



EXERCISE BOOK

Narrow Ruling

School BERRY LOGIC Standard X

Name.....

Subject ELECTRICAL

Commenced 6.7.25 Finished.....

RULES FOR MENSURATION

a = Area. l = Length. b = Breadth. h = Height.
 t = Thickness. v = volume. R and r = radius.
 D = diameter. c = Circumference.

Area of rectangle = $l \times b$. (N.B.— $l \times b$ must be in the same units, i.e., when l is in ft. b must be brought to ft.)

Area of parallelogram = $b \times h$.

Area of triangle = $\frac{b \times h}{2}$.

Area of four walls of a room = $2 h (l + b)$.

Cubic contents of rectangular solid = $l \times b \times h$.
 ... cylinder or pipe. $\pi r^2 h$. Base \times h.

Sum of the three angles of a triangle = 180° .

circumference = $2 \pi r$ or πD (π = the constant $3\frac{1}{7}$)

area = πr^2

area of hollow ring = $\pi (R + r)(R - r)$

surface area of cylinder (excluding area of two ends) = $2 \pi r h$

volume of cylinder = $\pi r^2 h$

volume of cone = $\frac{\pi r^2 h}{3}$

truncated cone = $\frac{\pi h}{3} (R^2 + Rr + r^2)$

Circle

MISCELLANEOUS

1 dozen = 12

1 score = 20

1 gross = 144

A cubic foot of fresh water weighs $62\frac{1}{2}$ lbs.

" " clay " 125 lbs.

" " loose earth " 95 lbs.

" " pine " 41 lbs.

" " oak " 59 lbs.

A gallon of water weighs approx. 10 lbs.

A cubic yard of compressed hay weighs about 225 lbs.

" " straw " 145 lbs.

" " coal (solid) weighs about 2,160 lbs.

" " sand weighs about 1 ton (approx.)

A tuft of straw should be 26 lbs.

" " old hay should be 56 lbs.

" " new hay should be 60 lbs.

36 tufts = a load.

5% Interest or Profit = $\frac{1}{20} = 1/-$ in the £.

Sound travels in air at approximately 1,100 ft. per second.

A halfpenny is 1 inch in diameter.

A noggins = 2 glasses. [4 noggins = 1 pint.]

Supplied for use in NAVAL & MILITARY SCHOOLS, etc., by
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forined

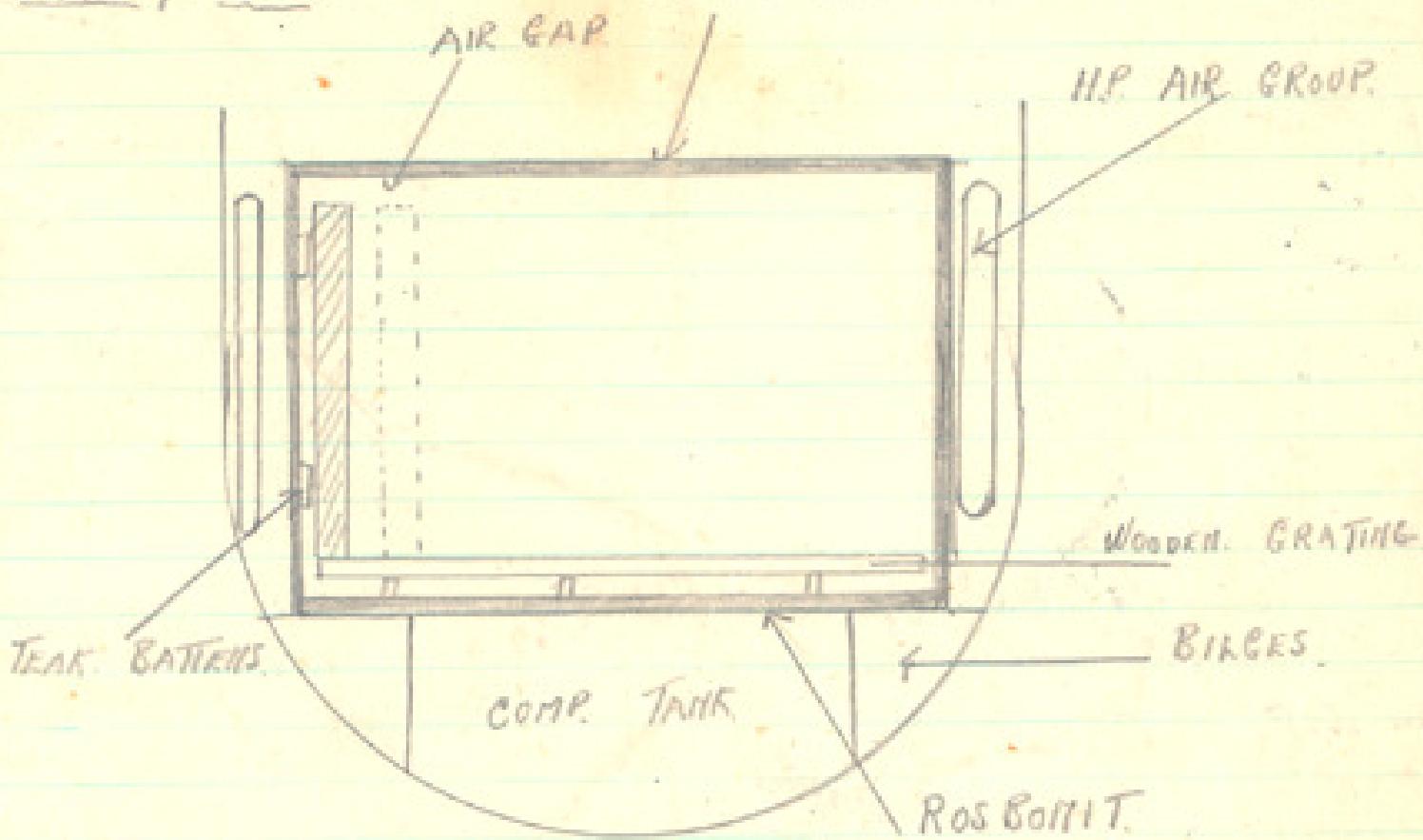
RosMANITE.

RosBONITE.

E
Pomo.

BATTERY TANK.

WOODEN LID

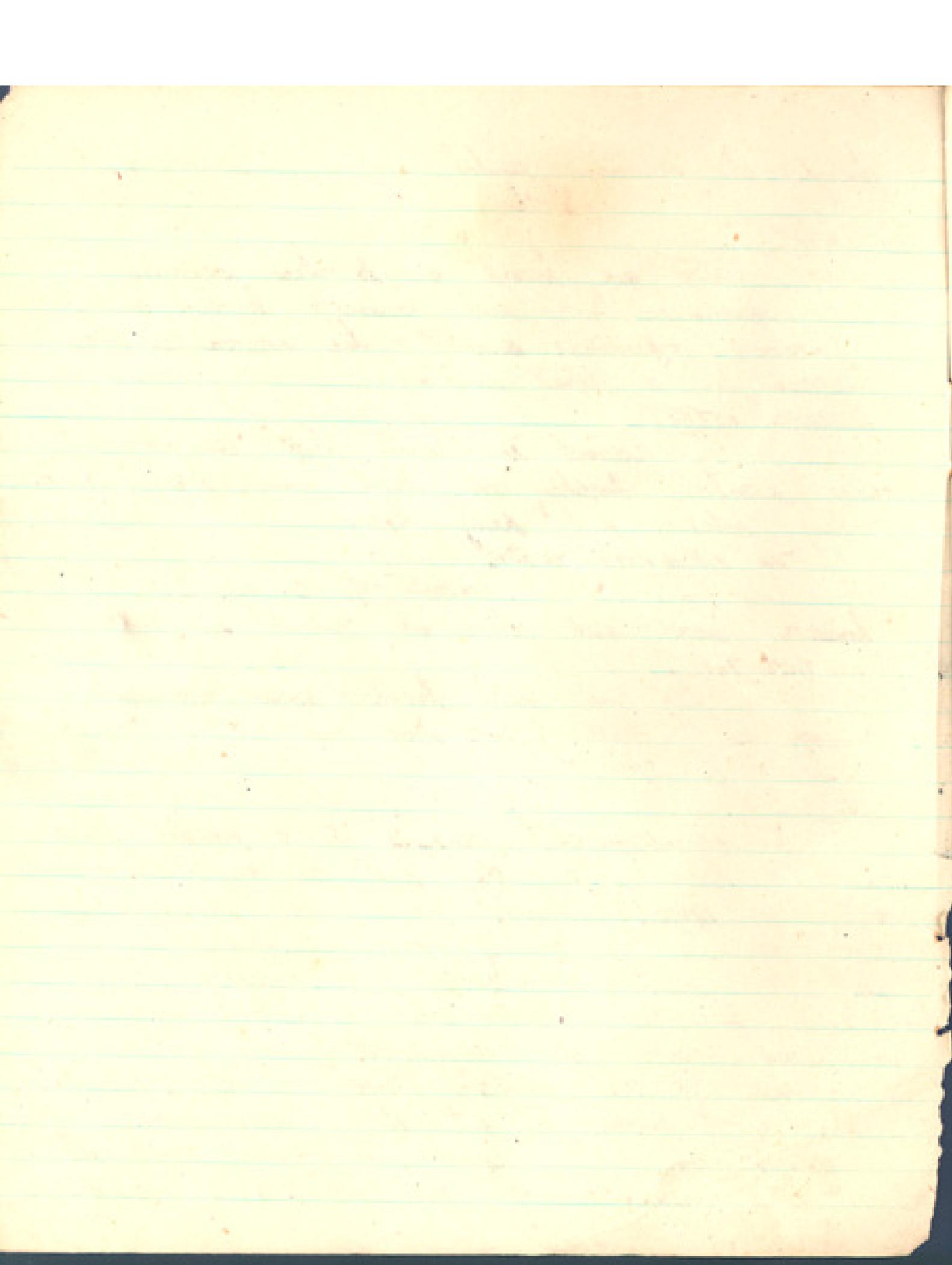


SUBMARINE CELLS.

Sub cells are usually known as
nickel ironed, and weigh 850 lbs. cost £100 each.
The containers are made of massive abonite, positive
plates are plumbate of lead, 21 in number, negative
plates are sponge lead, 22 in number, separators
are special pine wood, electrolyte is sulphuric
acid diluted to a density of 12-60.

TESTS ON CON TRUNKS

- 1/ Heat & pressure test, a 5 lbs air test for 5 minutes.
- 2/ Heat and distortion test, suspended $\frac{1}{2}$ in. at
temperature of 120 degrees.
- 3/ Dielectric tests. by h pass 2000 volts A.C.



through which it contains whilst in a sulphuric acid bath.

PLATES

Plates are bent over three respective equal size bars, and married together and pinwood separators inserted. The section is then placed in a heated furnace.

SEALING OUTFIT

Carded in Parent ship, consists of rubber washers, breaking out lead wires, French chalk sealing solution and putty knives.

ACID ACCIDENT OUTFIT

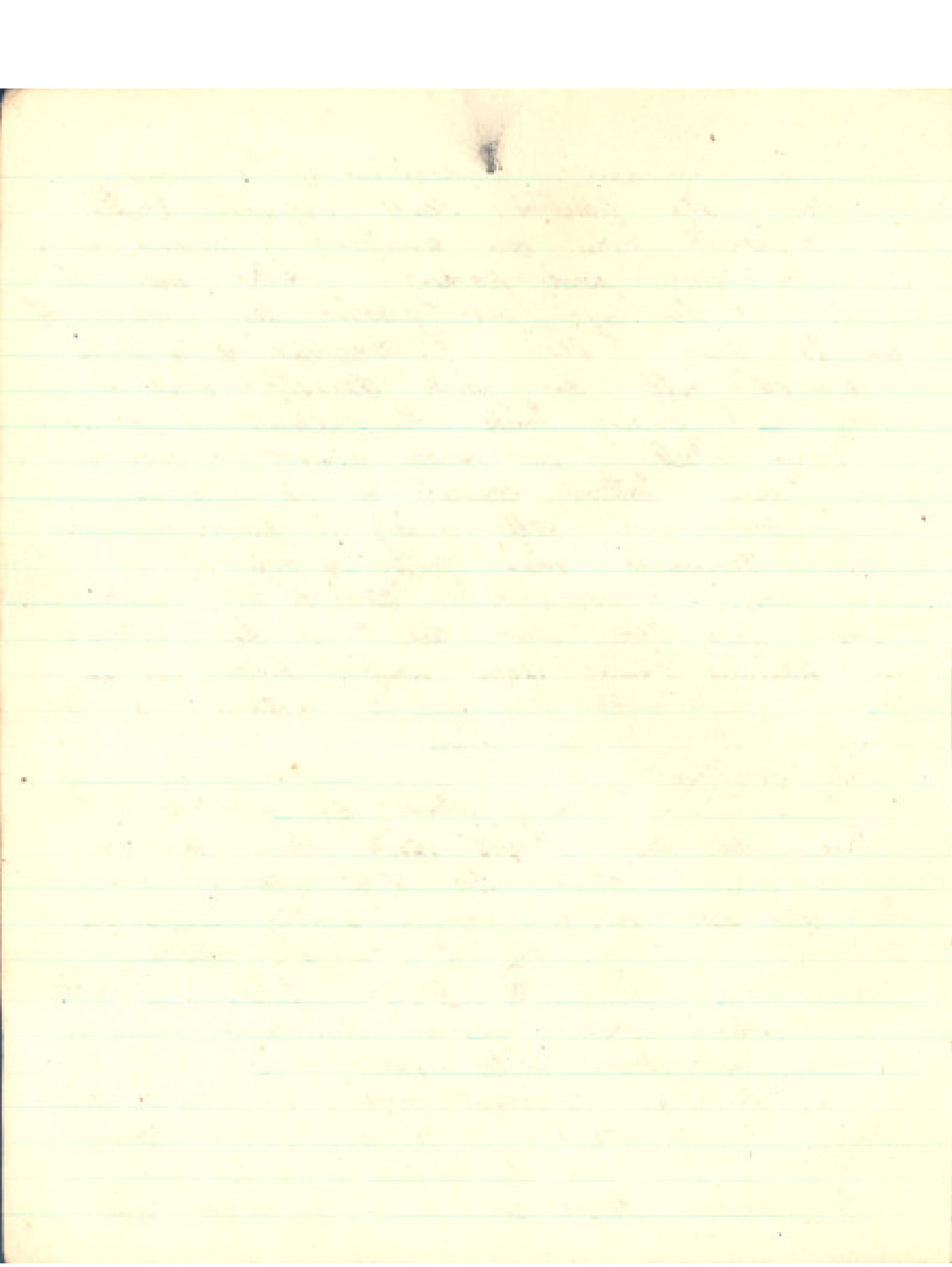
consists of an eye bath, boric acid and olive oil carried in S/5s.

LIFTING TOOLS

Leg irons and breaking irons, spanners, cutting out tools, (five long size shot) are carried in S/5s.

CELLS

A secondary cell consists of a positive plate, made of lead peroxide, and a negative plate, made of spongy lead, which are inserted in a container made of some insulating material, such as massive asbestos or louvres. The container is then filled with a dilute solution of sulphuric acid. The capacity of the cell is decided by the surface area of the plates, and in order to get the maximum capacity in the minimum space, each cell has a number of positive plates joined



together, and a number of negative plates joined together. The positive and negative plates are insulated from one another by means of wood or glass wool packing. The slower the rate of discharge, the greater the number of ampere hours. The indications of a fully charged cell, are peak density, peak voltage and gassing freely. The capacity of one 5/7 battery cell is 4000 ampere hours at 2 volts. Each battery consists of 112 cells in series, and each cell having 3 positive and 3 negative terminals, thus giving a capacity of 4000 ampere hours and 220 to 230 volts. In large type 5/7 there are 3 of these batteries in parallel, giving 12000 ampere hours, and in small type 5/7 there are two batteries in parallel, giving 8000 ampere hours.

BATTERY TANKS

Battery tanks are coated with Roslonit, at least $5\frac{1}{16}$ thick, as a protection in case acid should be spilt into the tank. The cells rest on a wooden grating, which in turn is built on top of wooden battens. Wooden plates form a packing between the cells. The batteries must always be stored according to the plan. Access plates fitted to the battery tanks form a convenient method of rigging the bottom of the tank. 2 Access plates are fitted on the deck for access to pilot cells. On docking, tanks are tested for leaks, i.e.

resulted to severe rust etc. received with
Rolanit and infected by the Test fluid, for
pin holes or air bubbles.

CANAL 17. ROUTINES FOR BATTERIES

DAILY

Take temperature and density reading of pilot cells.
Take battery voltage, right the stamp day
entry readings in the battery log.
Battery readings are taken every hour during
charging, also every watch while at sea.

WEEKLY

Give the battery a nominal or standard
charge.

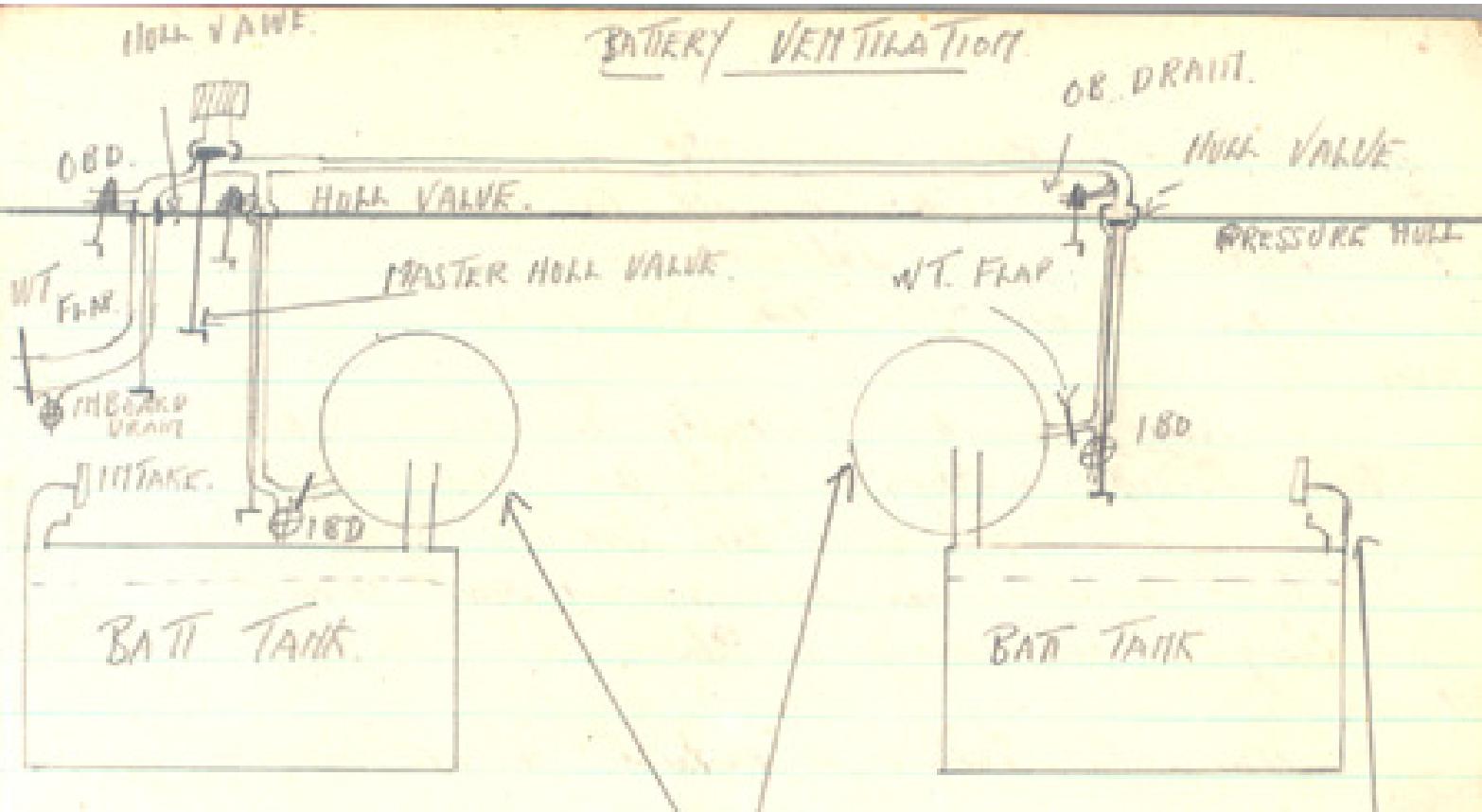
FORTNIGHTLY give the battery a nominal charge, plus
a 2 hours over charge at the fastest
charging rate.

MONTHERLY

Take all sound readings, top up with
distilled water, re-varnish the terminals, and give
the battery a nominal charge (i.e., full charge +
2 hours over charge).
Top distilled water before putting into cells.
nitrate of silver.

QUARTERLY

Discharge the battery to 1.67 volts per
cell, and charge the battery through
one complete cycle, followed by a levelling
charge for 4 hours at half the
fastest charging rate.



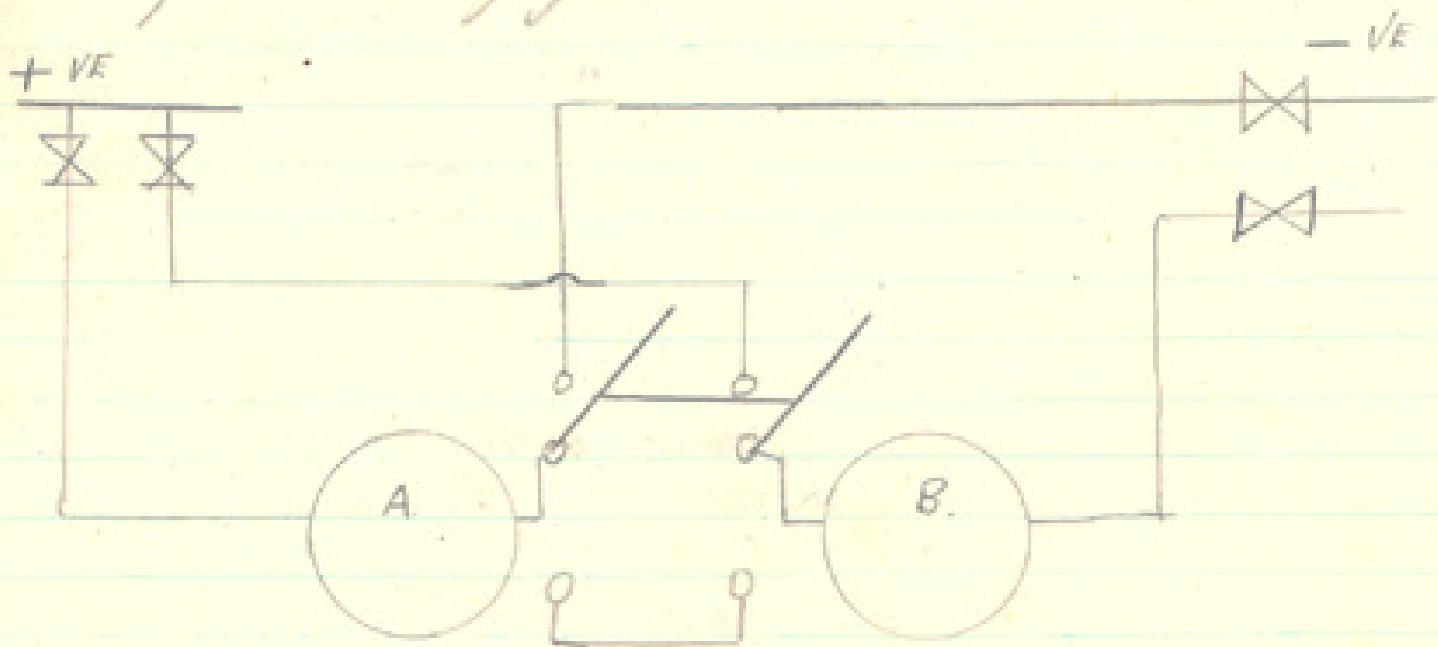
Battery is ventilated inboard at sea; and outboard in harbor.

To DRAINT DOWN

Open outboard drain for about 5 mins and then shut. open inboard drain and coach hull valve. if no water, shut inboard drain open water valves and intakes. start the fans and test at intakes by a piece of paper.

Main Motors

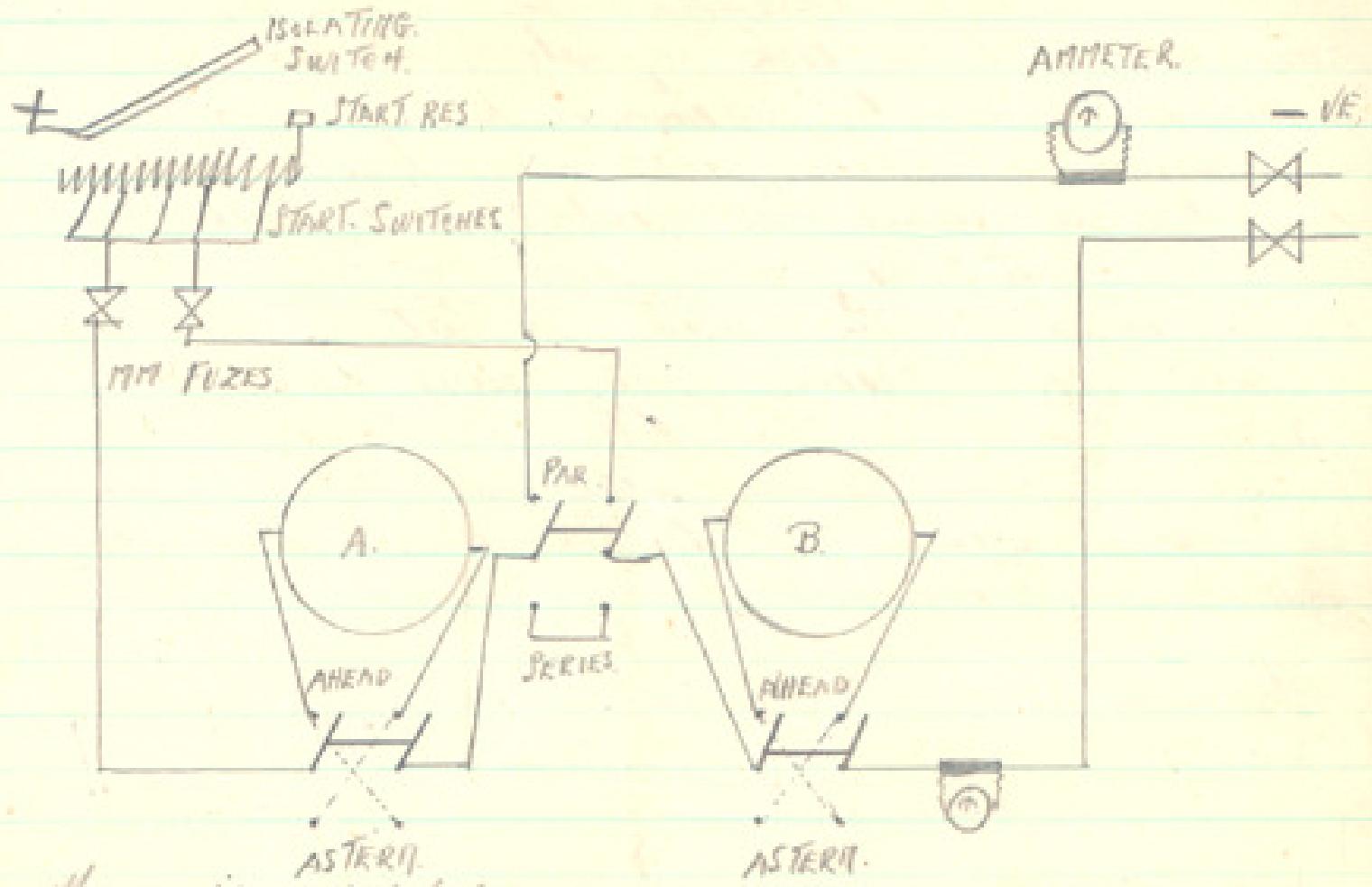
The requirements are that the armature will work equally well as a motor and as a dynamo. There are two armatures on each shaft in tandem. They are slightly under compounded and fitted with interpoles, and have a separately excited field. The motors are fitted in a splash type casing with copper plates for cooling, and slot holes for sighting the commutators. The main motors are fitted with a cooling system, which are always run when motors are charging.



GROPER Switched

Motors can be grouped in parallel or grouped down in series. The object of grouping is to conserve the battery.

Powered, maximum speed is 9 knots for ship.



Main motor interlocks.

Mechanical:

The Field switch must be made before the starting switches can be made.

3) The Starting switches must be broken before the Field switch can be broken.

3) The Starting switches must be made in the correct sequence.

4) The propeller must be down before the shaft in series switch can be put to shaft in series position.

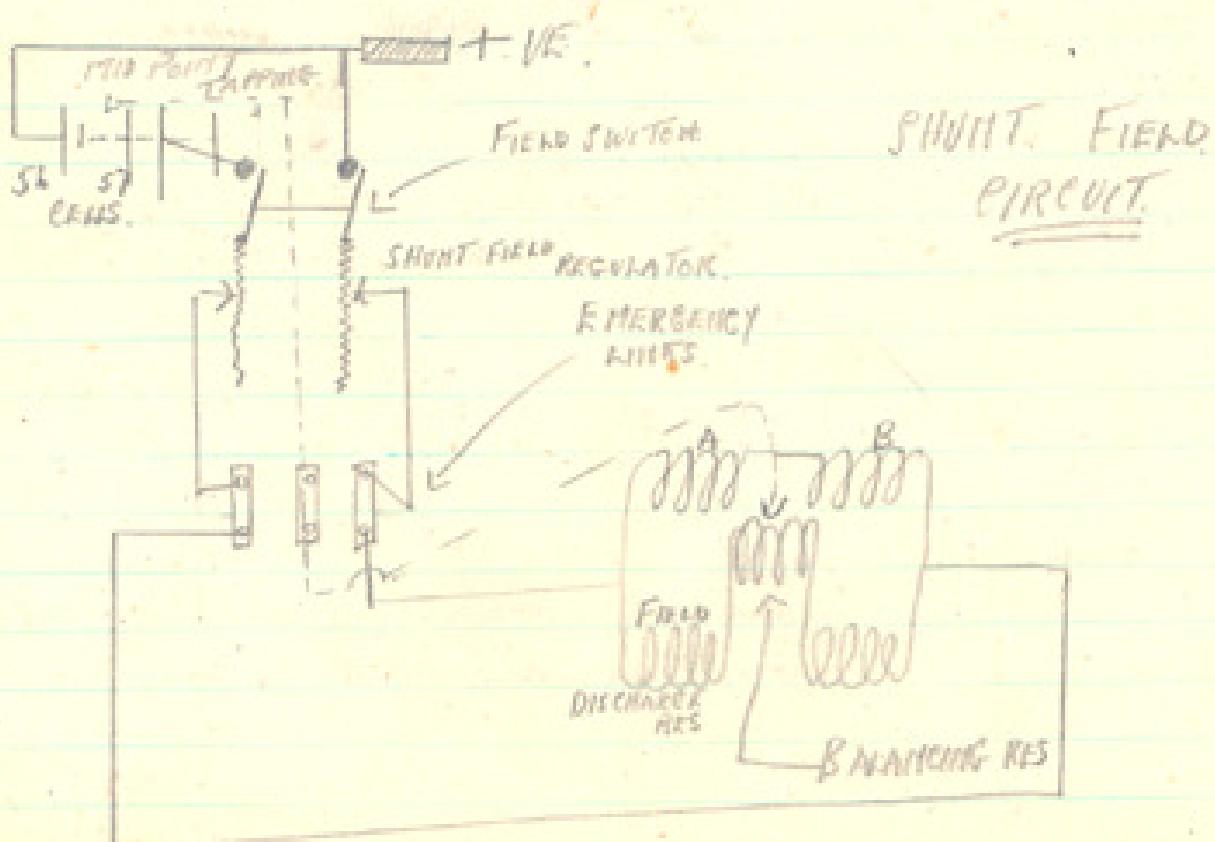
ELECTRICAL

1) Reverse and generator switches cannot be broken, while the starting switches are made.

- 2) Reverse cannot be put astern with the engine clutch in.
- 3) Engine astel cannot be put in with the reverse or ab astern position.

Working Main Alternator

Plugs come to star before breaking the starting switches, always reduce the field current to a minimum before breaking the field switch.



THE FIELD DISCHARGE RESISTANCE

Absorbs the inductive kick when breaking the field switch by providing a parallel path for the inductance to expend itself.

BREAKDOWN RESISTANCE

Fitted to balance the load on the armatures due to errors in construction or in dampness.

FIELD REGULATOR

Controls the strength of the field.

Stably regulating the speed of the motors.

FIELD EMERGENCY UNITS

Removed to isolate the field. In the event of a defective field it can be changed over to supply the good field with 112 volts from the 56-57 cells. The pairs of the defective machine are reversed.

NO LOAD TRIPPING

The switch between the emergency units permanently wired to give 112 volts from No 56-57 cells.

ISOLATING SWITCH

To isolate the starters in the event of a defect.

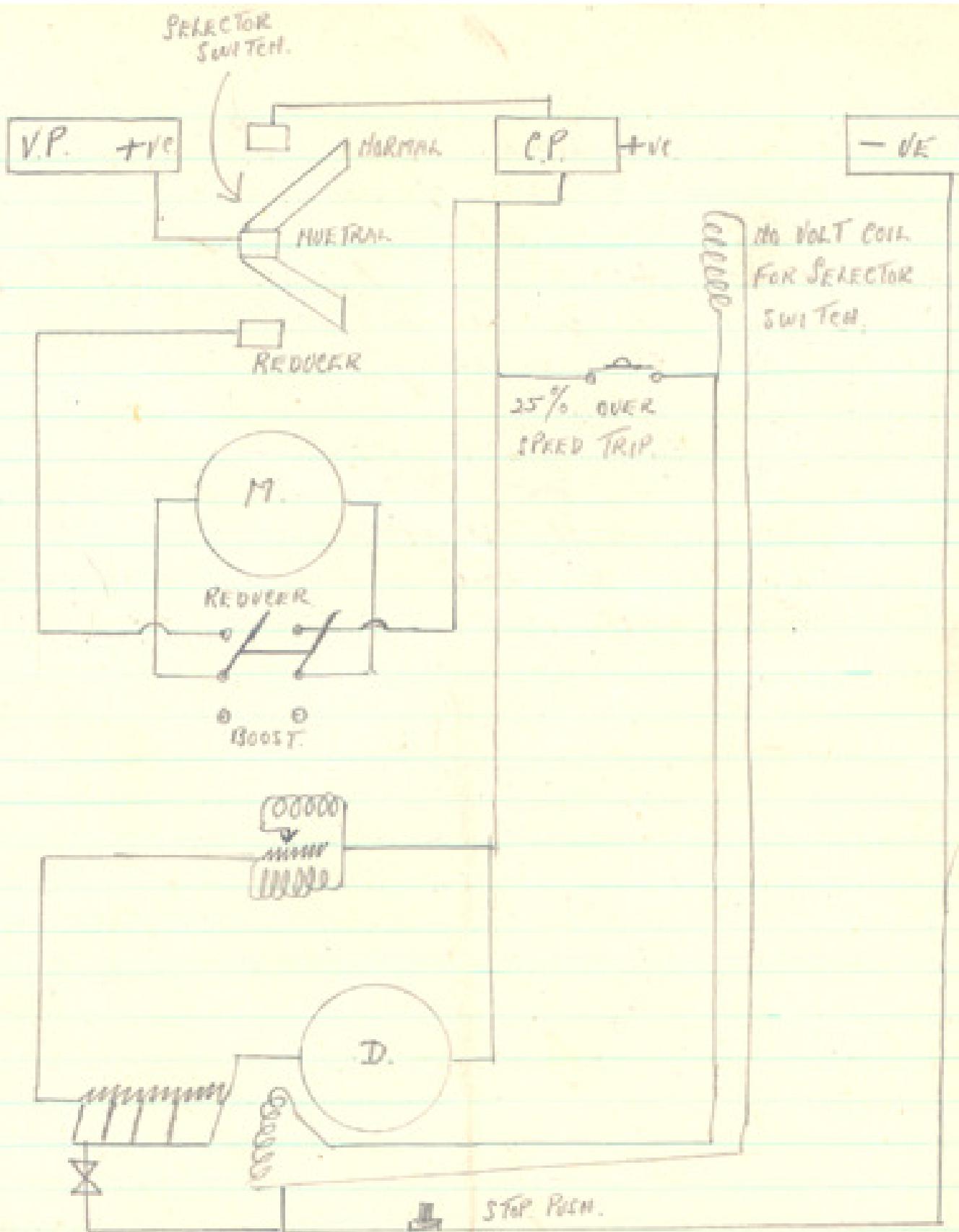
STARTING RESISTANCE

Prevents a heavy surge of current passing through a stationary armature and so burning it out.

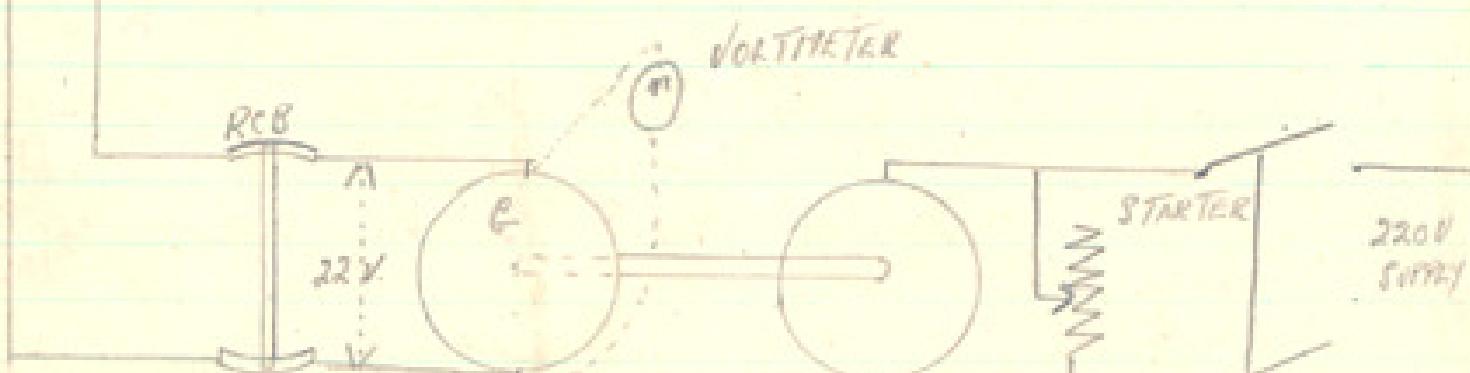
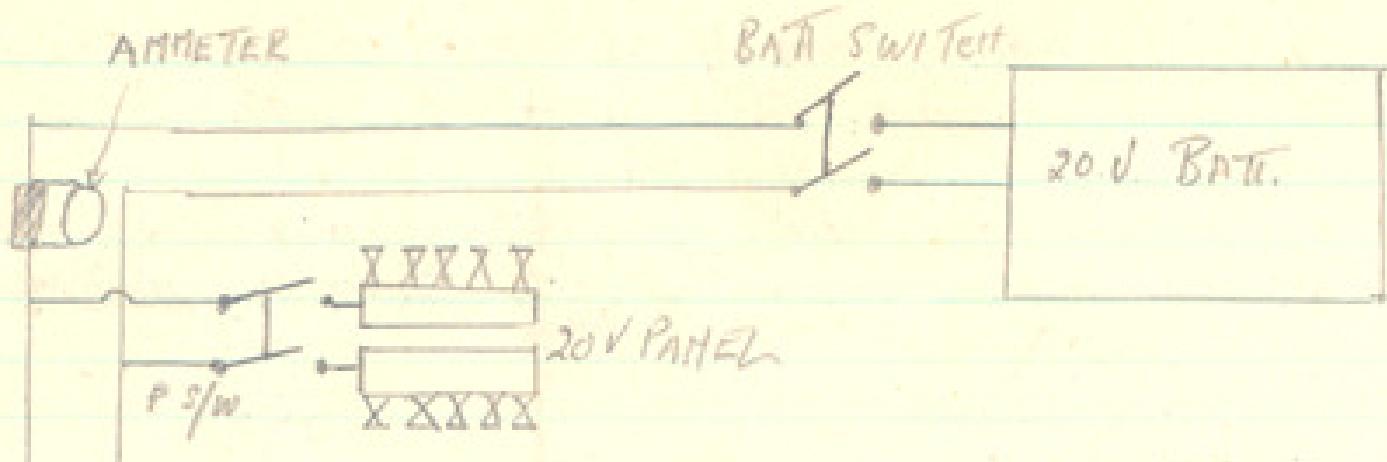
REDUCER

Reducer is a machine which is fitted to supply a constant voltage of 220 volts on the CP circuits when charging the main batteries. It can also be used to boost batteries and cells, up to 30 in number. It can also be used as an emergency supply to the 20 volt system.

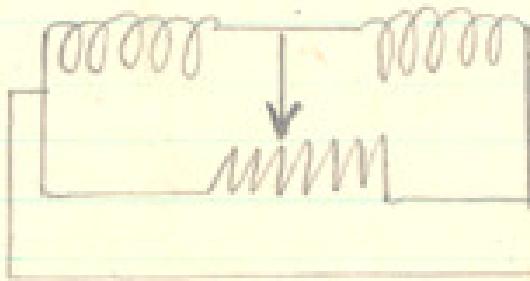
Reducer consists of 2 armatures on the same shaft. M₁ and D₁ has a variable field and D₁ is fused. M₁ armature is put in series with the CP circuits when running and D₁ is in parallel.



REDUCER CIRCUIT.



20V SYSTEM



20V System consists of a generator, panel and 20V battery. By the use of switches, the generator can charge the battery and supply its panels. In usual condition at no load, the generator supplies the panel and the battery.

floating. The reverse current breaker prevents the battery from discharging itself across the generator in the event of a 220 v failure.

Power can be fed from the generator, 20v Batt the Redars and the end 11 cells from 110v Battery. Present supplied by 20volt

of the Sperry Control

2) Projector Controls

3) Torpedo Firing Orders.

4) Tank Orders

5) Oldis Lamp

6) Enclosed Transmitters and Receivers.

7) Rely Dings, Chemist log, Chemist log.

8) Telephones

9) Alarms

Emergency lighting consists of Magazine Hand Lamps and Oilans lamps

CHARGING ROUTINE

STRONG CHARGE

1) Take the density and the temperature of the first cell.

2) Light the lamps dry

3) Take the first gas voltage.

4) Ventilate the battery.

5) By the board clear of earth

6) Light the engine clutch in and the fuel clutch out.

- ✓ Start the main under cooling fans and
✓ Start the circulators.
- ✓ Check to see if generator switch up.
- ✓ See the reverse ahead.
- ✓ Make the field switch and adjust to generate
 30 amperes.
- ✓ Start the Relays.
- ✓ Change over Reducer Selector switch and
 adjust the C.P.s to 210 volts.
- ✓ Put the resistance in the Police and
 Navigation light circuits.
- ✓ Put Voltmeter Selector switch to A or B.
- ✓ Report to 1st Lieut. "Ready to Charge".

To START THE CHARGE

The E.R.A. starts the engine, and when the voltage rises 5 to 10 volts above the battery voltage, in starting switches snapily. The charge is controlled by the rectifying of the engine, and final adjustments by the short field regulator.

To BREAK THE CHARGE. - The E.R.A. reduces the revs of the engine until the ammeter reads about 50 amperes on the charge side. She pulls out the starting switches snapily. Adjust the C.P.s and police and navigation light voltage immediately after starting.

reducing and heating the charge.

A RUNNING CHARGE.

As for a standing except that the tail clutches are in, and lattices are ventilated inboard.

TO REPAKE THE MOTORS FOR SEA.

- 1/ Take the density and temp. of the pilot cell.
- 2/ Light the lamps dry.
- 3/ See the load clear of earth.
- 4/ Light the engine clutch out and the tail clutch in.
- 5/ Check the generator switch up.
- 6/ Set the reverse to ahead.
- 7/ Start the main water cooling fans and circulators.
- 8/ Make the field switch in a Full Field.
- 9/ Light the control room, "Main Motor" really painted up.



METRIC MEASURES

Kilo. (1,000)	Hecto. (100)	Deka. (10)	Gramme (g) {	Deci. Metre (m) {	Centi. dg. dm. cl.	Milli. mg. mm. ml.
Kg. Km. Kl.	Hg. Hm. Hl.	Dg. Dm. Dl.	Litre (l)	1/10	1/100	1/1,000

(Note.—dm. with a small "d" is a decimetre = 1/10 of a metre.
Dm. with a capital "D" is a Decometre = 10 metres.)

There are certain connections between the metric system and the British measures.
(They are only approximate.)

1 cm. = rather less than 2/5 in.	1 KM. = 5/8 mile or 5 furlongs.
1 in. = 39.37 ins. (rather more than a yd.)	1 l. = 1 pt. (rather less than 1 quart).
1 g. (.032 oz.) is the weight of 1 cc. of water.	1 Kg. = 2½ lb.
1 cu. ft. of water = 6½ gallons. (approx.)	1 HL = 22 gallons. (approx.)

WEIGHT

16 ounces (oz.)	= 1 pound (lb.)
14 lb.	= 1 stone
28 lb.	= 1 quarter (qr.)
4 qrs. or 112 lb.	= 1 hundredweight (cwt.)
20 cwt. or 2240 lb. or 100 stone	= 1 ton
(Meat—14 lb. live : 8 lb. dead = 1 stone)	

INDIAN WEIGHT

5 Todas	= 1 Chittack (2 oz. approx.)
16 Chittacks	= 1 Seer (2 lb. approx.)
40 Seer	= 1 Maund (80 lb. approx.)

SQUARE OR AREA MEASURE

(used to measure surfaces)	
144 sq. in.	= 1 sq. ft.
9 sq. ft.	= 1 sq. yd.
484 sq. yd.	= 1 sq. ch.
1210 sq. yd.	= 1 rood.
4840 sq. yd. or 4 roods or 10 sq. ch.	= 1 acre.
640 acres	= 1 sq. mile.

(N.B.—Six square feet must not be confused with six feet square.)

1 Hectare (Ha.) = 100 acres = 2½ acres (approx.)

100 Ha. = 1 Sq. Km.

A football pitch is 1½ acres (approx.)

To measure the surface of a rectangular shape it is necessary to multiply length by breadth (expressed in the same unit).

LENGTH

12 inches (in.)	= 1 foot (ft.)
3 ft.	= 1 yard (yds.)
22 yds.	= 1 chain (ch.)
	(length of cricket pitch)
10 chs. or 220 yds.	= 1 furlong (fur.)
8 fur. or 1760 yds. or 5280 ft. or 63360 ins.	= 1 mile.
3 miles	= 1 league.
5 fms.	= 1 fathom.
A nautical-mile	= 2020½ yds.
A cable's length	= $\frac{1}{10}$ nautical mile (taken as 200 yds.)

CUBIC MEASURE

[used to measure solids or volumes].	
1728 cubic inches	= 1 cu. foot.
27 cu. ft.	= 1 cu. yard.
128 cu. ft. (a heap approx. 6' × 4' × 5')	= 1 cord of wood.
To measure the volume of a solid it is necessary to multiply together length and breadth and thickness (expressed in the same unit).	

TROY WEIGHT

(For Gold, Silver and Jewels)	
24 Grains	= 1 Pennyweight (dwt.)
20 Pennyweights	= 1 ounce (oz.)
12 ounces	= 1 Pound (lb.)

LIQUID MEASURE

4 gills	= 1 pint (pt.)
2 pts.	= 1 quart (qt.) (it is a quarter of a gallon).
4 qts.	= 1 gallon (gal.).
36 gallons (beer)	= 1 barrel.

DRY MEASURE

(Corn, etc.)	
2 gallons	= 1 peck (pk.)
4 pk.	= 1 bushel (bush.)
8 bush.	= 1 quarter (2 sacks).
1 bush. (oats) weighs 40 lbs. (average)	
1 .. (barley) ..	50 lbs. "
1 .. (wheat) ..	60 lbs. "
1 sack flour weighs 280 lbs. (approx.)	

MONEY

12 pence	= 1 shilling (1/-).
100 pence	= 8/4.
240 pence	= 1 pound (£1).
1000 pence	= £1.34.
10/-	= 1/- or .5 of £1.
5/- (crown)	= .25 or .25 of £1.
6/-	= .5 or .25 of £1.
2½ (half a crown)	= .25 or .125 of £1.
2/- (florin)	= .25 or .1 of £1.
1/4	= .125 or .0625 of £1.
1/3	= .1666 or .0625 of £1.
1/6	= .1666 or .05 of £1.
6d.	= .125 or .025 of £1.

To convert shillings to decimal of £ multiply by 5 and divide by 100.

To convert decimal of £ to shillings divide by 5 and multiply by 100.

French 100 centimes =

1 franc (12½ to the £ roughly)

American 100 cents =

1 dollar (4·86 to the £ roughly)

3 Pies = 1 Pice.

12 Pies or 4 Pies = 1 Anna.

16 Annas = 1 Rupee (≈ 1/6).

German 100 Pfennige =

1 Mark (20·43 to the £ roughly)