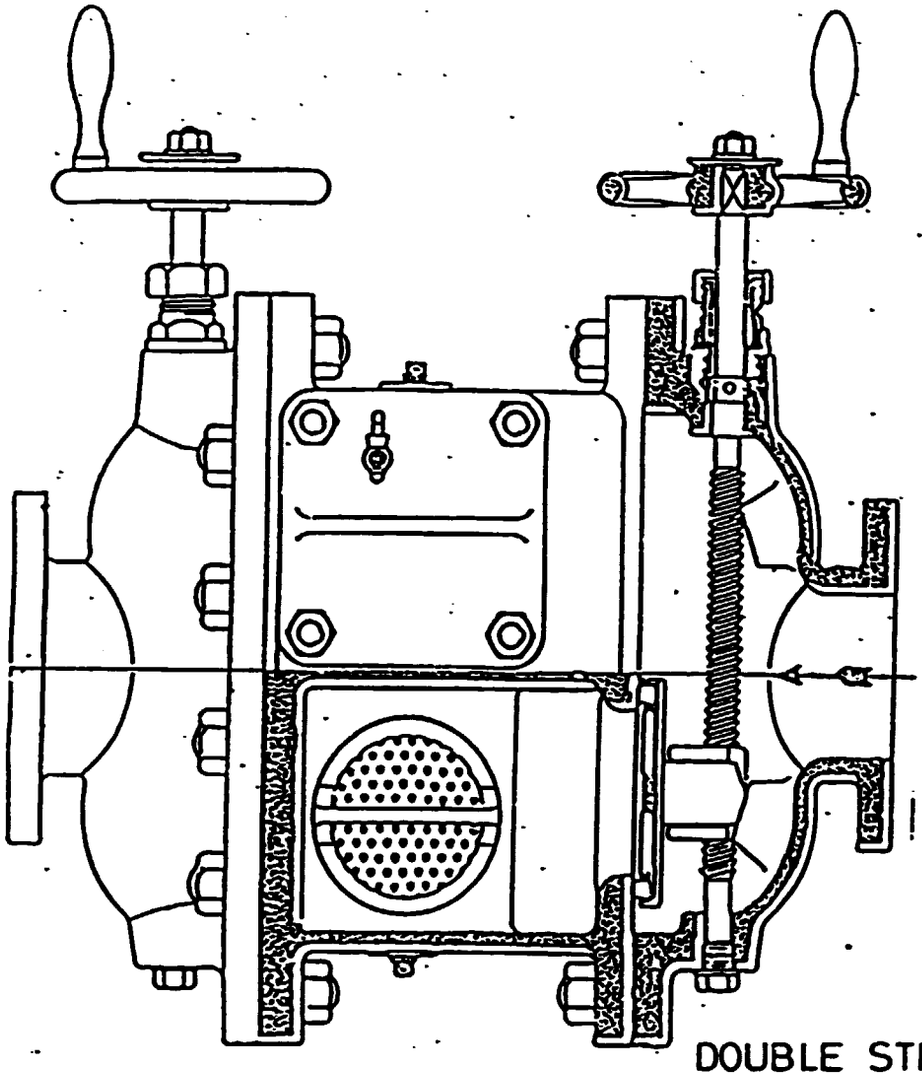
RELIEF VALVE



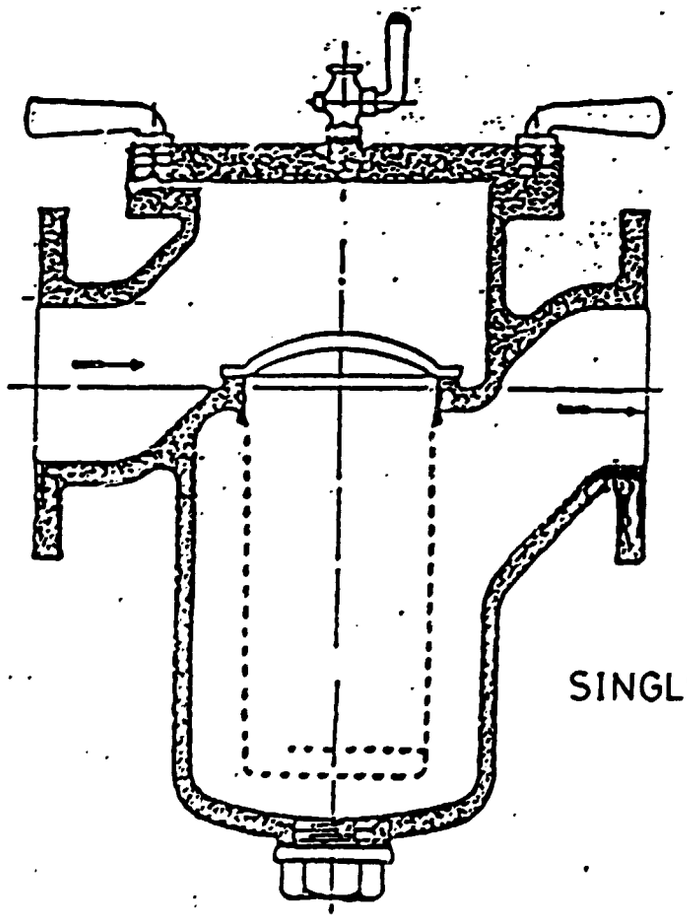
GATE VALVE



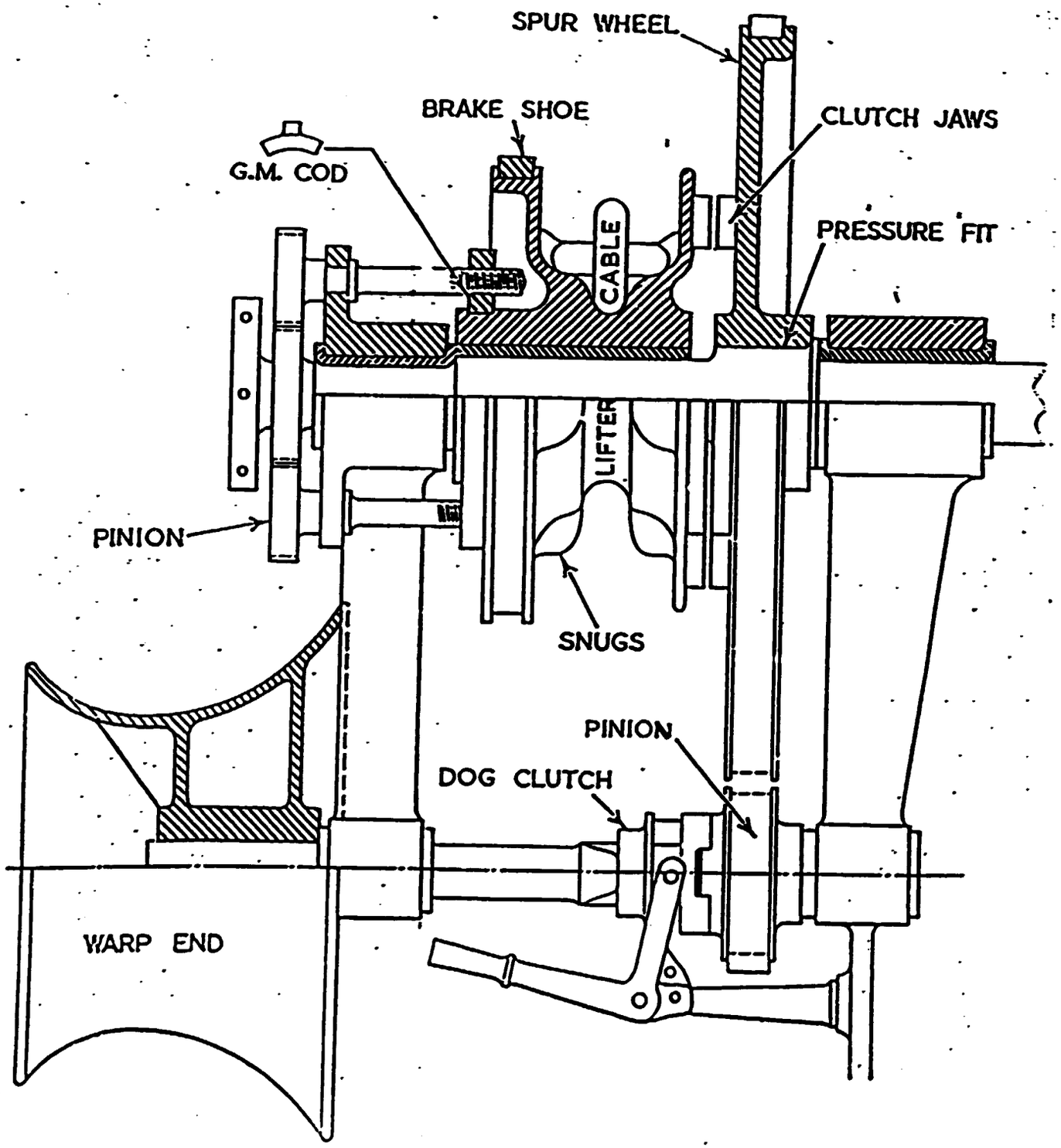
STEAM STOP VALVE



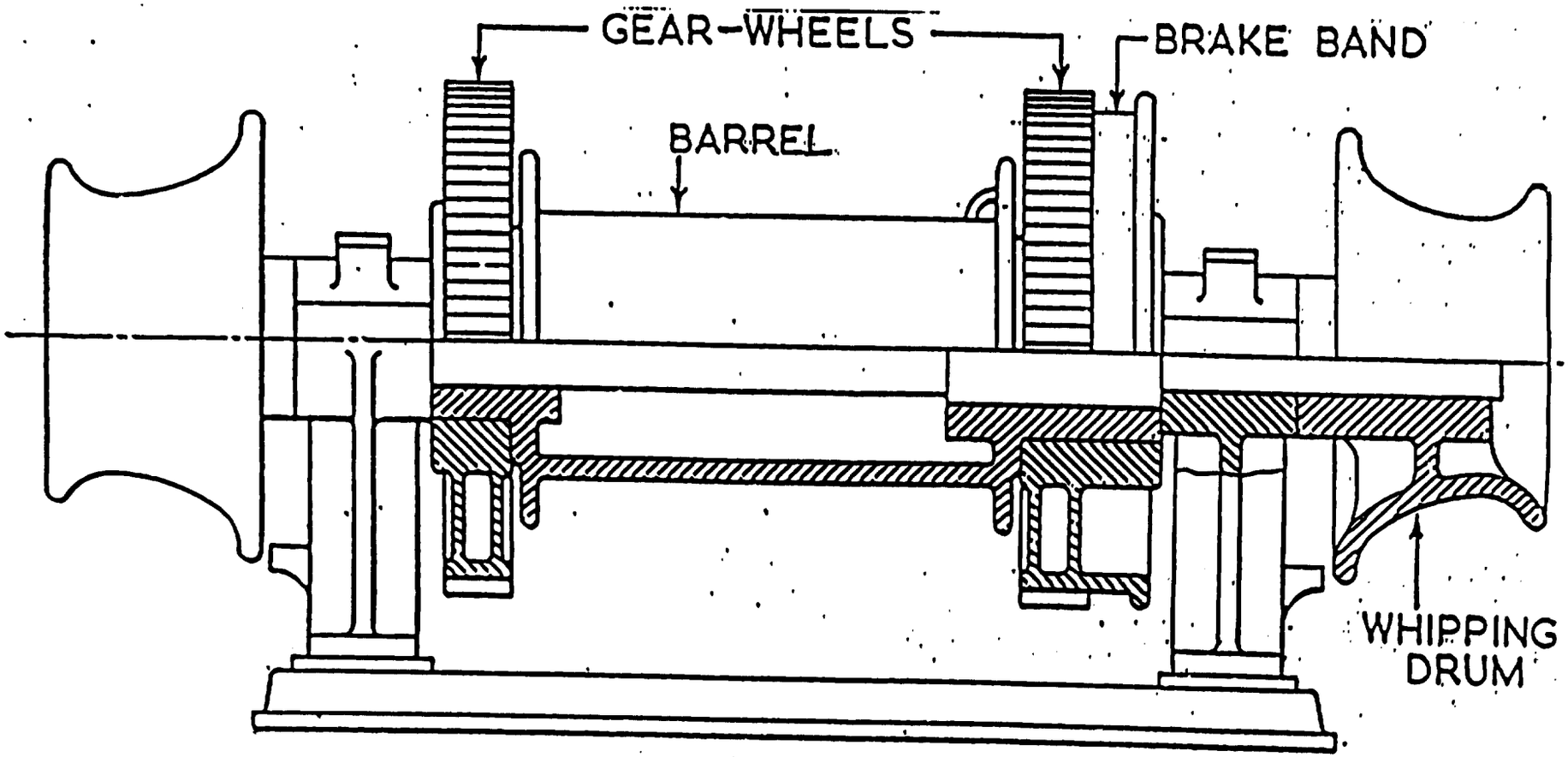
DOUBLE STRAINER



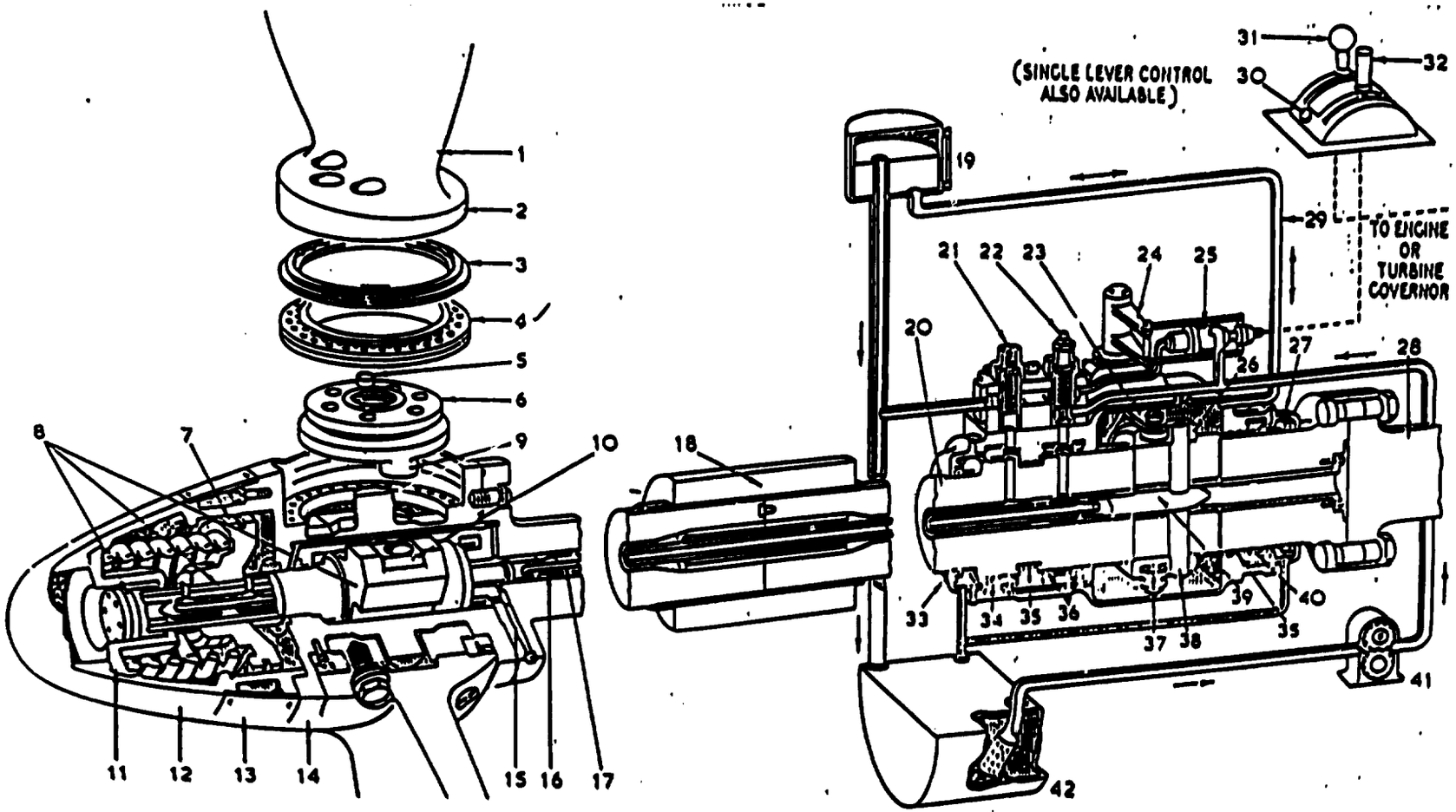
SINGLE STRAINER



PART PLAN OF WINDLASS DOG-CLUTCH-TYPE LIFTER



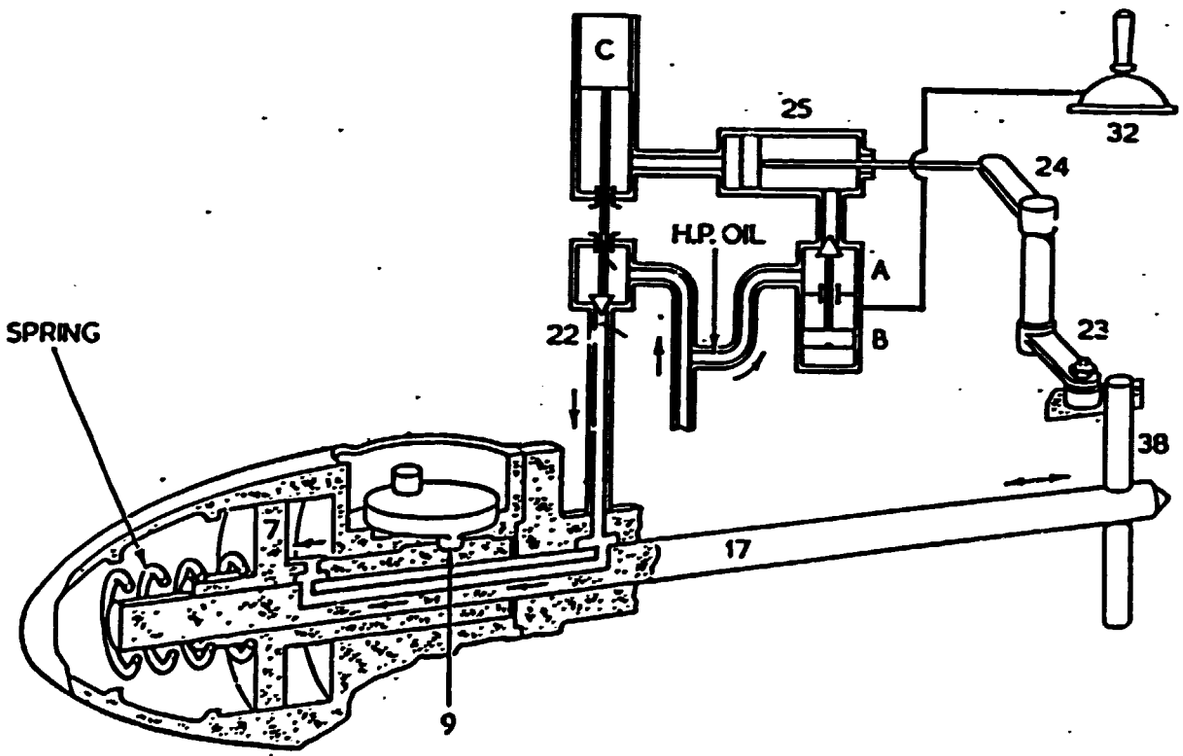
BARREL ASSEMBLY OF STEAM WINCH



"KaMeWa" Controllable-pitch Propeller
(For key to figures see opposite page)

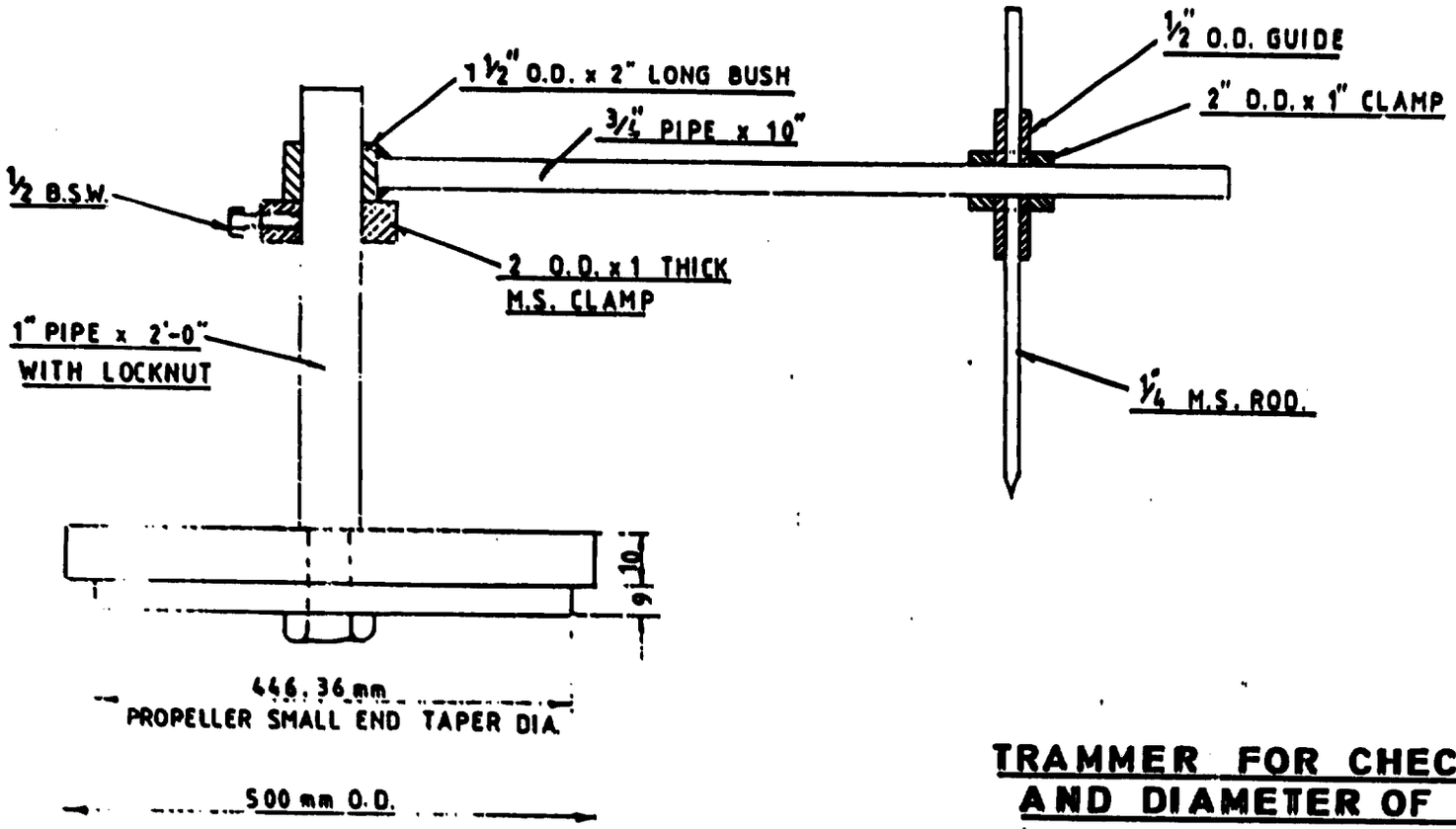
Key to Figure

1. Propeller blade.
2. Flange.
3. Sealing ring.
4. Bearing ring.
5. Alignment dowel.
6. Crank pin ring.
7. Actuating piston.
8. Piston rod assembly (which moves fore and aft with the piston).
9. Crank pin.
10. Sliding shoe with hole for crank pin.
11. Springholder and safety spring.
12. Hub cone.
13. Fairing plate.
14. Hub body.
15. Passages, for equalizing pressure in all parts of hub chamber.
16. Universal joint.
17. Valve rod.
18. SKF-coupling.
19. Upper oil tank.
20. Intermediate shaft.
21. Back pressure regulating valve.
22. Inlet pressure regulating valve.
23. Yoke lever.
24. Linkage to yoke lever.
25. Pitch control auxiliary servomotor.
26. Sliding sleeve.
27. End cover.
28. Intermediate shaft or direct coupling to prime mover.
29. Fill and static pressure line.
30. Indicator lamp for engine load.
31. Speed control.
32. Pitch control.
33. End cover.
34. Low pressure seal.
35. White metal bearings for supporting and positioning oil distribution box on shaft.
36. High pressure seal.
37. Roller guides at extremity of yoke lever.
38. Key.
39. Valve rod.
40. Low pressure seal.
41. Positive displacement pressure pump driven by propeller shaft or separate motor.
42. Lower oil storage tank usually incorporated in ship structures.



Simplified Diagram of "KaMeWa" Propeller Operating gear

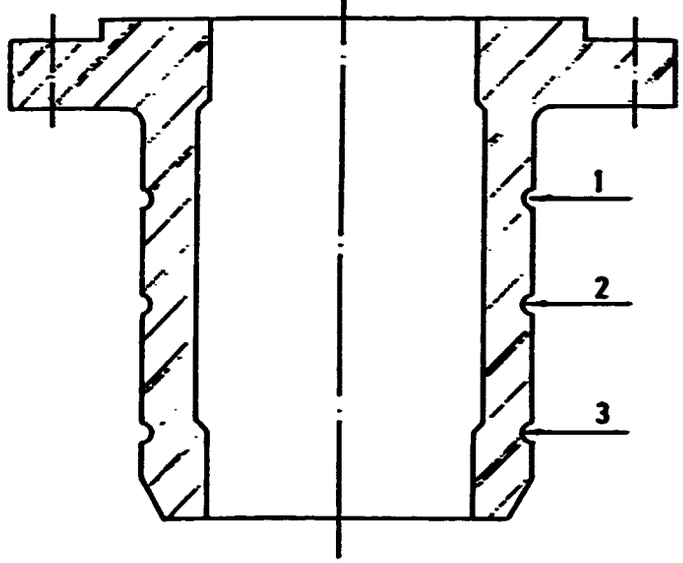
Operation: Movement of 32 on the bridge actuates piston B opening Valve A. H.P. oil is now admitted to 25 which operates lever 24. This operates pin 38 which slides rod 17 along to open the oil port to piston 7. At the same time the movement of 25 lifts piston C opening valve 22 admitting H.P. oil to the passage in 17 through which it reaches the main piston 7; the movement thus operates pin 9 which being eccentric to the centre line of the blade, turns the blade, so changing the pitch.



TRAMMER FOR CHECKING PITCH AND DIAMETER OF PROPELLER

SIMPLEX SEAL
STERN TUBE SEAL

AFT LINER



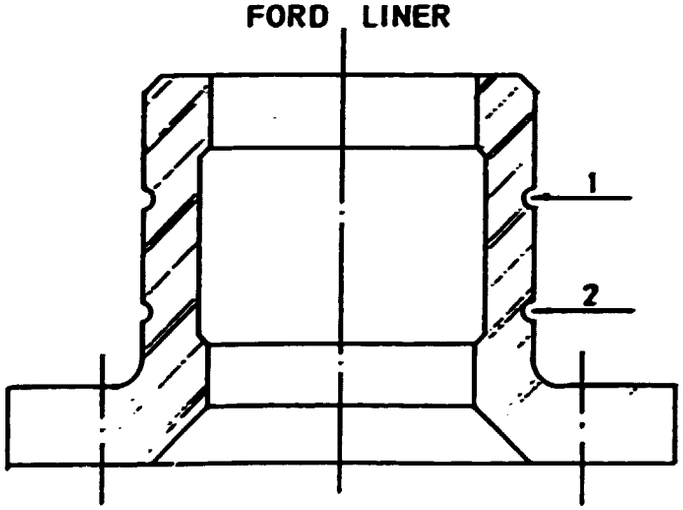
ORGINAL STANDARD:_____
BEFORE SIZE MACHINING
DEEP OF GROOVES

1	
2	
3	

FLOATING RING SIZE

RECONDITION SIZE:_____

FORD LINER

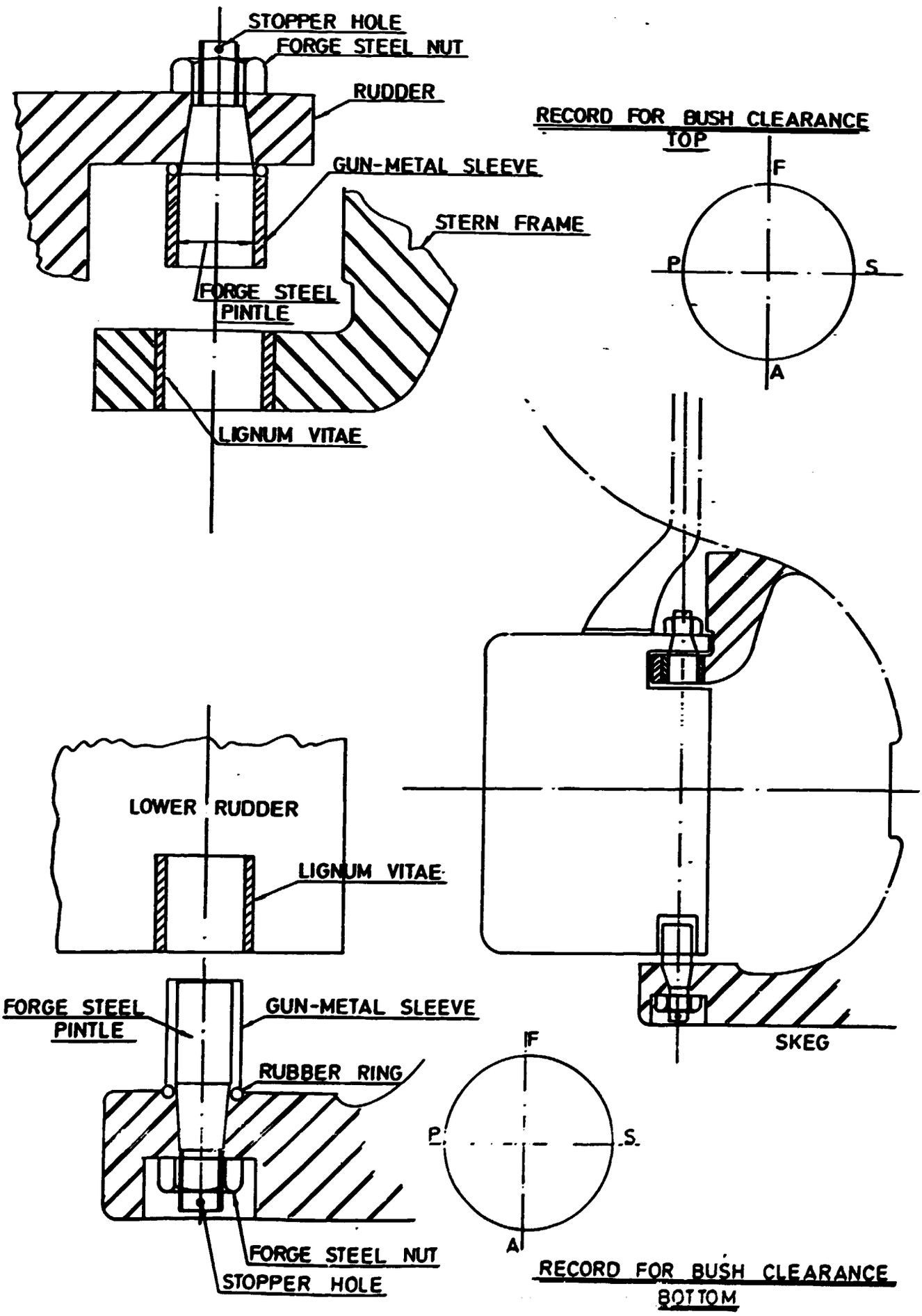


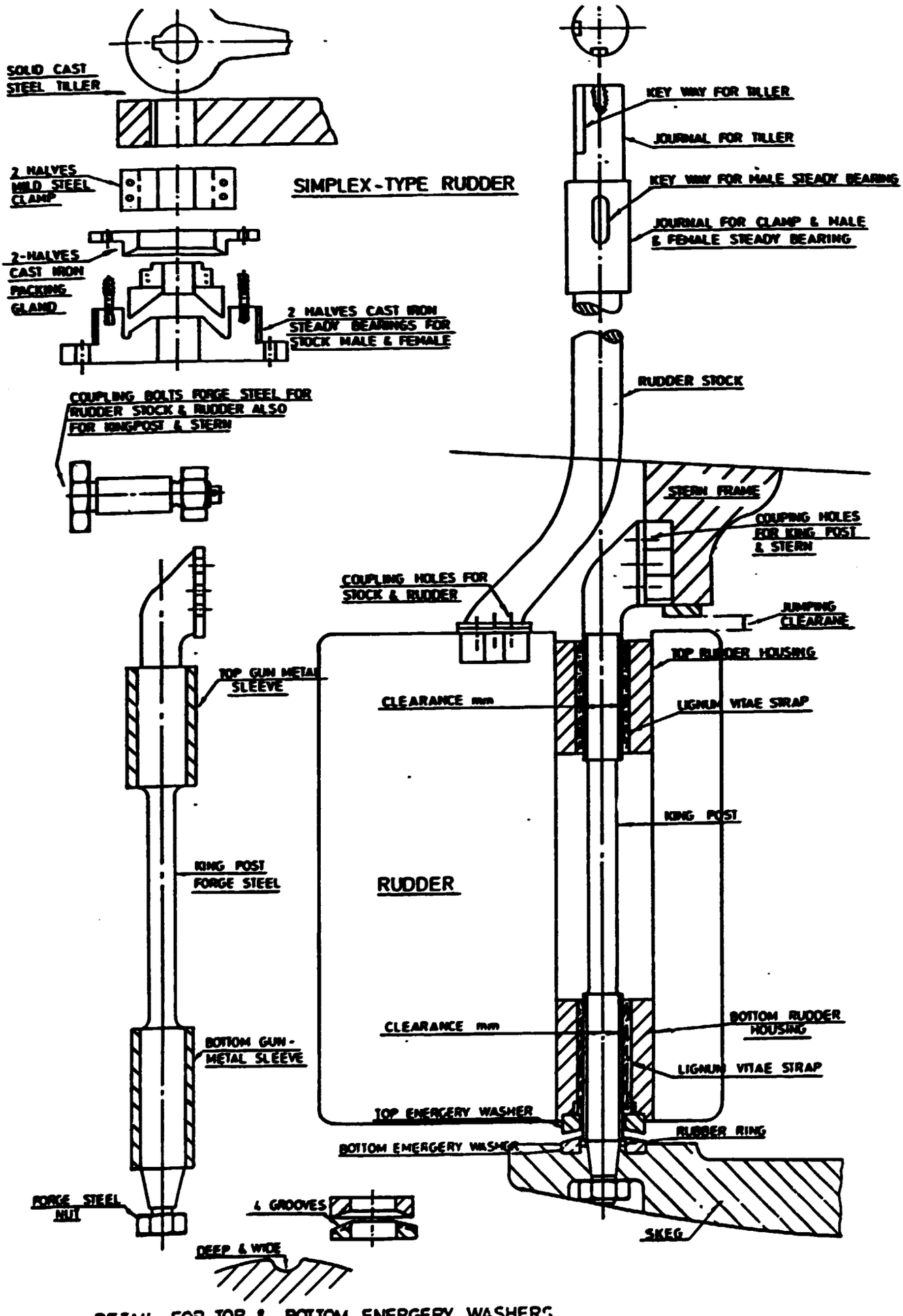
ORGINAL STANDARD:_____
BEFORE SIZE MACHINING
DEEP OF GROOVES

1	
2	

RECONDITION SIZE:_____

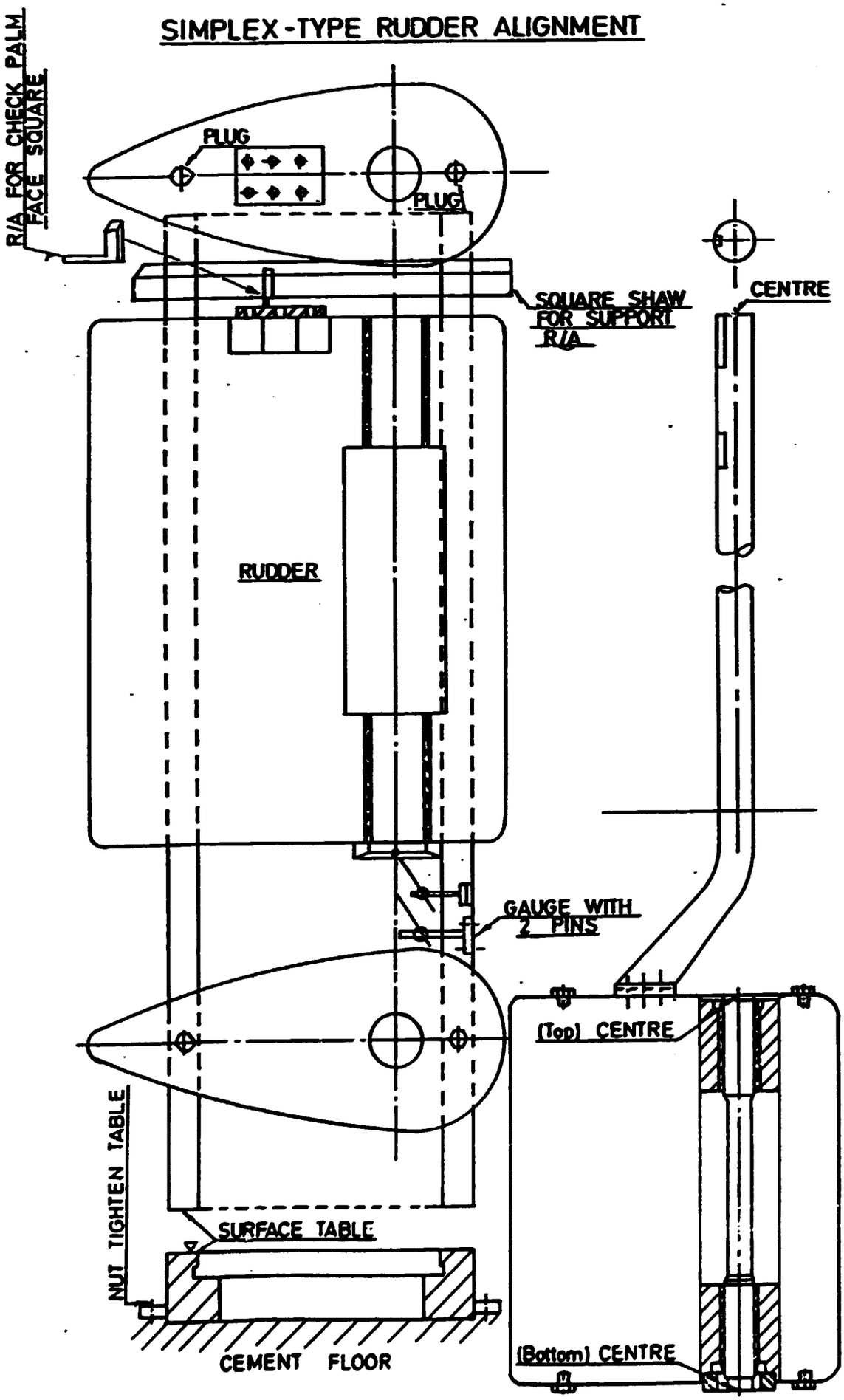
HINGED RUDDER WITH TWO PINTLES



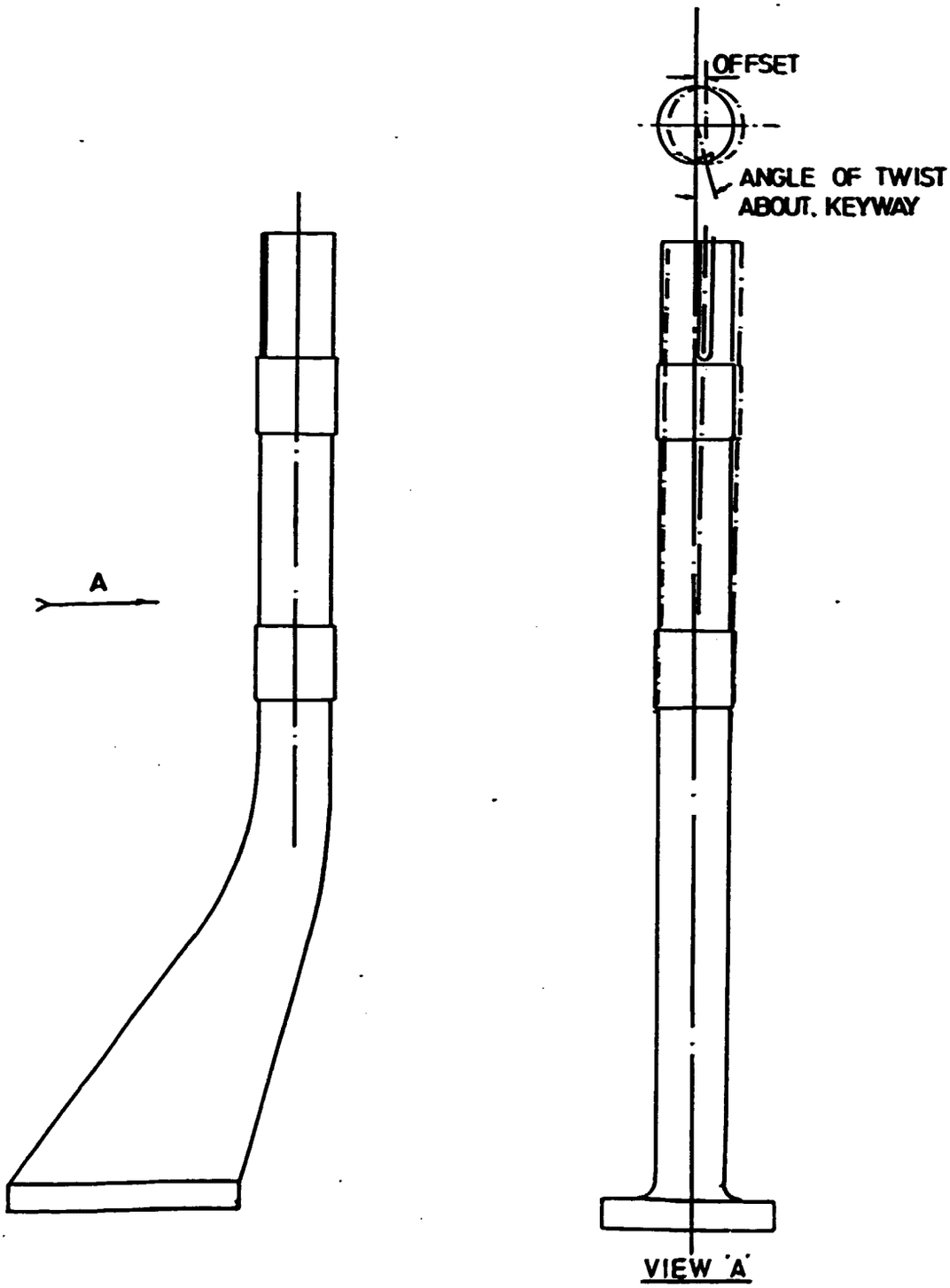


DETAIL FOR TOP & BOTTOM ENERGERY WASHERS

SIMPLEX-TYPE RUDDER ALIGNMENT



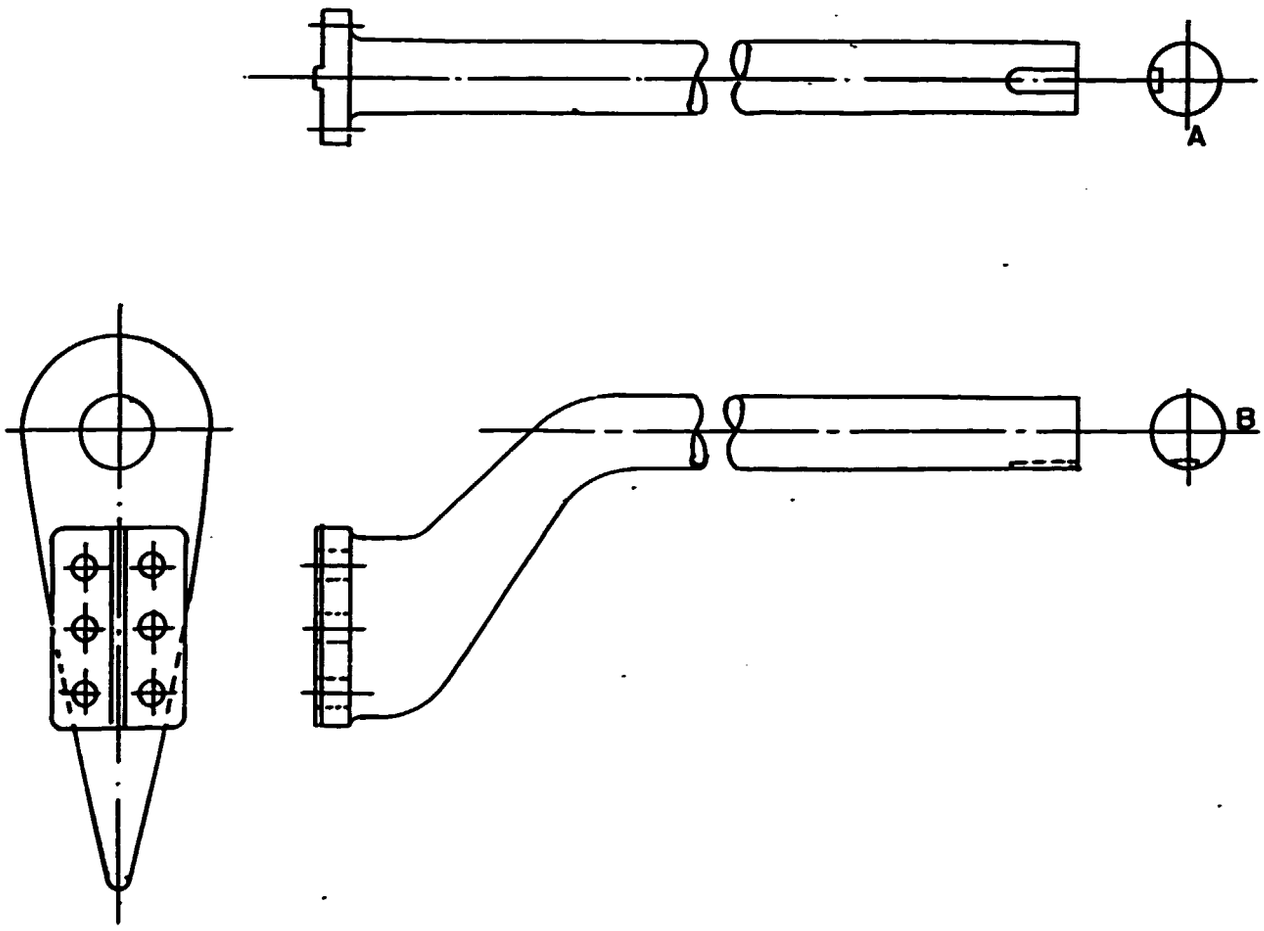
RUDDER STOCK : Deflections



Remarks:

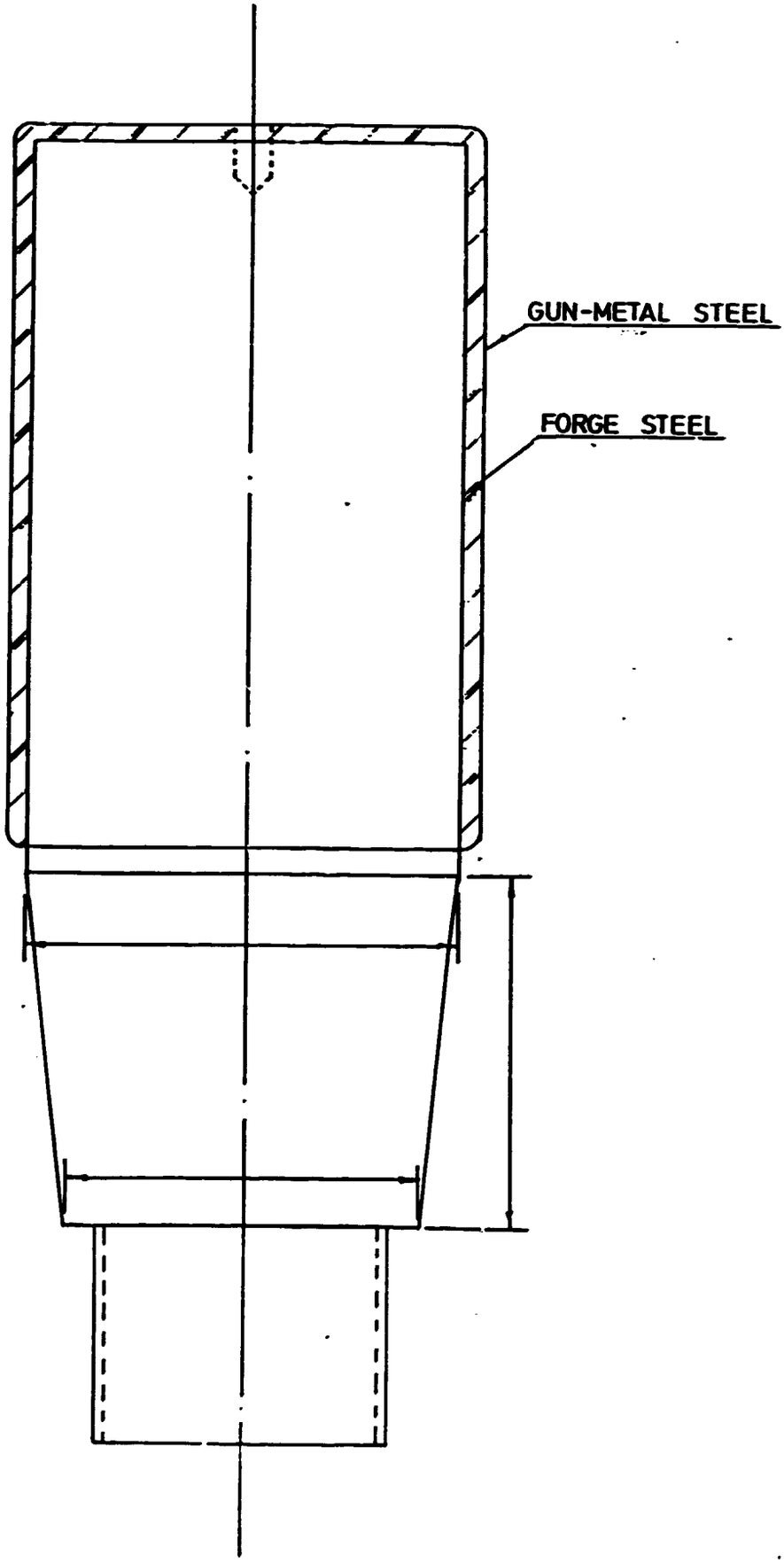
RUDDER STOCK CALIBRATION
(AFTER ANNEALING & STRIAGTENING)

Measurement In : _____

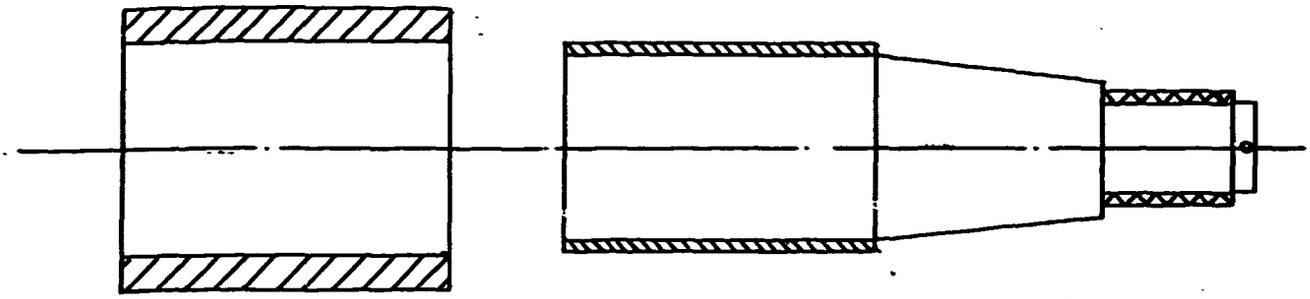


Remarks :

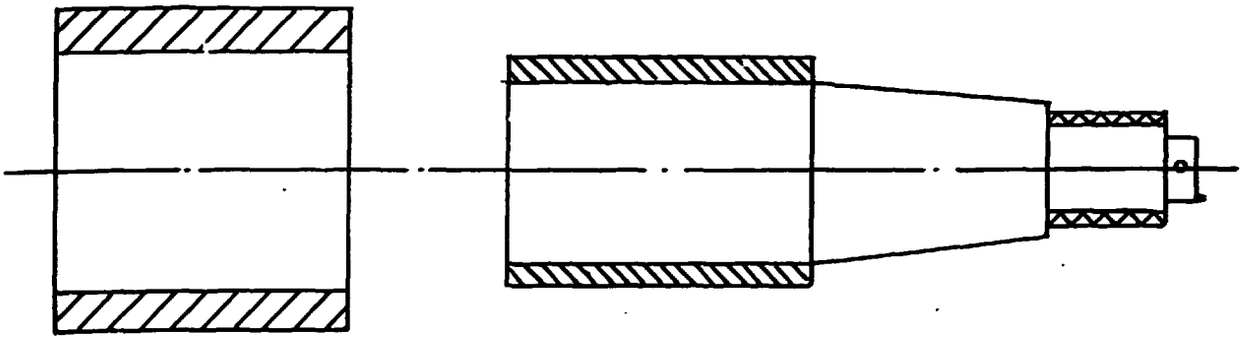
RUDDER PINTLE TOP & BOTTOM



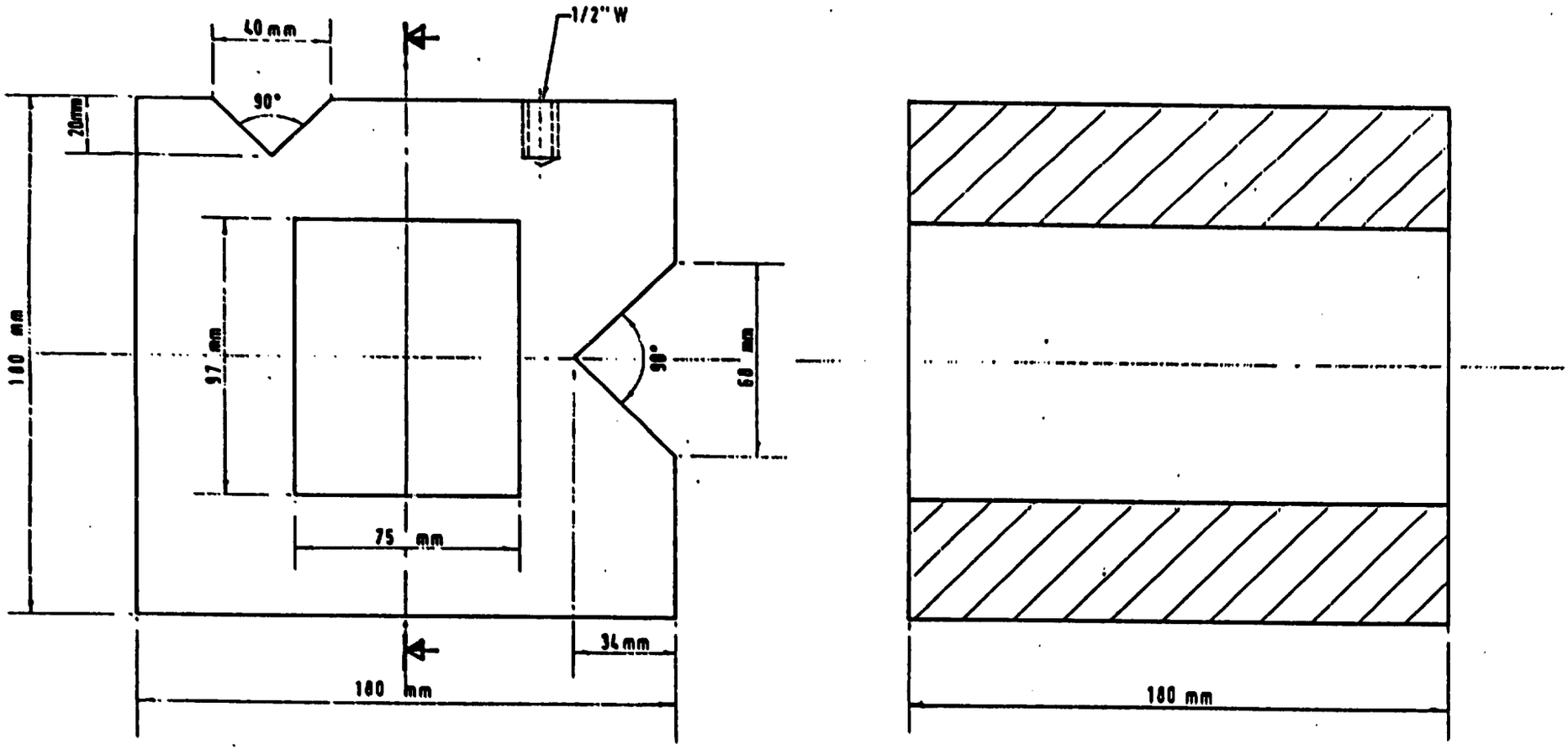
RECORD OF PINTLE & BUSH SIZE



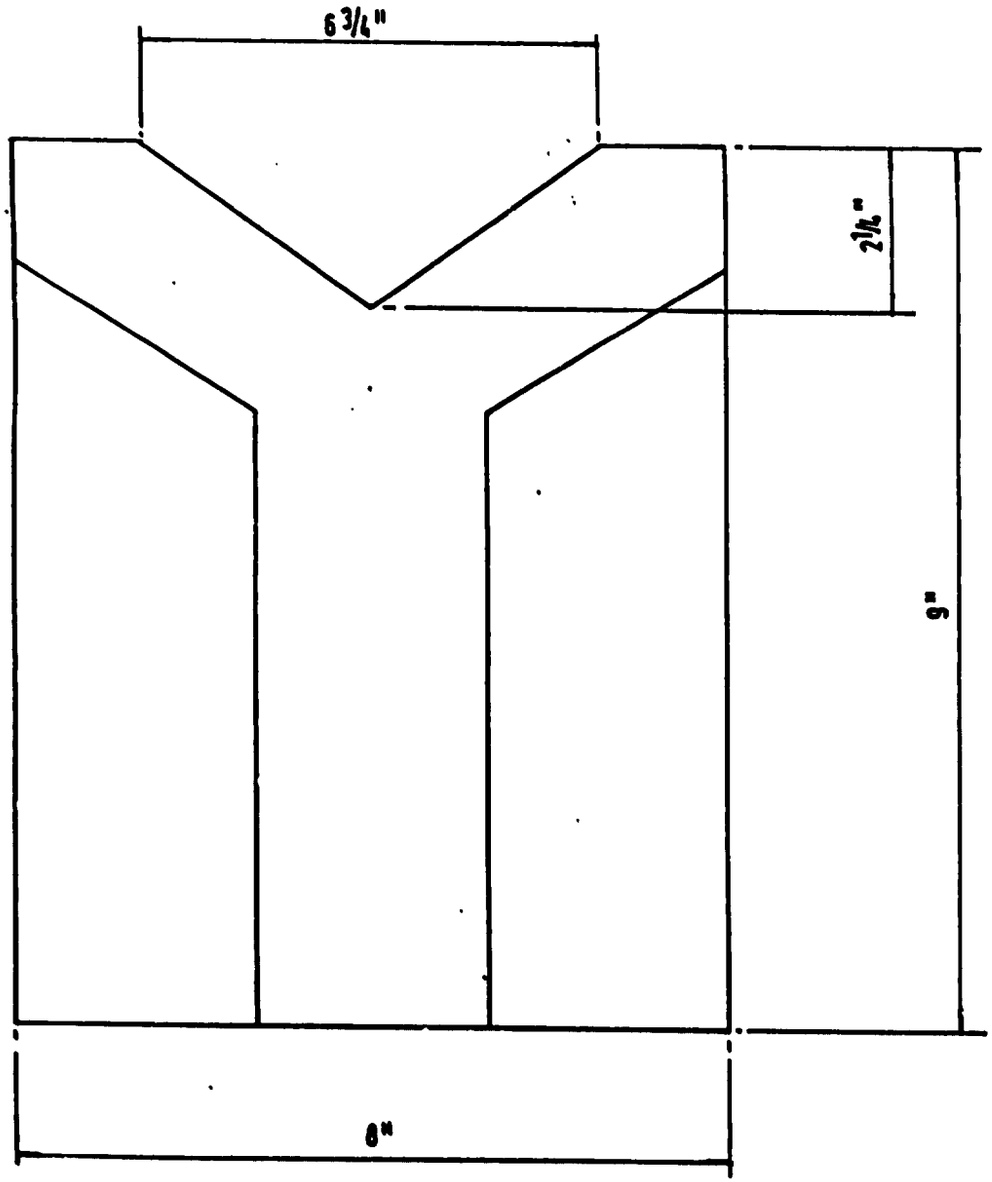
	TOP BUSH		TOP PINTLE
O.D.		O.D.	
I.D.			

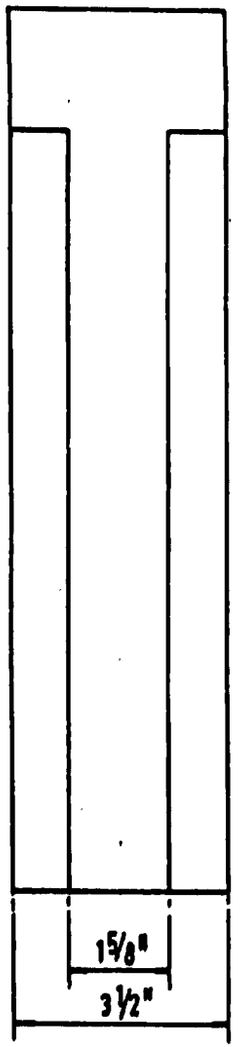


	BOTTOM BUSH		BOTTOM PINTLE
O.D.		O.D.	
I.D.			



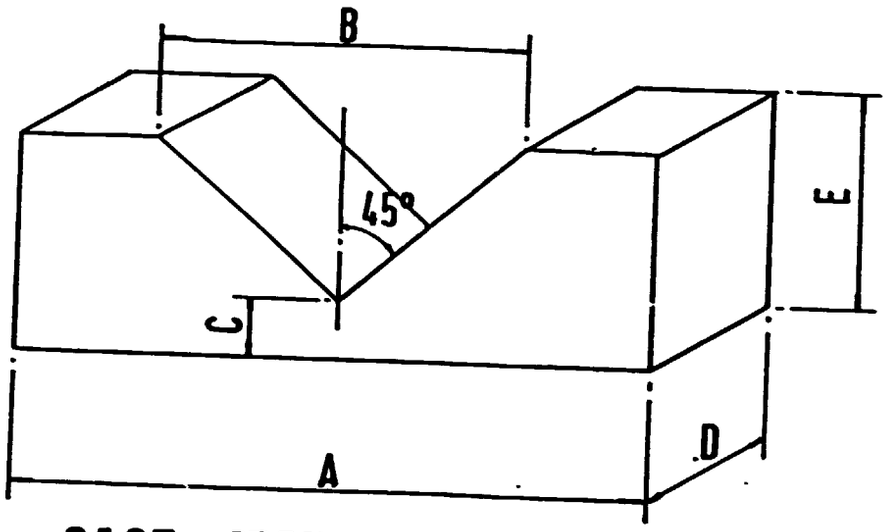
CAST IRON VEE BLOCK





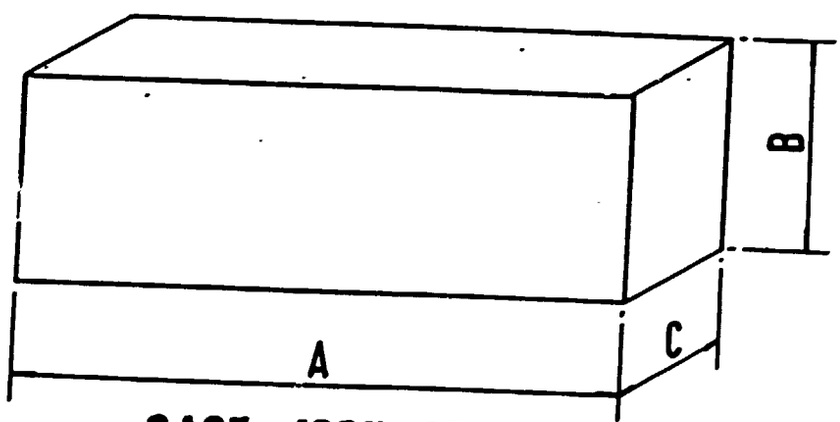
CAST IRON VEE BLOCKS

2-OFF



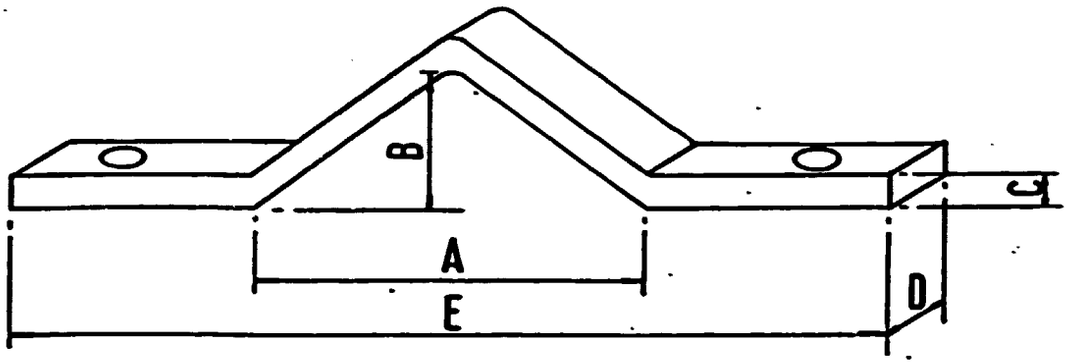
CAST IRON VEE BLOCKS

2-OFF — A = 10"	2-OFF — A = 6"	2-OFF — A = 4"
B = 8"	B = 4"	B = 2"
C = 2"	C = 1"	C = 1"
D = 4"	D = 4"	D = 3"
E = 6"	E = 4"	E = 3"



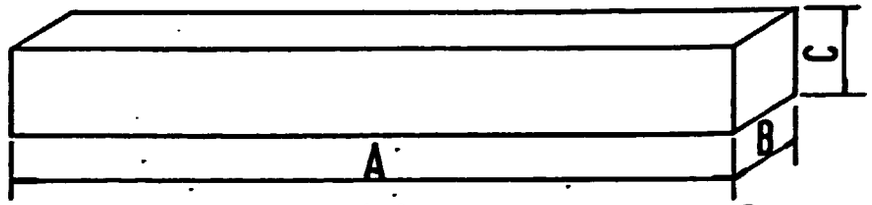
CAST IRON BLOCKS

4-OFF — A = 12"	4-OFF — A = 8"	4-OFF — A = 7"
B = 6¼"	B = 6¼"	B = 4½"
C = 3¼"	C = 4"	C = 2¾"

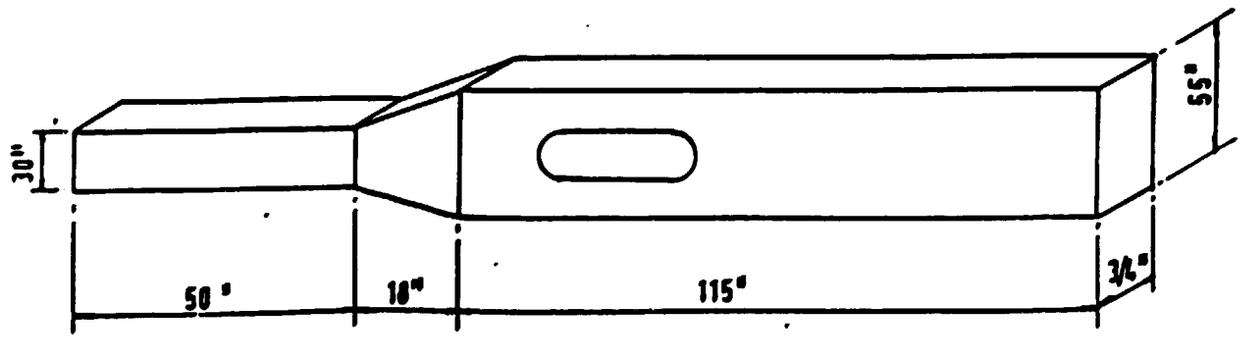


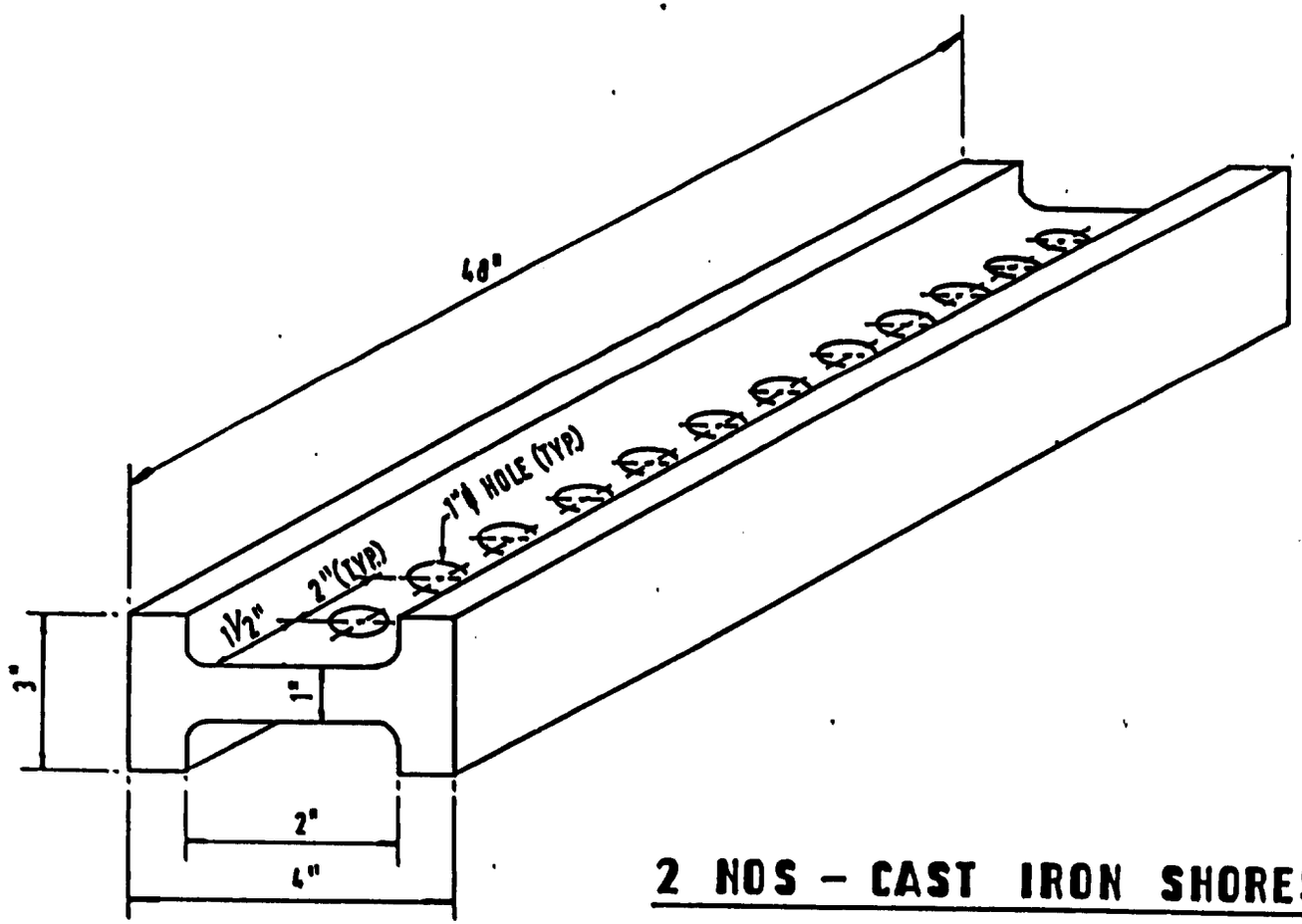
M.S. CLAMP

2 - OFF	2 - OFF
A = 6"	A = 9"
B = 3"	B = 5"
C = 1" THICK	C = 1¼" THICK
D = 1¾" WIDE	D = 2½" WIDE
E = 13"	E = 17"

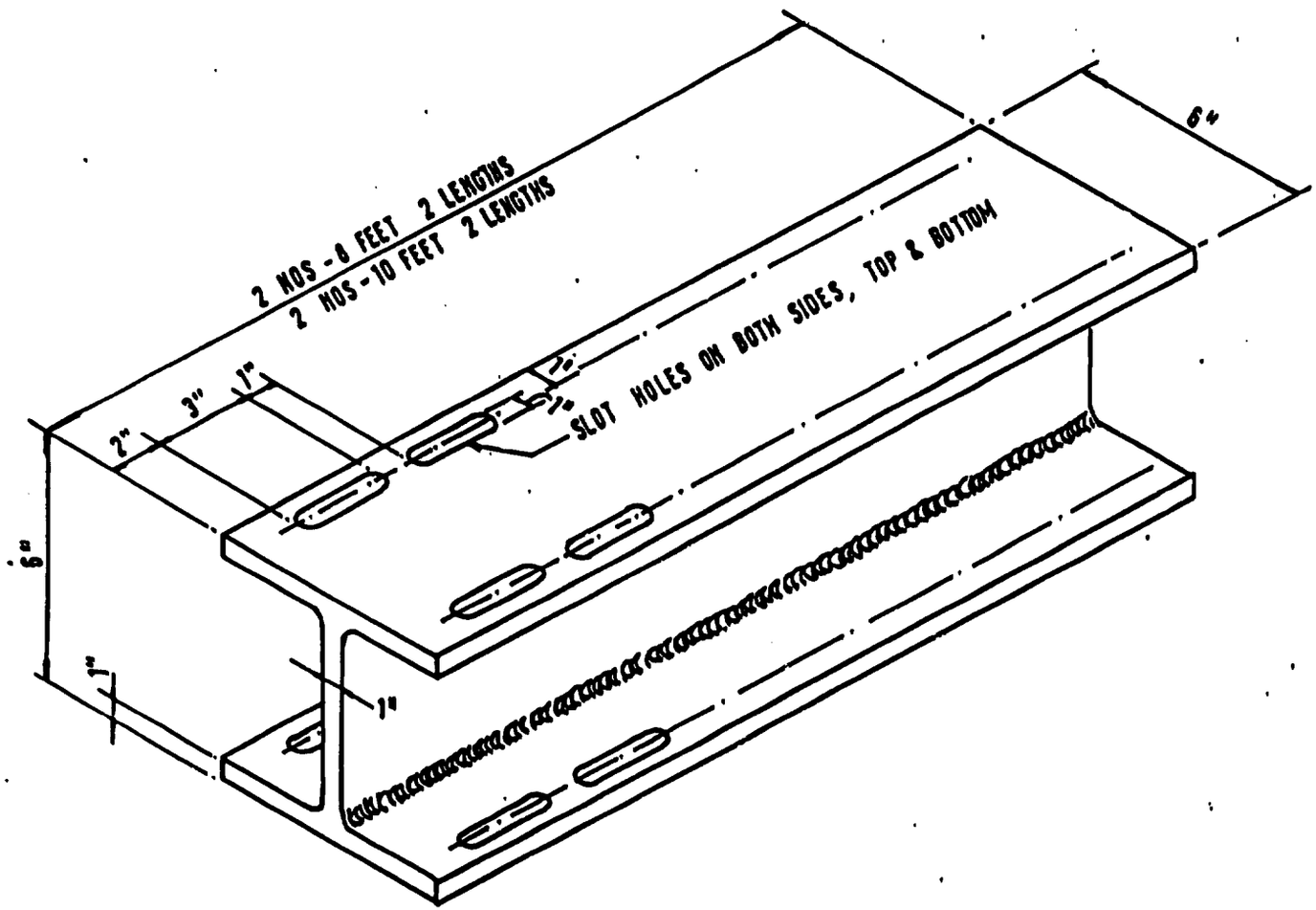


A = 24"	A = 18"	A = 12"
B = 1½"	B = 1½"	B = 1½"
C = 1½"	C = 1½"	C = 1½"

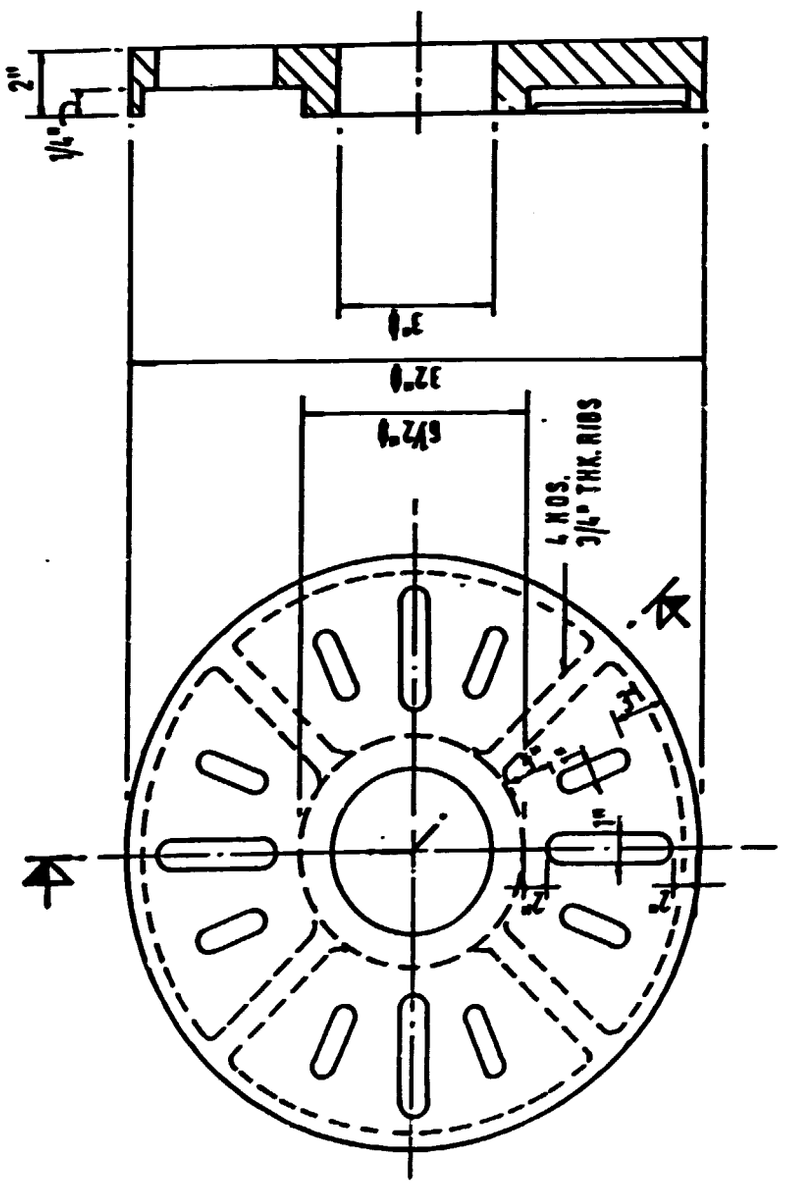




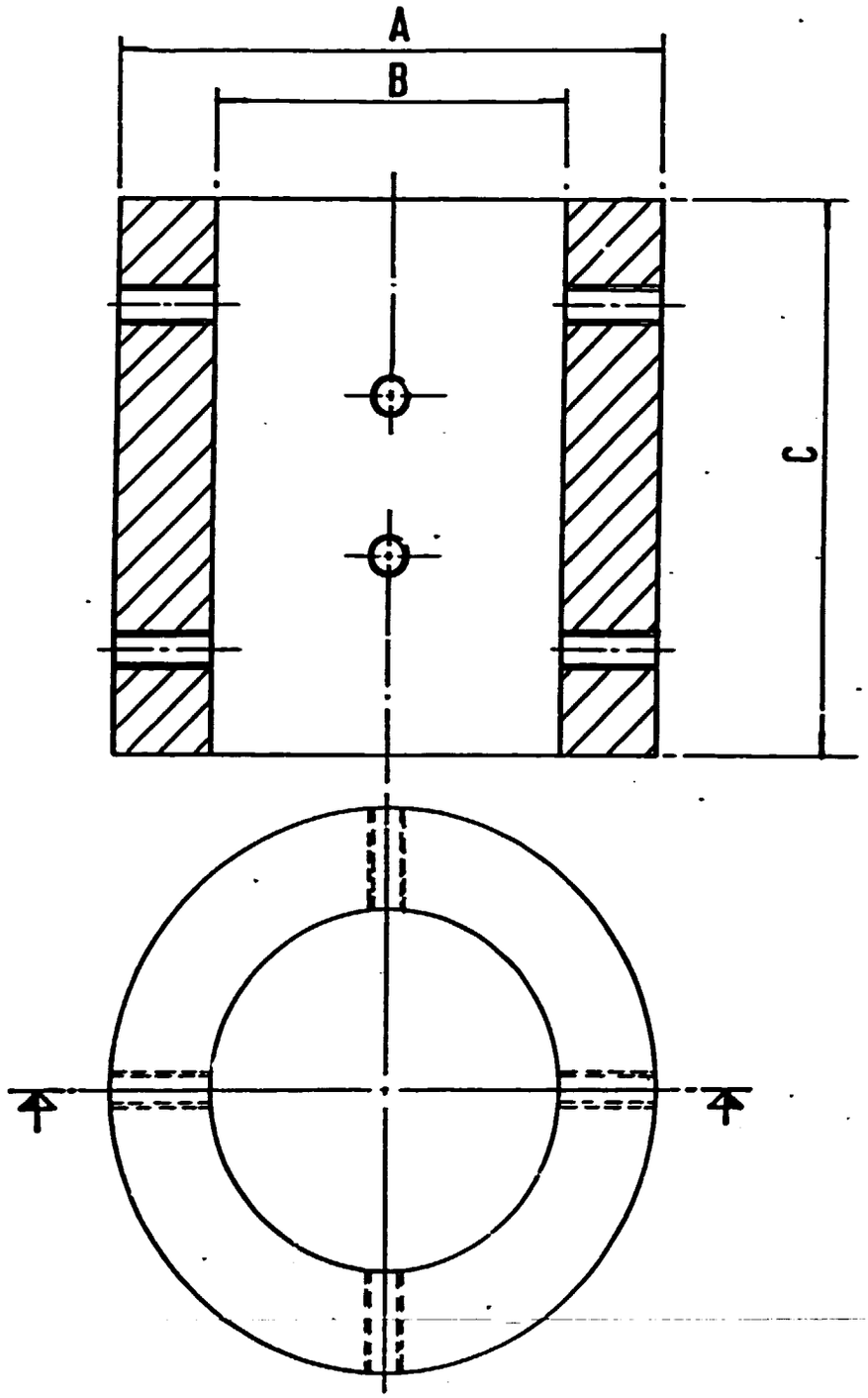
2 NOS – CAST IRON SHORES



CAST IRON SHORES

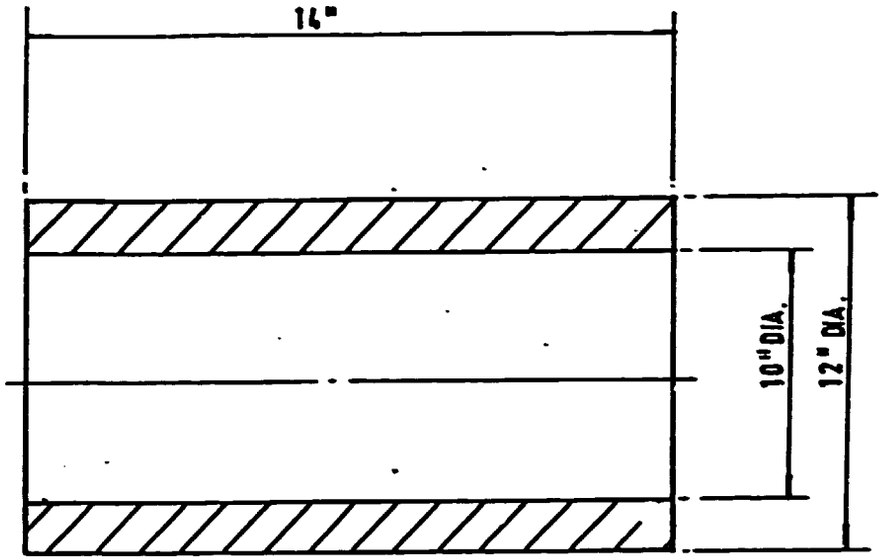


1 NO. CAST IRON FACE PLATE

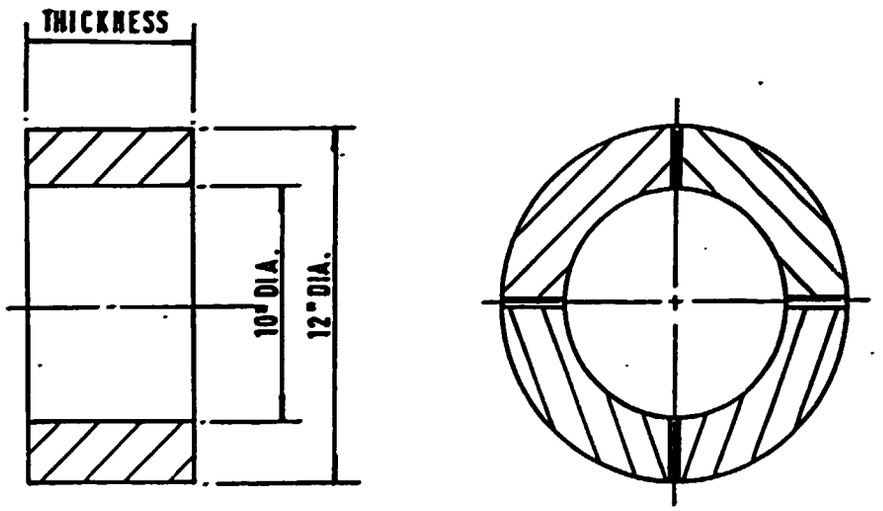


CAST IRON STEADY BUSH

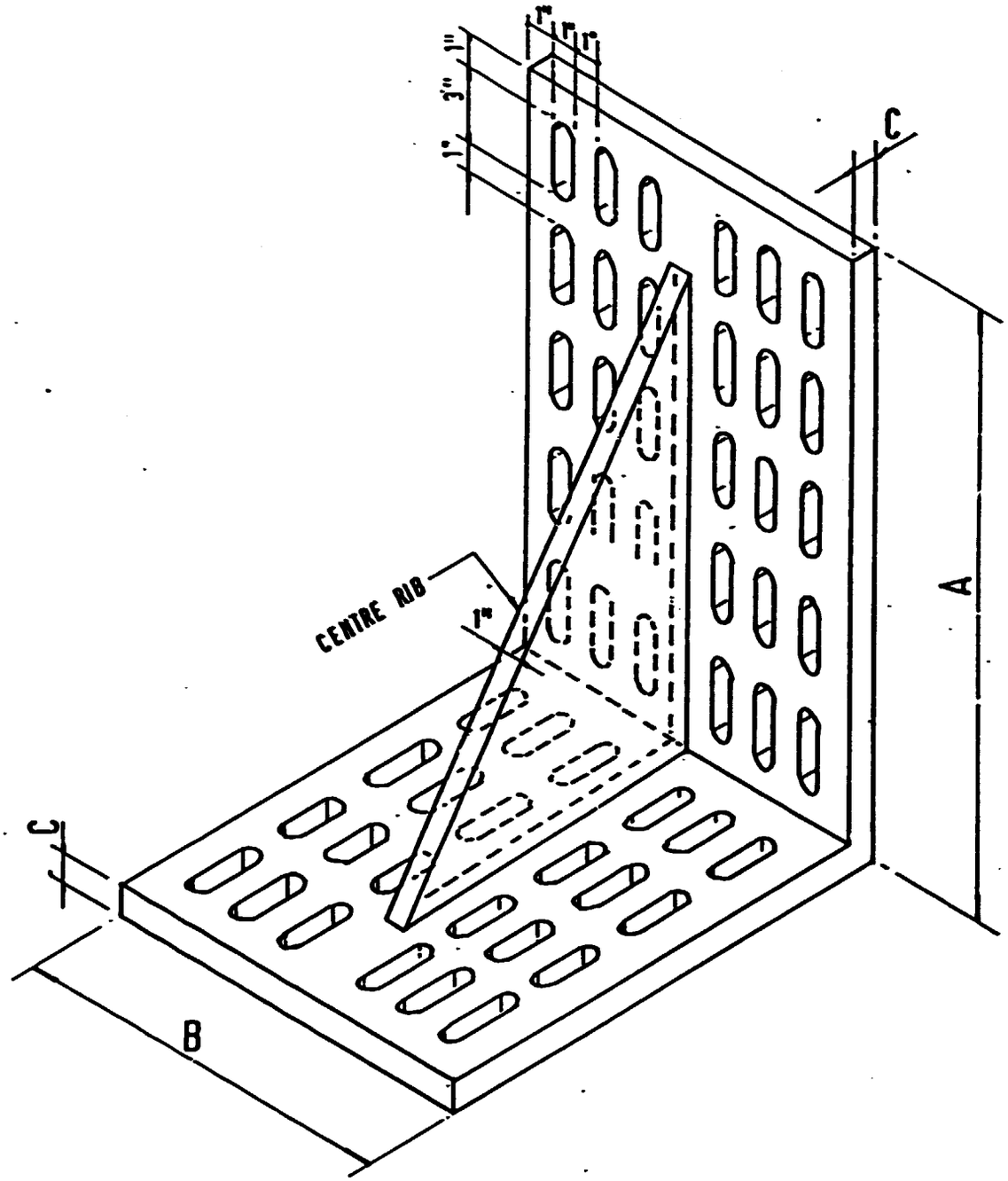
1 OFF	A = 14 5/8"	B = 11 5/8"	C = 11 3/4"
1 OFF	A = 8 5/8"	B = 7"	C = 7 7/8"
1 OFF	A = 4 1/4"	B = 3 3/16"	C = 8 1/8"



SPOOL FOR SQUARE RING CUT IN PIECE

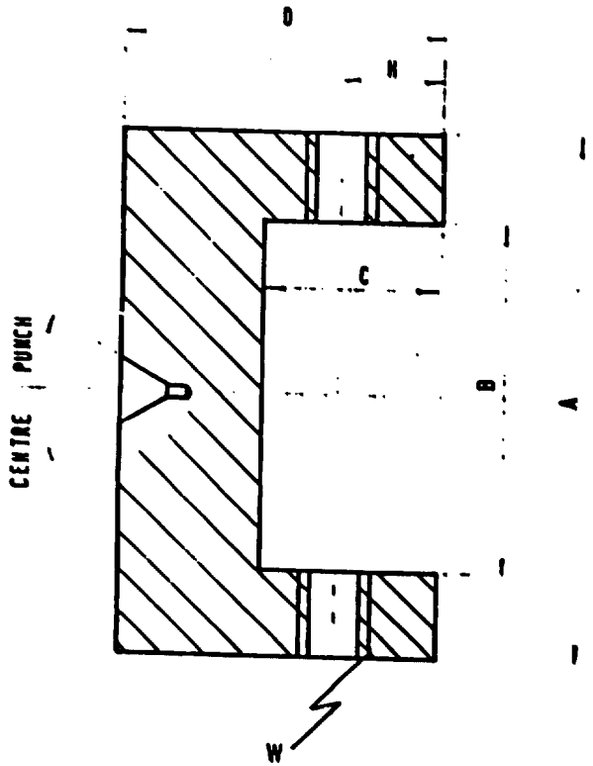


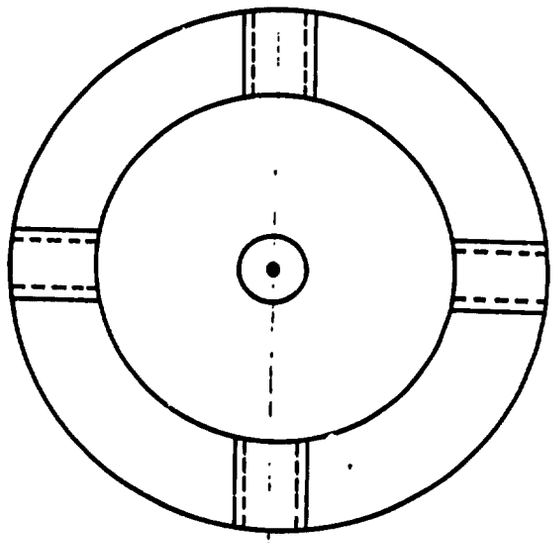
SQUARE CHOCKS

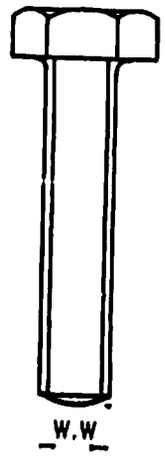


	A	B	C
2 OFF –	12"	8"	1"
2 OFF –	16"	12"	1⅛"
2 OFF –	24"	16"	1⅛"

ANGLED SHORES

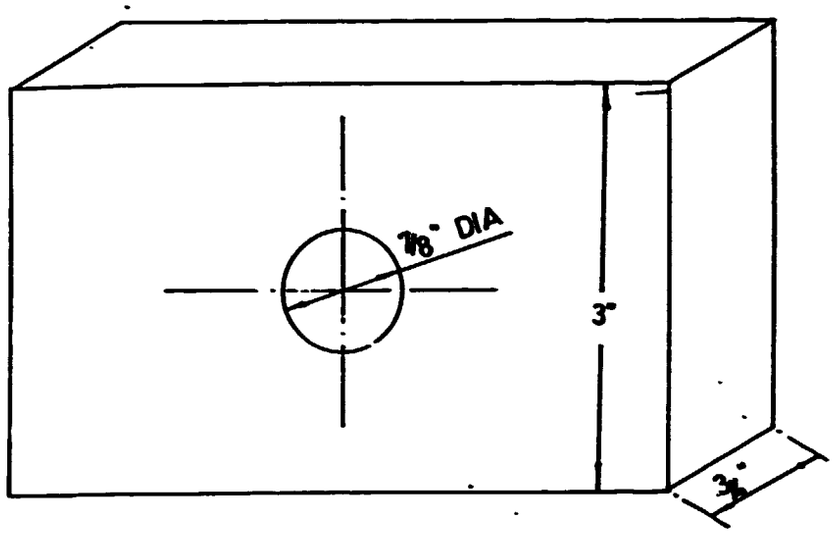




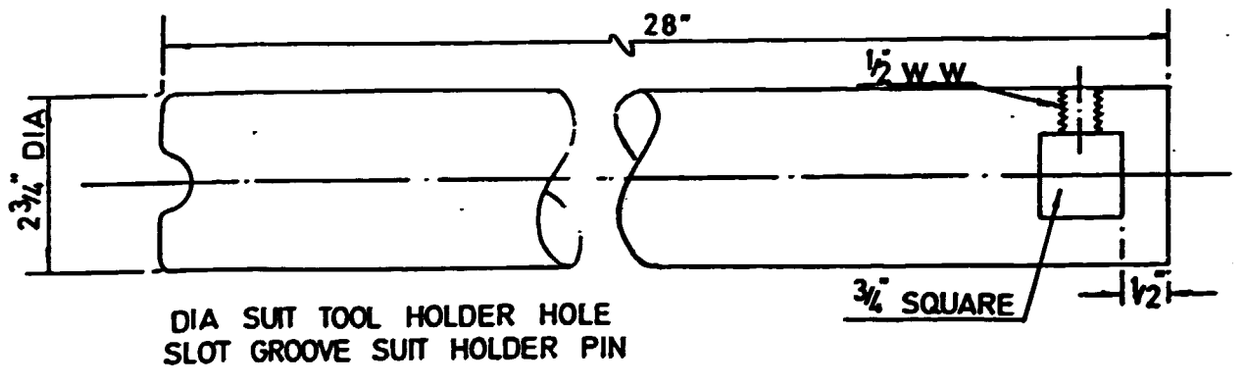


MILD STEEL END - CENTRES

	1	2	3	4	5	6
A	3"	5-3/8"	6"	8-1/4"	10"	15"
B	2"	4-3/16"	5"	6-1/8"	8-1/4"	13"
C	1"	1-1/8"	1-1/4"	1-1/8"	1-1/2"	1-1/2"
D	1-3/4"	1-3/4"	2-1/4"	2·1/4"	2-1/2"	2-1/2"
H	9/16"	9/16"	9/16"	9/16"	3/4"	3/4"
W	3/8" W.W.	3/8" W.W	3/8" W.W	3/8" W.W	5/5" W.W	5/8"



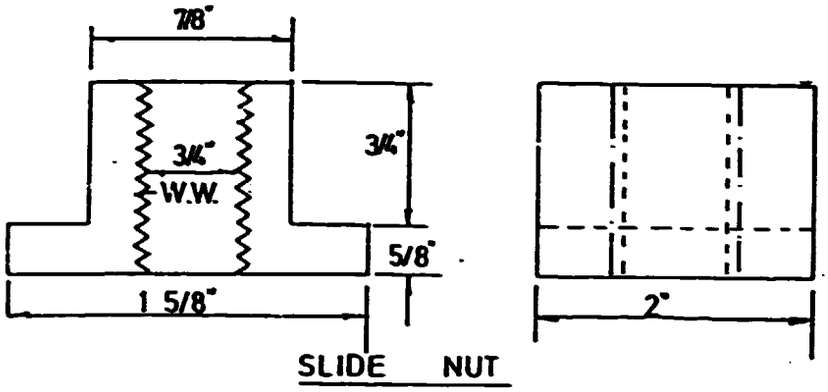
HOLDING PLATES



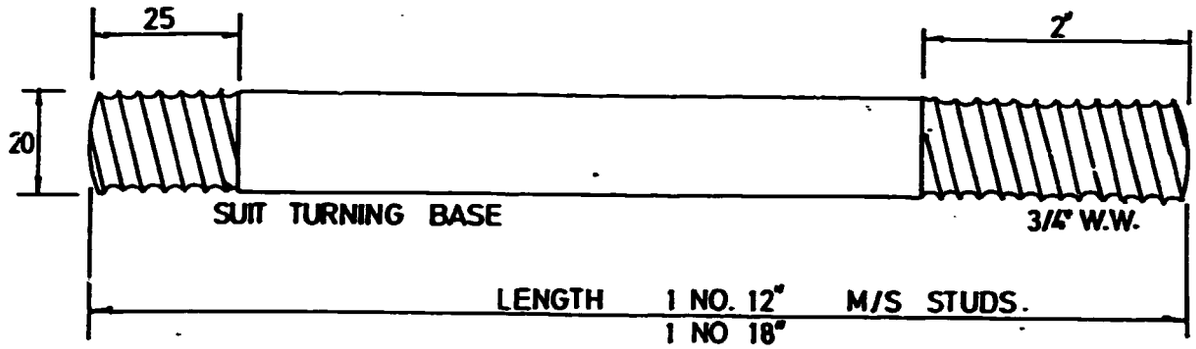
DIA SUIT TOOL HOLDER HOLE
SLOT GROOVE SUIT HOLDER PIN

FORGED STEEL BORING BAR

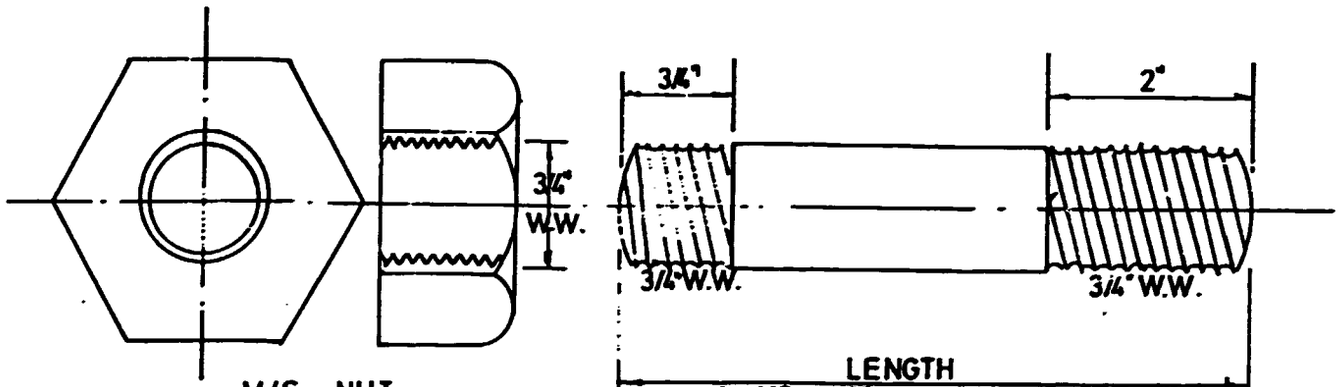
TOOLS FOR VERTICAL BORING MACHINE



SLIDE NUT

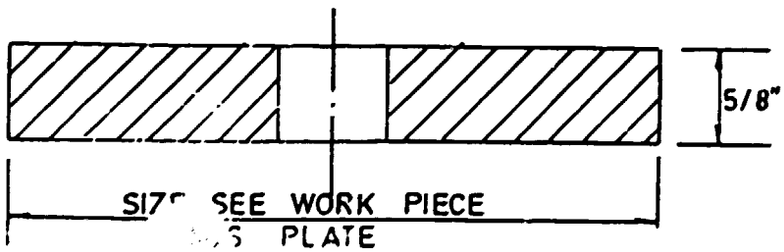


LENGTH 1 NO. 12" M/S STUDS.
1 NO 18"
1 NO 24"
1 NO 36"



M/S NUT-

LENGTH
4 NO. = 6" M/S STUDS
4 NO. = 8"

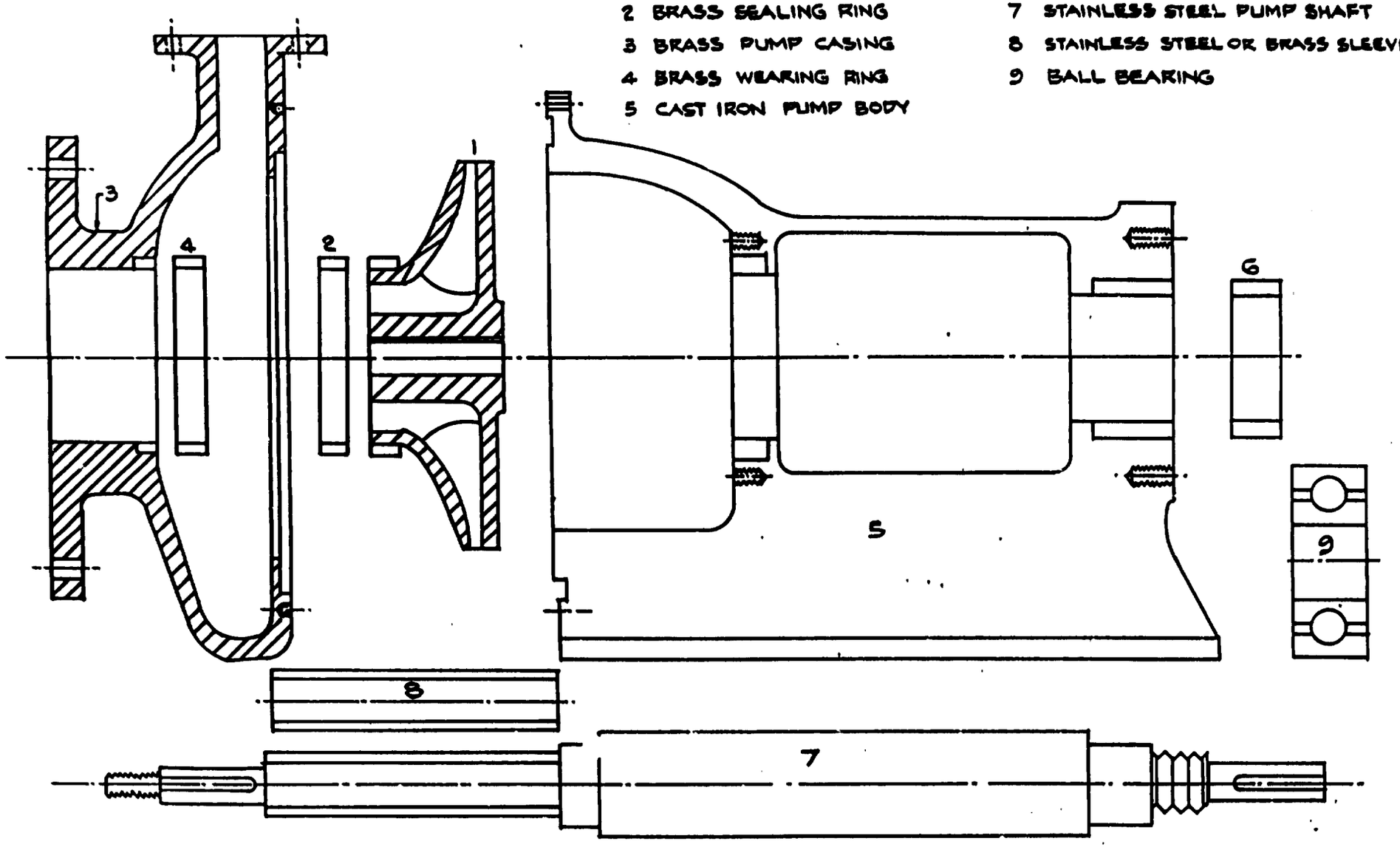


ROUND CLAMPING PLATE

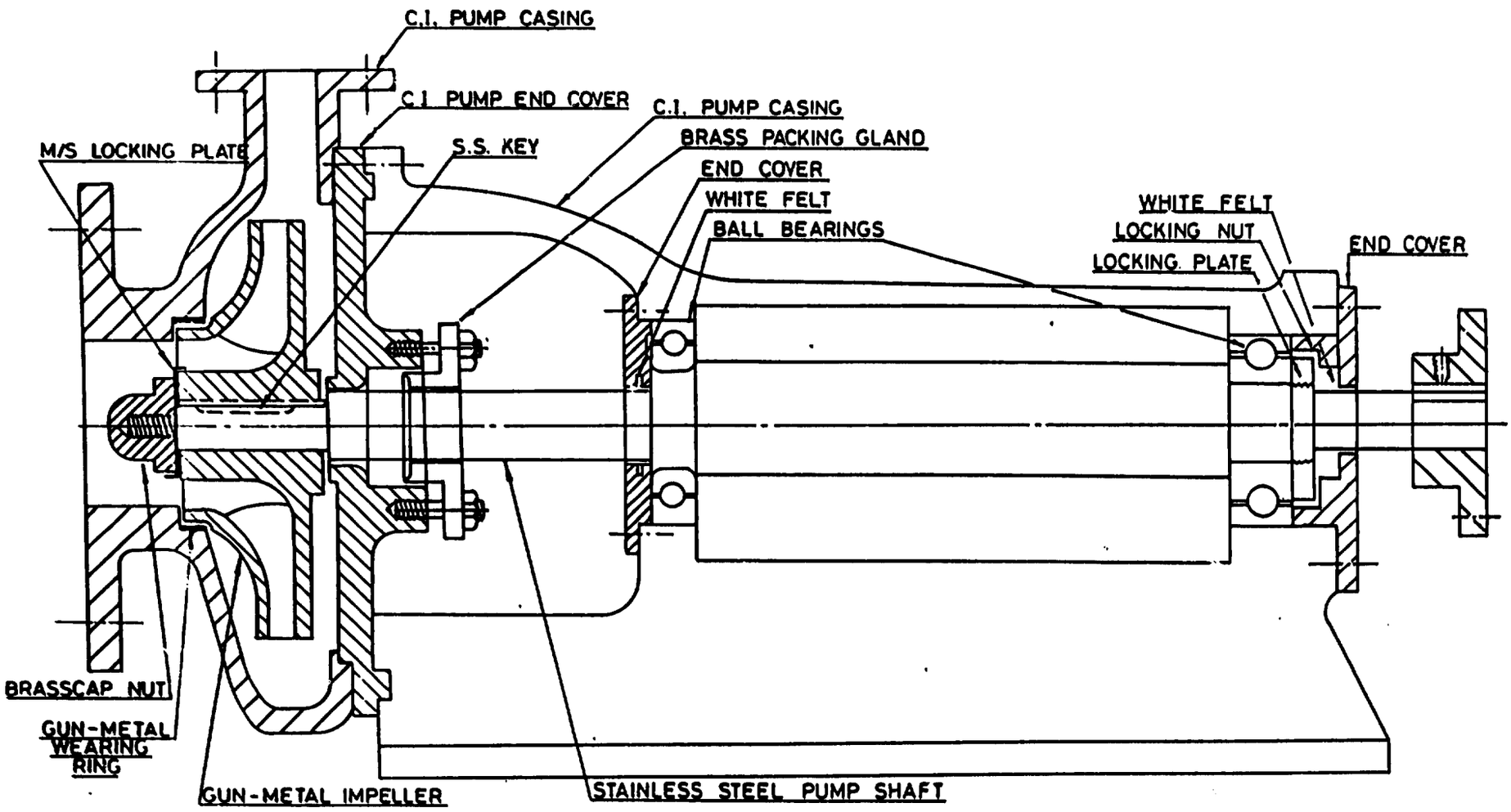
DETAIL:- RECONDITION OF PUMPS

NOTE:- B-B = BALL BEARING S/S = STAINLESS STEEL

1 BRASS IMPELLER
2 BRASS SEALING RING
3 BRASS PUMP CASING
4 BRASS WEARING RING
5 CAST IRON PUMP BODY
6 MILD STEEL BALL BEARING SLEEVES
7 STAINLESS STEEL PUMP SHAFT
8 STAINLESS STEEL OR BRASS SLEEVE
9 BALL BEARING

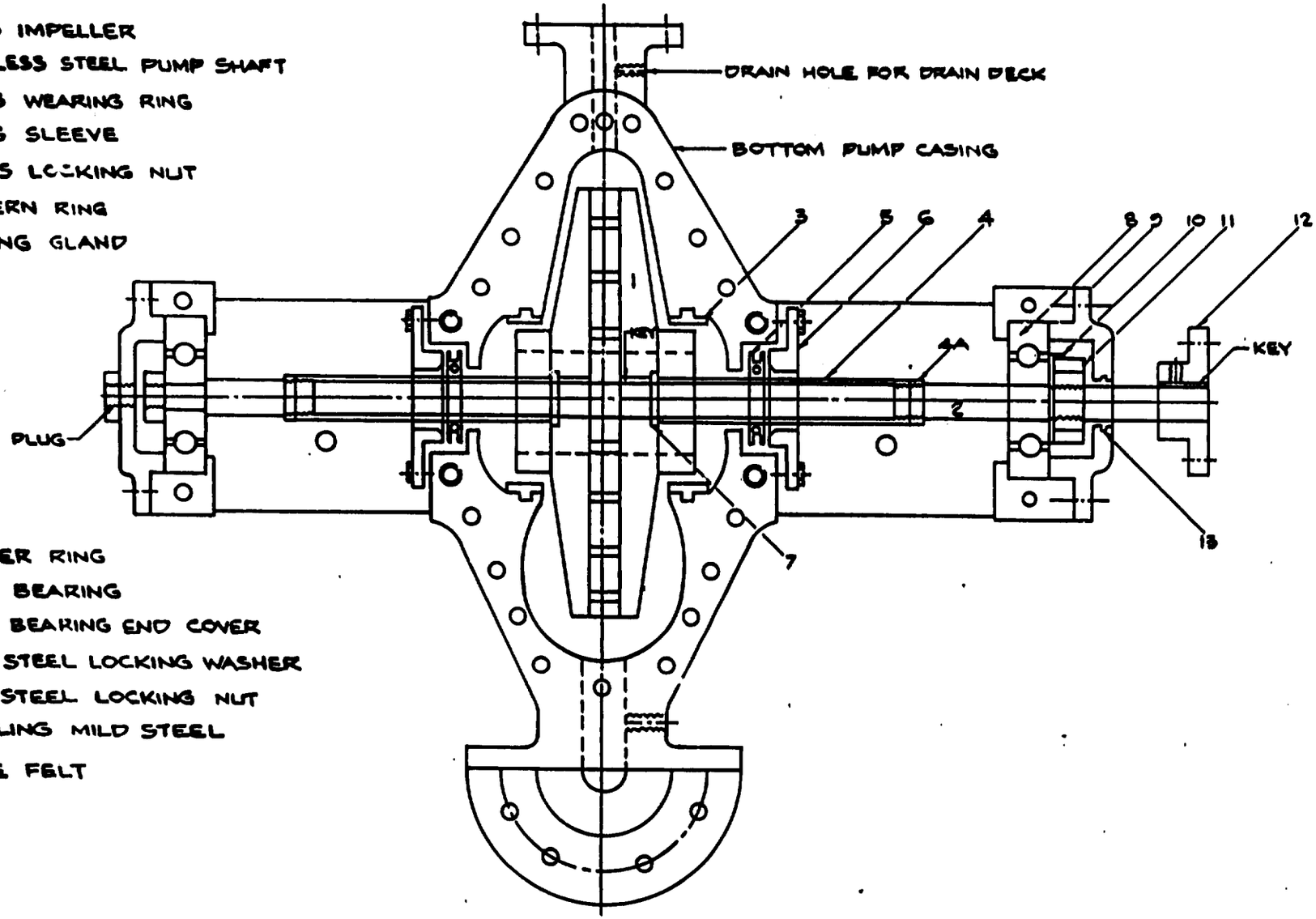


FRESH WATER OR SALT WATER COOLING PUMPS



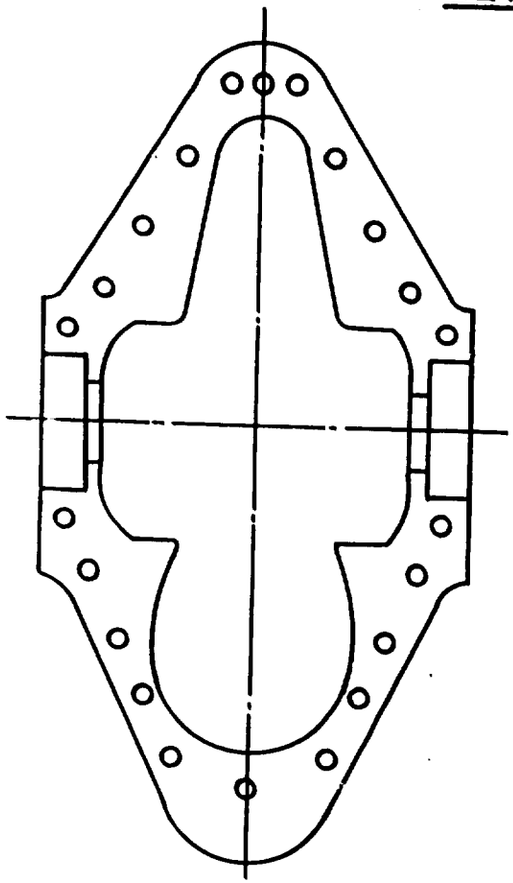
DETAILS OF F/W AND S/W COOLING PUMPS

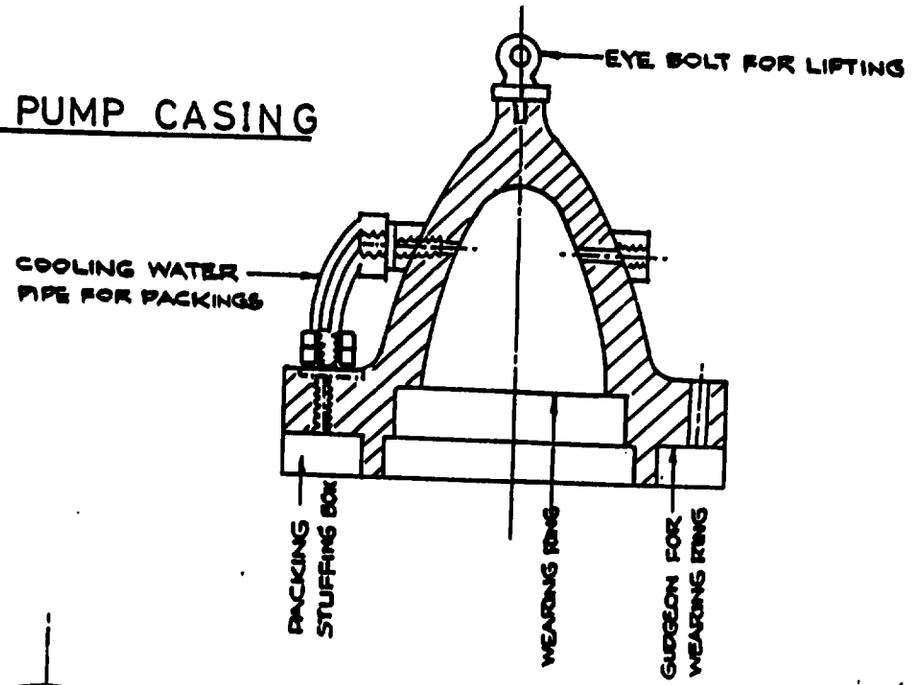
1 BRASS IMPELLER
2 STAINLESS STEEL PUMP SHAFT
3 BRASS WEARING RING
4 BRASS SLEEVE
4A BRASS LOCKING NUT
5 LANTERN RING
6 PACKING GLAND

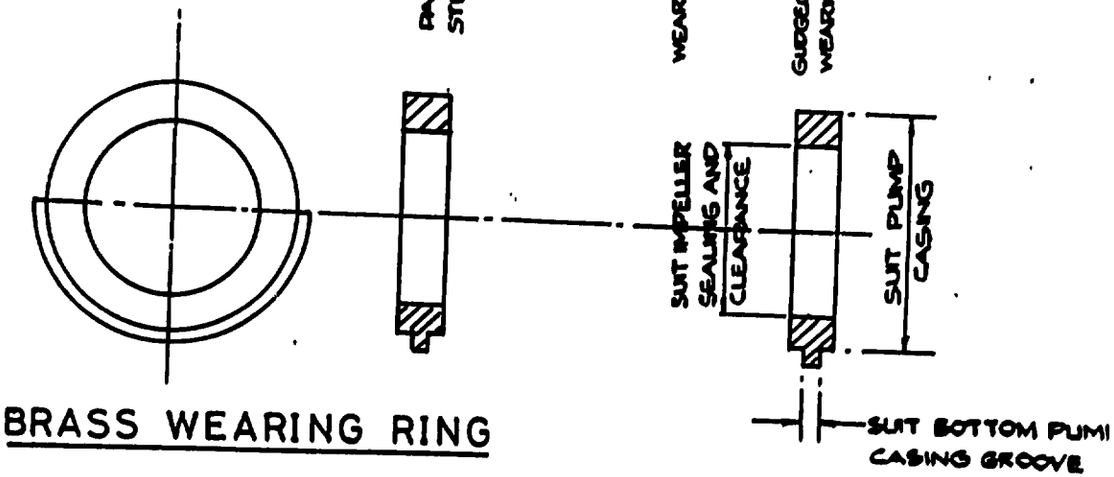


7 RUBBER RING
8 BALL BEARING
9 BALL BEARING END COVER
10 MILD STEEL LOCKING WASHER
11 MILD STEEL LOCKING NUT
12 COUPLING MILD STEEL
13 WHITE FELT

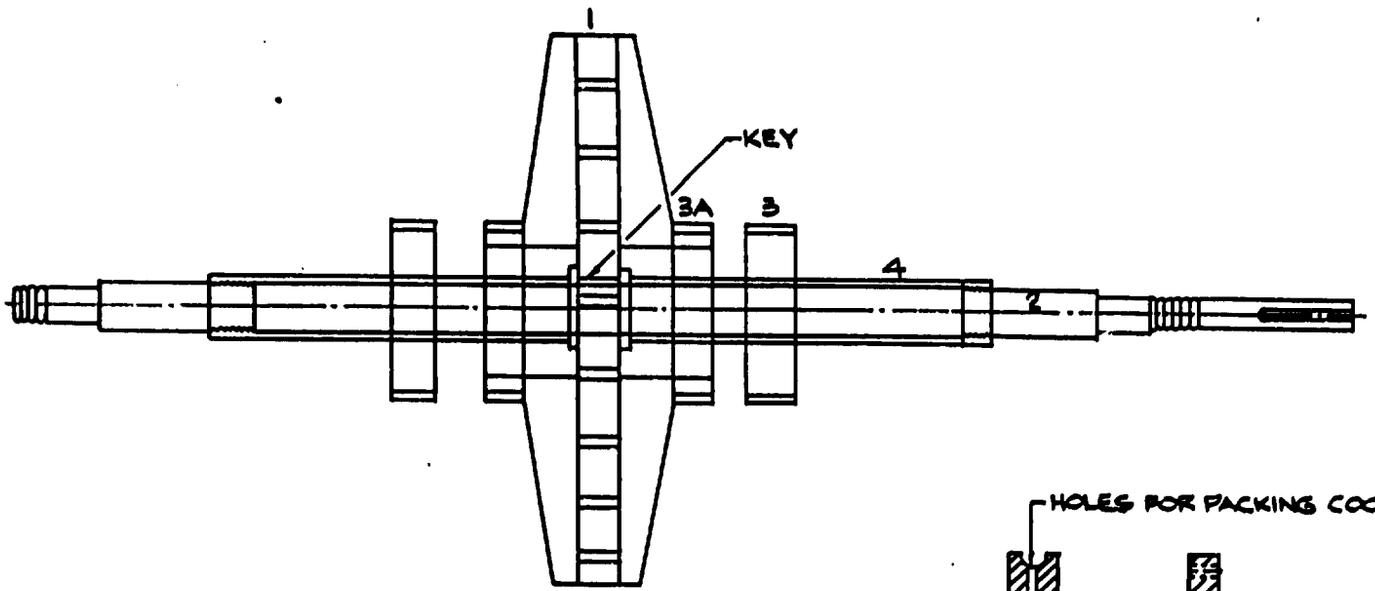
DETAIL OF TOP PUMP CASING

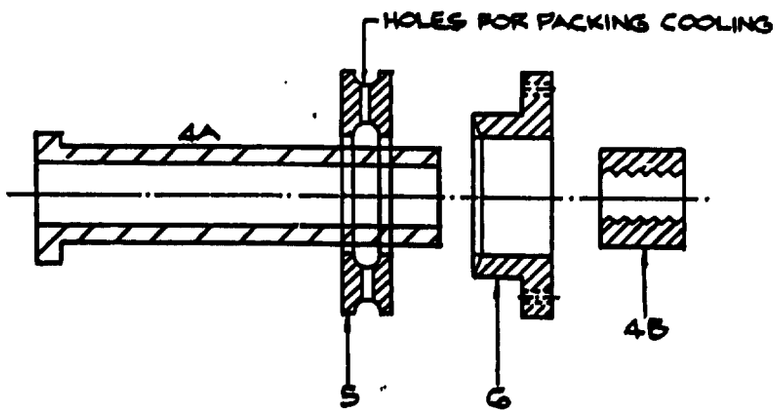




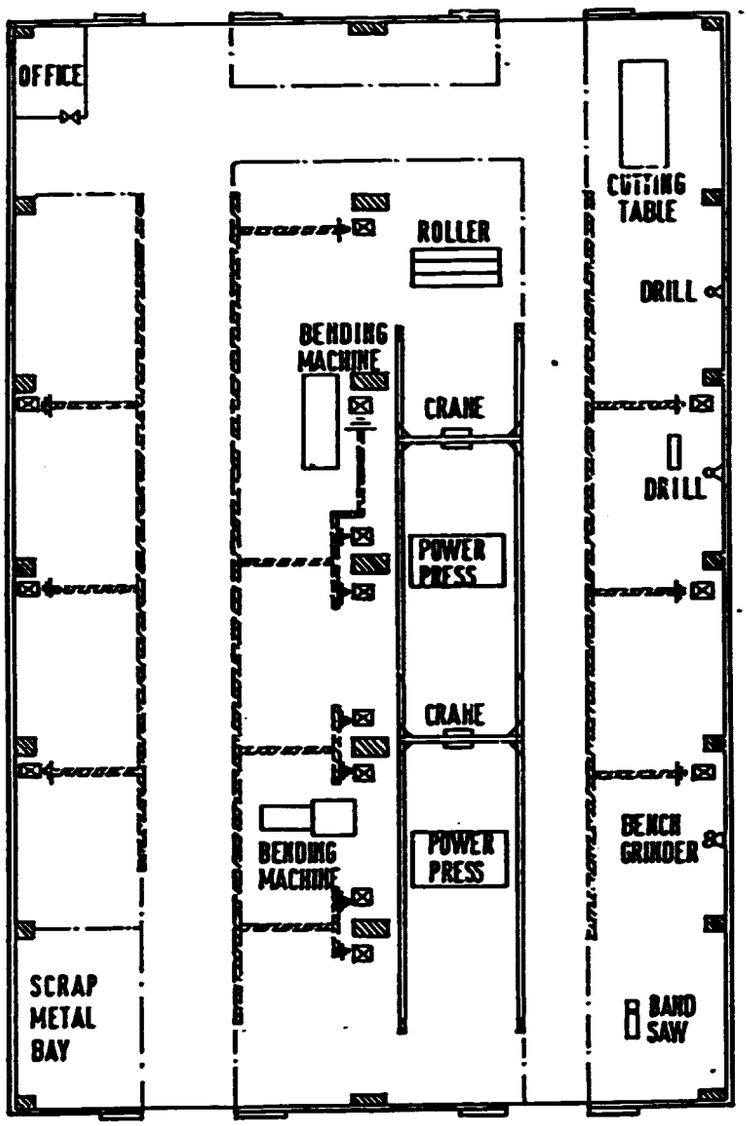


BRASS WEARING RING





1 BRASS IMPELLER
2 STAINLESS STEEL PUMP SHAFT
3 BRASS WEARING RING
3A IMPELLER SEALING
4 PACKING SLEEVES BRASS
4A PACKING SLEEVES SLIGHTY SKIM OR RENEW
5 BRASS LANTERN RING
6 PACKING GLAND
4B BRASS LOCKING NUT



PROPOSED LAYOUT OF STEELWORK SHOP

NOT TO SCALE

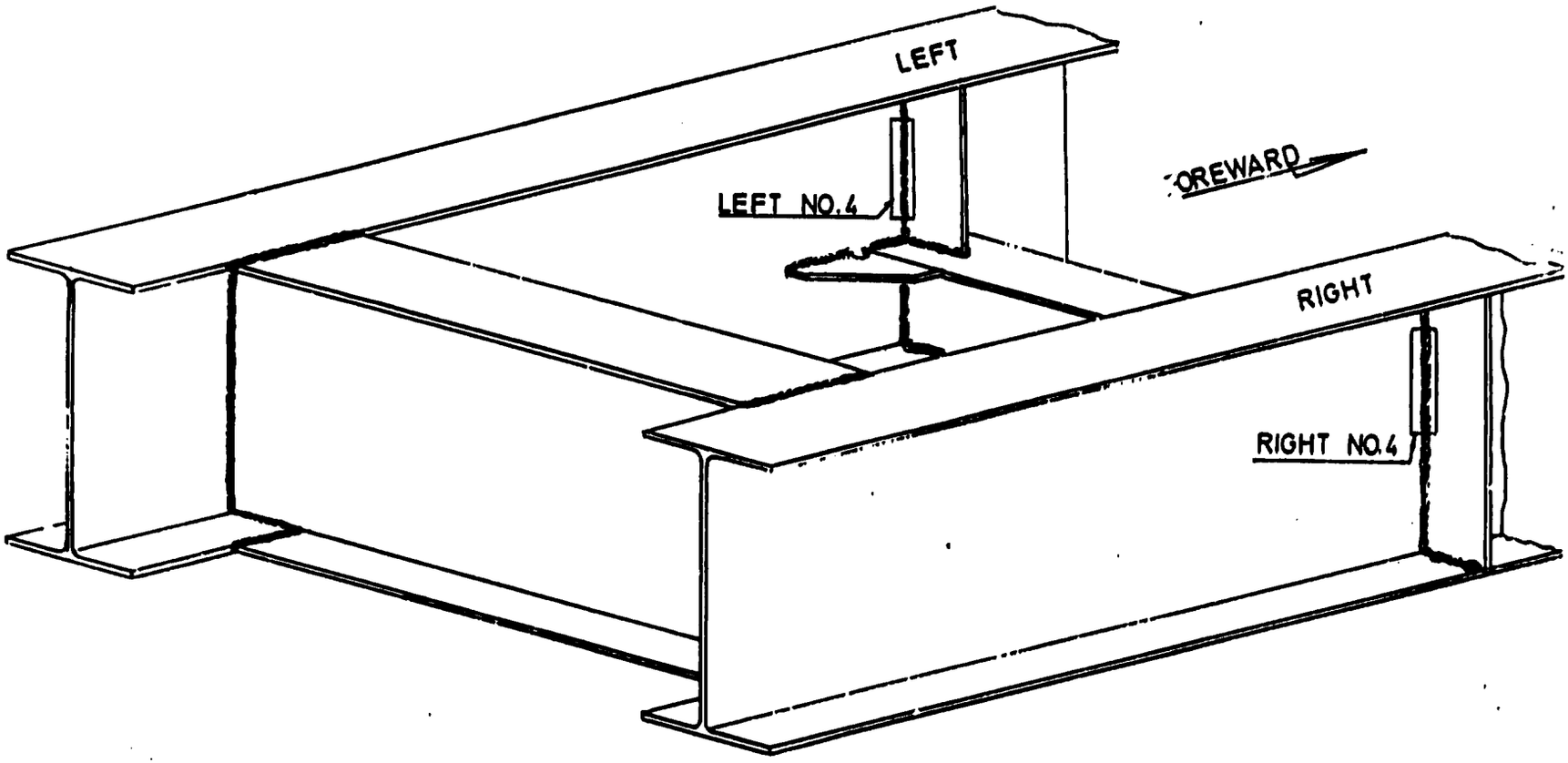
KEY

⊠ ELECTRIC ARC WELDING TRANSFORMER

⏚ EARTH

2" X 3/8" METAL STRIP FOR EARTH

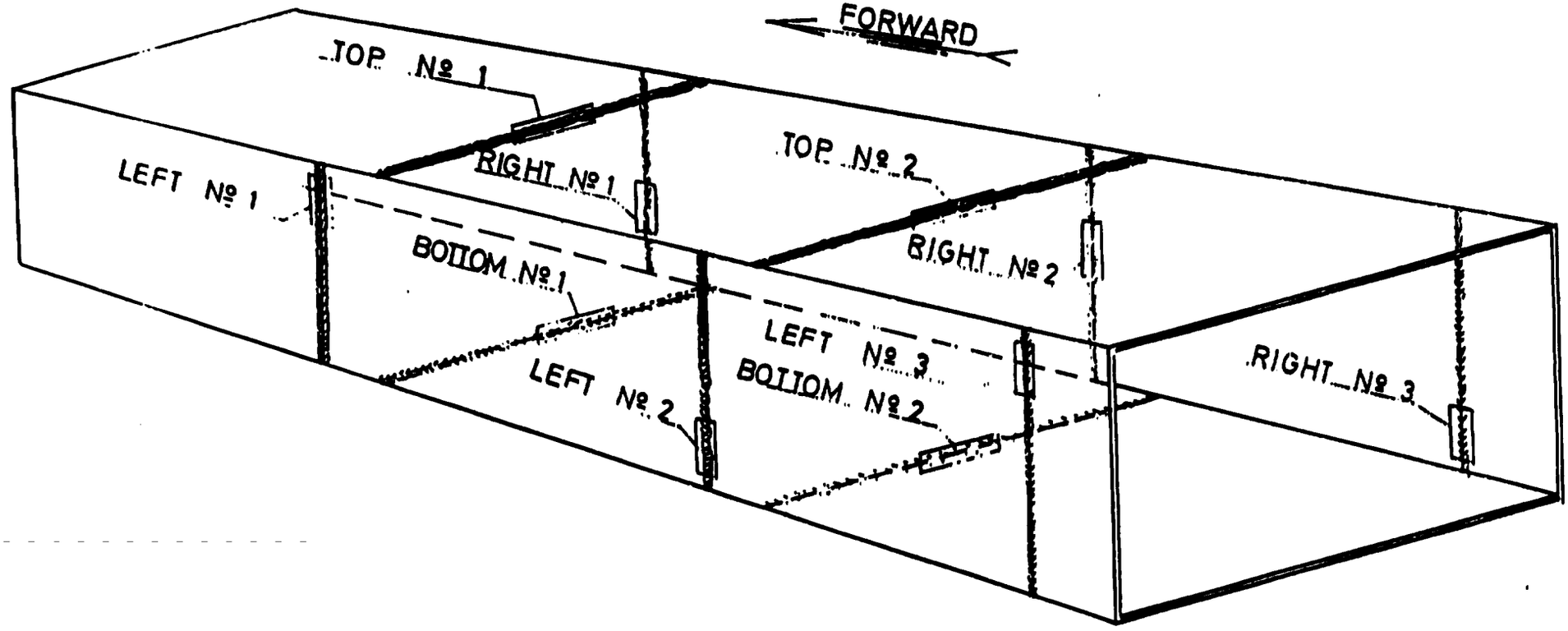
—·—·— YELLOW COLOUR DEMARKATION LINE (ON FLOOR)



40 TONS CRANE JIB

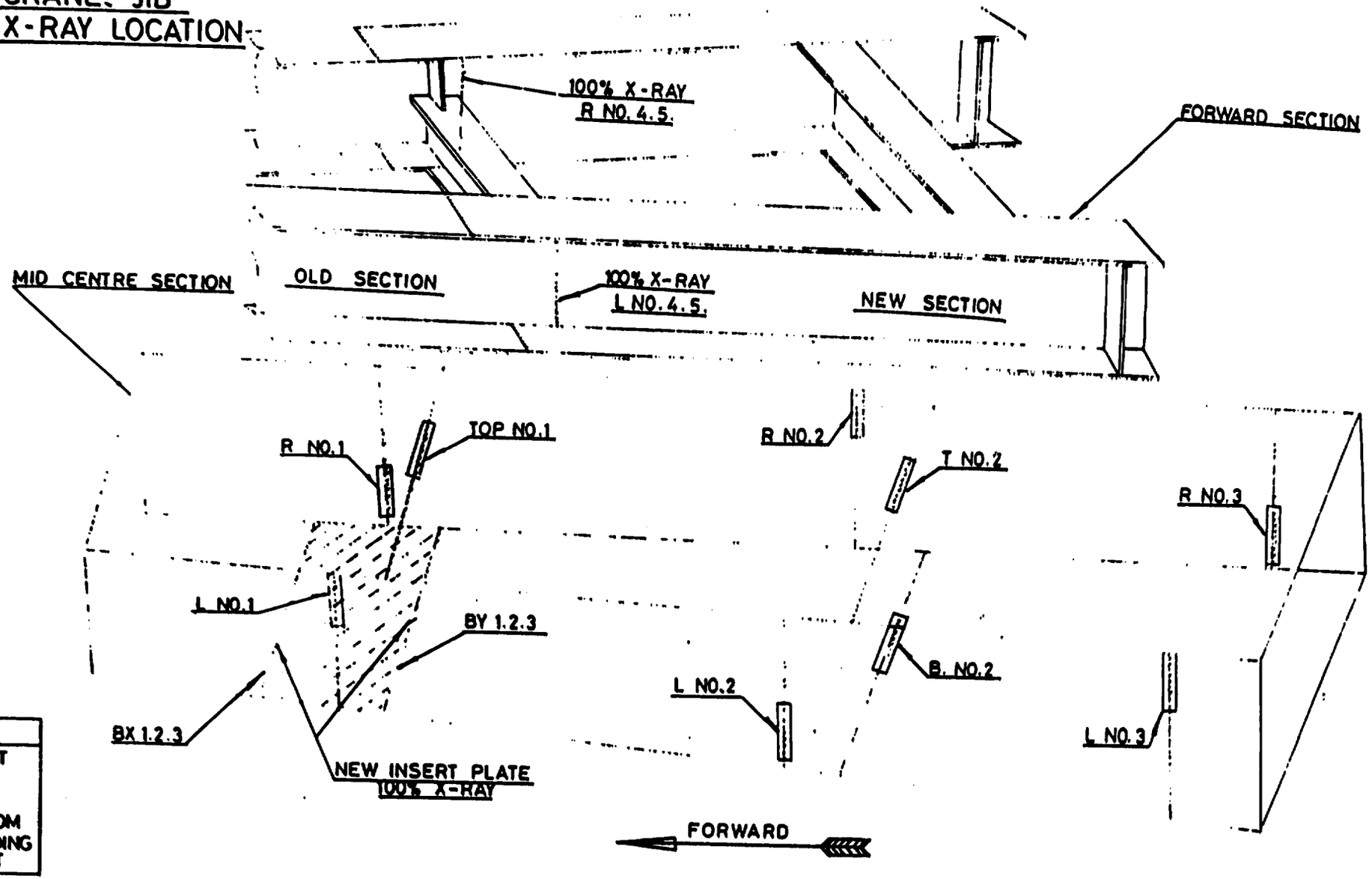
FOREWARD SECTION

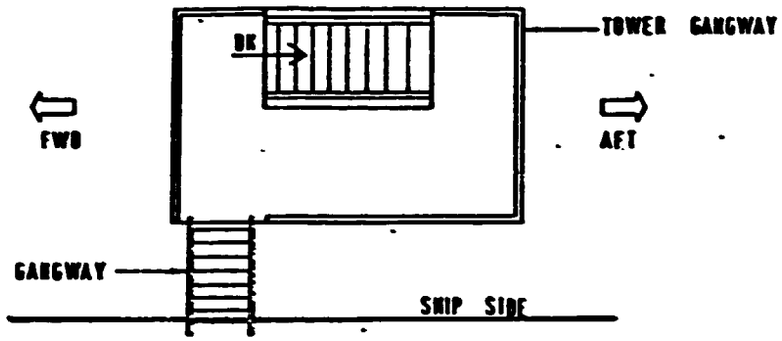
RADIOGRAPH LOCATION



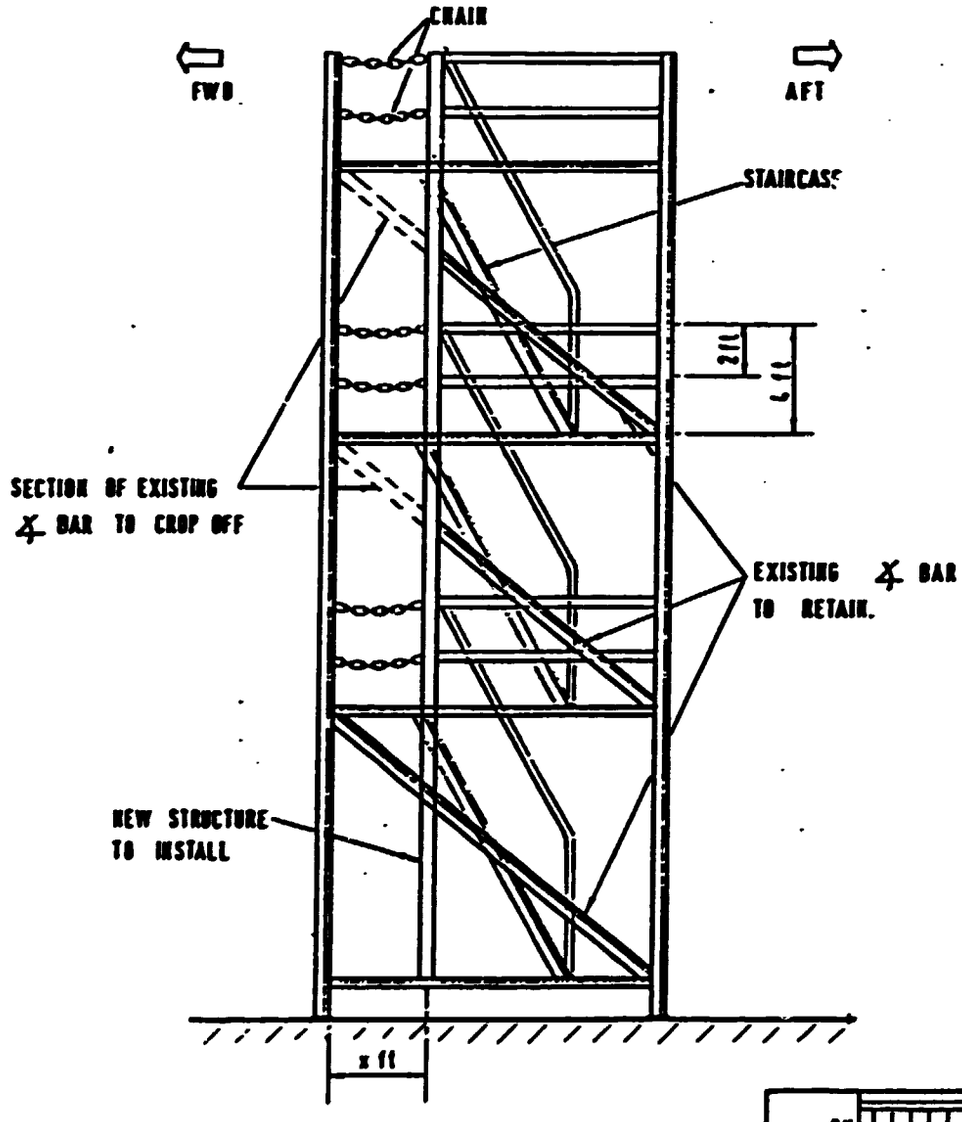
40 TONS
CRANE - JIB - CENTRE SECTION
RADIOGRAPH LOCATION

40 TONS CRANE - JIB X-RAY LOCATION

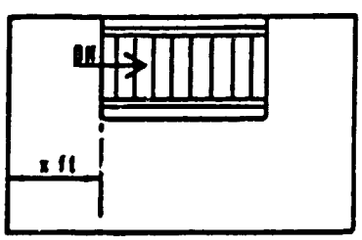




TOP VIEW



SIDE VIEW



PLAN VIEW

x ft = THE WIDTH OF x ft IS EQUAL TO THE WIDTH FROM THE EDGE OF PLATFORM TO STAIRCASE.

DIAGRAMS ILLUSTRATE CHANGES (MODIFICATION) TO IMPROVE THE SAFTY ASPECT OF A TOWER GANGWAY.

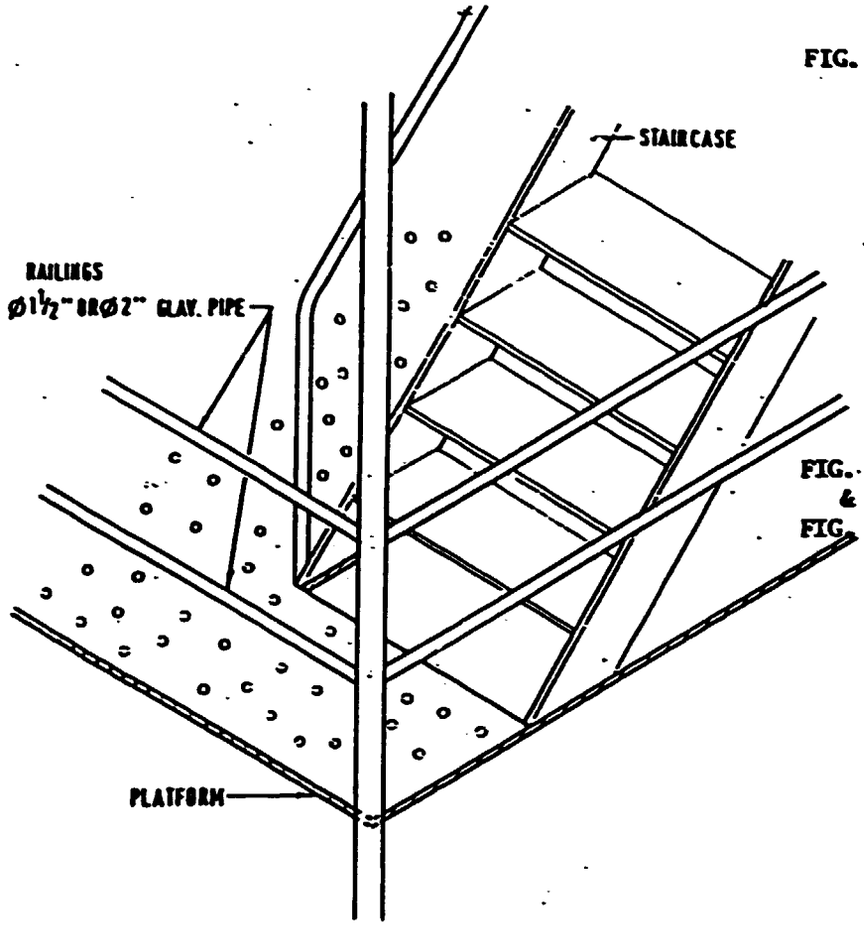


FIG. A : PROVISION OF RAILINGS (DOUBLE TIER 2 FT. HIGH RESPECTIVELY) WILL PREVENT A PERSON FROM FALLING/ SLIPPING OFF THE PLATFORM FROM HEIGHT.

FIG. A

FIG. B & FIG. C : PROVISION OF STANDARD COLOUR PLATE WILL PROVIDE WARNING VISION TO A DECENDING PERSON. SHOULD THIS FAIL THE RUBBER PACKING WILL ABSORB THE IMPACT AVOIDING SERIOUS INJURY TO THE MAN'S FOREHEAD.

DRAWING 11

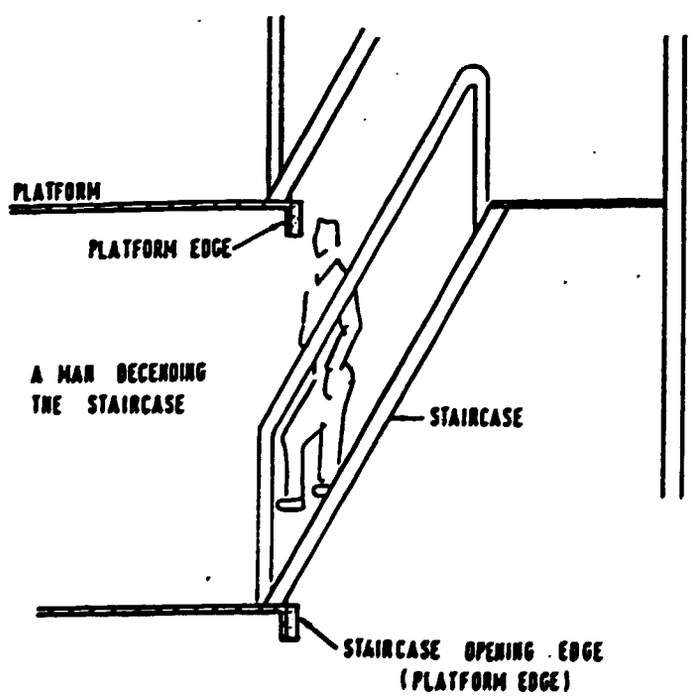


FIG. B

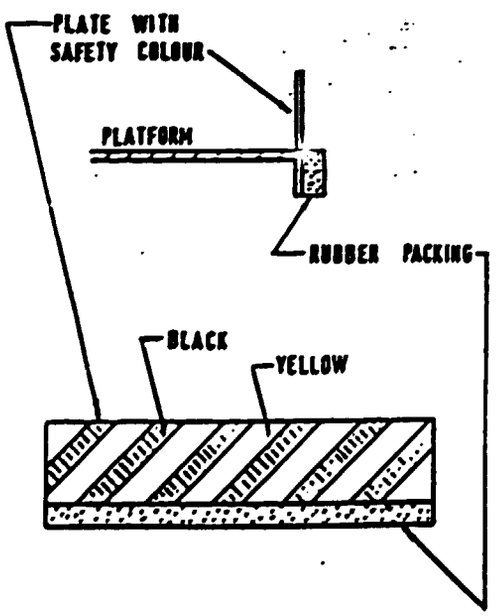
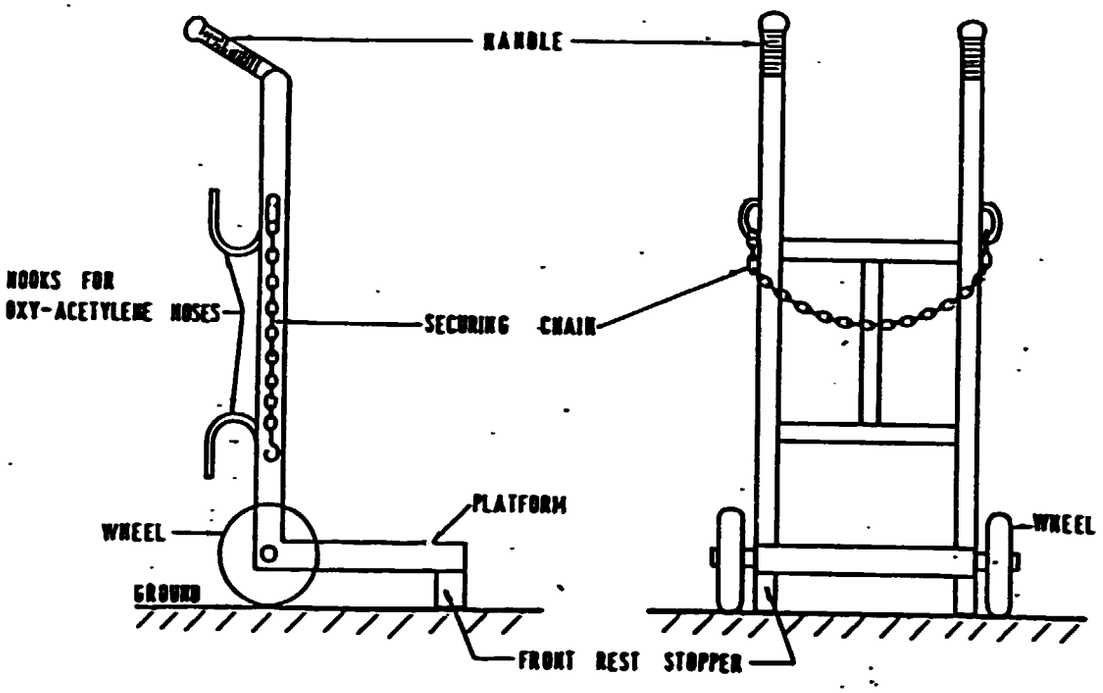


FIG. C

TROLLEY FOR OXY-ACETYLENE CYLINDERS
(FOR USE IN WORKSHOP)



HAZARDS OF ACETYLENE GAS

Acetylene gas under certain temperatures and pressures and also through shock, may decompose into its element hydrogen and carbon. Its pressure could build up 11 times prior to decomposition. In storage containers this dangerous propensity is countered by partially filling with acetone. Under pressure acetone forms a solution with acetylene, preventing instability of the gas.

SAFETY HINTS IN THE HANDLING OF OXY-ACETYLENE CYLINDERS

1. Use trolley or carrier to move gas cylinders.

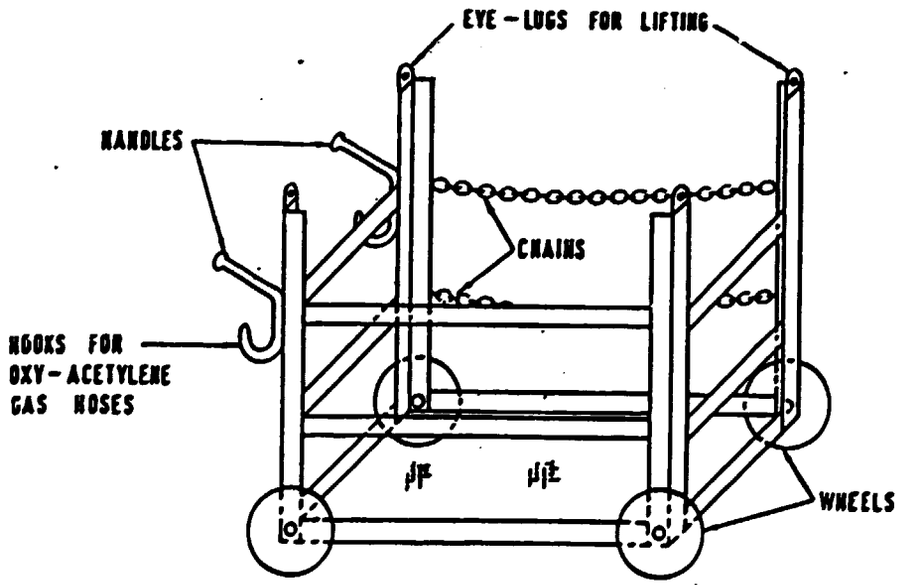
2. Keppe acetylene cylinders in the upright position.

3. Don't lift or carry cylinders by handling their valves or fittings.

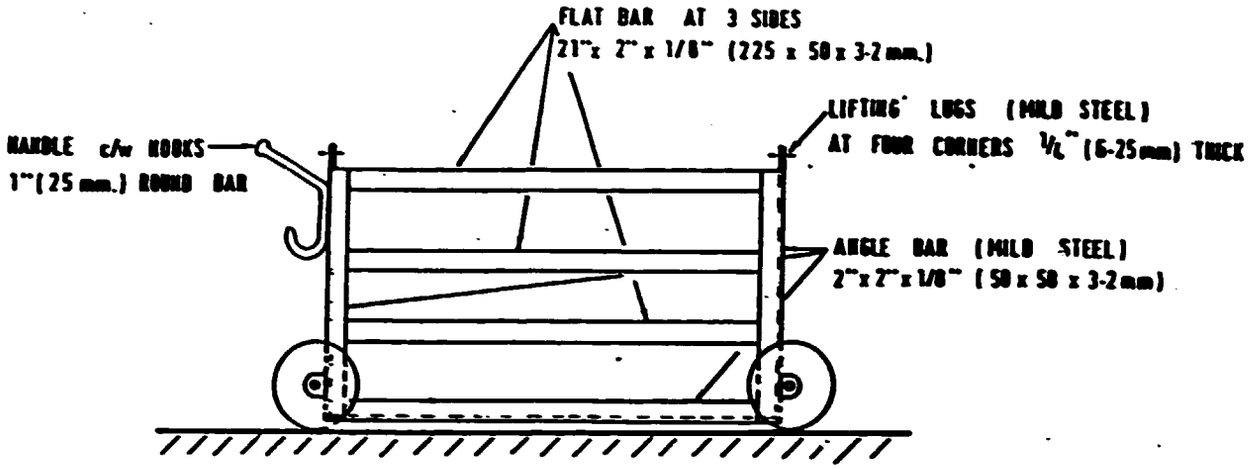
4. Keep all cylinders from direct sunlight, heat and flammable materials.

5. Ensure all cylinder valves and fittings and kept free from oil and grease at all time.

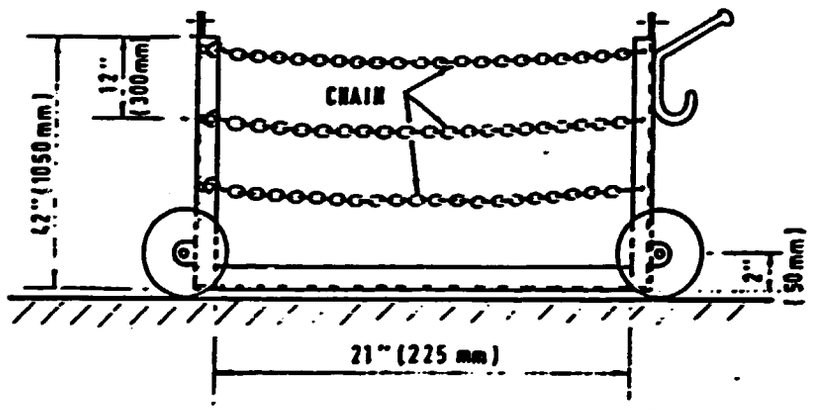
6. Don't allow cylinders to come into contact with electrical apparatus or live wires.



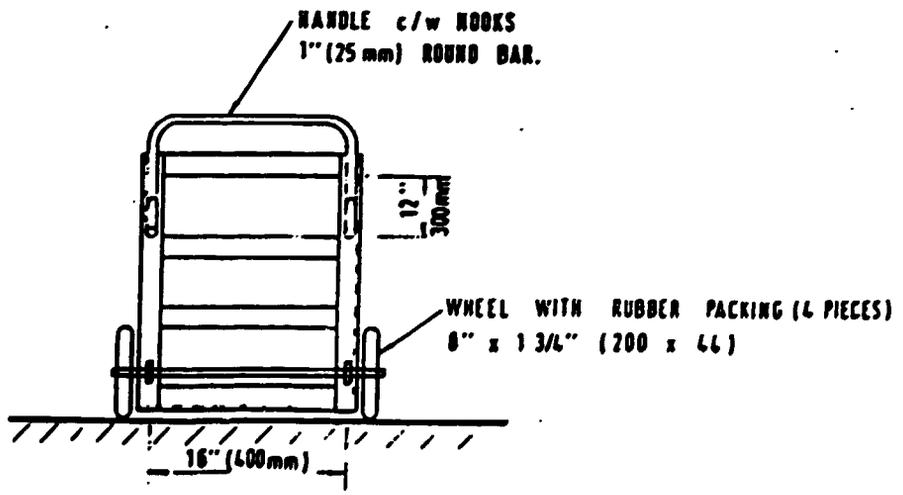
CRADEL FOR OXY-ACETYLENE CYLINDERS
(FOR USE IN DOCK BOTTOM)



SIDE VIEW (RIGHT)

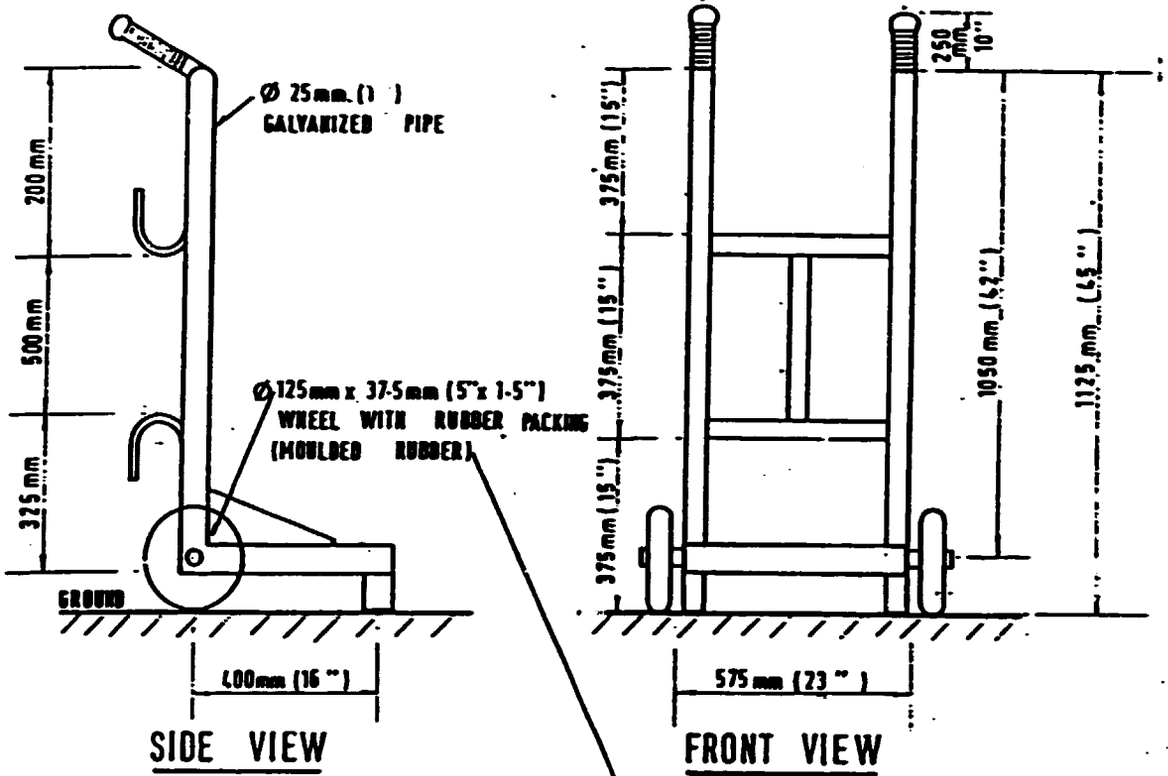


SIDE VIEW (LEFT)



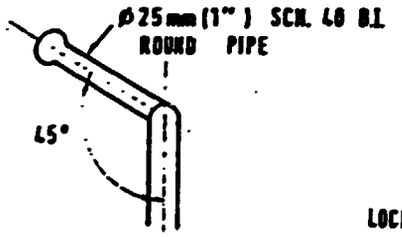
BACK VIEW

OXY – ACETYLENE GAS CYLINDER TROLLEY

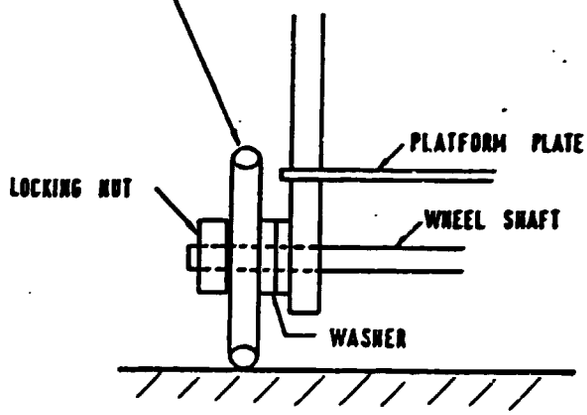


SIDE VIEW

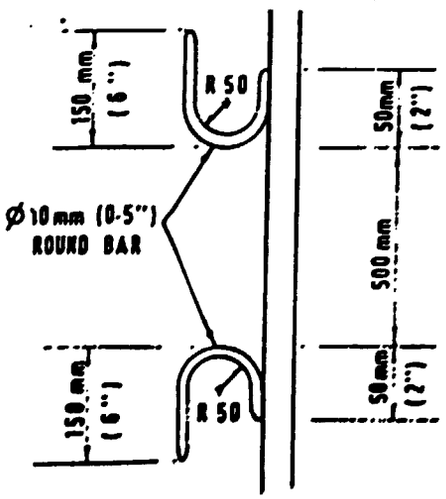
FRONT VIEW



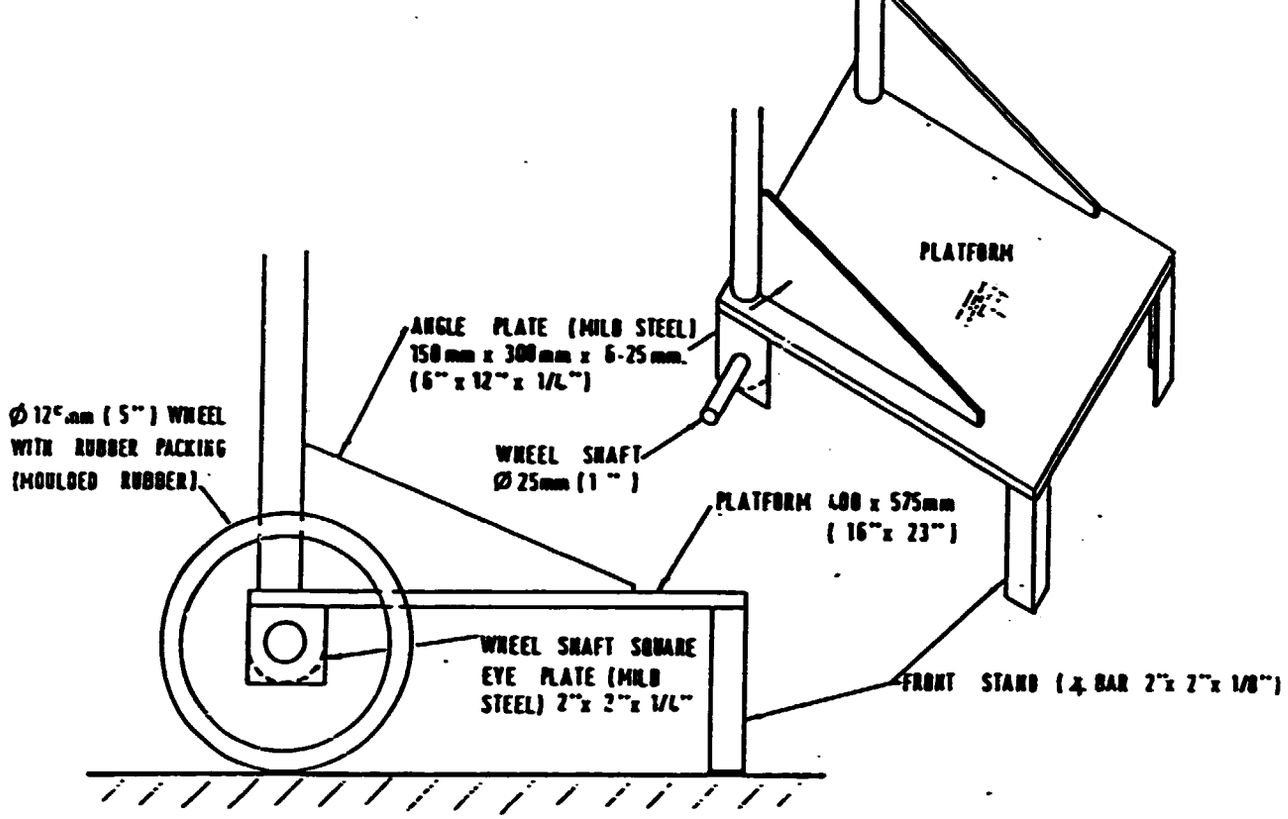
HANDLE

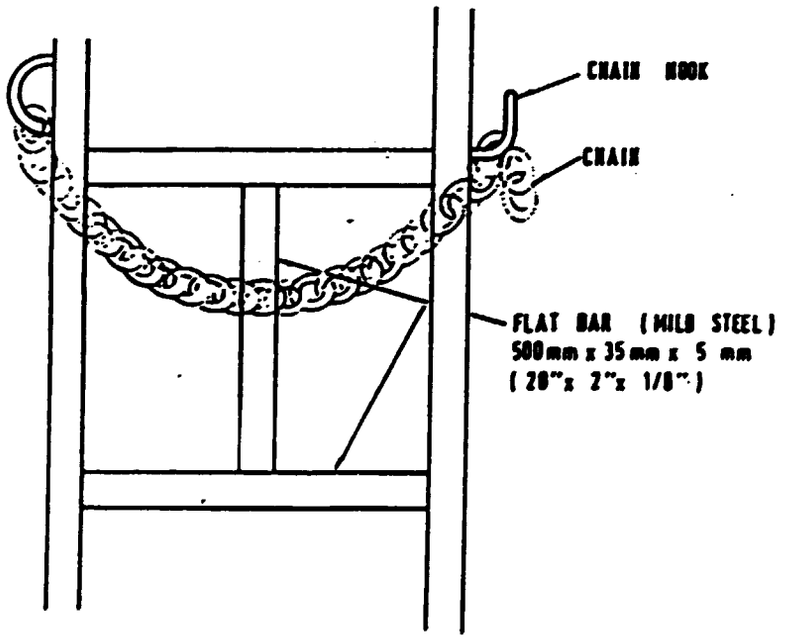


WHEELS



OXY-ACETYLENE GAS HOSES HOOKS (4 PIECES)

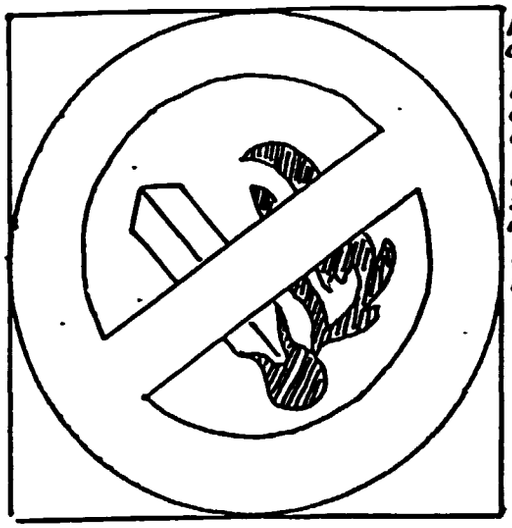




BACK REST

FRAME

NO NAKED FLAME



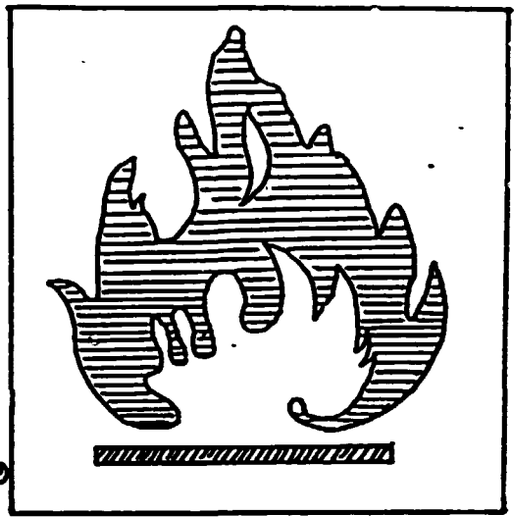
RED CIRCLE

BLACK OUTLINE OBJECT

BLACK AT SHADED AREA

WHITE BACKGROUND

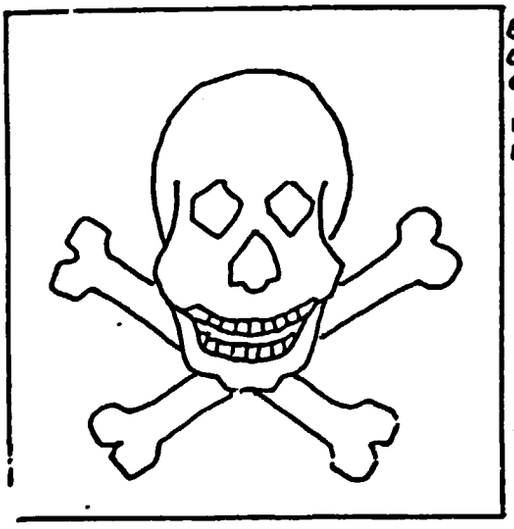
HIGHLY FLAMMABLE SUBSTANCES



BLACK OBJECT

RED BACKGROUND

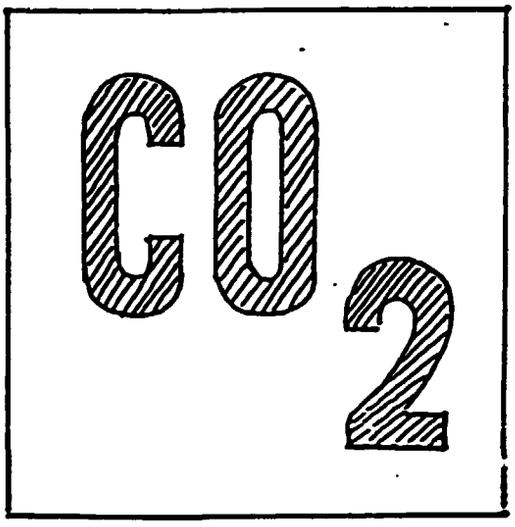
POISONOUS SUBSTANCES



BLACK OUTLINE OBJECT

WHITE BACKGROUND

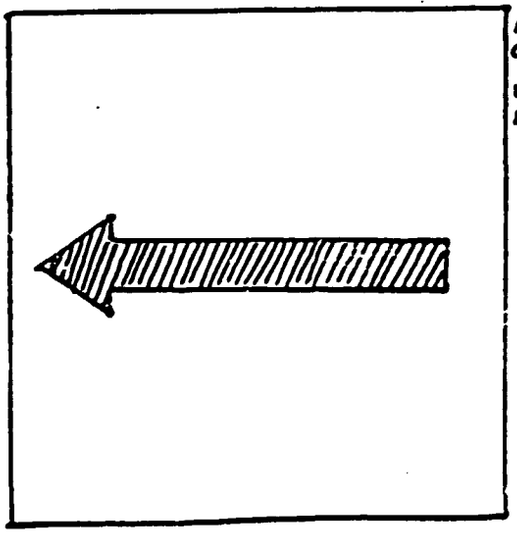
FIXED CO_2 FIRE-FIGHTING SYSTEM



RED OBJECT

WHITE BACKGROUND

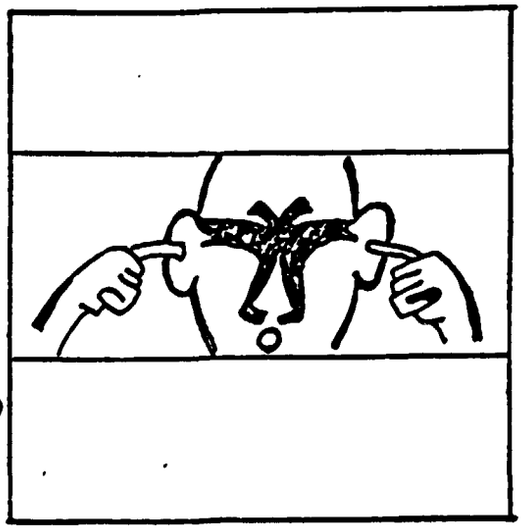
EMERGENCY EXIT



RED OBJECT

WHITE BACKGROUND

NOISY AREA

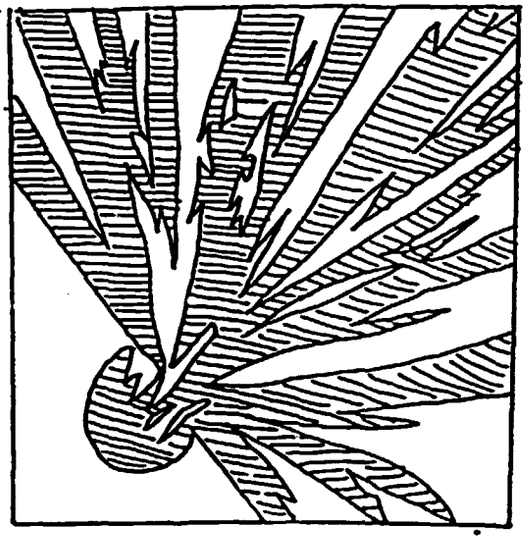


BLACK OUTLINE OBJECT

YELLOW BACKGROUND

WHITE TOP AND BOTTOM HALF.

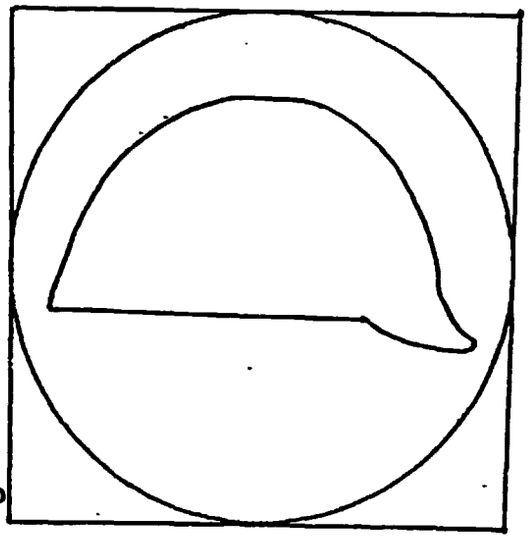
EXPLOSIVE SUBSTANCES



BLACK OBJECT

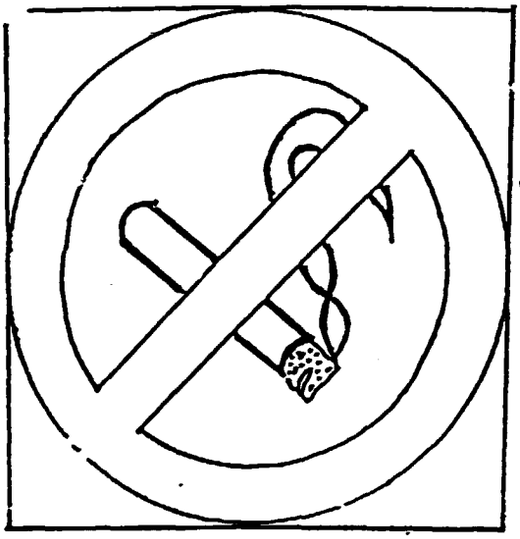
ORANGE BACKGROUND

SAFETY HELMET AREA



WHITE OBJECT
BLACK OUTLINE
GREEN BACKGROUND

NO SMOKING

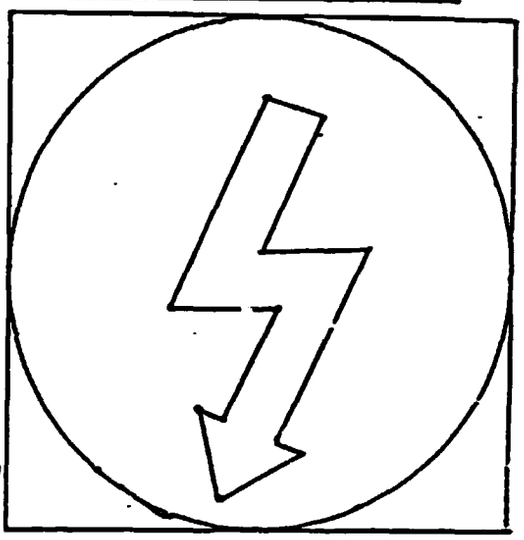


RED CIRCLE

BLACK OUTLINE OBJECT

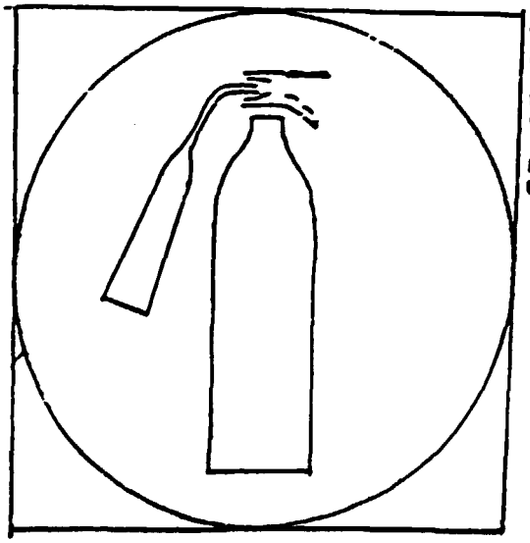
WHITE BACKGROUND

ELECTRICAL HAZARD



WHITE OBJECT
BLACK OUTLINE
RED BACKGROUND

FIRE EXTINGUISHER

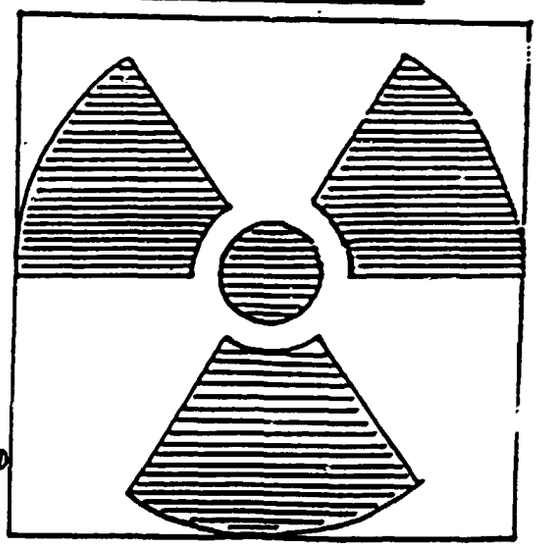


WHITE OBJECT

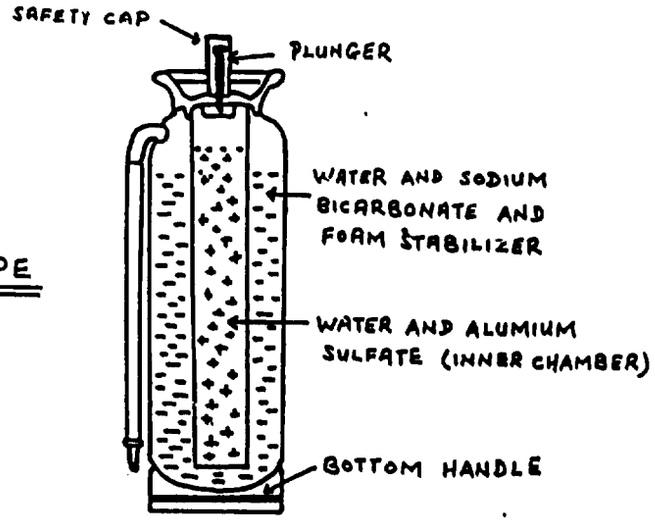
BLACK OUTLINE

RED BACKGROUND

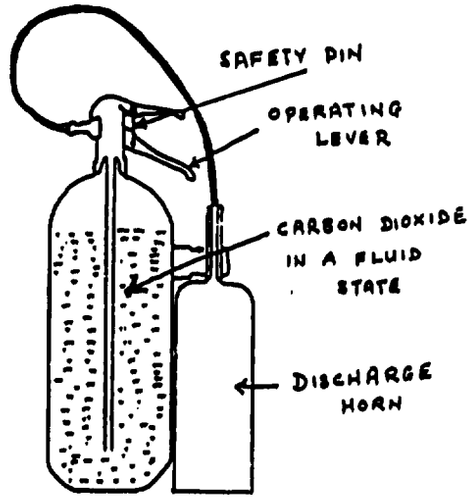
RADIO-ACTIVE SUBSTANCES



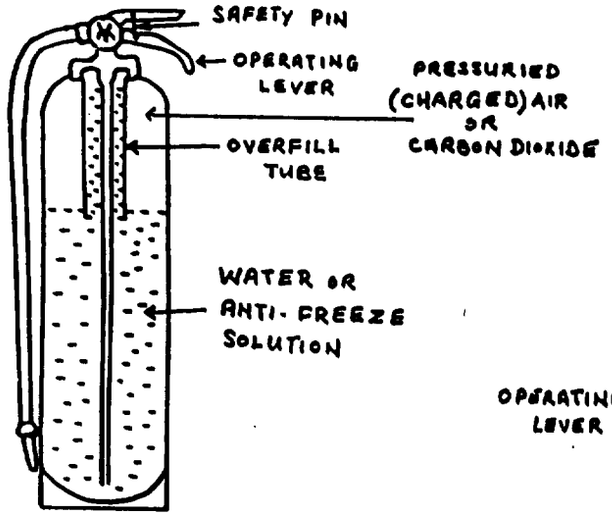
BLACK OBJECT
YELLOW BACKGROUND



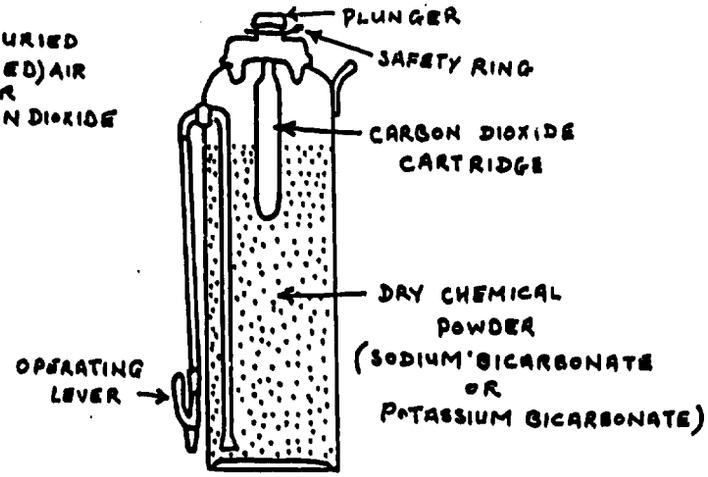
FOAM TYPE



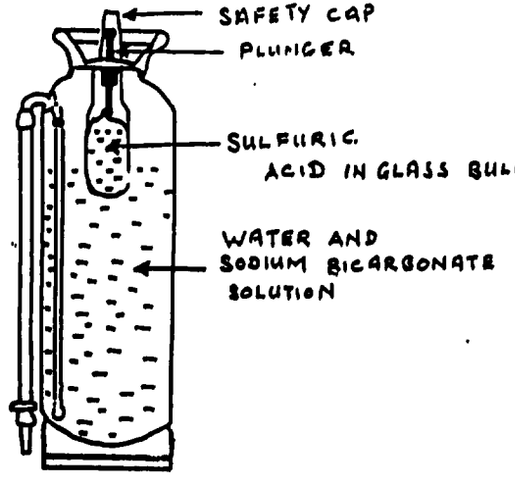
CARBON DIOXIDE TYPE



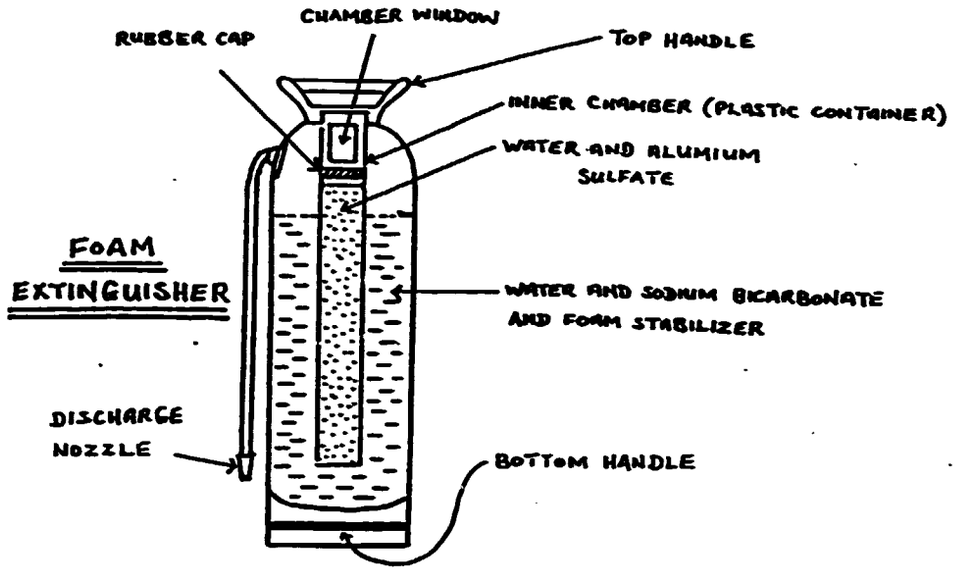
WATER PRESSURE TYPE



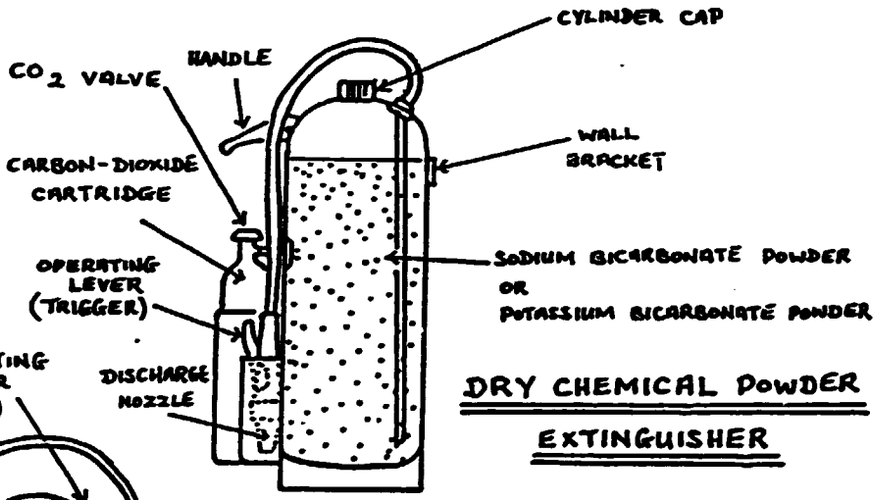
DRY CHEMICAL POWDER TYPE



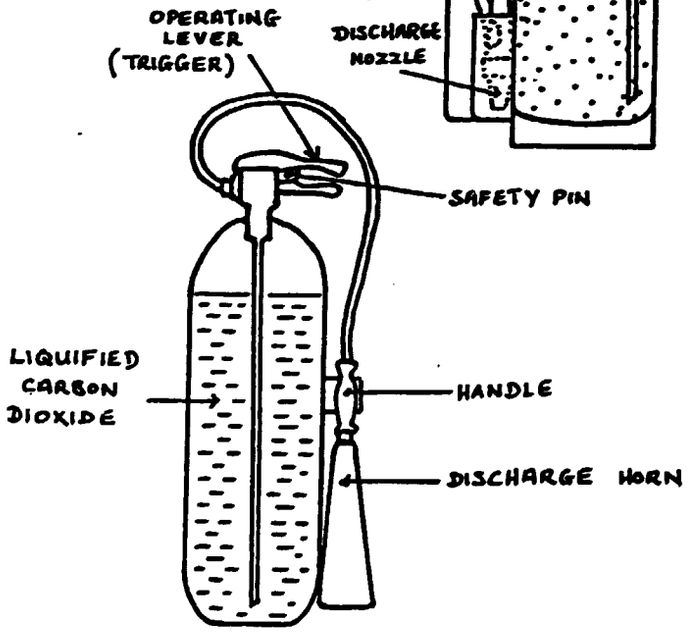
SODA ACID TYPE



FOAM EXTINGUISHER



DRY CHEMICAL POWDER EXTINGUISHER



CARBON DIOXIDE EXTINGUISHER