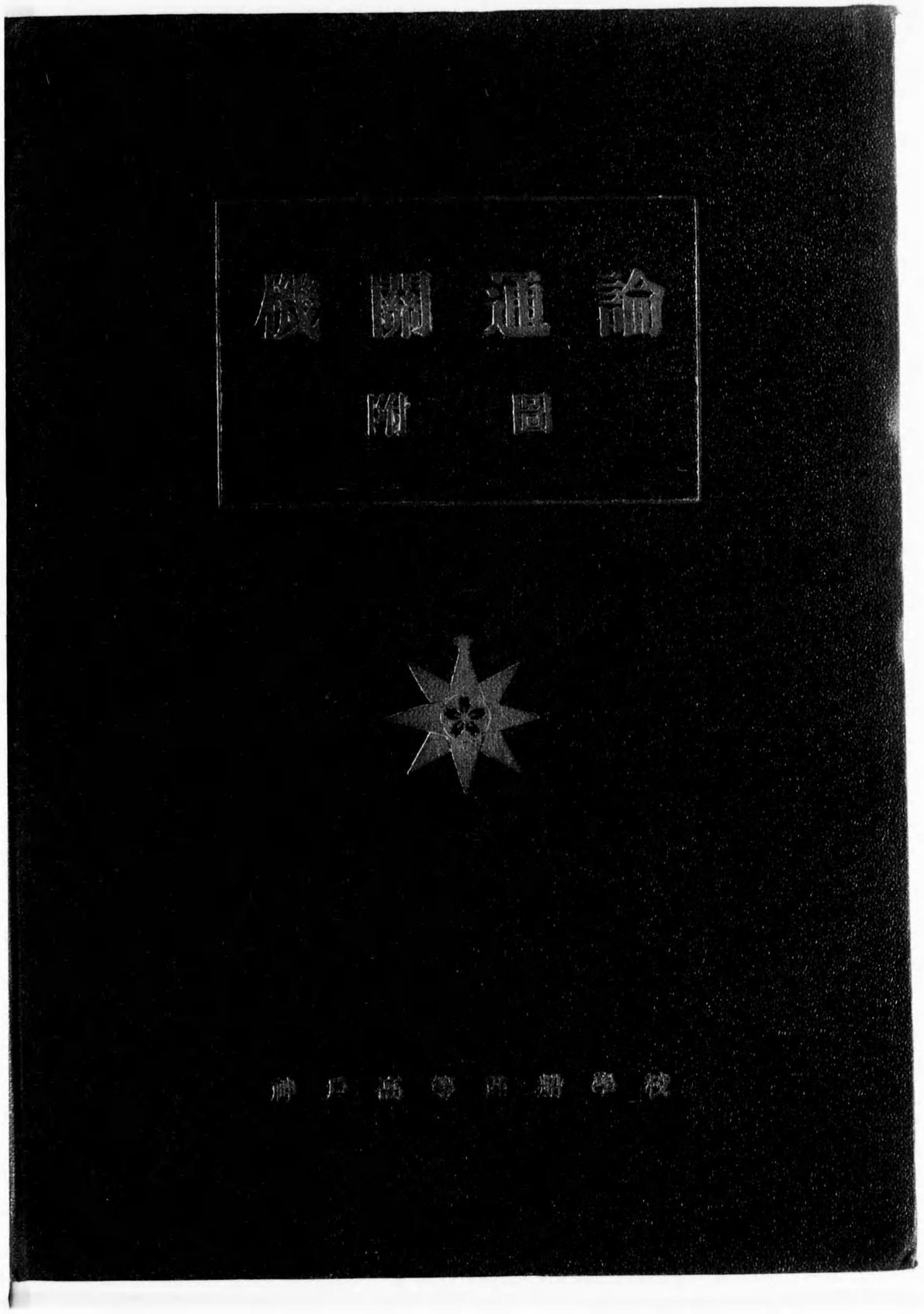
始



機關通論

附圖

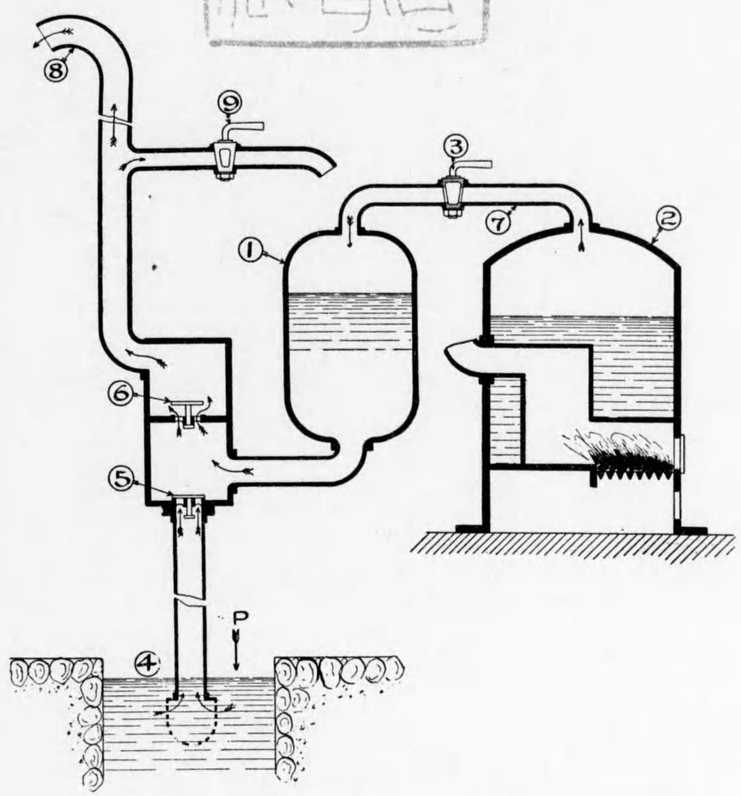
神戸高等商船學校

Fig. 1.

SAVERY'S PUMP.

(PATENTED IN 1698)

BY SAVERY



1. Receiver.
2. Boiler.
3. Steam Cock.
4. Water.
5. Suction Valve.
6. Delivery Valve.
7. Steam Pipe.
8. Discharge Pipe.
9. Cooling Water Cock.

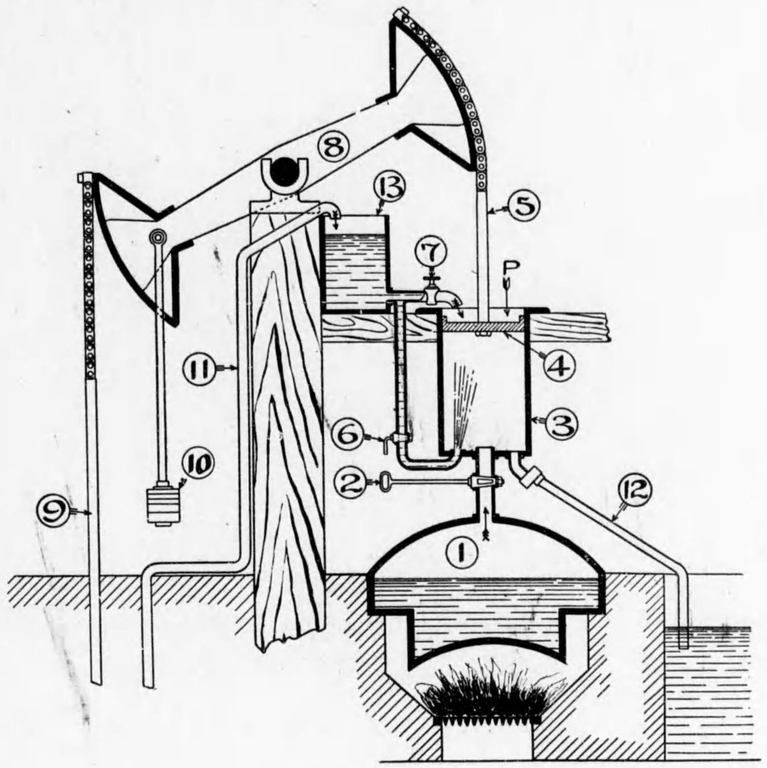
Fig. 2.

NEWCOMEN'S ENGINE.

(INVENTED IN 1728 BY THOMAS NEWCOMEN)

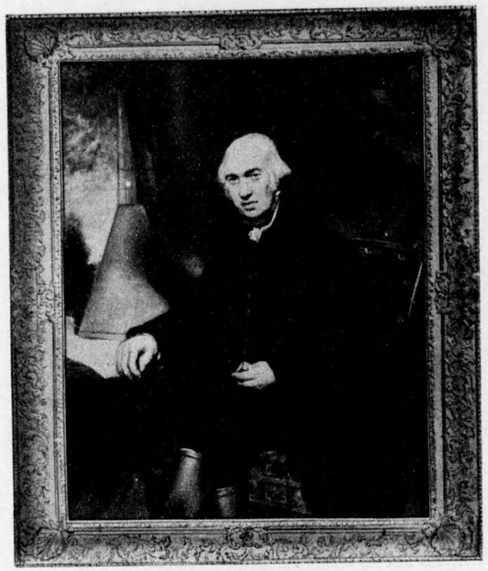
Fig. 3.

NEWCOMEN'S ENGINE.



1. Boiler.
2. Throttle Valve.
3. Cylinder.
4. Piston.
5. Piston Rod.
6. Cooling Water Cock.
7. Water Service Cock.
8. Wooden Beam.
9. Pump Rod.
10. Weight.
11. Pump Discharge Pipe.
12. Drain Pipe.
13. Water Tank.

Fig. 4. (A)

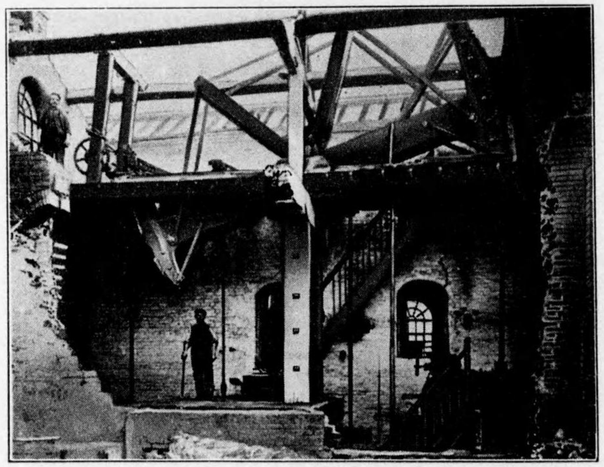


James Watt.

Fig. 4. (B)

EARLY WATT PUMPING ENGINE.

(CYLINDER IS SINGLE-ACTING 30" DIAM BY 8' STROKE)



This Engine constructed in 1776 by Messrs. Boulton and Watt for pumping station of Birmingham canal, and was worked till 1898 and now preserved at Ocker Hill, Tipton.

It is believed to be the first engine sold by the maker.

Fig. 5. (A)

WATT'S SINGLE ACTING PUMPING ENGINE.

(CONSTRUCTED IN 1777).

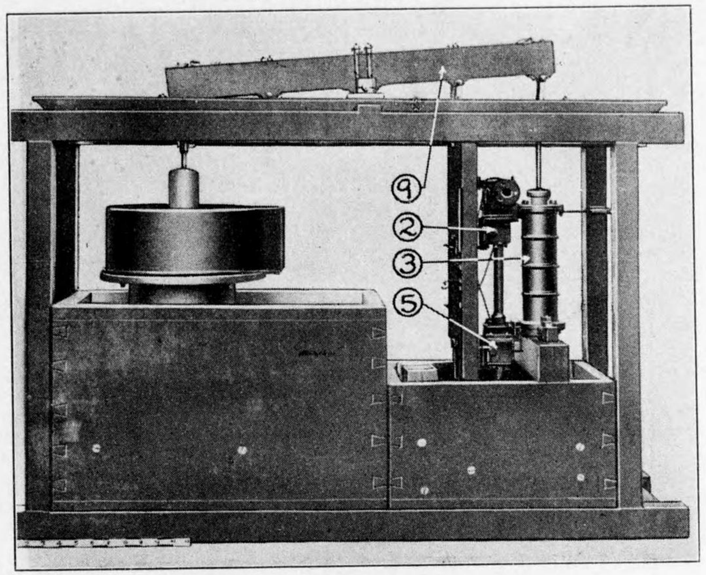


Fig. 5. (B)

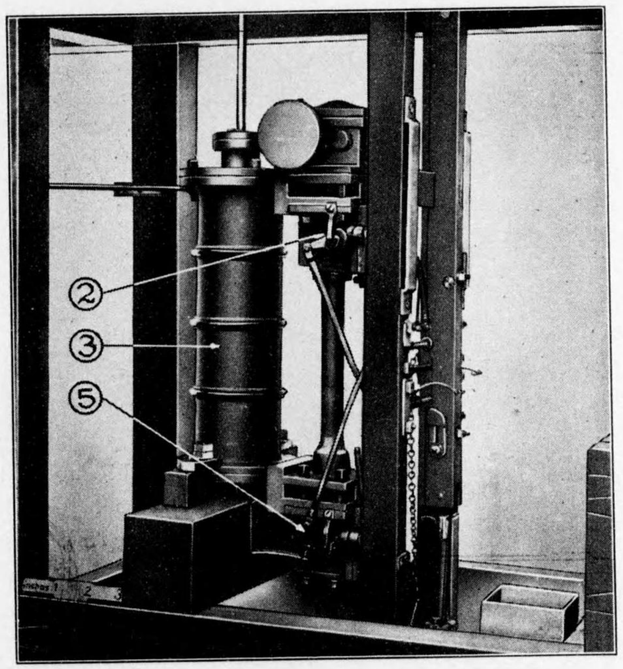
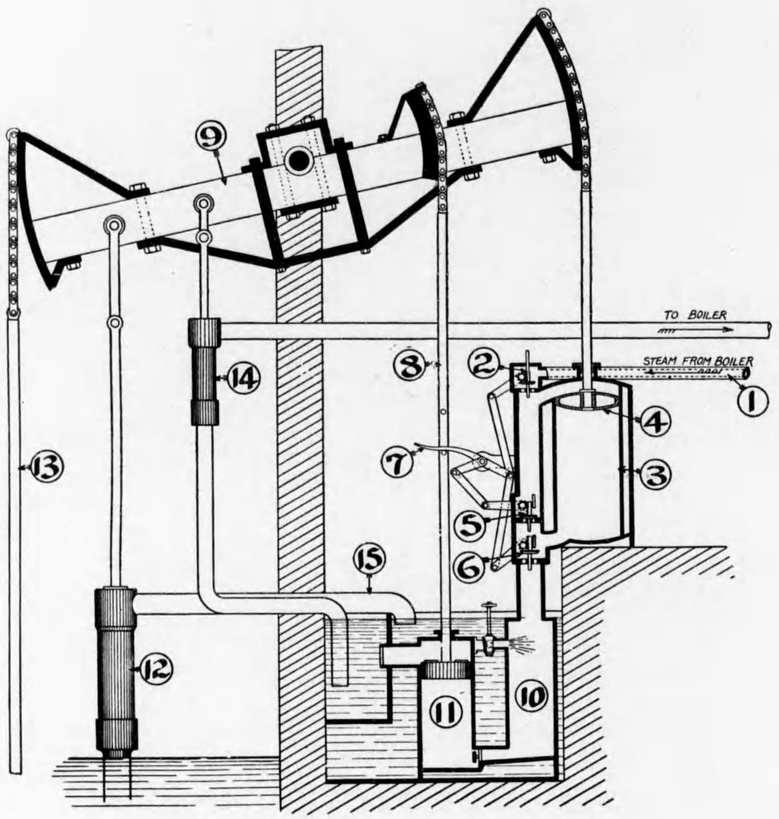


Fig. 6.

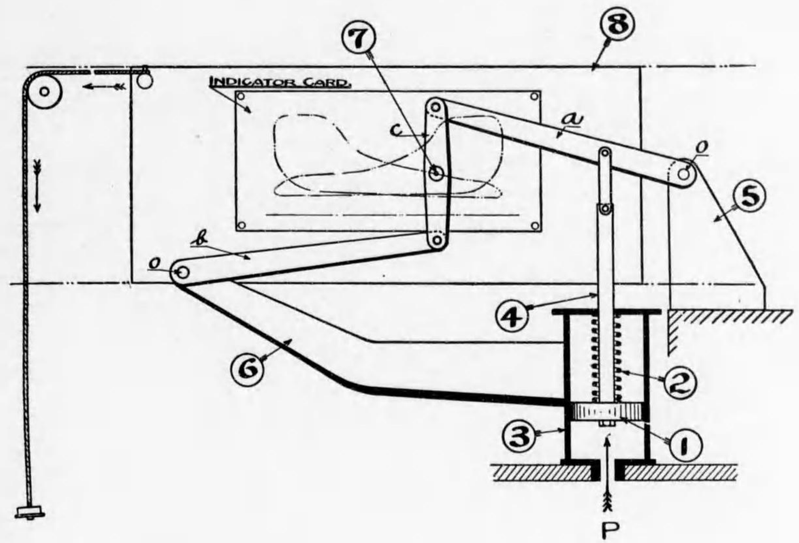
WATT'S SINGLE ACTING ENGINE.



1. Steam Pipe.
2. Steam Valve.
3. Cylinder.
4. Piston.
5. Equilibrium Valve.
6. Exhaust Valve.
7. Tappet.
8. Air Pump Rod.
9. Wooden Beam.
10. Condenser.
11. Air Pump.
12. Circulating Pump.
13. Weighted Pump Rod.
14. Feed Pump.
15. Discharge Pipe.
16. Hot Well.

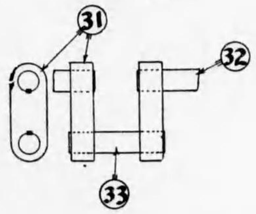
Fig. 7.

WATT'S STEAM INDICATOR.



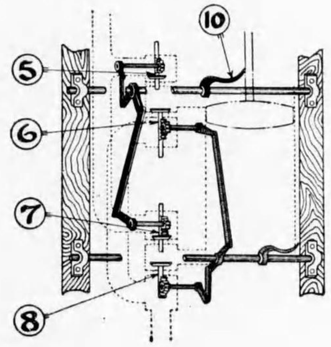
1. Piston.
2. Spring.
3. Cylinder.
4. Piston Rod.
a. b. c. Parallel Motion.
o. Fulcrum.
5. Arm
6. "
7. Pencil.
8. Moving Plate (Drum.)

Fig. 8. (B)



31. Crank Web.
32. Crank Shaft.
33. Crank Pin.

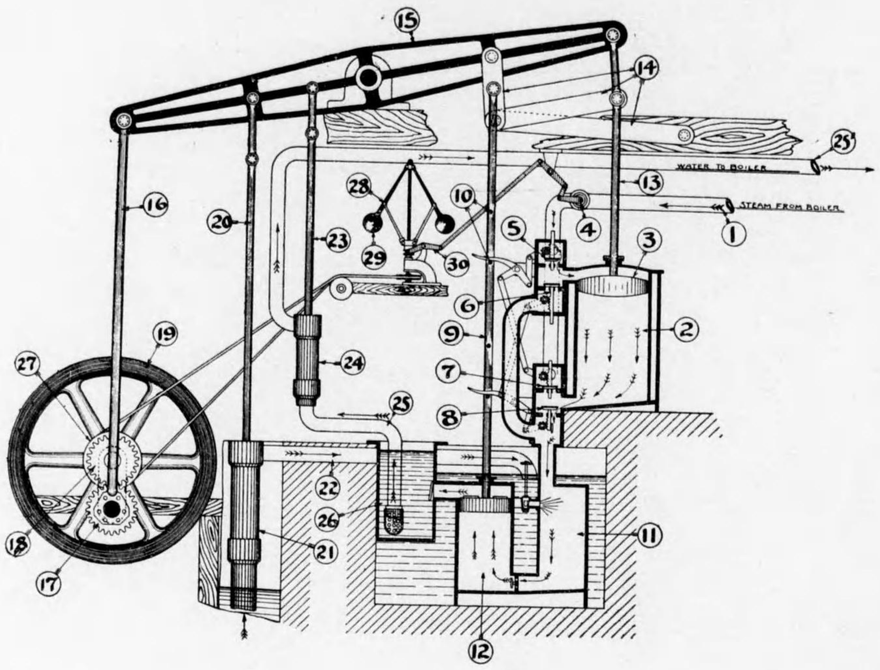
Fig. 8. (C)



5. Steam Inlet Valve. Top side
6. Exhaust Valve. Top side
7. Steam Inlet Valve. Bottom side
8. Exhaust Valve. Bottom.
10. Tappet.

Fig. 8. (A)

WATT'S DOUBLE ACTING ENGINE.



1. Steam Pipe.
2. Cylinder.
3. Piston.
4. Throttle Valve.
   Top side
5. Steam Inlet Valve.
   Top side
6. Exhaust Valve.
   Bottom side
7. Steam Inlet Valve.
   Bottom side
8. Exhaust Valve.
9. Air Pump Rod.
10. Tappet.
11. Condenser.
12. Air Pump.
13. Piston Rod.
14. Parallel Motion.
15. Iron Beam.
16. Connecting Rod.
17. Planet Wheel.
18. Sun Wheel.
19. Fly Wheel.
20. Circulating Pump Rod.
21. Circulating Pump.
22. Discharge Pipe.
23. Feed Pump Rod.
24. Feed Pump.
25. Feed Pipe.
26. Hot Well.
27. Belt Pulley.
28. Governor.
29. Ball (governor weight).
30. Bell Crank.

Fig. 9. (A)

WATT'S DOUBLE ACTING ROTATIVE BEAM ENGINE.

(Flected at Soho, near Birmingham, in 1788)

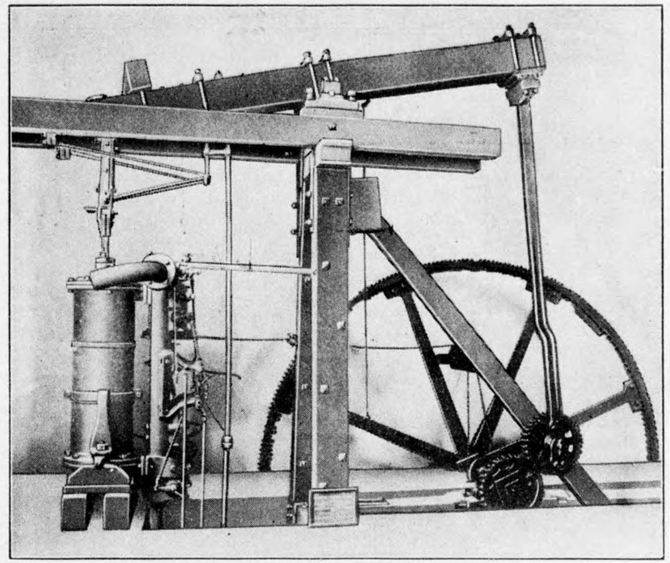
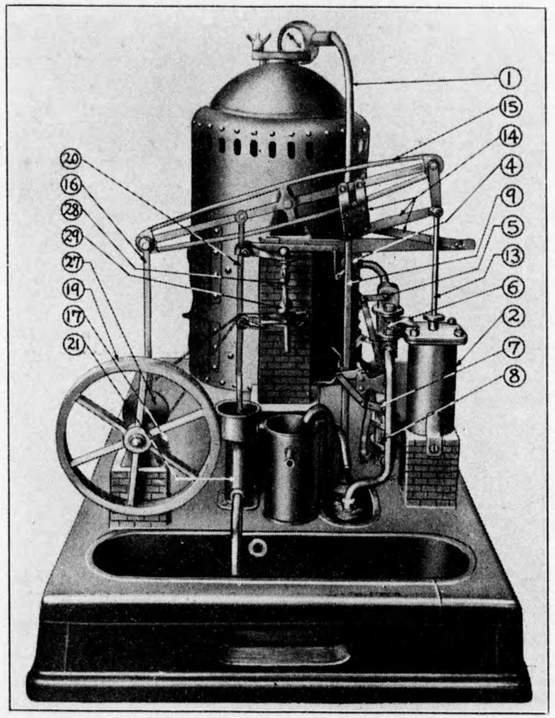
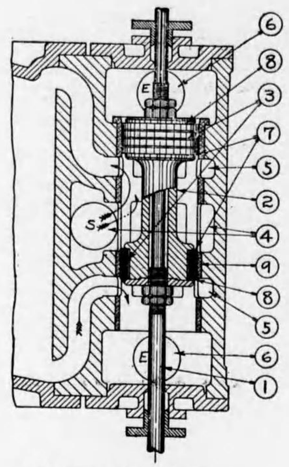


Fig. 9. (B) MODEL.



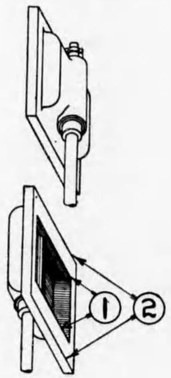
(KOBE HIGHER MERCHANTILE MARINE SCHOOL)

Fig. 10. (B)



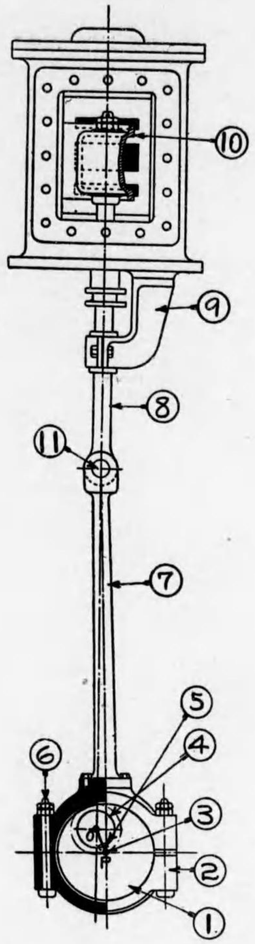
1. Valve Spindle.
2. Piston Slide Valve Body.
3. Packing-ring.
4. Steam Inlet.
5. Steam Port.
6. Exhaust Port and Pipe.
7. Steam Edge.
8. Exhaust Edge.
9. False-face.

Fig. 10. (C)



1. Exhaust Edge.
2. Steam Edge.

Fig. 10. (A)



1. Eccentric Sheave.
2. Eccentric Strap.
3. Eccentric Throw.
4. Shaft.
5. Position of Key.
6. Strap Bolt.
7. Eccentric Rod.
8. Valve Spindle.
9. Valve Spindle Bracket or Guide.
10. D Slide Valve.
11. Fork End Gudgeon Pin.

Fig. 11.

CLASSIFICATION OF "D" SHAPED OUTSIDE CUT-OFF VALVE.

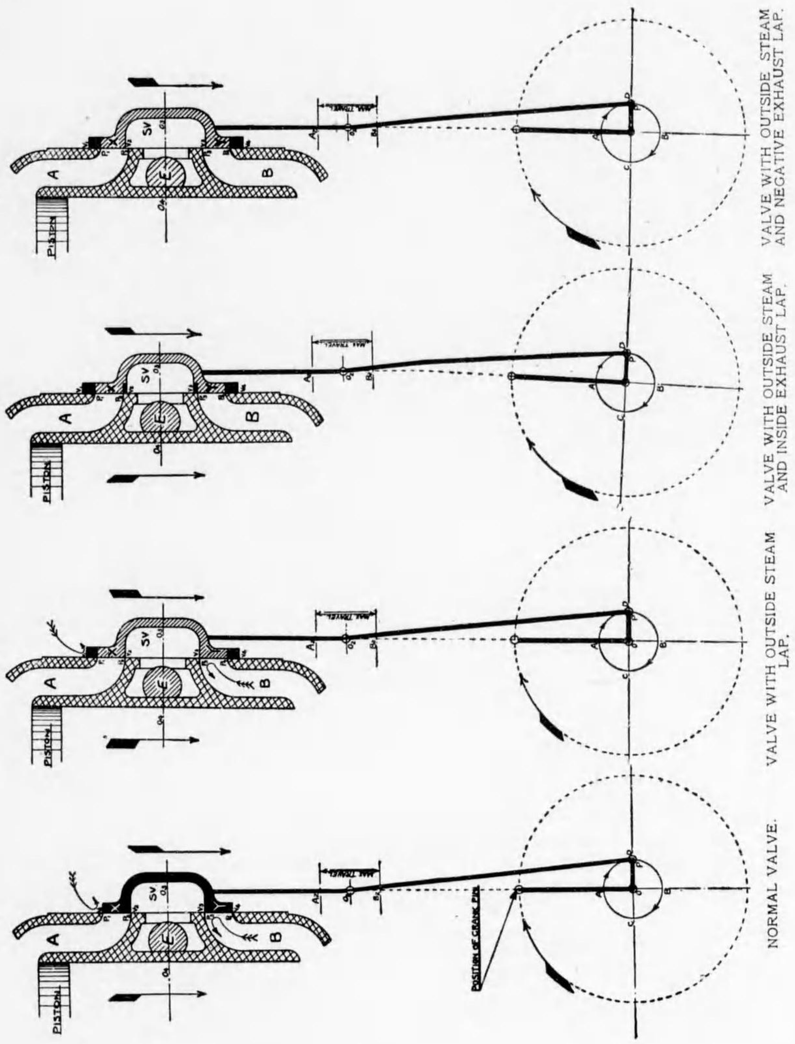


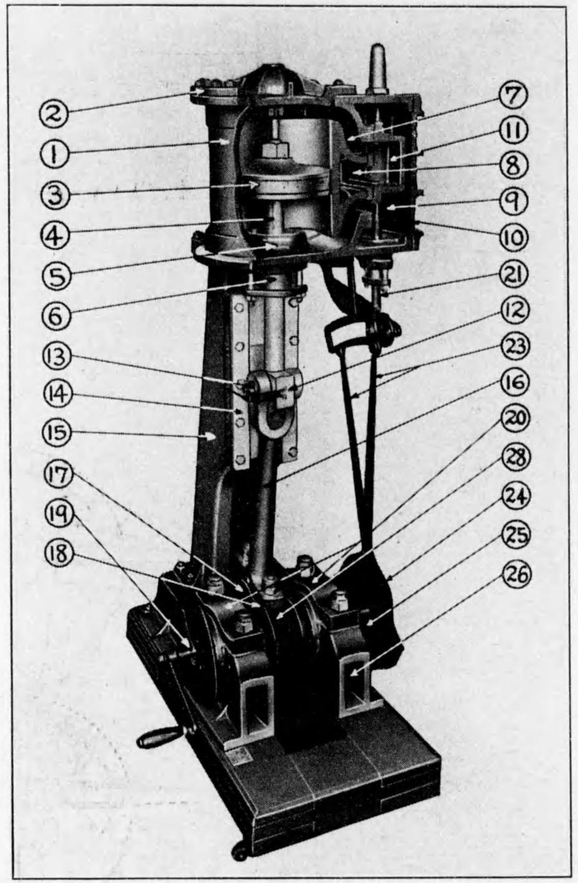
Fig. 12. CLASSIFICATION OF "D" SHAPED INSIDE CUT-OF VALVE.

Fig. 13. LEAD AND ANGULAR ADVANCE OF SEVERAL KINDS OF "D" SHAPED VALVE.

Fig. 14.

SINGLE CYLINDER STEAM ENGINE.

MODEL.



(KOBE HIGHER MERCHANTILE MARINE SCHOOL)

Fig. 15. (B)

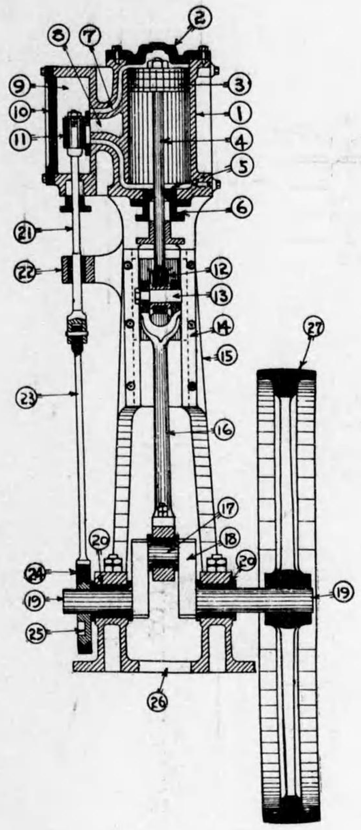
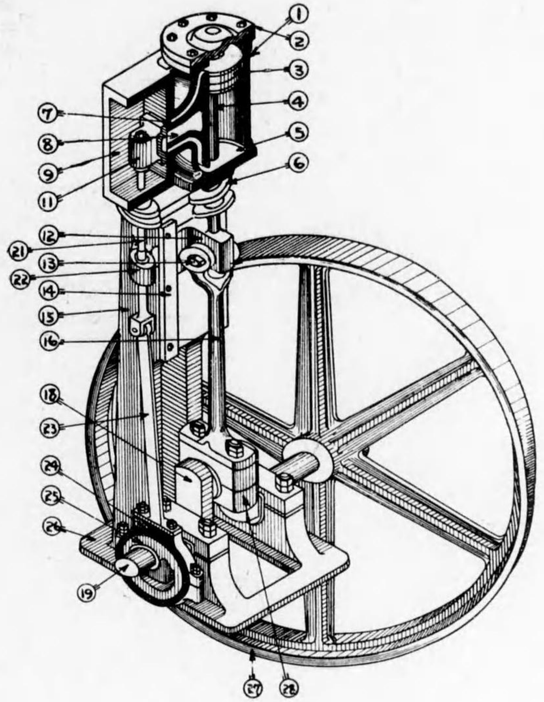


Fig. 15. (A)

NAMES OF THE PARTS.
SINGLE CYLINDER STEAM ENGINE.



1. Cylinder.
2. Cylinder Cover.
3. Piston & Packing Ring.
4. Piston Rod.
5. Cylinder Bottom.
6. Stuffing Box.
7. Steam Port.
8. Exhaust Port.
9. Valve Chest.
10. Valve Chest Cover.
11. D Slide Valve.
12. Cross Head.
13. Gudgeon Pin.
14. Guide Bar.
15. Engine Column.
16. Connecting Rod.
17. Crank Pin.
18. Crank Arm.
19. Crank Shaft.
20. Main Bearing.
21. Valve Spindle.
22. Spindle Guide.
23. Eccentric Rod.
24. Eccentric Strap.
25. Eccentric Sheave.
26. Sole (or Beb) Plate.
27. Fly Wheel.
28. Crank Pin Brass.

Fig. 16. (A)

OPERATION OF SLIDE VALVE.

Fig. 16. (B)

OPERATION OF SLIDE VALVE.

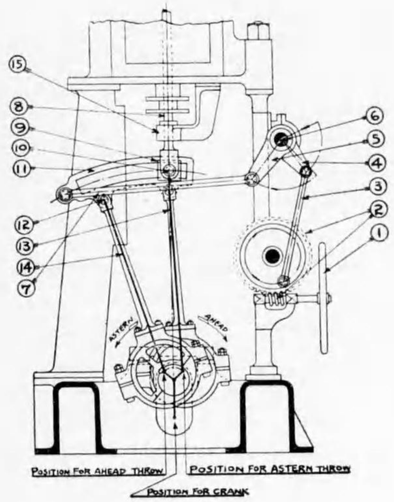
Fig. 17.

George Stephenson

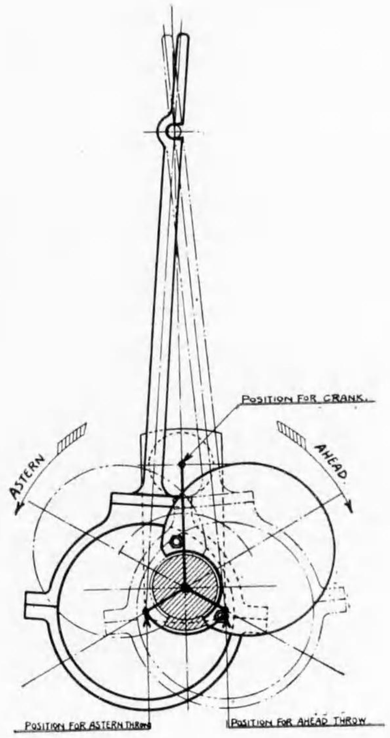
Fig. 18.

(A)

STEPHENSON'S
REVERSING GEAR.



(B)



LOOSE ECCENTRIC REVERSING GEAR.

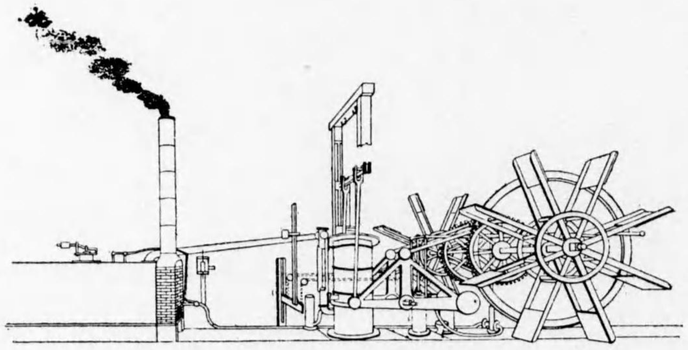
1. Reversing Wheel.
2. Reversing Worm & Worm Wheel.
3. Drag-link or Reversing Rod.
4. Bell Crank Arm.
5. Reversing Arm.
6. Weigh Shaft.
7. Suspension Rod.
8. Valve Spindle.
9. Link Block.
10. Link Block Gudgeon Pin.
11. Link Bar.
12. Gudgeon Pin for Fork End.
13. Astern Eccentric Rod.
14. Ahead " "
15. Valve Spindle Guide.

Fig. 19.

Robert Fulton

The inventor of steamship

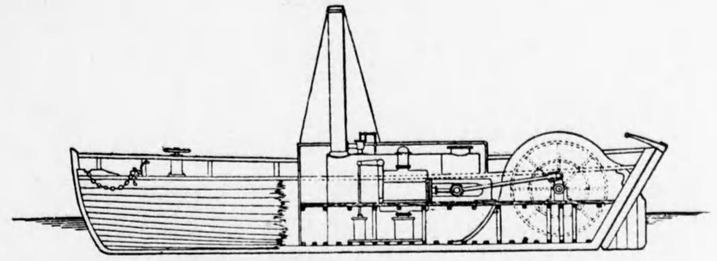
Fig. 20.



P. S. Clermont

The first steamship built by Robert Fulton in America.

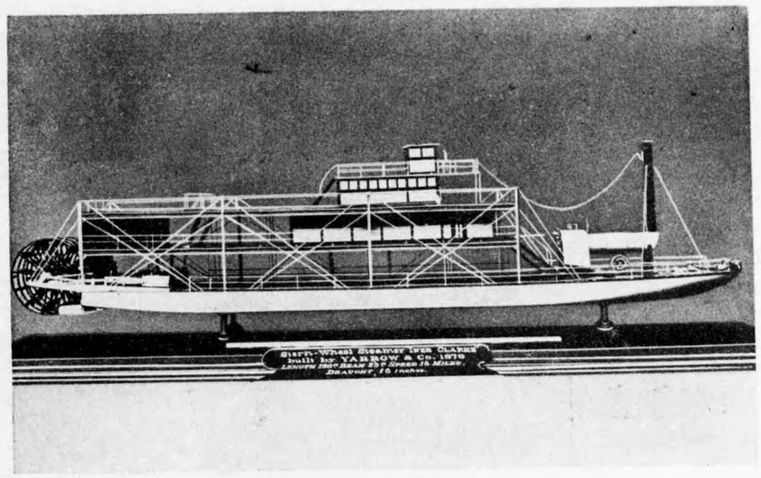
Fig. 21.



Stern wheeler, Charotte Dundas.

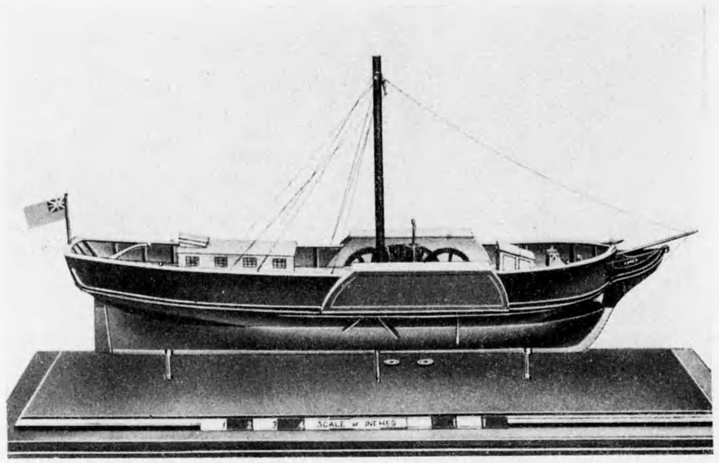
The first steamship built in Great Britain by William Symington at 1802.

Fig. 22



Modern steam-wheeler.

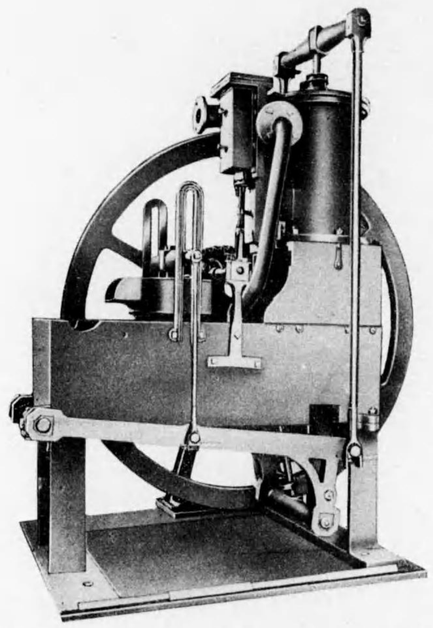
Fig. 23. (A)



P. S. Comet.

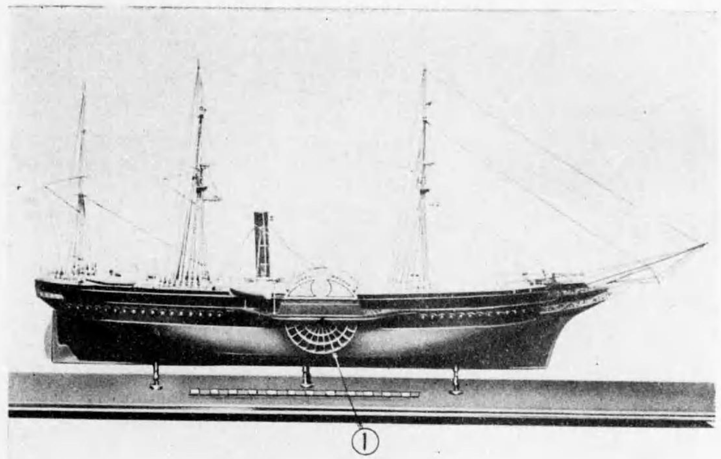
The first steam boat built at Clyde bank. (1821)

(B)



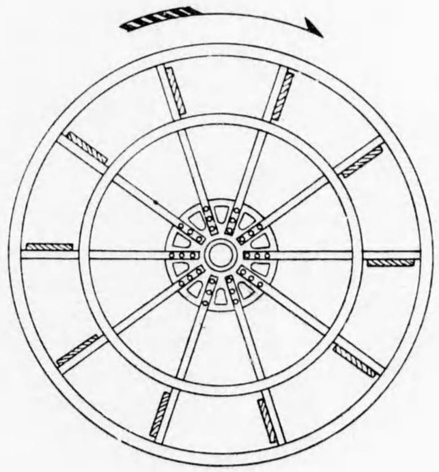
The steam engine fitted on P. S. Comet.

Fig. 24. (A)



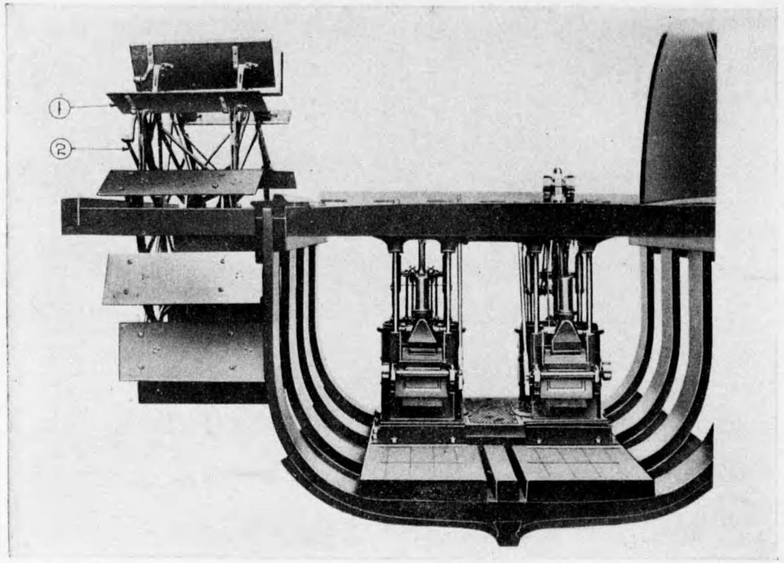
Paddle steamer. (Hibernia)

(B)



Paddle wheel.

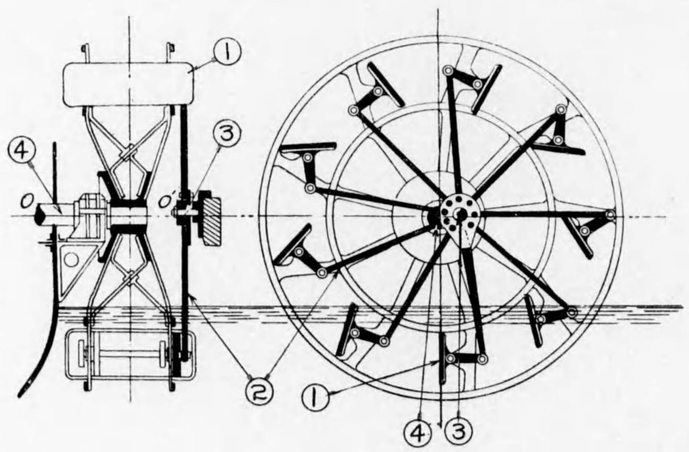
Fig. 25. (A)



Model of feathering paddle ship (Science museum S. K. London)

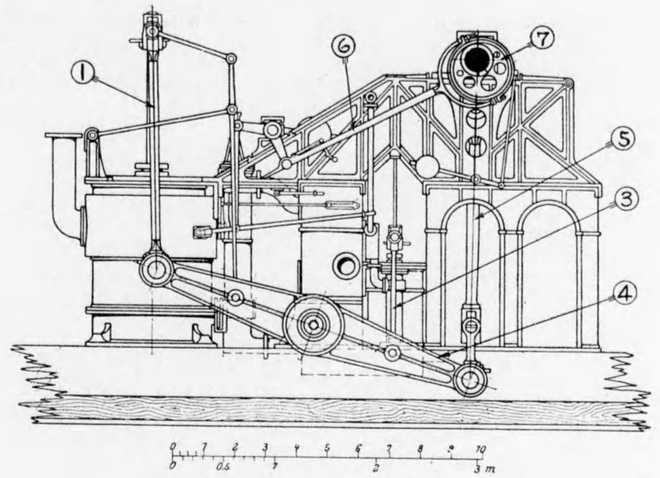
1. Blade.
2. Eccentric rod.
3. Eccentric pin.
4. Propeller shaft.

(B)



Feathering paddle wheel.

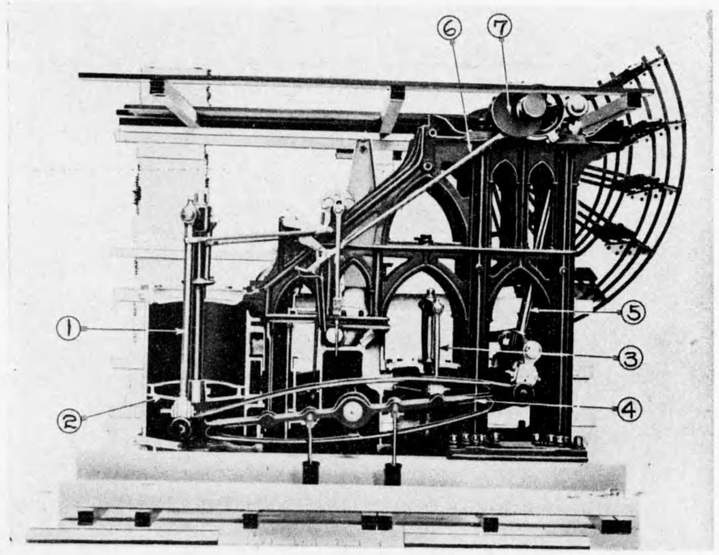
Fig. 26. (A)



Side lever engine.

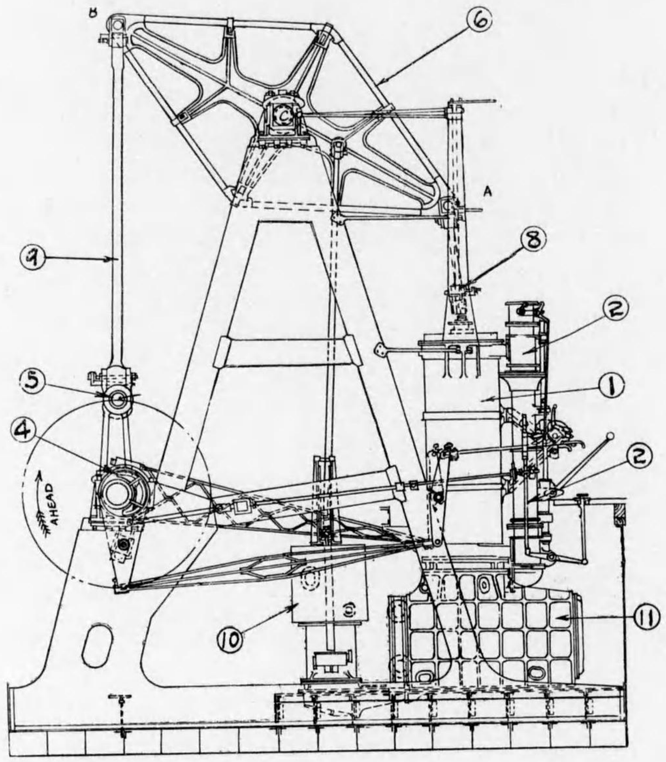
1. Connecting rod.
2. Piston.
3. Air pump rod.
4. Side lever.
5. Connecting rod for crank.
6. Eccentric rod.
7. Eccentric sheave.

(B)



Model of side lever engine (Science Museum S. K. London)

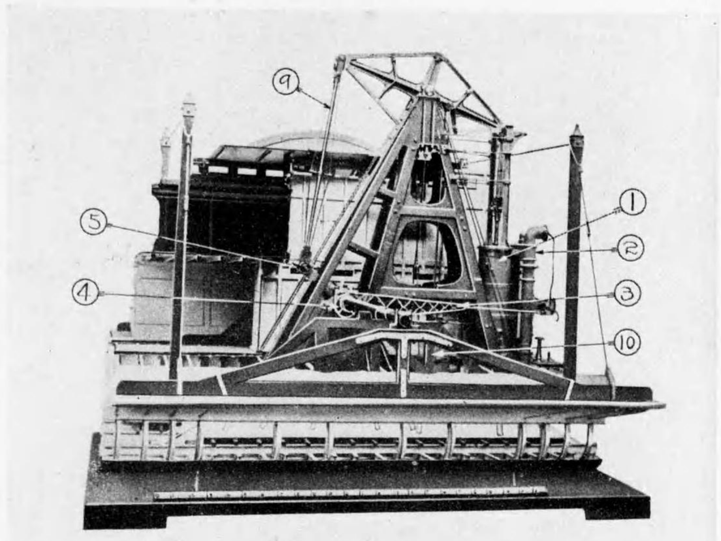
Fig. 27. (A)



Beam engine American type.

1. Steam cylinder.
2. Valve casing.
3. Eccentric rod.
4. Eccentric sheave.
5. Crank pin.
6. Beam.
7. Paddle wheel.
8. Piston rod cross head guide.
9. Connecting rod for crank.
10. Air pump.
11. Condenser.

Fig. 28. (B)



Model of paddle ship fitted beam engine Science museum S. K. London)

(C)

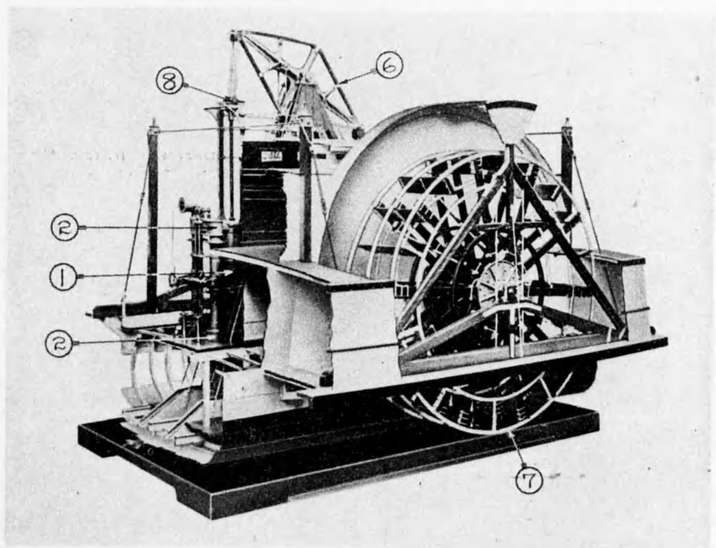
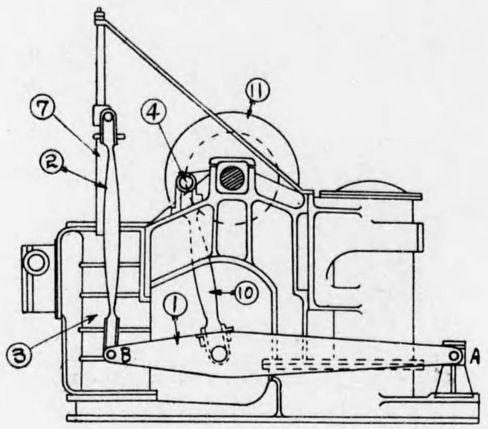


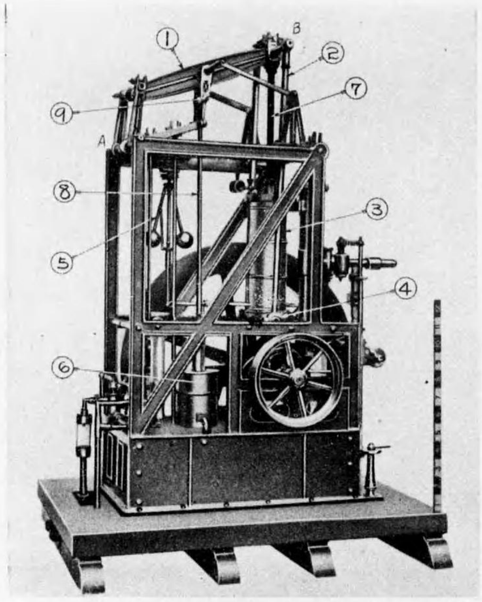
Fig. 29. (A)



Grasshopper engine.

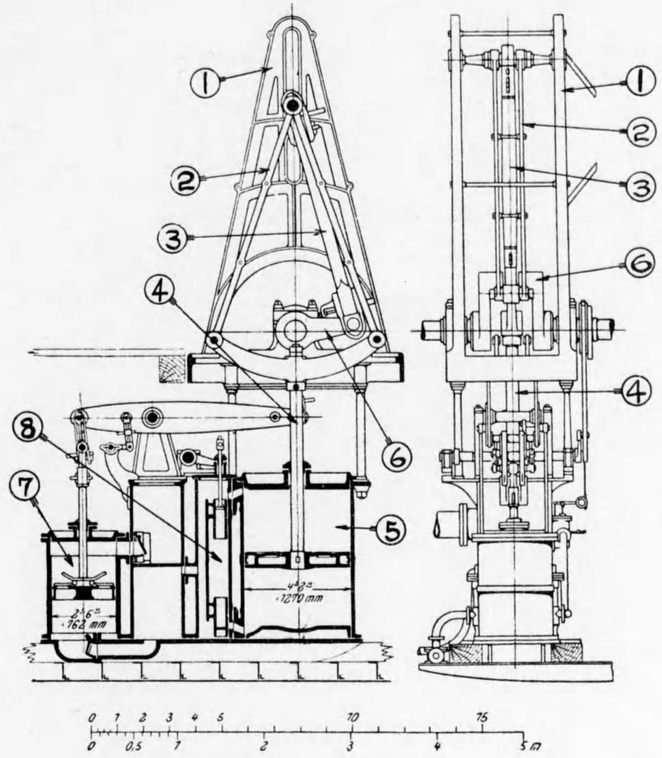
1. Side lever.
2. Connecting rod for piston rod.
3. Steam cylinder.
4. Crank pin.
5. Watt's governor.
6. Air pump.
7. Piston rod.
8. Air pump rod.
9. Parallel motion.
10. Connecting rod for crank.
11. Fly wheel.

(B)

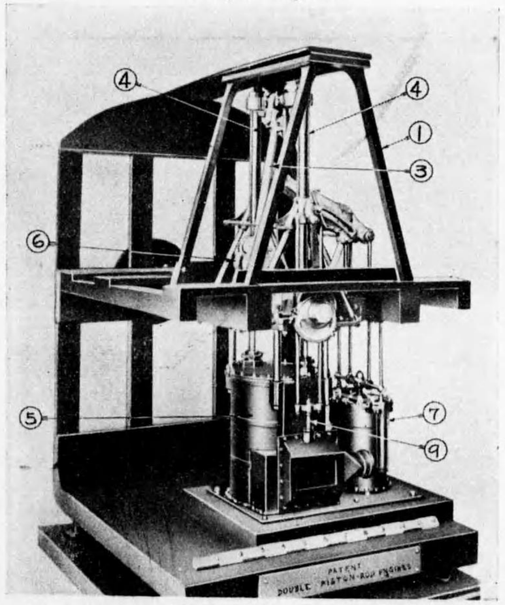


Model of Grasshopper engine.

Fig. 30. (A)



Steeple engine.

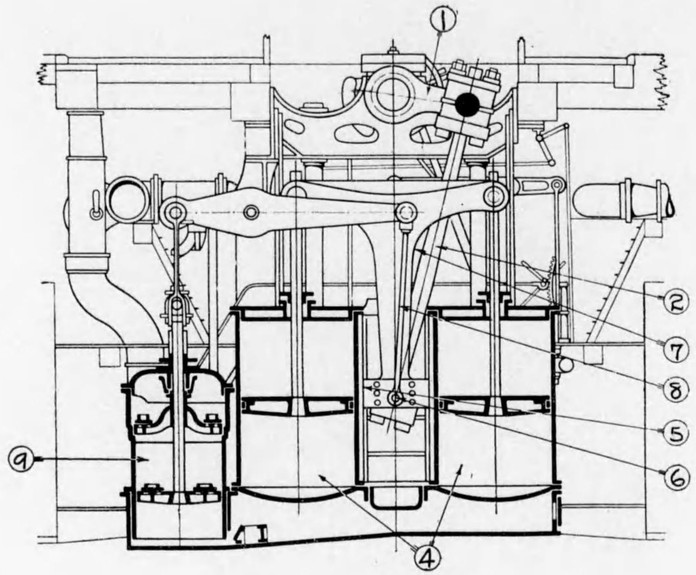


(B)

1. Frame.
2. Piston rod fork end.
3. Connecting rod.
4. Piston rod.
5. Cylinder.
6. Crank.
7. Air pump.
8. Slide valve.
9. Valve spindle.

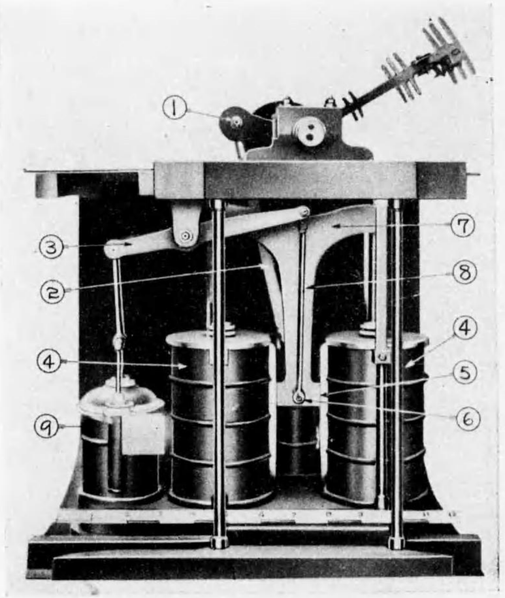
Model of double rod steeple engine (Scienec museum S. K. London)

Fig. 31. (A)



Double cylinder engine.

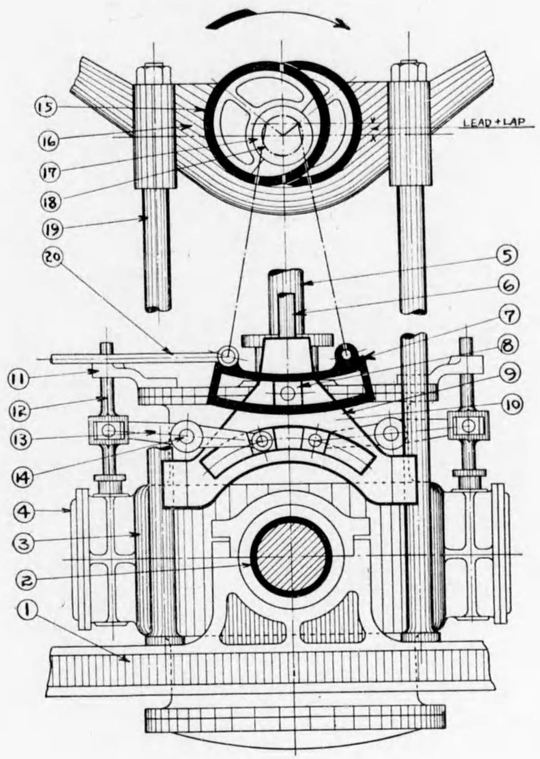
(B)



Model of double cylinder engine.

1. Crank.
2. Connecting rod.
3. Pump lever.
4. Cylinder.
5. Guide.
6. Cross head pin.
7. Piston rod T head bar.
8. Pump lever rod.
9. Air pump.

Fig. 32. (A)

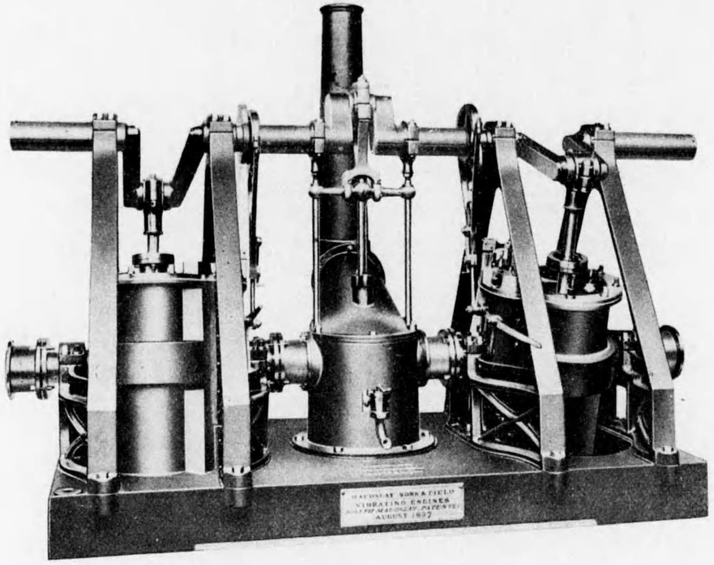


Oscillating engine.

(Crank on top centre.)

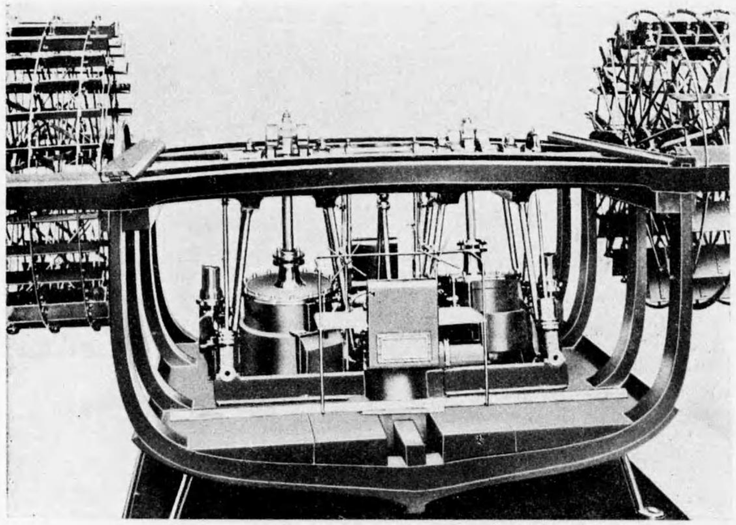
1. Engine bottom framing.
2. Trunnion.
3. Cylinder belt.
4. Valve chest.
5. Piston rod.
6. Tail guide.
7. Reversing link.
8. Fixed block.
9. Main quadrant.
10. Moving block.
11. Guide bracket.
12. Valve rod.
13. Rocking lever.
14. Pin.
15. Ahead pulley.
16. Engine top framing.
17. Shaft.
18. Eccentric throw circle.
19. Vertical pillars or columns.
20. Drag link.

Fig. 32. (B)



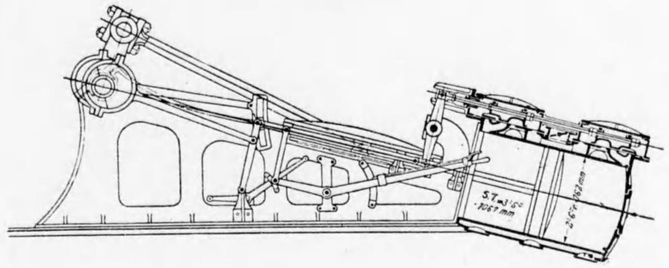
Model of oscillating engine.

(C)



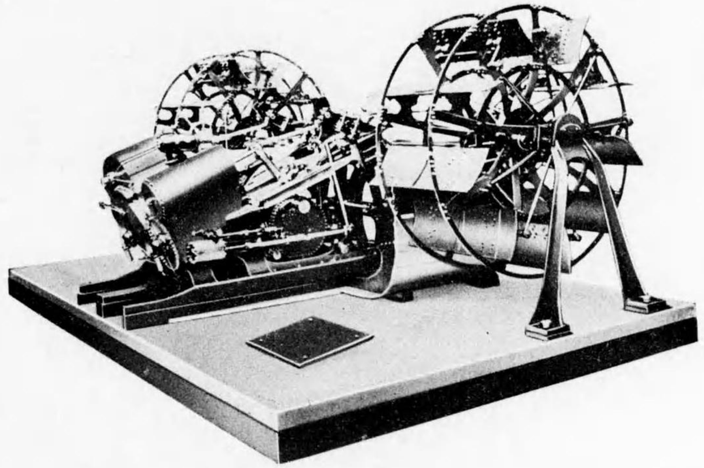
Model of P. steamer fitted with oscillating engine.

Fig. 33. (A)



Diagonal engine.

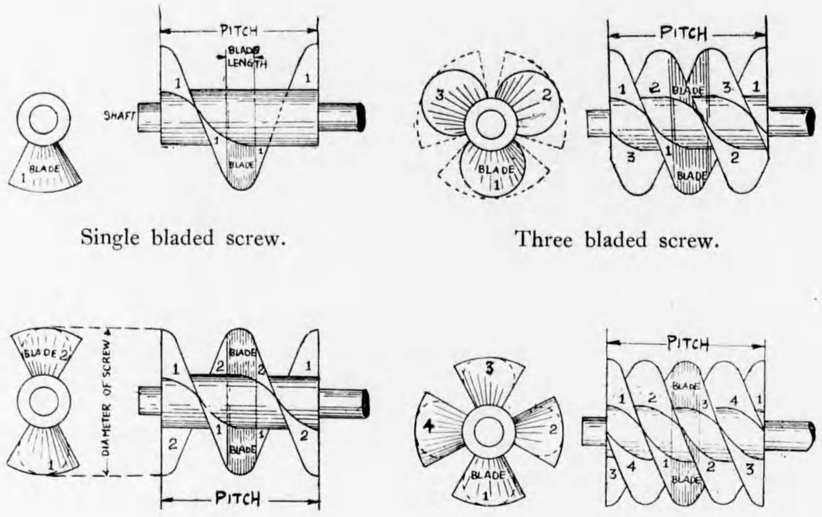
(B)



Model of diagonal engine fitted on paddle steamer.

Fig. 34.

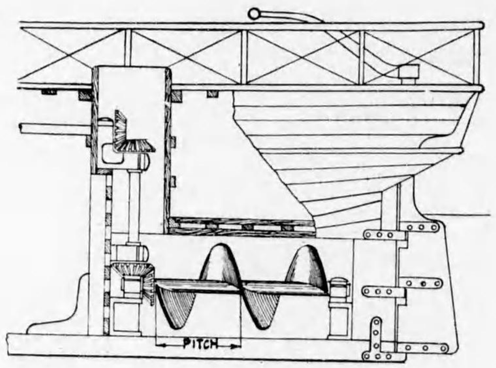
Screw propeller.



Single bladed screw.

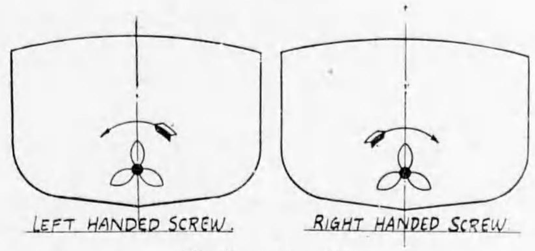
Three bladed screw.

Fig. 35.

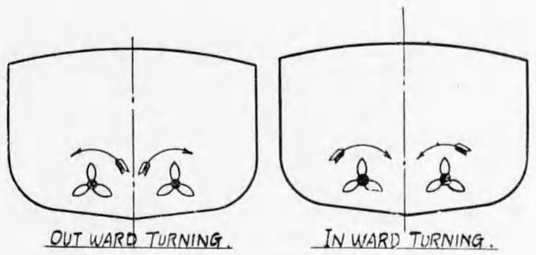


Francis Pettit Smith's screw as first tried.

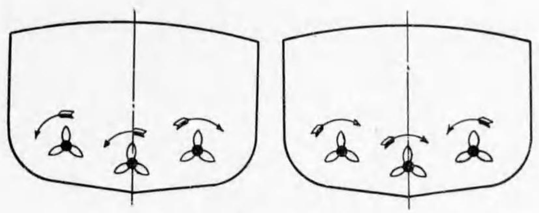
Fig. 36.



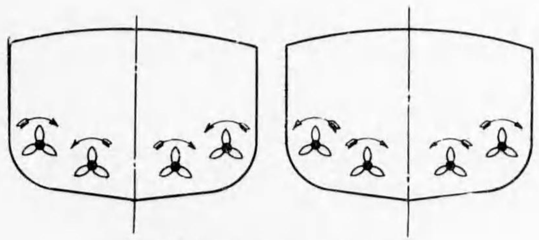
Single screw ship.



Twin screw ship.



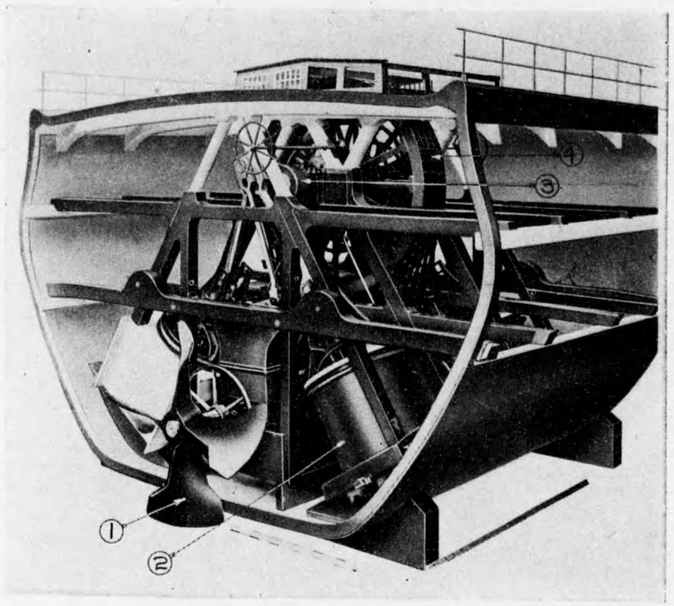
Triple screw ship.



Quadraple screw ship.

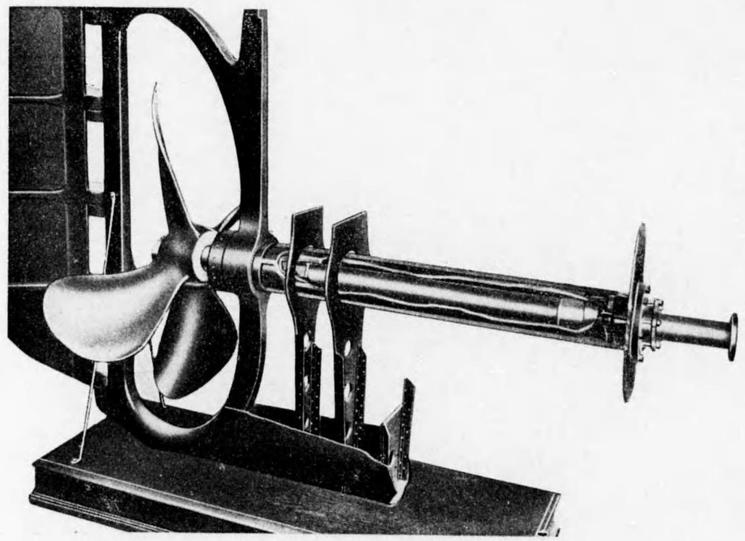
Fig. 37.

1. Screw propeller.
2. Steam cylinder.
3. Crank.
4. Gear chain wheel.



Model of screw steamer fitted with geared engine.

Fig. 38.

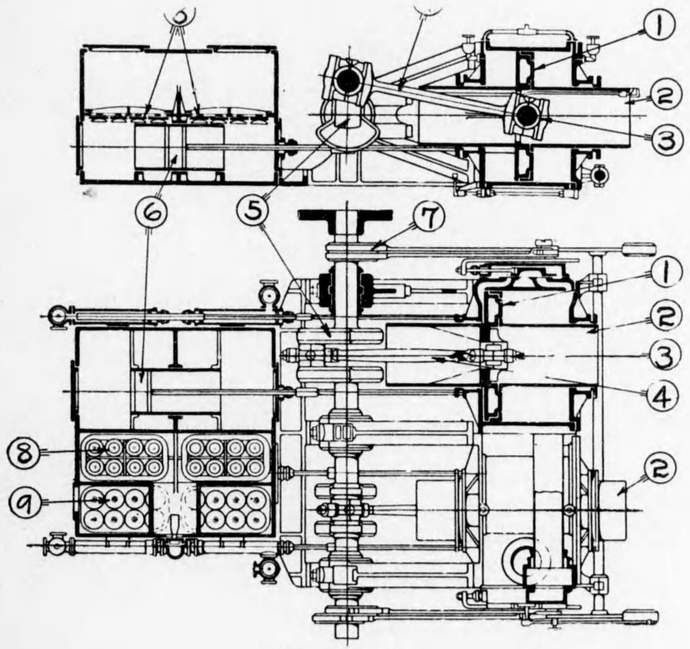


Model of screw propeller and stern tube.

Fig. 39.

Inventor of trunk engine.
John Penn

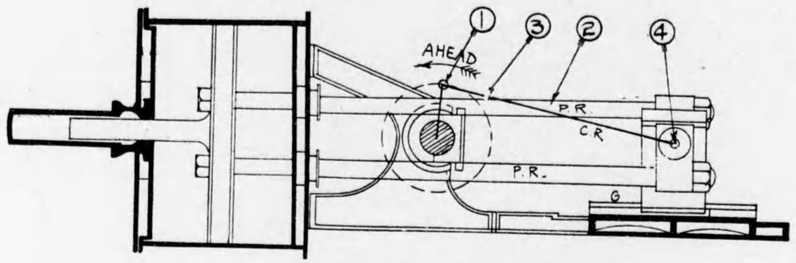
Fig. 40.



1. Piston.
2. Trunk.
3. Cross head gudgeon pin.
4. Connecting rod.
5. Crank.
6. Air pump.
7. Eccentric sheave.
8. Suction valve for air pump.
9. Delivery valve.

Trunk engine.

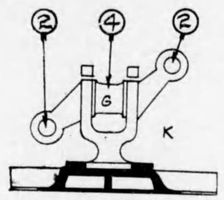
Fig. 41. (A)



Return connecting rod engine.

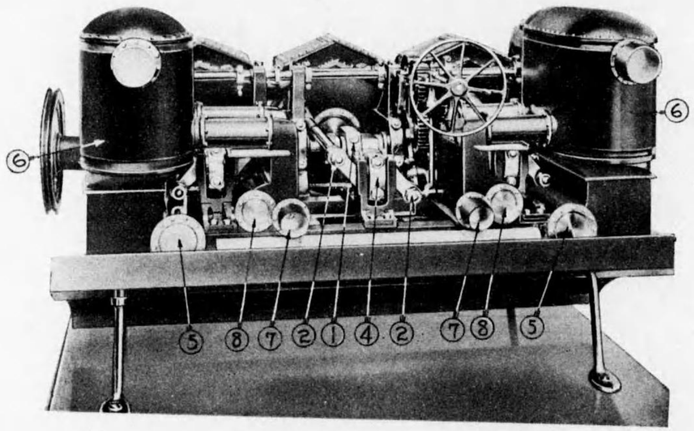
1. Crank pin.
2. Piston rod.
3. Connecting rod.
4. Cross head gudgeon pin.
5. Circulating pump.
6. Condenser.
7. Air pump.
8. Feed pump.

B)



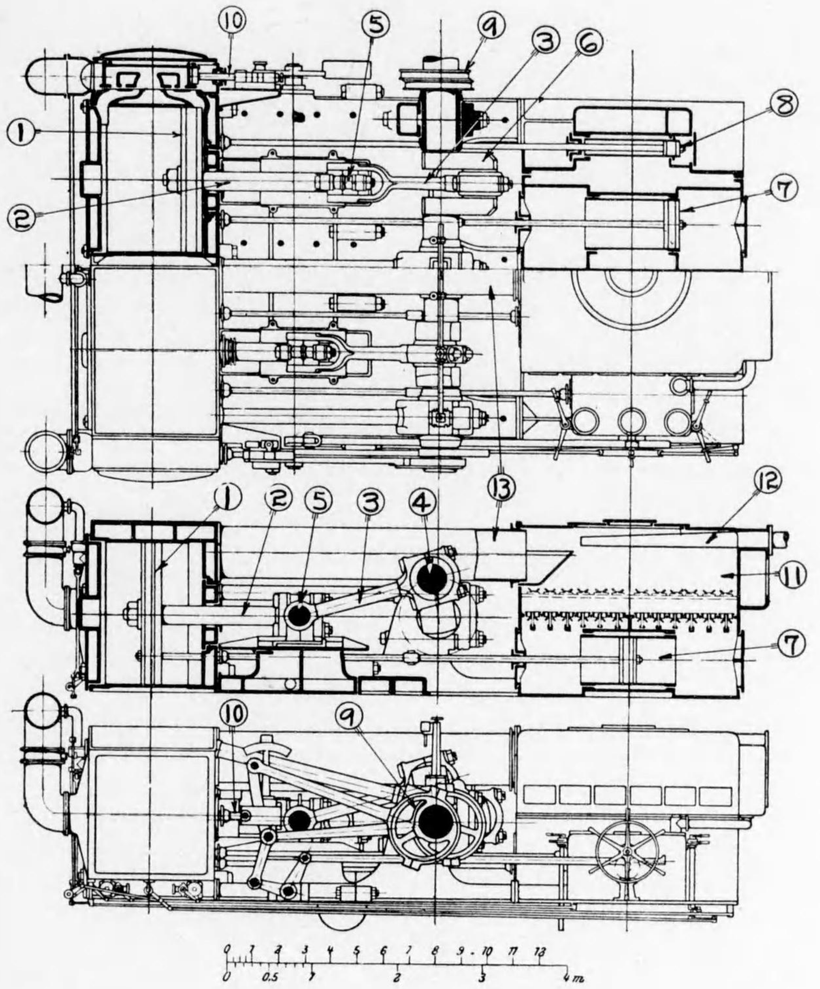
Cross head & gudgeon pin.

(C)



Model of return connecting rod engine.

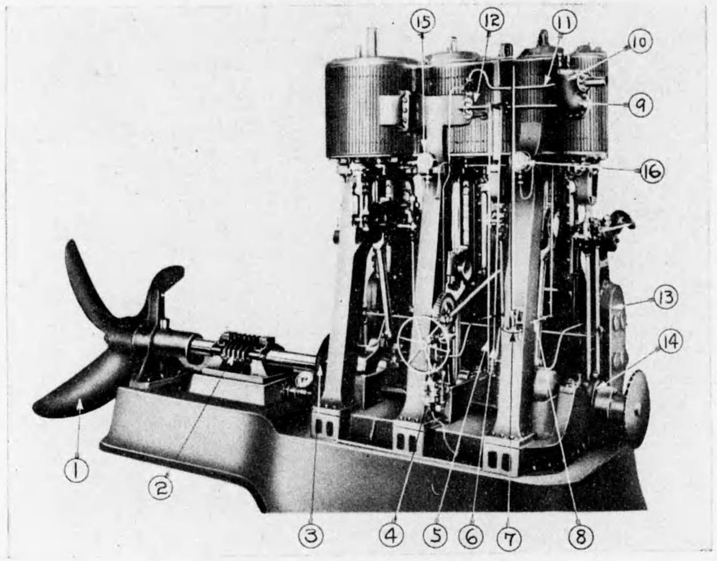
Fig. 42.



Horizontal direct acting engine.

1. Piston.
2. Piston rod.
3. Connecting rod.
4. Crank pin.
5. Cross head gudgeon pin.
6. Crank arm.
7. Air pump.
8. Feed pump.
9. Eccentric sheave.
10. Slide valve spindle.
11. Jet condenser.
12. Sea water injection pipe.
13. Eduction pipe.

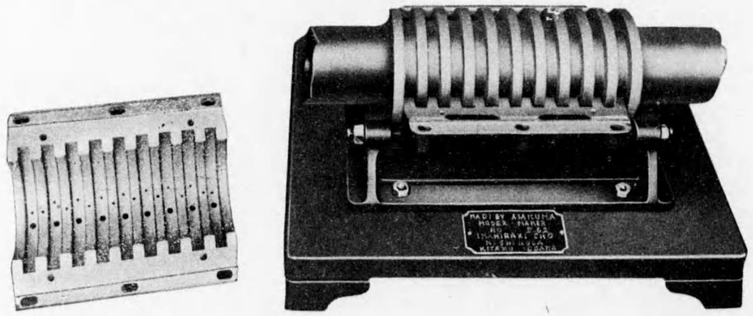
Fig. 43.



Inverted vertical direct acting engine.

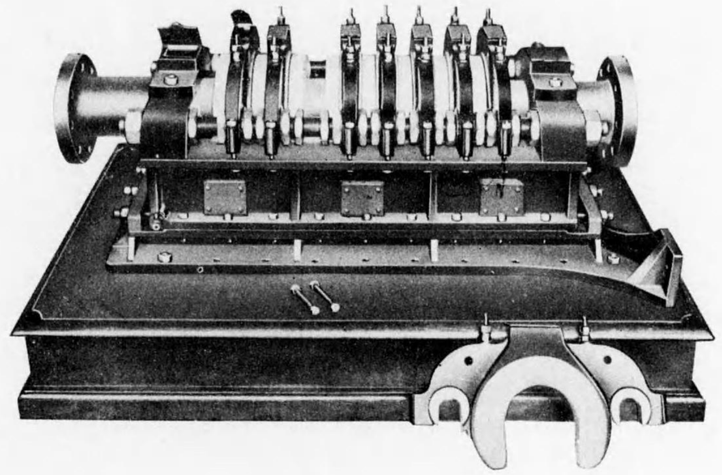
1. Screw propeller.
2. Thrust bearing.
3. Turning wheel.
4. Starting engine.
5. M. P. Starting steam valve handle.
6. L. P. Starting steam valve handle.
7. Regulating valve handle (manoeuvring valve.)
8. Throttle valve handle.
9. Throttle valve chest.
10. Regulat.ng valve box.
11. Starting steam pipe.
12. Starting valve.
13. Condenser.
14. Eccentric sheave.
15. Vacuum gauge.
16. Pressure gauge.

Fig. 44. (A)



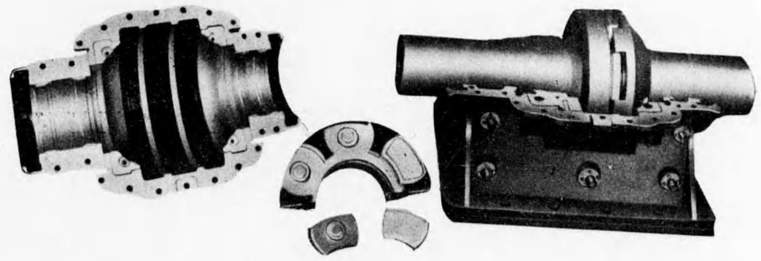
Thrust bearing closed type.

Fig. 44. (B)



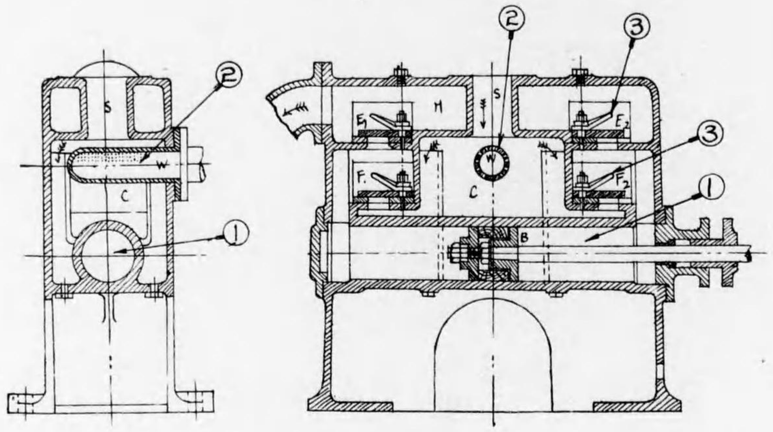
Thrust bearing (Open type)

(C)



Michell thrust bearing.

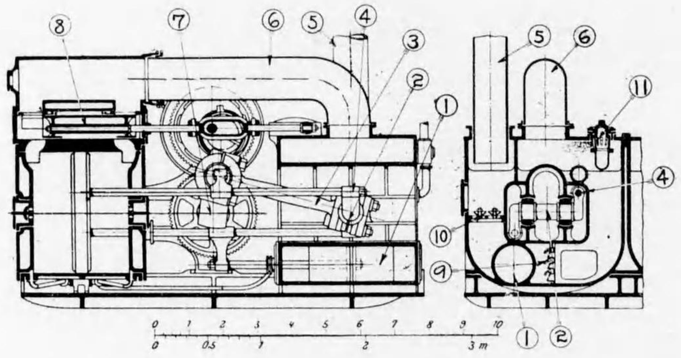
Fig. 45. (A)



Jet condenser.

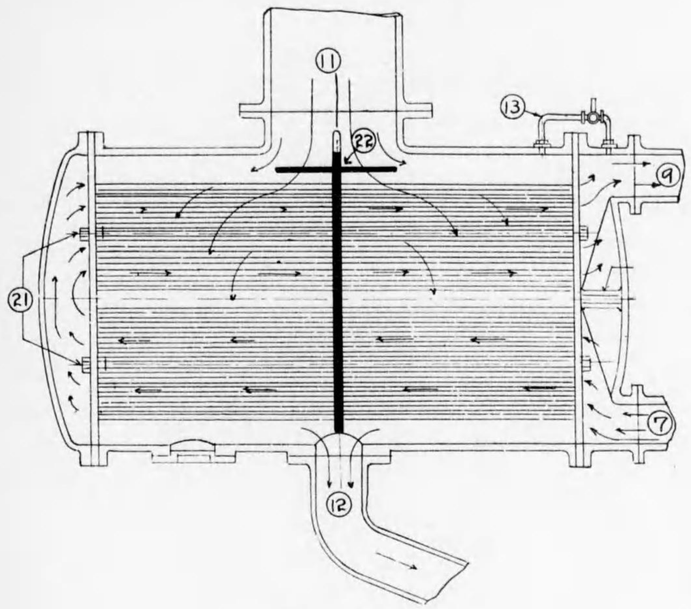
1. Air pump. 2. Injection pipe. 3. Suction & delivery valve.

(B)



1. Air pump.
2. Gudgeon pin.
3. Connecting rod.
4. Piston rod cross head.
5. Hot well.
6. Eduction pipe.
7. Crank arm.
8. Slide valve.
9. Suction valve.
10. Delivery valve.
11. Injection pipe.

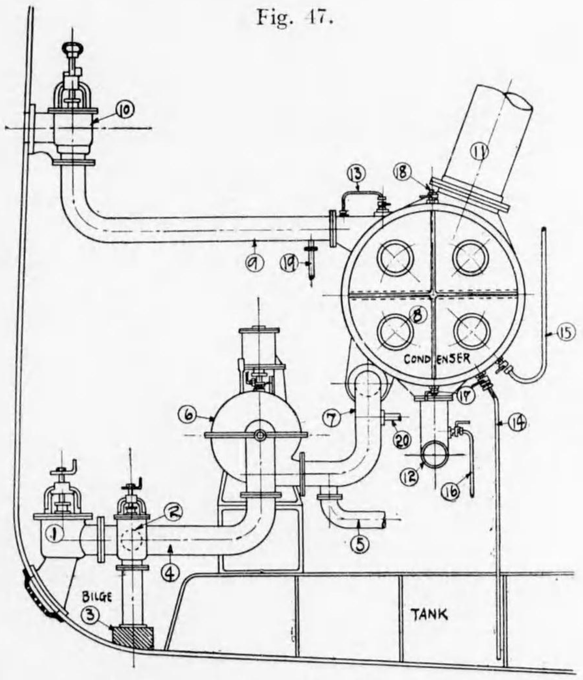
(Air pump)



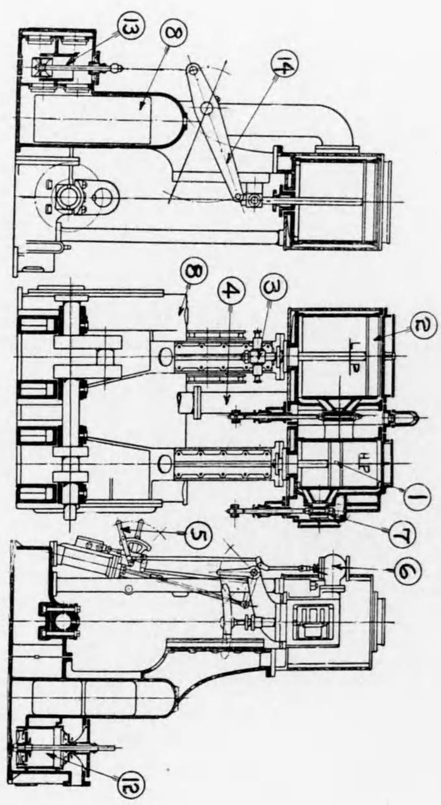
Surface condenser.

1. Main injection valve.
2. Bilge injection valve.
3. Rose box.
4. Circulating pump suction pipe.
5. Ballast pump delivery.
6. Centrifugal circulating pump.
7. Condenser circulating water suction.
8. Condenser division plate.
9. Circulating water delivery.
10. Ship skin valve.
11. Eduction pipe.
12. Air pump suction.
13. Sea water extra cock.
14. Extra feed cock.
15. Vacuum gauge pipe.
16. Soda cock.
17. Drain cock.
18. Soda cock.
19. Evaporatpr feed pipe.
20. Water service pipe.
21. Stay.
22. Buffle plate.

Fig. 47.



Condenser and circulating water connection.



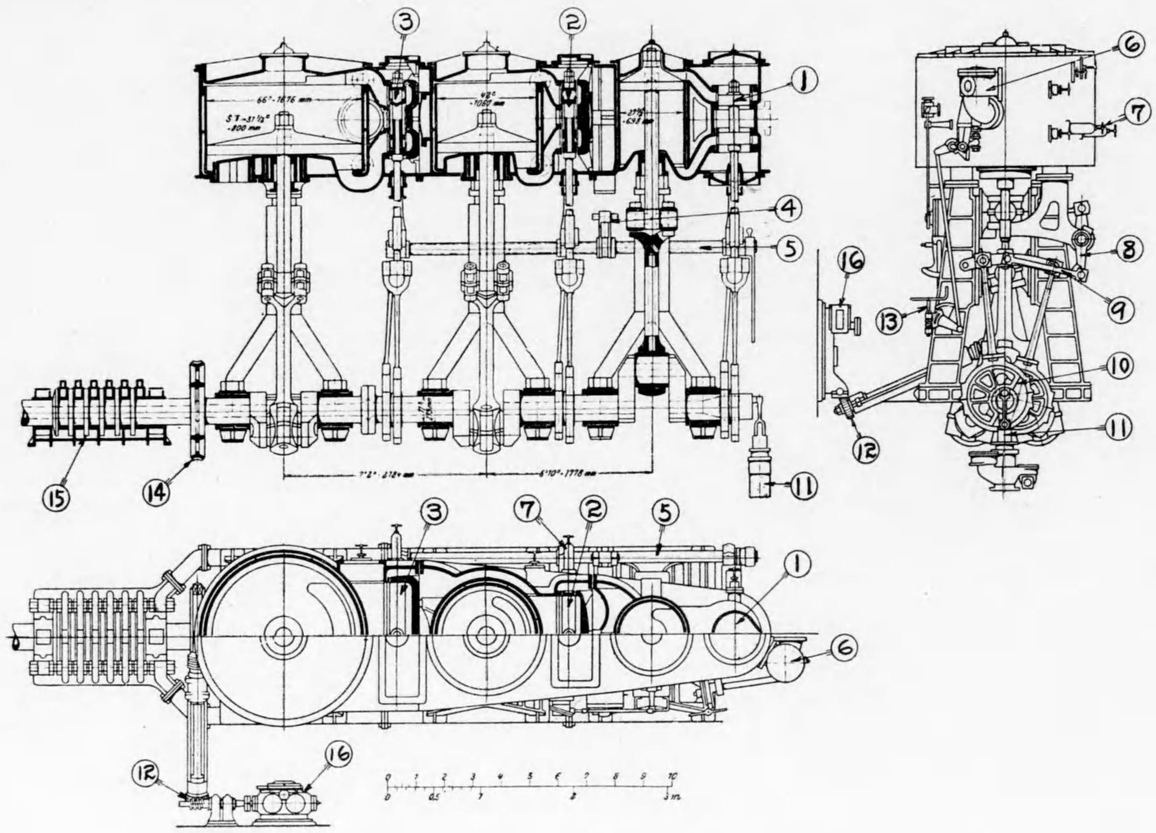
Compound engine.

Fig. 48.

1. H. P. Piston.
2. L. P. Piston.
3. Cross head.
4. Eduction pipe.
5. Throttle valve handle.
6. Regulating valve.
7. Slide valve.
8. Condenser.
9. Feed pump.
10. Bilge pump.
11. Pump rod cross head bar.
12. Air pump.
13. Circulating pump.
14. Pump lever.

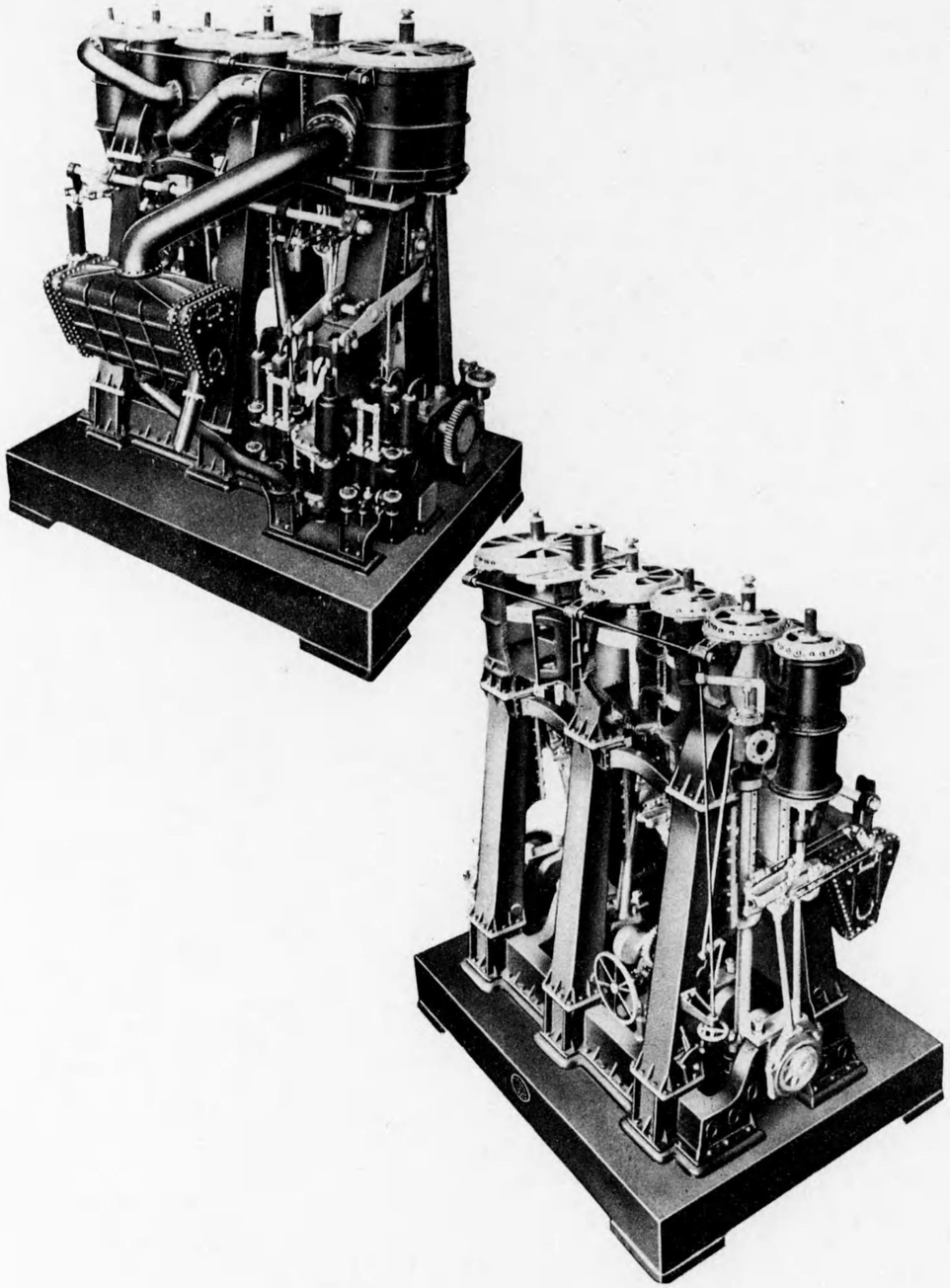
Triple expansion engine.

Fig. 49.



1. H. P. Piston slide valve.
2. M. P. Flat slide valve.
3. L. P. Flat slide valve.
4. Weigh shaft reversing arm.
5. Weigh shaft.
6. Regulating valve.
7. Safety valve.
8. Bell crank arm.
9. Suspension rod.
10. Eccentric sheave.
11. Bilge pump.
12. Turning gear.
13. Regulating valve handle.
14. Turning wheel.
15. Thrust bearing.
16. Turning engine.

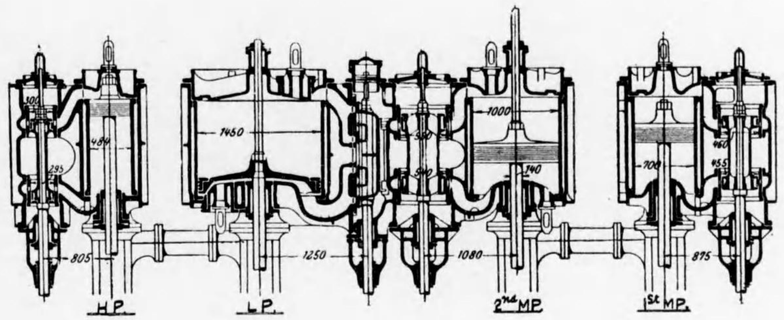
Fig. 50. (A, B)

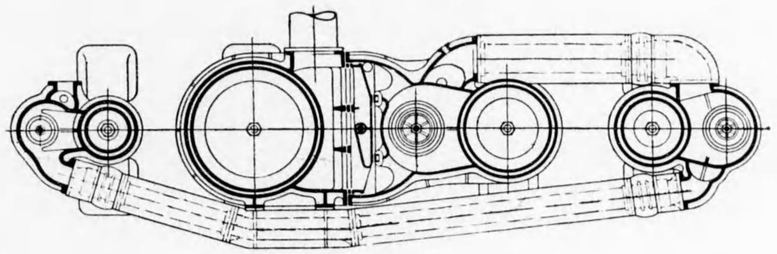


Model of triple expansion engine.

Quadruple expansion engine.

Fig. 51.

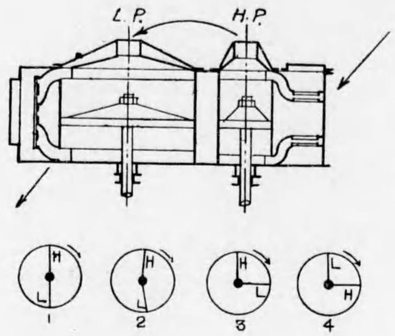




Arrangement of cylinders & cranks of compound engine.

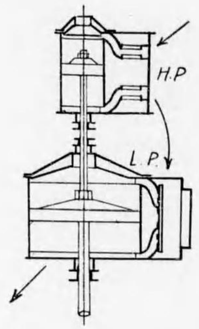
Fig. 52.

1



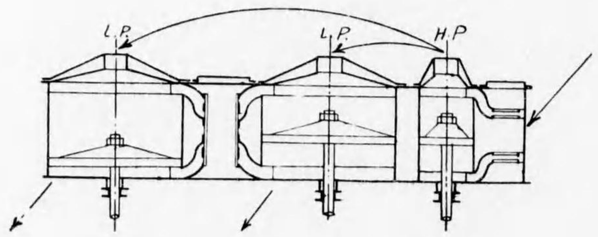
Compound engine.

2



Tandem compound engine.

3

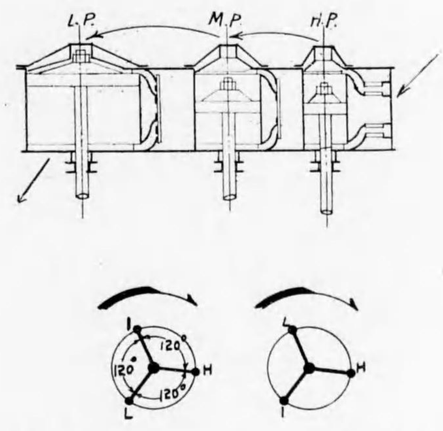


Three cylinders compound engine.

Triple compound engine.

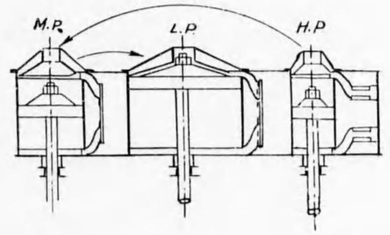
Fig. 53.

1



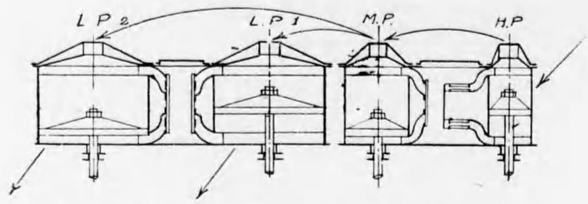
3 Cylinders triple expansion engine with 3 cranks.

2



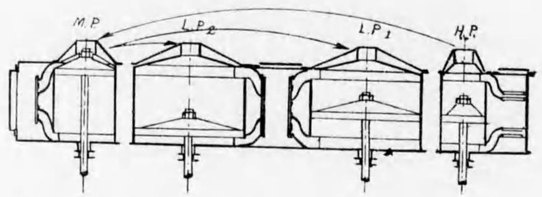
3 Cylinders triple expansion engine with 3 cranks.

3



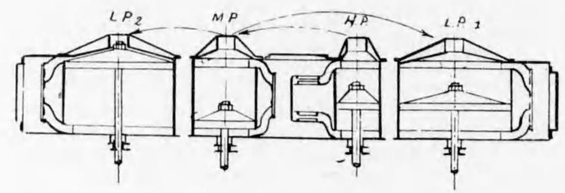
4 Cylinders 4 Cranks triple expansion engine.

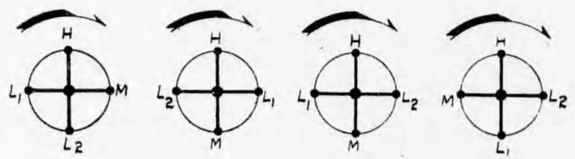
4



4 Cylinders 4 Cranks triple expansion engine.

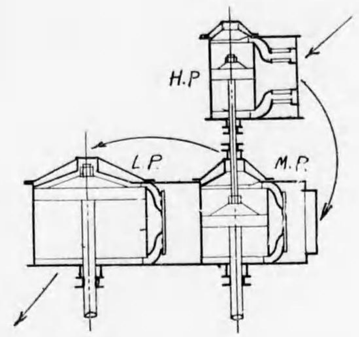
5





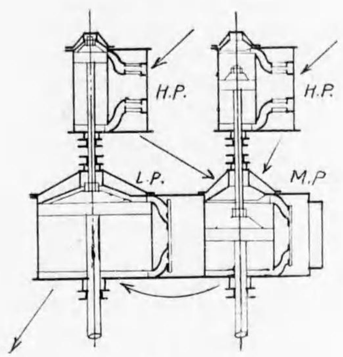
4 Cylinders 4 Cranks triple expansion engine.

6



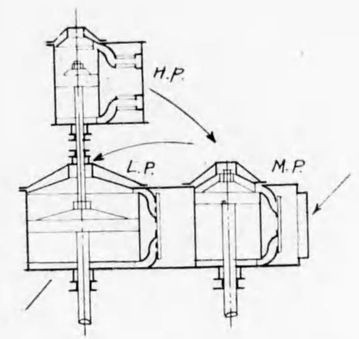
3 Cylinders 2 Cranks (MP Tandem)
Triple expansion engine.

8



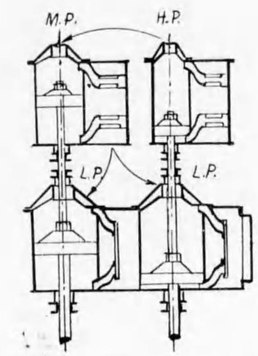
4 Cylinders 2 Cranks (Tandem)
Triple expansion engine.

7

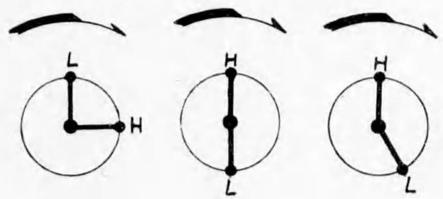


3 Cylinders 2 Cranks (LP Tandem)
Triple expansion engine.

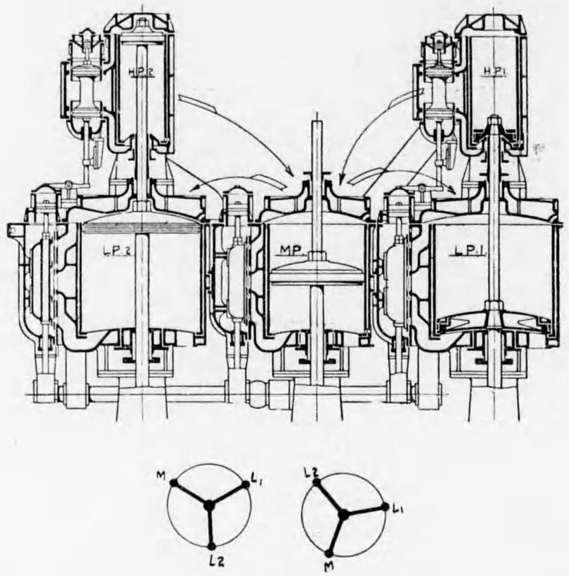
9



4 Cylinders 2 Cranks (Tandem)
Triple expansion engine.

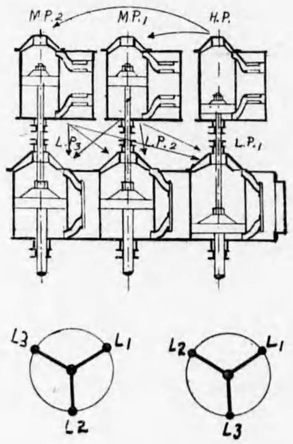


10



5 Cylinders 3 Cranks (Tandem) Triple expansion engine.

11

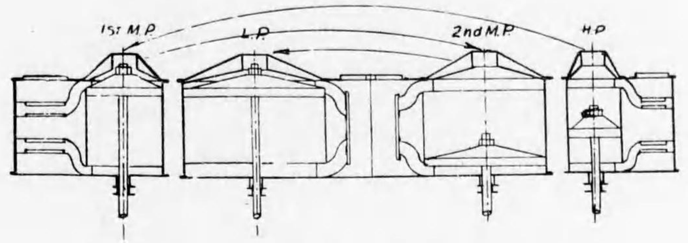


6 Cylinders 3 Cranks (Tandem) Triple expansion engine.

Quadruple expansion engine.

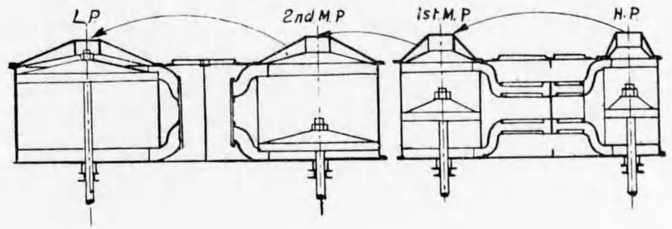
Fig. 54.

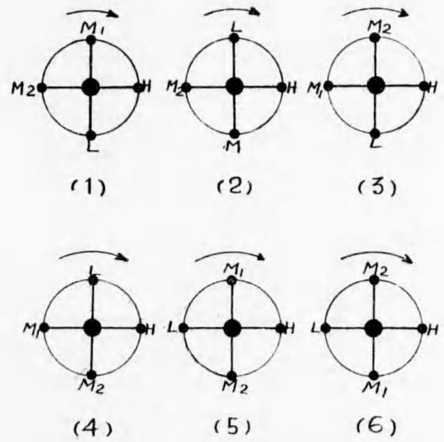
1



4 Cylinders 4 Cranks quadruple expansion engine.

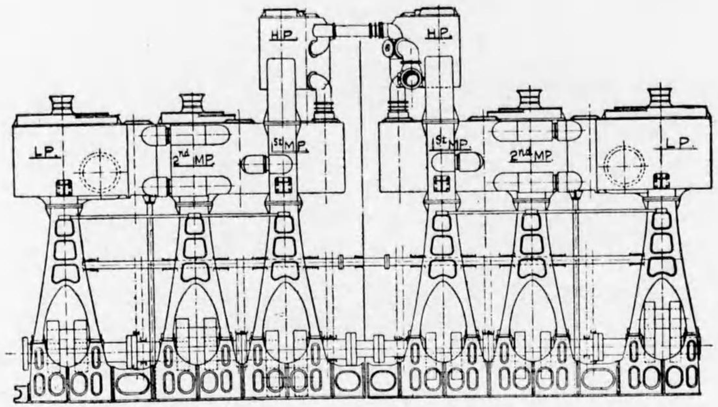
2

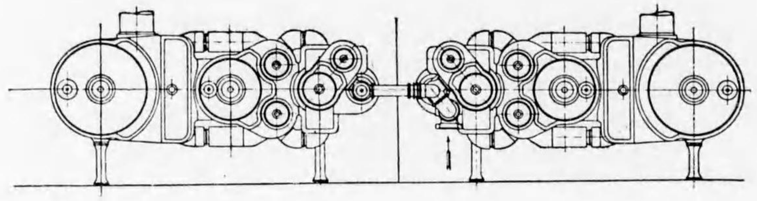


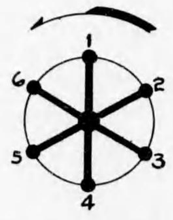


4 Cylinders 4 Cranks quadruple expansion engine.

3

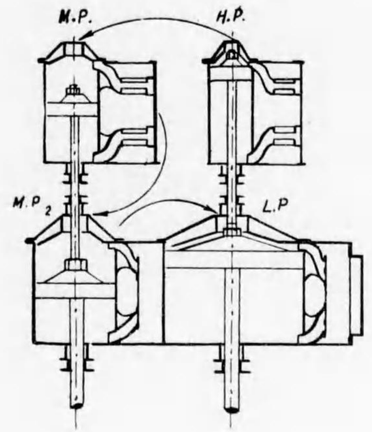


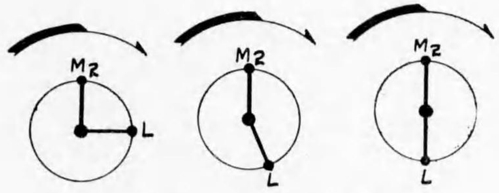




4 Cylinders 3 Cranks (Tandem) Quadruple expansion engine.

4

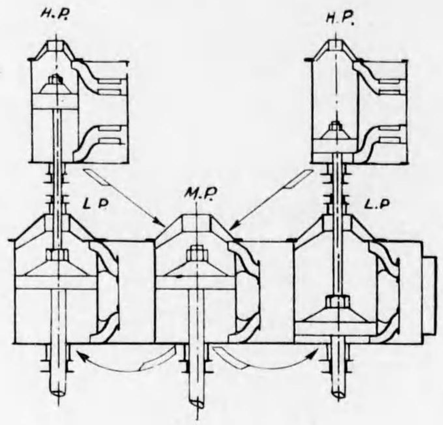


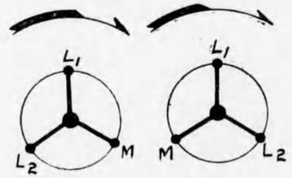


4 Cylinders 2 Cranks (Tandem)

Quadruple expansion engine.

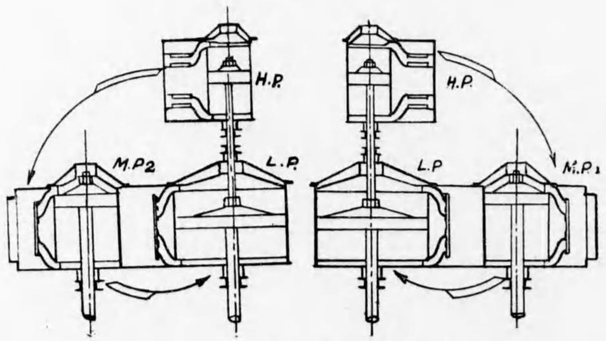
5





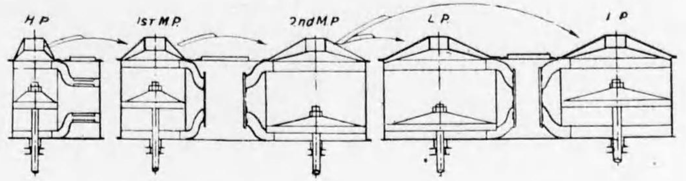
5 Cylinders 3 Cranks triple expansion engine.

6



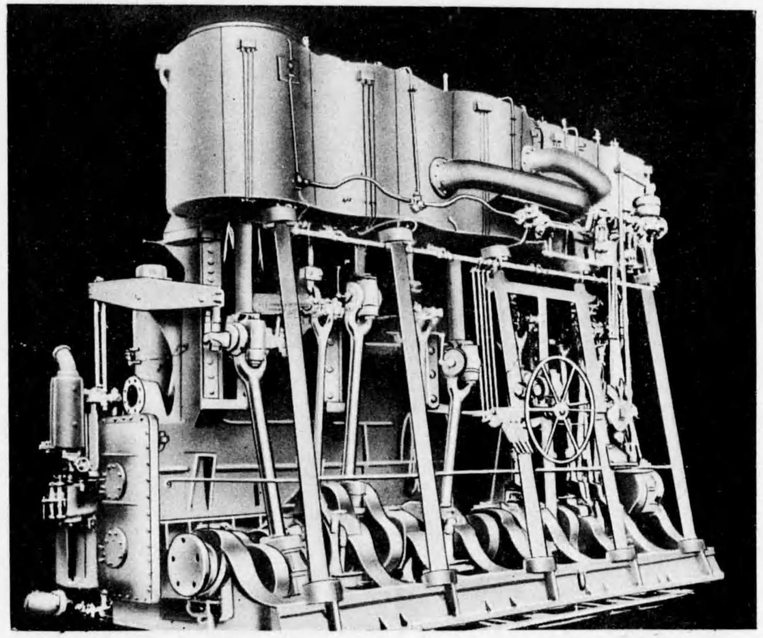
6 Cylinders 4 Cranks triple expansion engine.

7



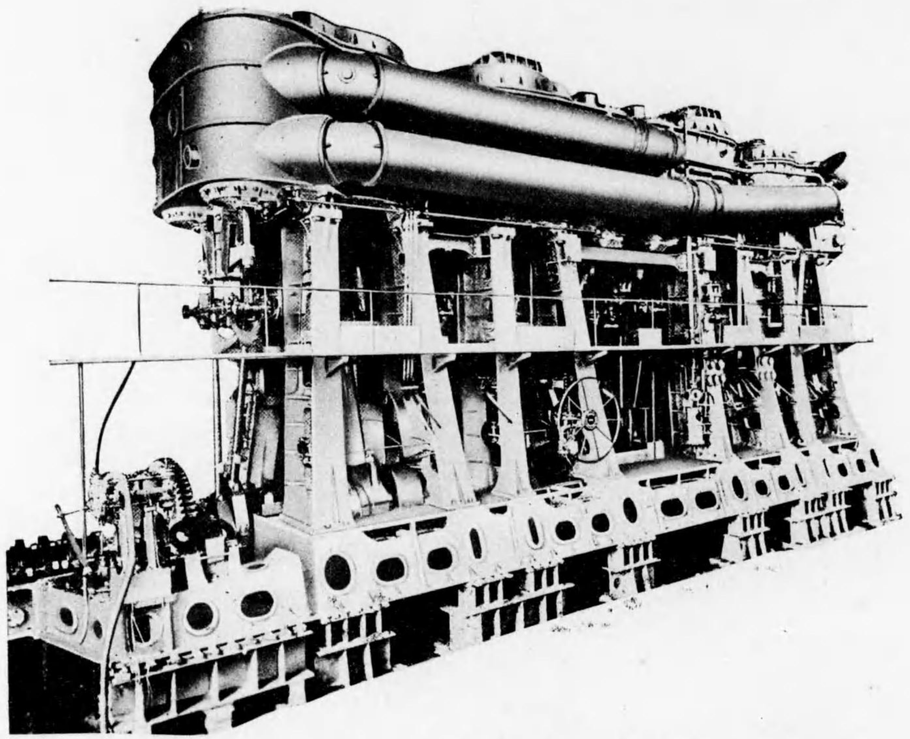
5 Cylinders 5 Cranks quadruple expansion engine.

Fig. 55.



5 Cylinders Quadruple expansion engine of S.S. "Inchdune"

Fig. 56.



Quadruple expansion engine (4 Cranks 6 Cylinders) of S.S. "Deutschland".

Fig. 57.

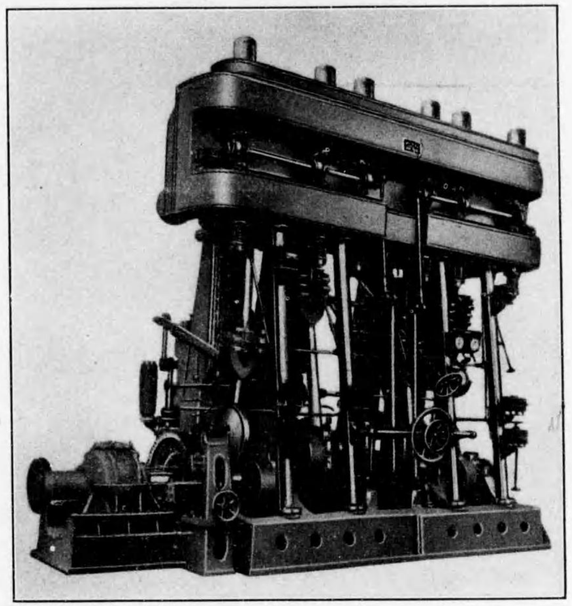
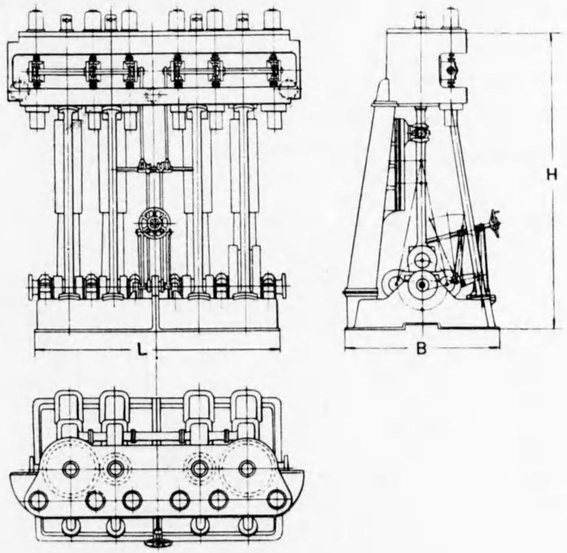


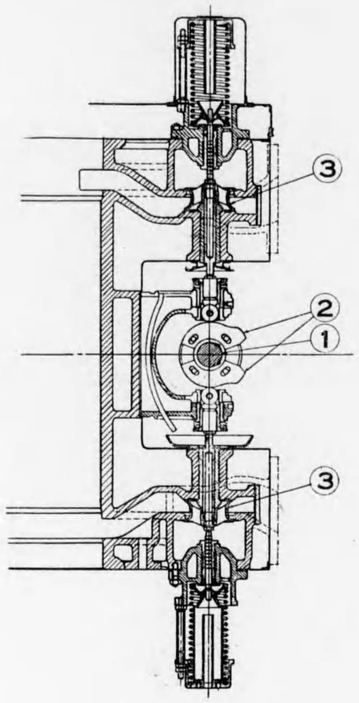
Fig. 58.



Lentz engine

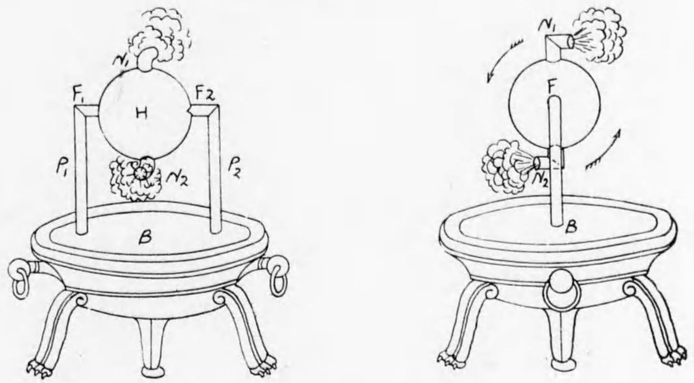
Fig. 59.

Poppet valve.



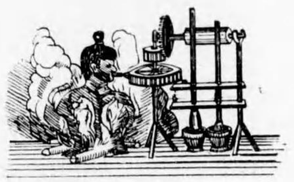
1. Cam shaft.
2. Cam.
3. Double beat valve.

Fig. 60.



Hero's Engine.

Fig. 61.



Branca's Engine.

Fig. 62.

A.

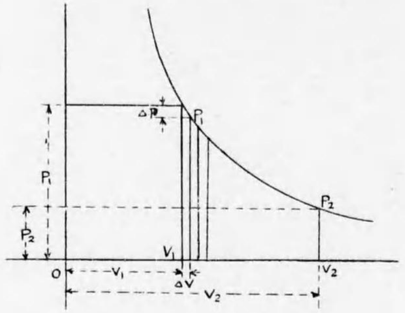


Diagram of work-done by Reciprocating engine.

B.

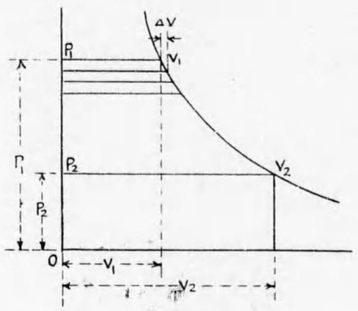


Diagram of work-done by steam turbine.

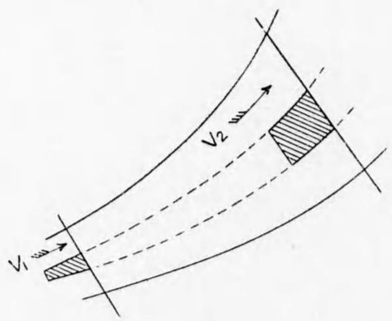
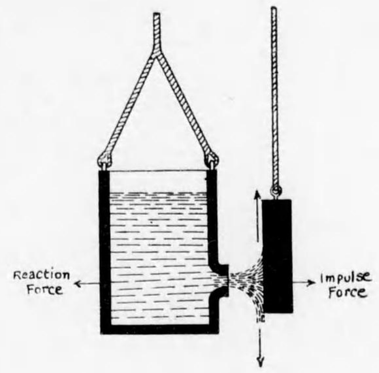


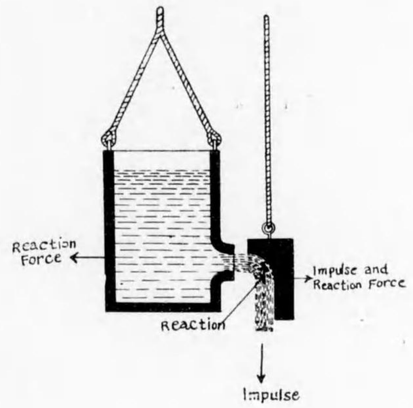
Diagram of work-done steam itself in nozzle.

Fig. 63.

A.



B.



C.

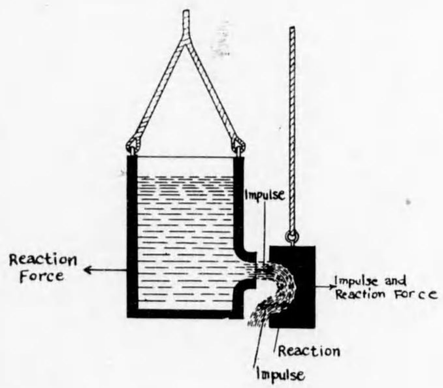
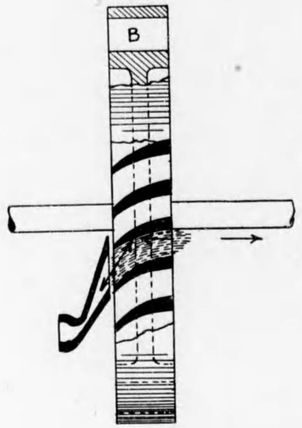


Fig. 64.

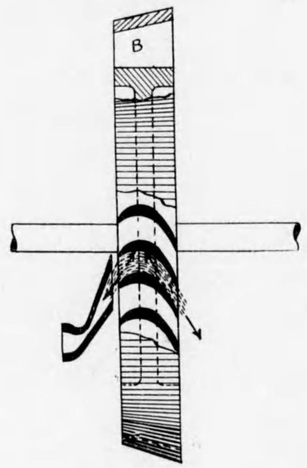
Several kinds of turbine blade.

A.



Single curvature blade.

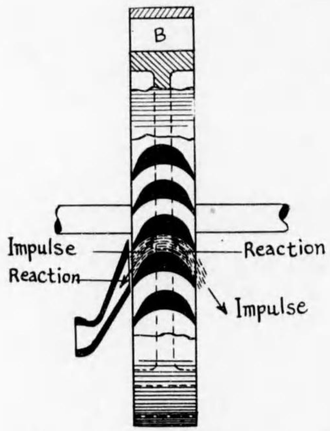
B.



(Reaction blade)

Double curvature blade.

C.

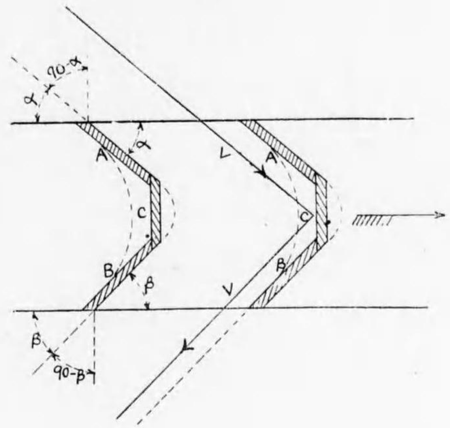


(Impulse blade)

Double curvature blade.

Fig. 65.

A.



B.

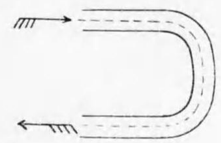
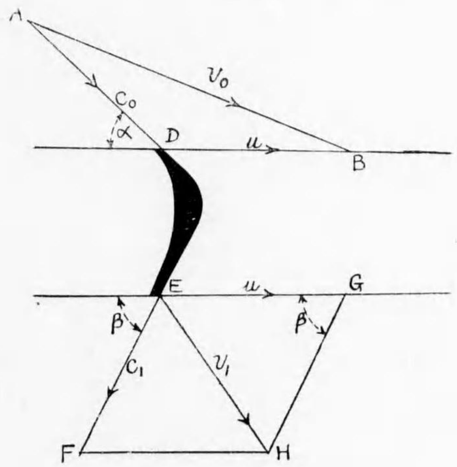
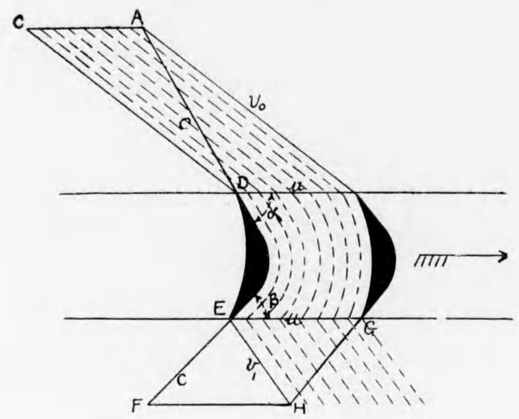


Fig. 66.

A.



B.



C.

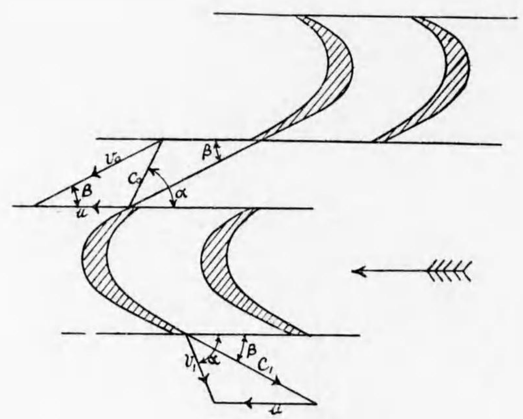
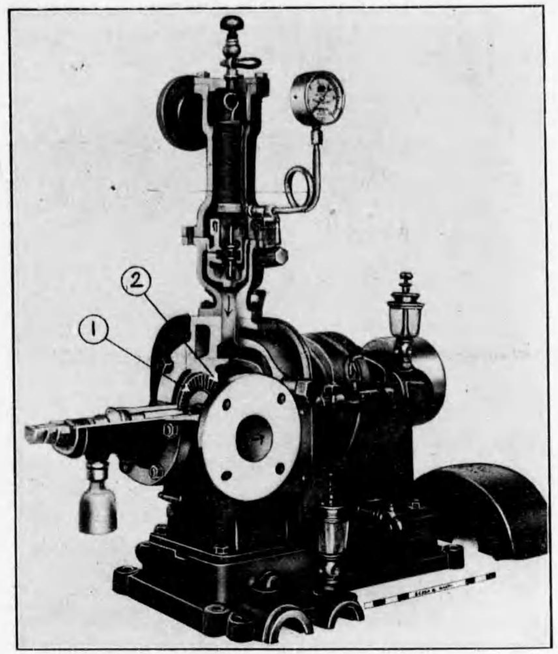


Fig. 67.

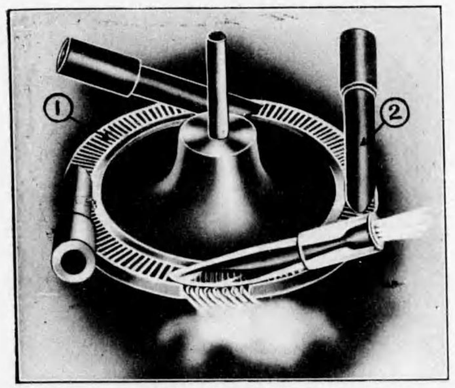
A.



1. Wheel.
2. Nozzle.

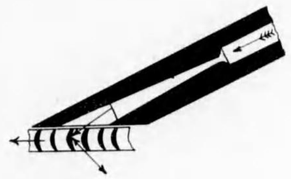
De Laval steam turbine.

B.



Wheel and nozzle.

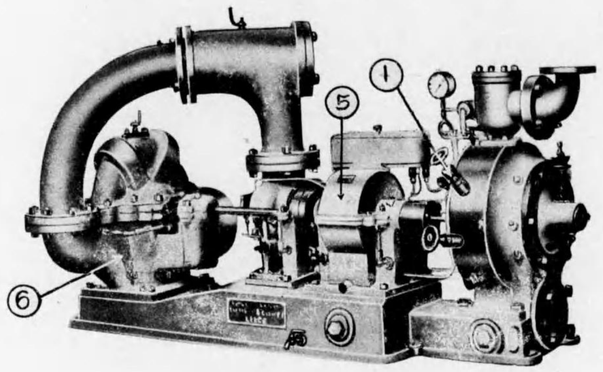
C.



Nozzle.

Fig. 68.

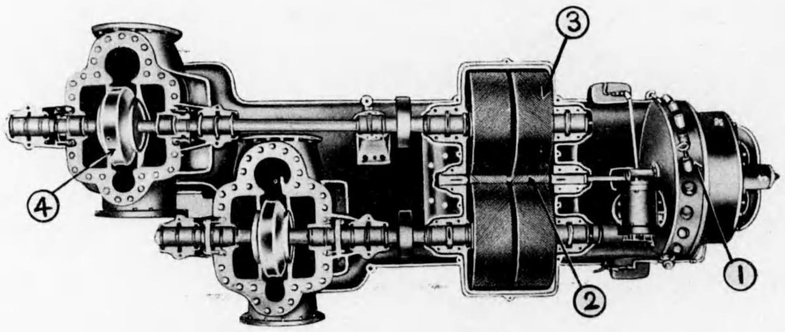
A.



De Laval steam turbine & pump.

1. Steam nozzle.
2. Pinion on turbine shaft.
3. Gearwheel.
4. Wheel of turbine pump.
5. Gear case.
6. Turbine pump.

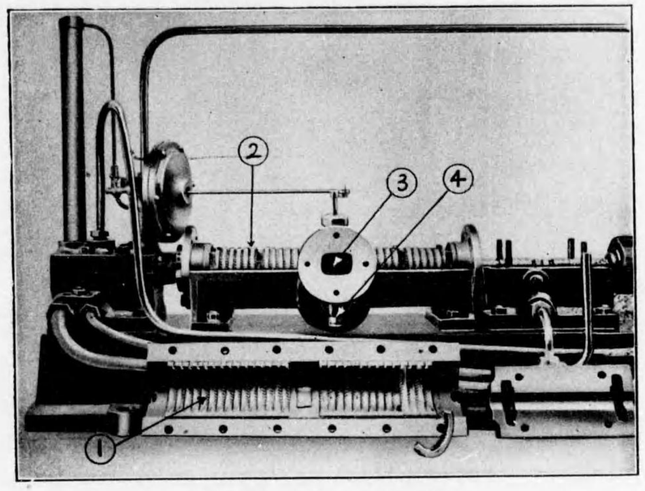
B.



Section of De Laval steam turbine & pump.

Fig. 69.

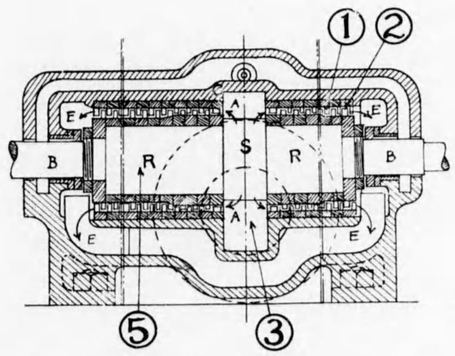
A.



Parsons turbine first tried.

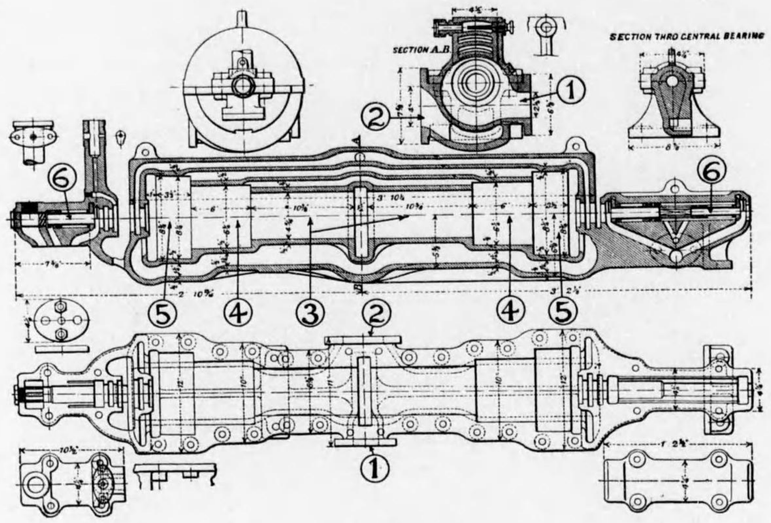
1. Guide blade.
2. Moving blade.
3. Steam inlet.
4. Exhaust outlet.
5. Rotor.

B.



Sectional diagram of Parsons turbine.

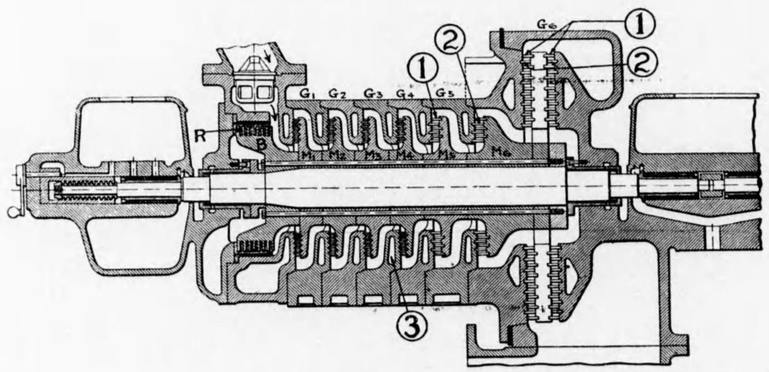
Fig. 70.



Parsons stepped turbine.

1. Steam inlet.
2. Exhaust outlet.
3. First step.
4. Second step.
5. Third step.
6. Main bearing.

Fig. 71.



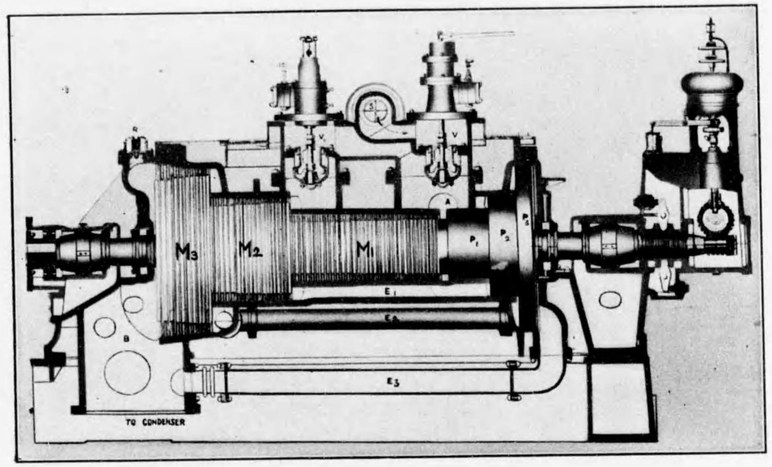
Parsons radial turbine.

1. Moving blade.
2. Guide blade.
3. Steam jacket.

Fig. 72.

Improved single flow Parsons turbine.

A.



M_1 First step.
M_2 Second step.
M_3 Third step.
P_1 Balance piston for first step.
P_2 Balance piston for second step.
P_3 Balance piston for third step.

B.

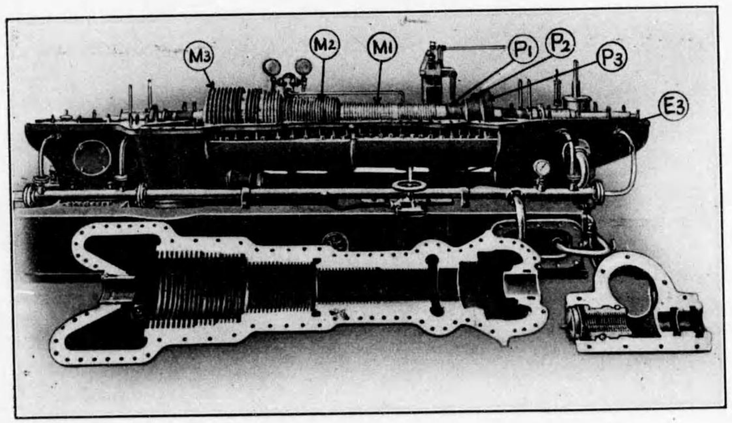
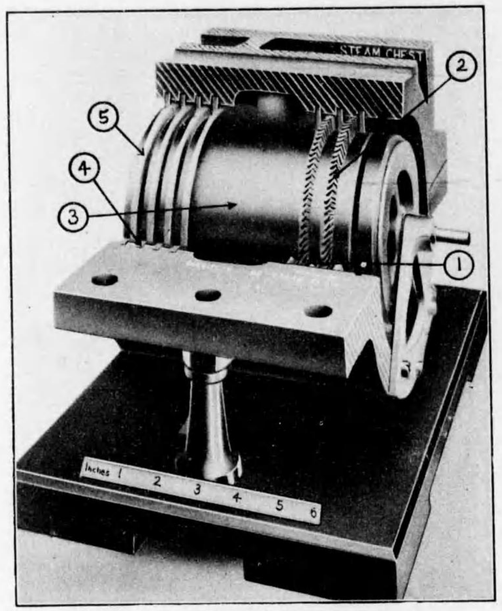


Fig. 73.

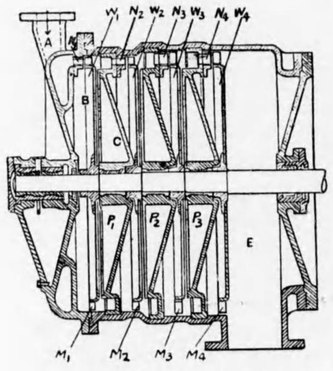


1. Guide blade.
2. Moving blade.
3. Rotor.
4. Labyrinth packing.
5. Balance piston. (Dummy ring)

The lecture model of Parsons turbine.

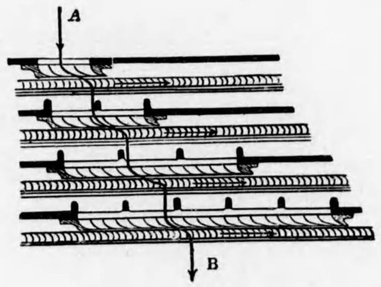
Fig. 74.

A.



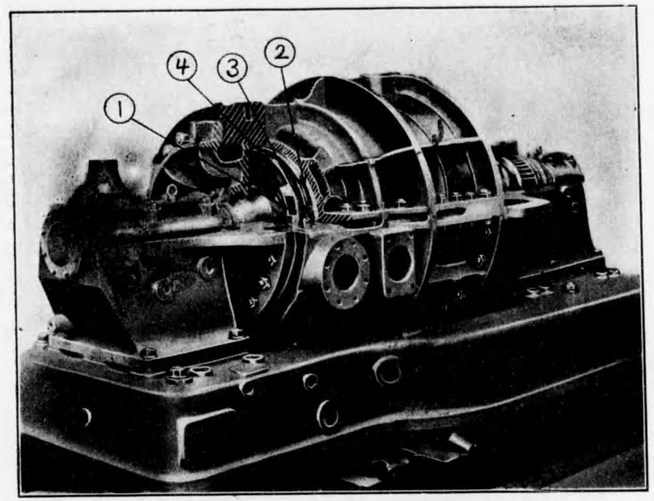
Section of multicellular Rateau turbine

B.



Steam nozzle of Rateau turbine.

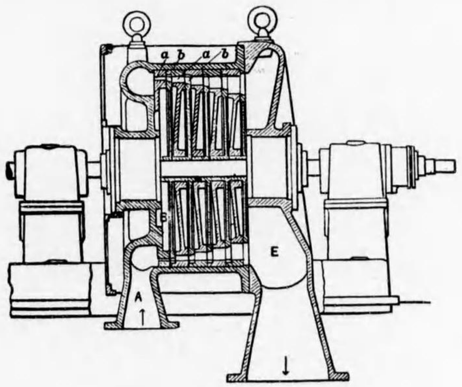
Fig. 75.



Model of multicellular Rateau turbine.

1. Diaphragm and nozzle.
2. Wheel & blade.
3. Diaphragm and nozzle.
4. Wheel & blade.

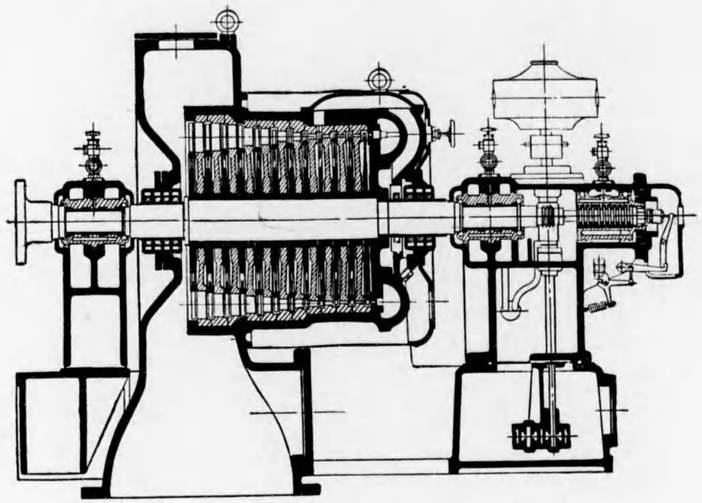
Fig. 76.



A Steam inlet.
E Exhaust Port.
a Steam nozzle.
b Blade.

Section of Zoelly turbine.

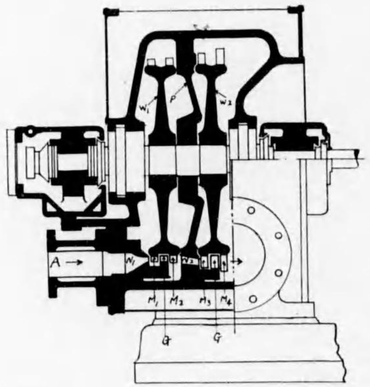
Fig. 77.



Section of De Laval multi-stage turbine.

Fig. 78.

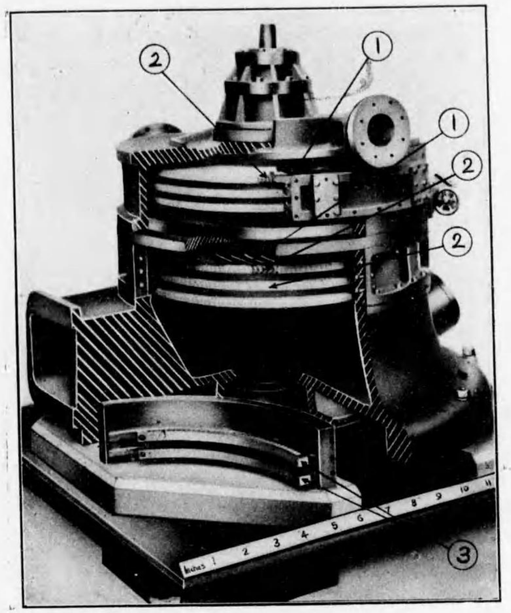
A.



A Steam inlet.
N_1 N_2 N_3 Steam nozzle.
M_1 M_2 M_3 M_4 Blade.
W_1 W_2 Wheel.
P Diaphragm.

Section of Curtis turbine.

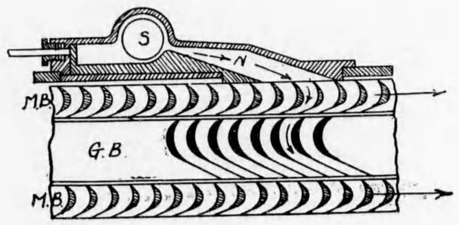
B.



Curtis turbine.

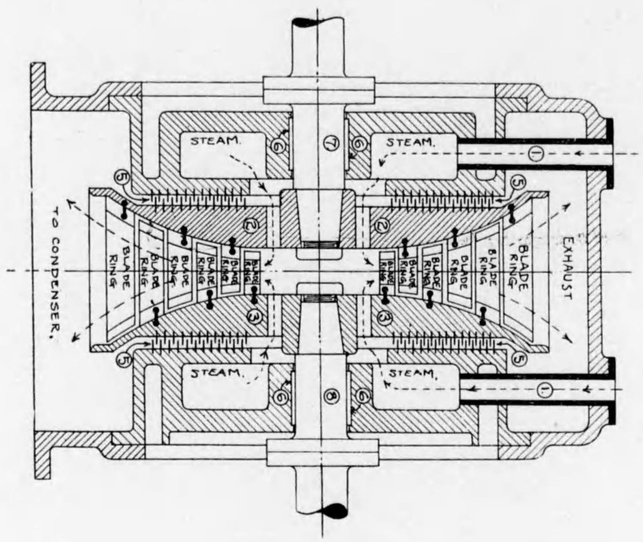
1. Steam nozzle. 2. Blade & wheel.

C.



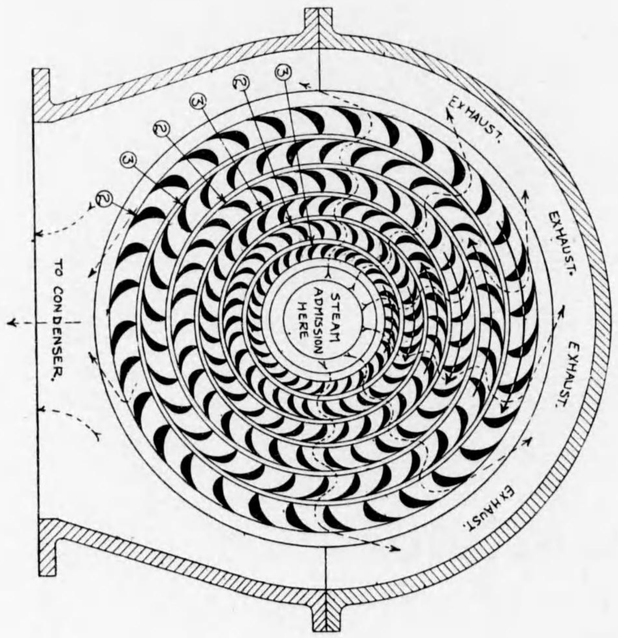
S Steam inlet.
N Steam nozzle.
M. B Moving blade.
G. B Guide blade.

Section of wheel & nozzle of Curtis turbine.



A.

Fig. 79.



B.

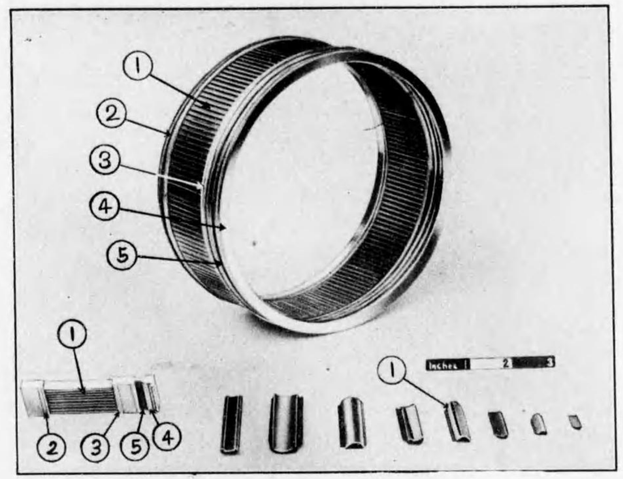
Section of Ljungstrom turbine. (Stal turbine.)

1, 1. Steam admission pipes.
2. Revolving disc and blades of same (right hand).
3. " " (left hand).
4, 4. Taper on driving shafts for discs 2 and 3.

5, 5. Dummy labyrinth packing to check steam leakage.
6, 6. Bearing.
7. Shaft of disc 2.
8. " 3.

Fig. 80.

Blade Ring of Stal Turbine.

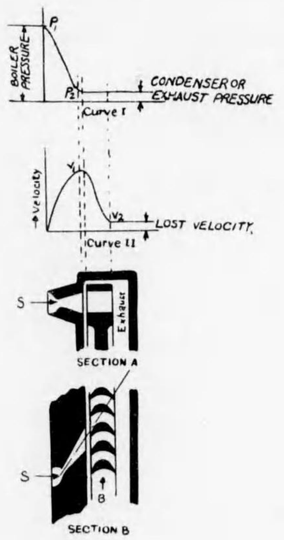


1. Blade.
2. Dovetail root.
3. Strengthring.
4. Caulking ring.
5. Expantion ring.

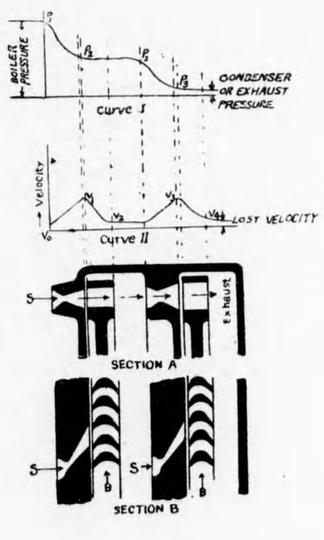
Fig. 81.

Pressure & Velocity Diagram of Several Turbine.

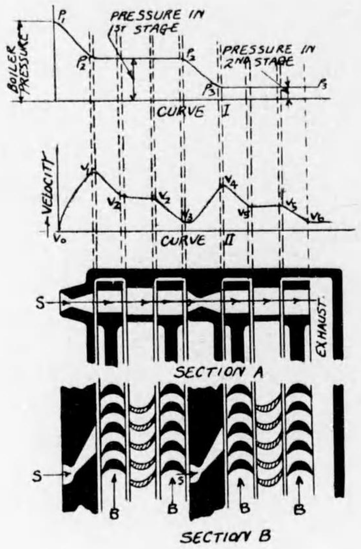
A.



B.



C.



D.

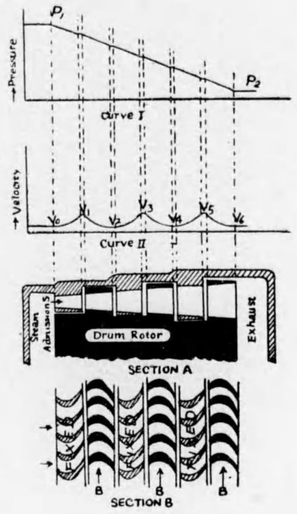
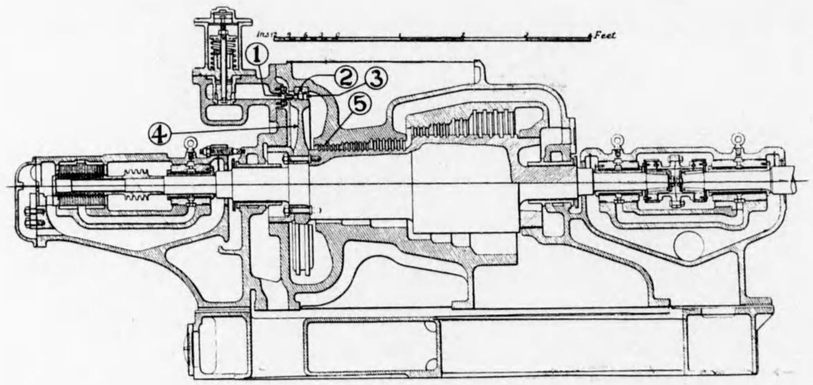


Fig. 82.

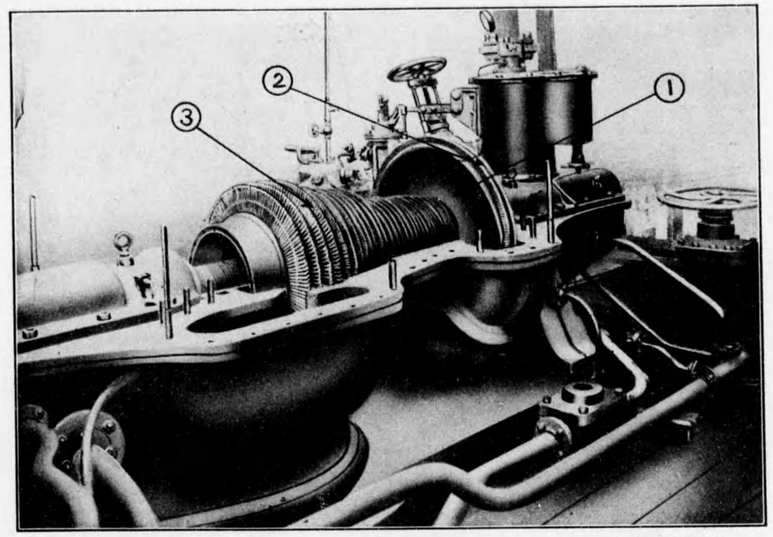
Parsons Impulse Reaction Turbine.

A.



1. Nozzle.
2. Guide blade.
3. Moving blade.
4. Impulse wheel.
5. Reaction blade.

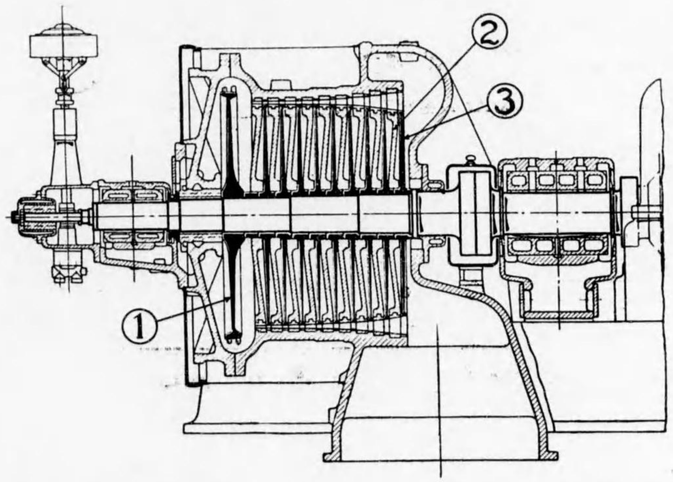
B.



1. Impulse wheel. 2. Impulse blade. 3. Reaction blade.

Fig. 83.

Curtis Impulse Reaction Turbine.



1. Impulse wheel. 2. Impulse wheel. 3. Diaphragm.

Fig. 84.

The "Turbinia" Steaming at 34 knots.

Fig. 85.

First Turbine Machinery of the "Turbinia."

First Radial-Flow Turbine of the "Turbinia."

(General Arrangement.

Fig. 86.

Shaft Dynamometer.

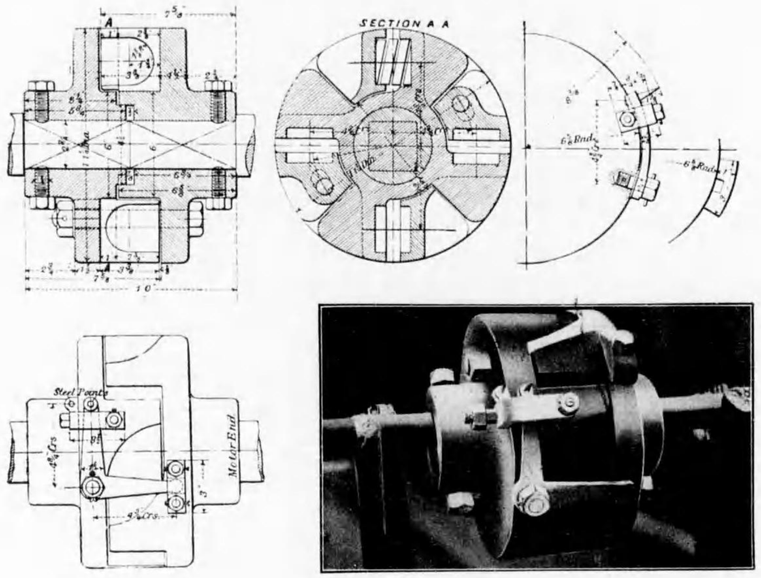


Fig 87.

Propeller Testing Apparatus.

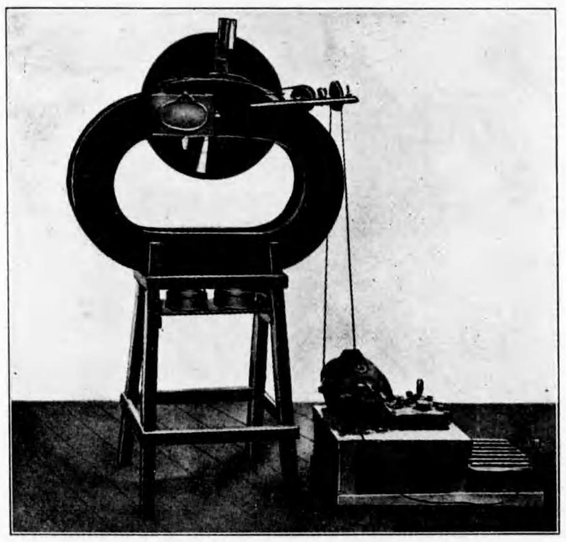
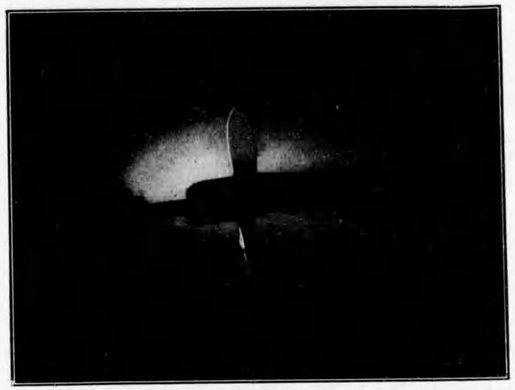
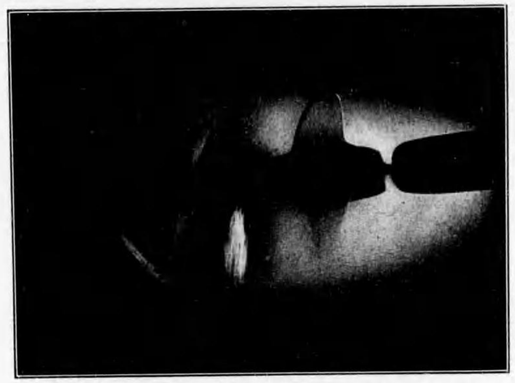


Fig. 88.

Experiments on Cavitation.



(1) Beginning of Cavitation; 1500 Revolutions.



(2) Advanced Stage in Cavitation; 1500Revolutions.

(3) Final Stage of Cavitation; 2000 Revolutions.

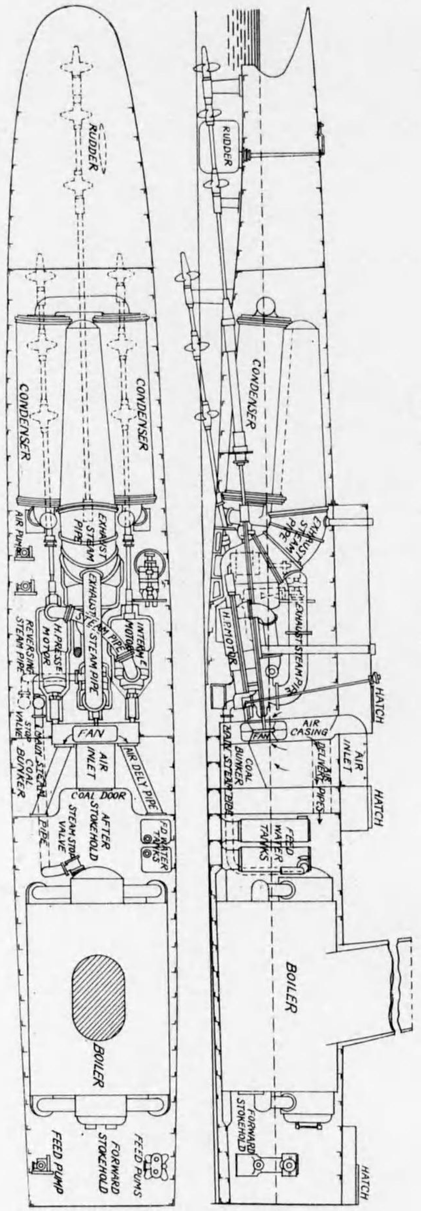
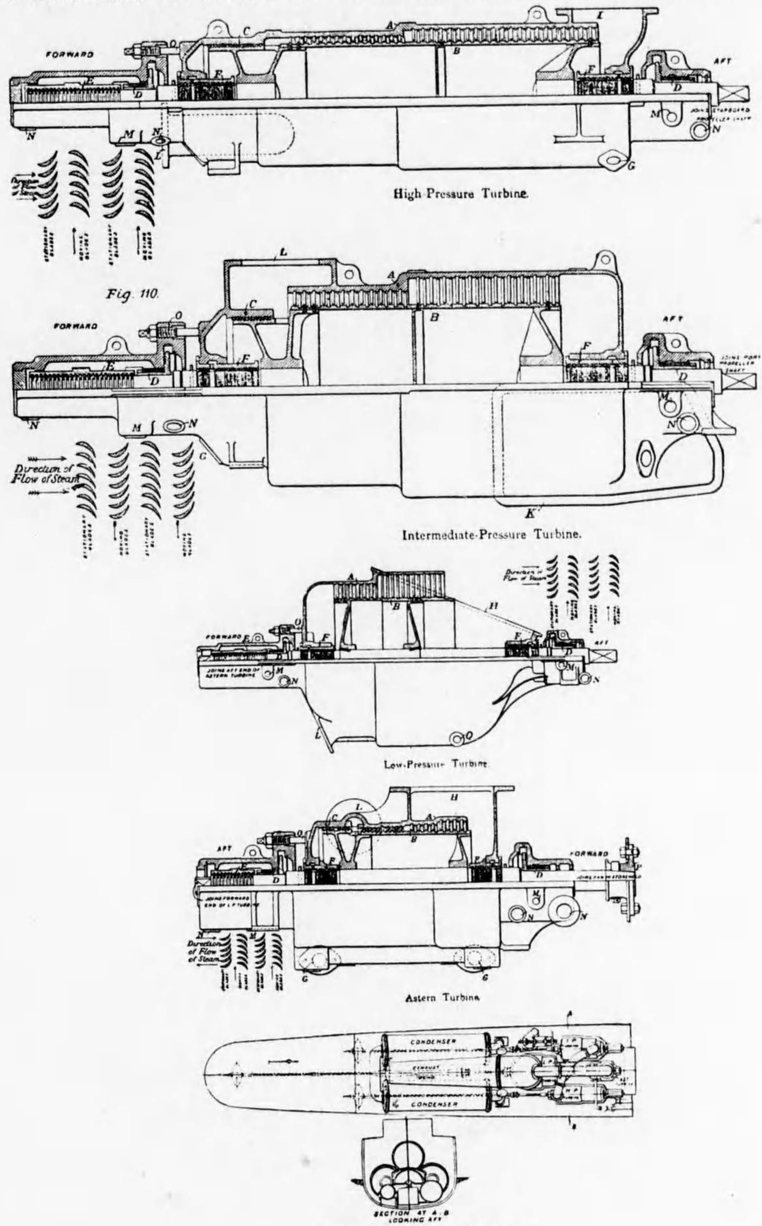


Fig. 89.

Arrangement of Machinery in the Turbinia.

Fig. 90.

Parallel-Flow Turbines of the Second Installation of the "Turbinia."



High-Pressure Turbine.

Fig. 110.

Intermediate-Pressure Turbine.

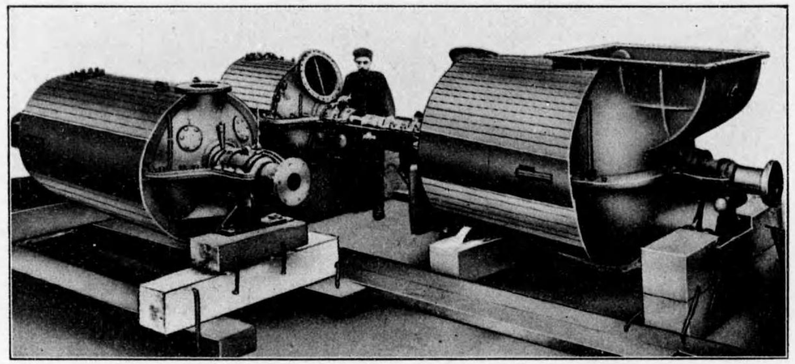
Low-Pressure Turbine.

Astern Turbine.

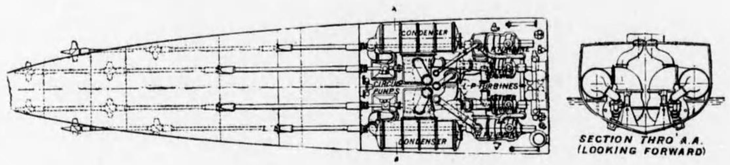
General Arrangement of Turbines.

Fig. 91.

One Set of Engine for H. M. Torpedo-boat Destroyer "Viper"
Supplied by the Parsons Marine Steam Turbine Company Limited.



General Arrangement of Machinery in the "Viper"



H. M. Torpedo Boat Destroyer "Viper." Steaming at 37 Knots.

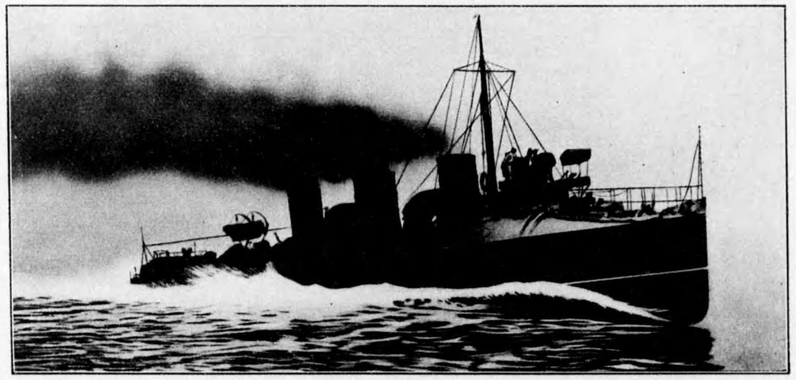
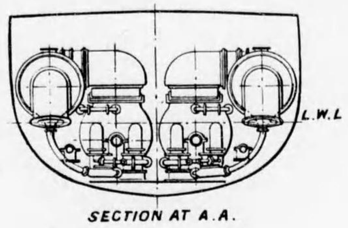
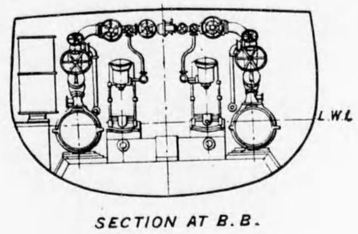
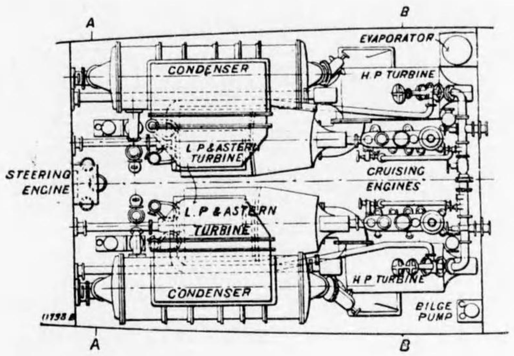


Fig. 92.

General Arrangement of Machinery in the "Velox."







Steaming at 27.12 Knots on Four Hours' Trial.
H. M. Torpedo Boat Destroyer "Velox."

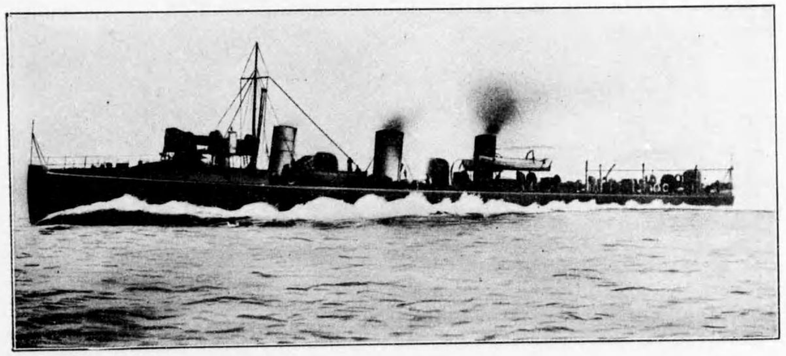
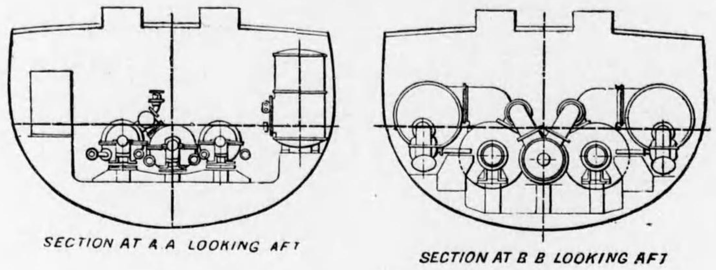


Fig. 93.

General Arrangement of Machinery in the "Eden"



H. M. Torpedo Boat Destroyer "Eden."
Steaming at 26.23 Knots on Four Hours Trial.

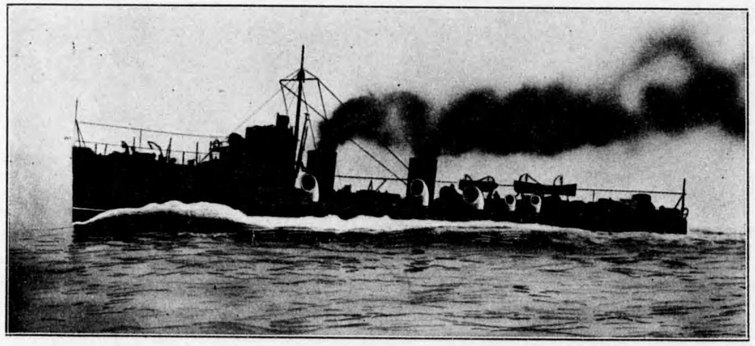
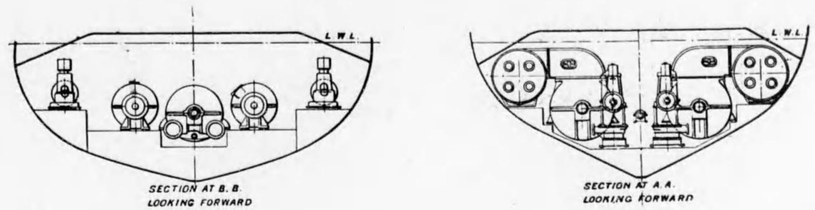


Fig. 94.

Gneeral Arrangement of Machinery in H. M. Cruiser "Amethyst."



H. M. Cruiser "Amethyst." Speed Attained, 23.63 Knots on Fours' Trial.

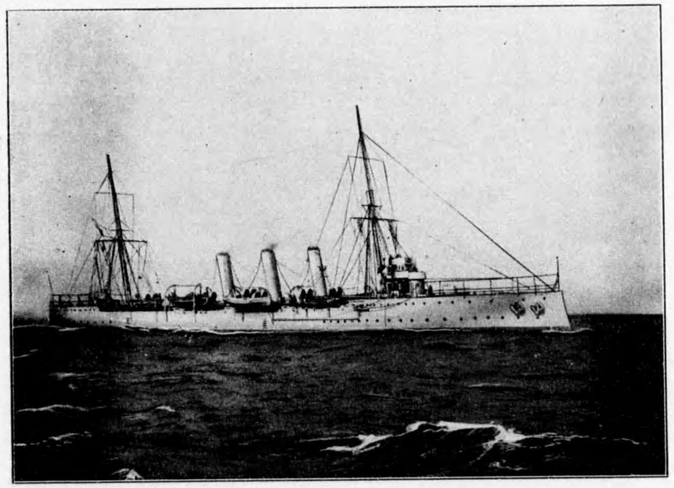
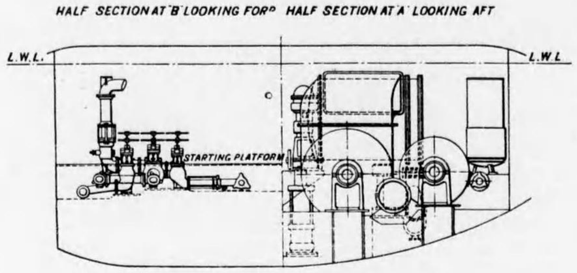
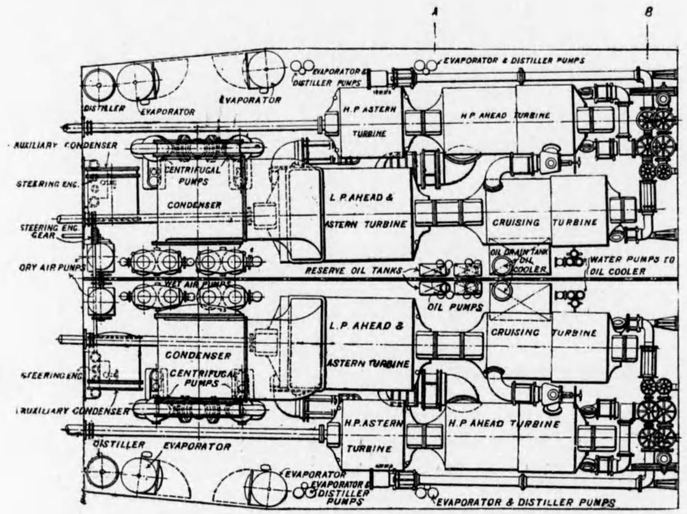


Fig. 95.

H. M. Battleship. "Dreadnought"



Turbine Machinery of the Battleship. "Dreadnought"



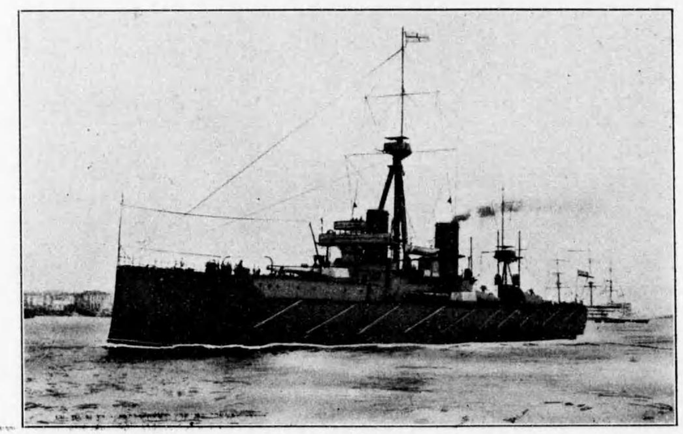
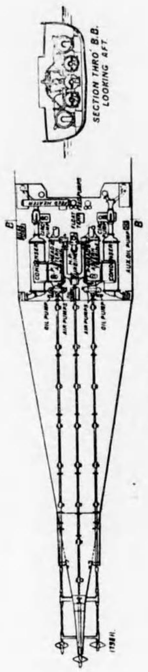
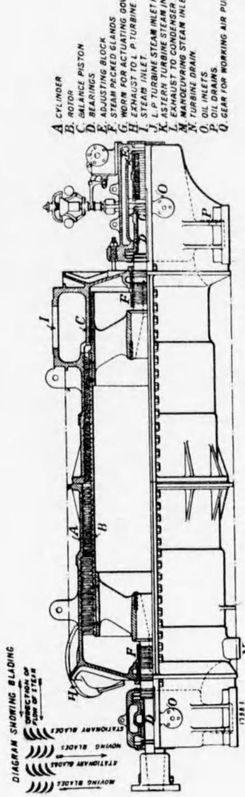


Fig. 96.

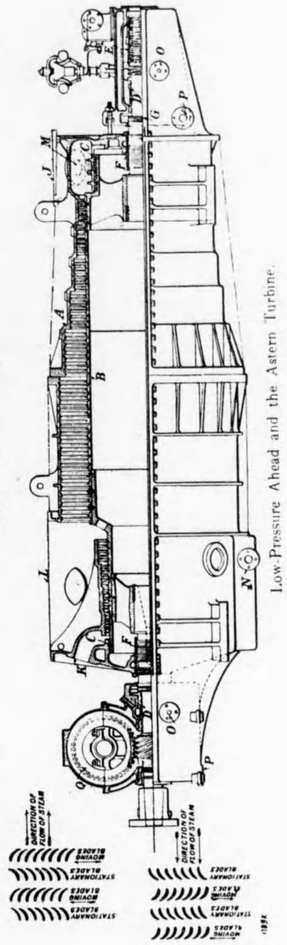
The Turbine Machinery of the "King Edward" the First Turbine Merchant Ship.



General Arrangement of Machinery.



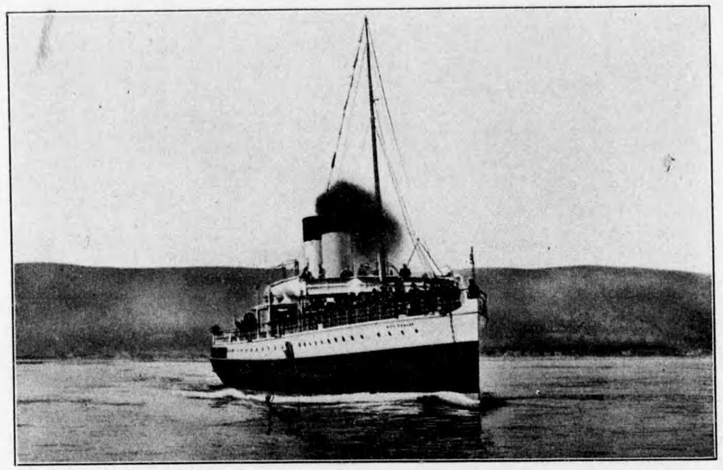
High-Pressure Ahead Turbine.



Low-Pressure Ahead and the Astern Turbine.

Fig. 97.

The First Turbine Merchant Steamer, "King Edward"
(Speed attained, 20.48 Knots.)



Under-water part of the Stern of the King Edward.

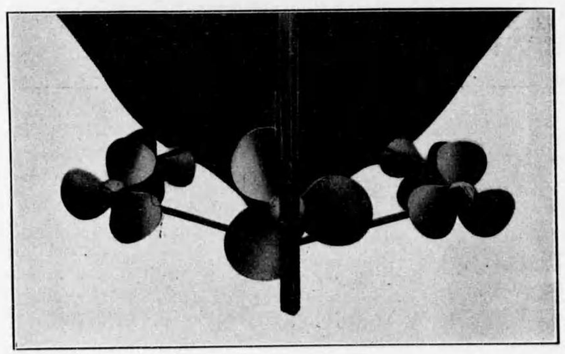
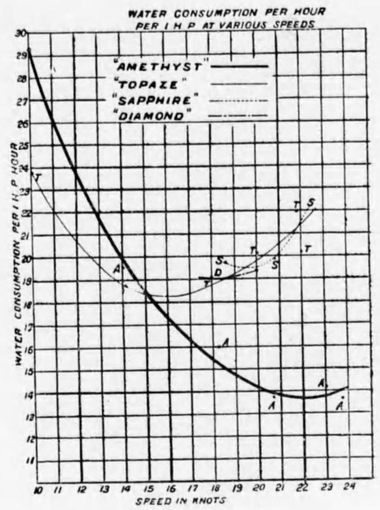
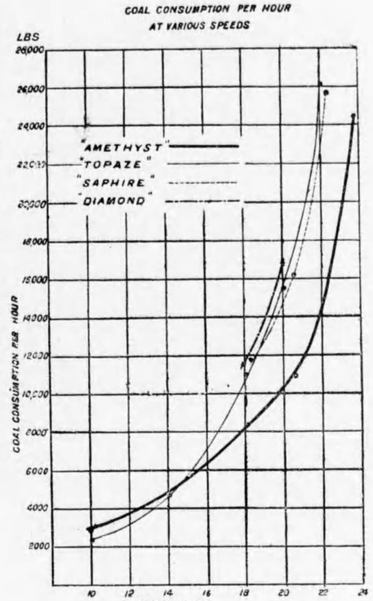
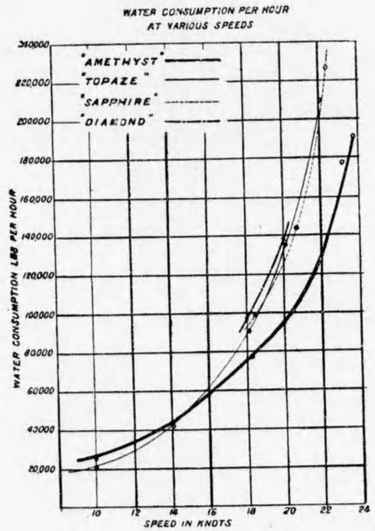


Fig. 98.







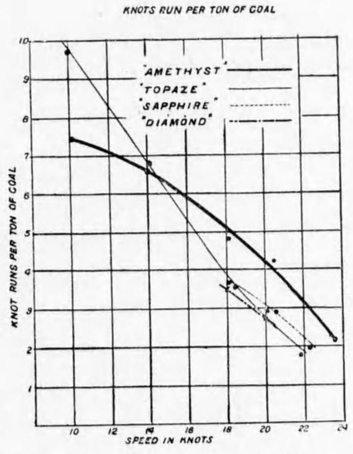
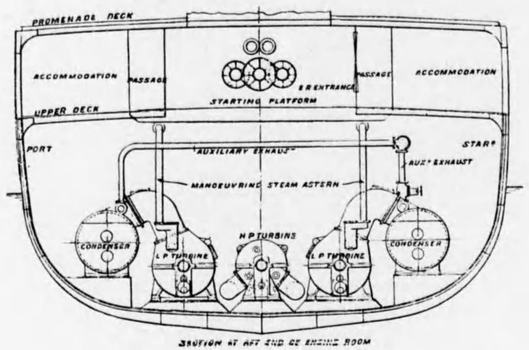


Diagram of Performances of "Amethyst" and of Sister Ships with Piston Machinery.

Fig. 99.

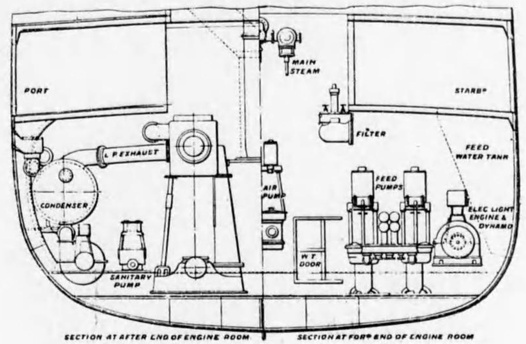
Comparison of Piston Engines of "Antrim" and Turbine Engines of "Londonderry."

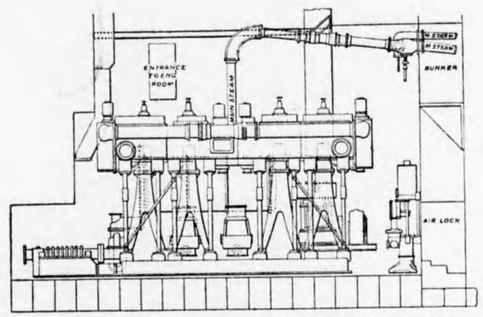
(A) Turbine Machinery of "Londonderry."



Turbine Machinery of "Londonderry"

(B) Quadruple-Expansion Machinery of "Antrim."





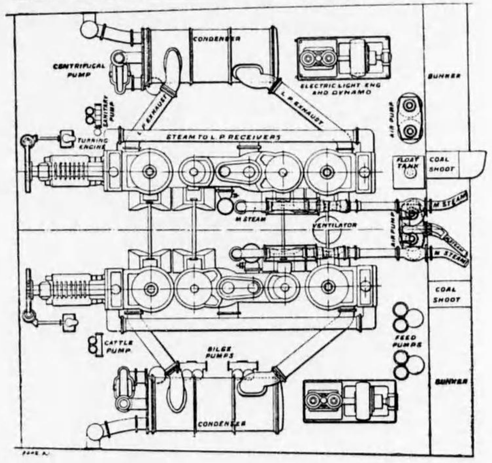
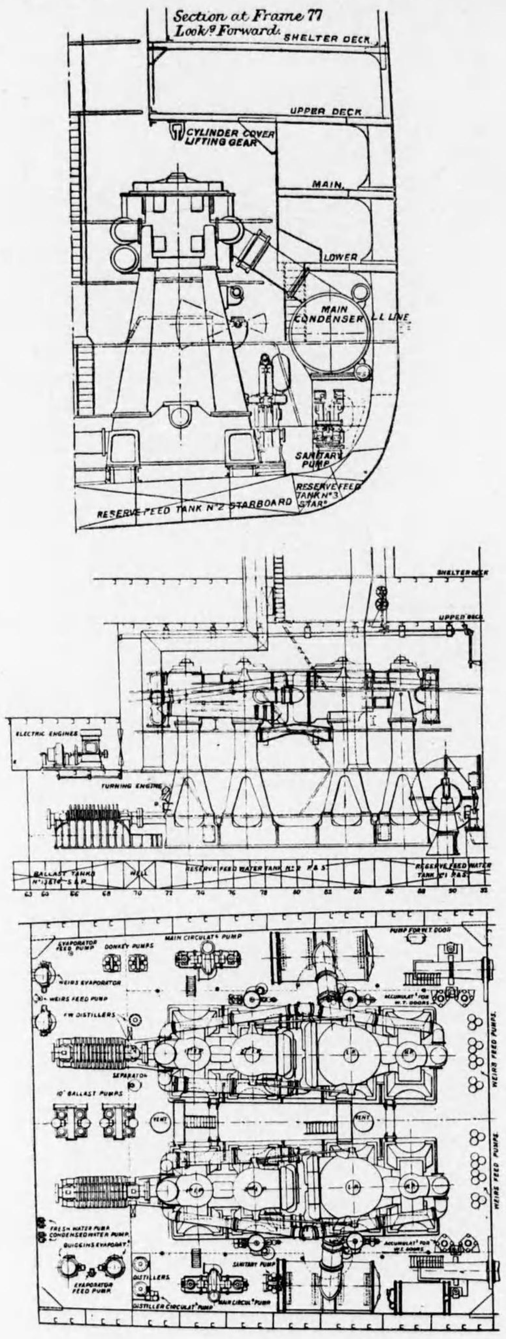


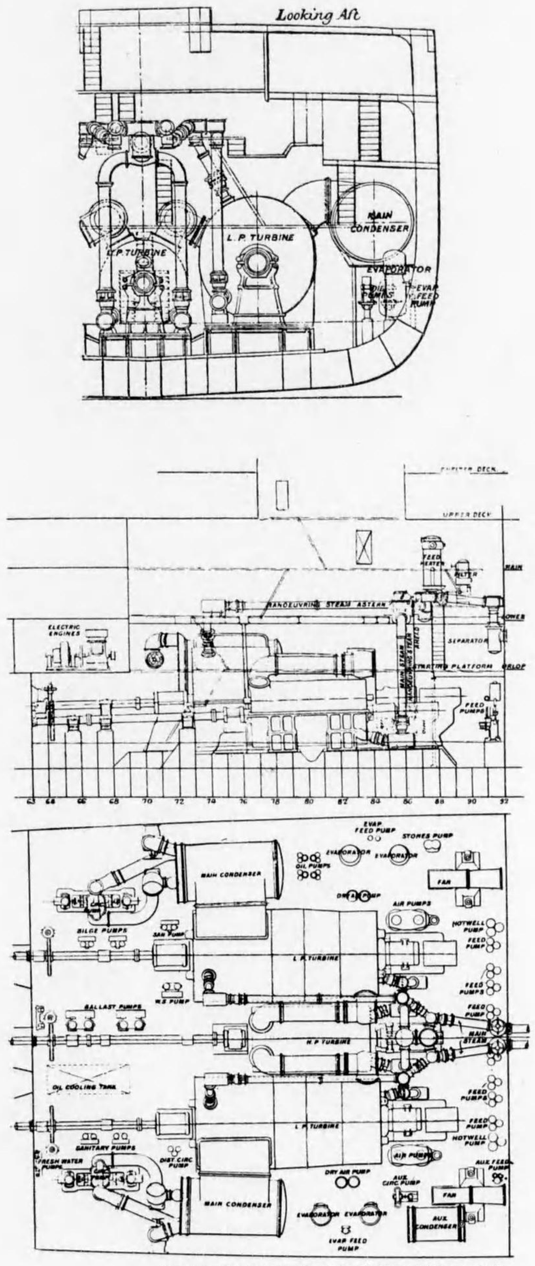
Fig. 100.

Comparsion of Piston Engines of "Caronia" and Turbine Engines of "Carmania."

(A) Reciprocating Engines in the Cunard Liner "Caronia."



(B) Turbine Engines in the Cunard Liner "Carmania."



Turbine Engines in the Cunard Liner "Carmania"

Fig. 101.

The Turbine Cunard Liner "Carmania."

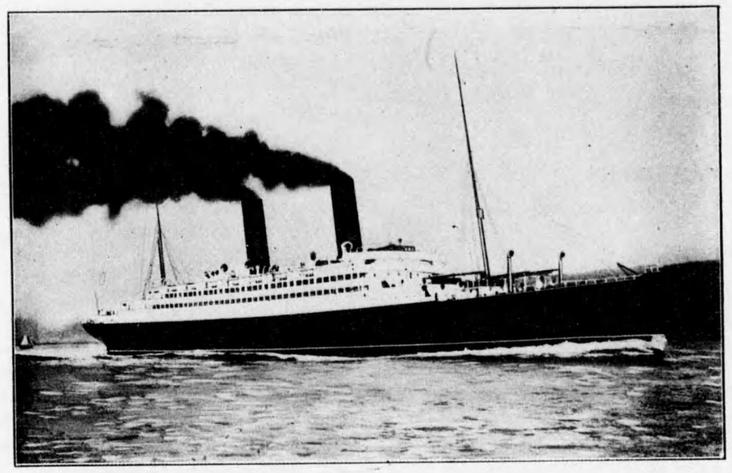


Fig. 102.

The "Turbinia" alongside the "Mauretania"

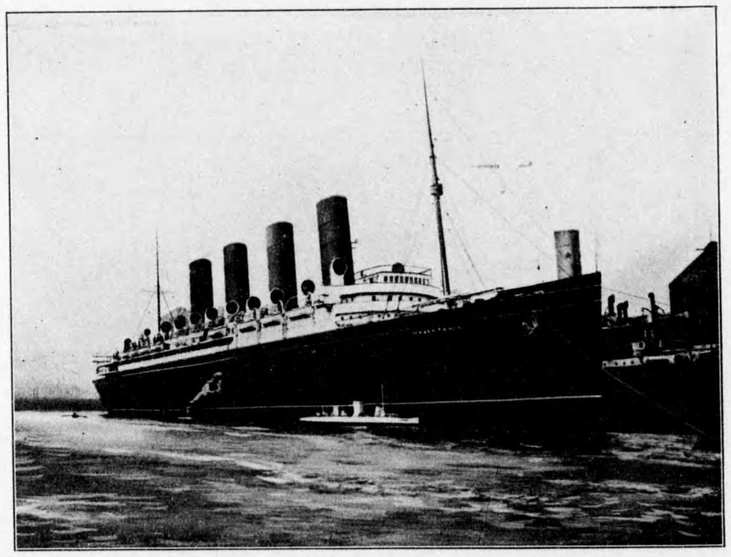


Fig. 103.

Stern of the S. S. "Lusitania"

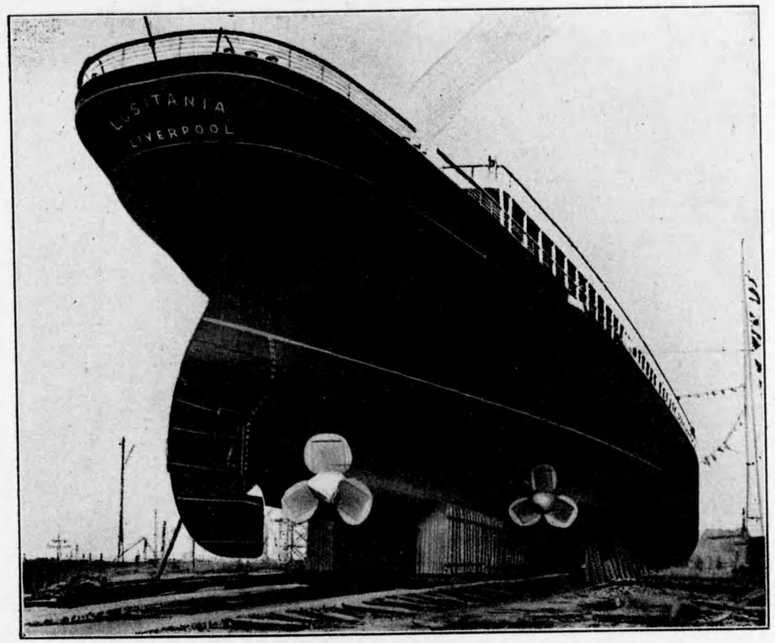
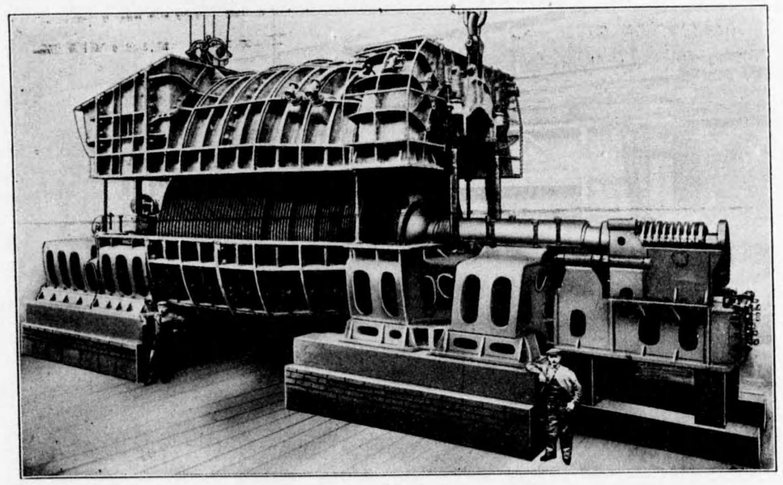
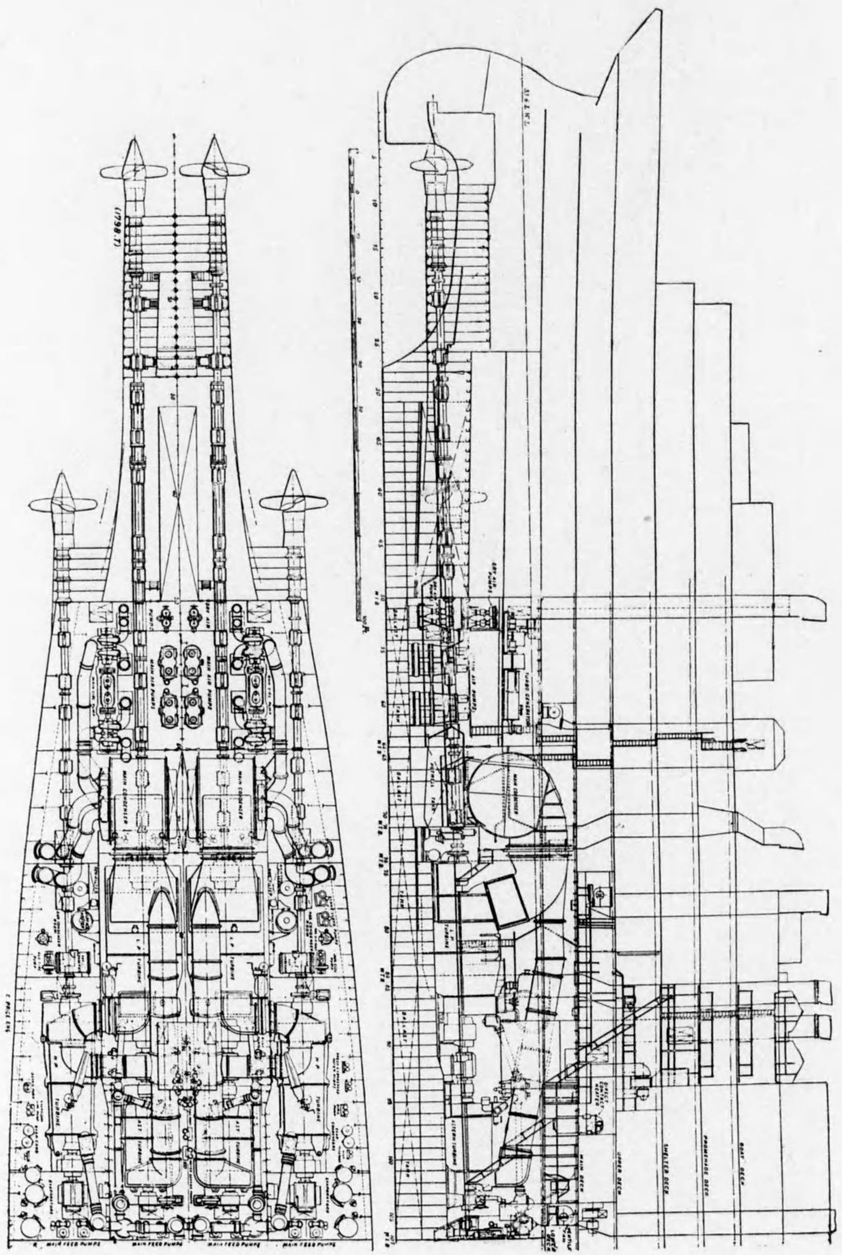


Fig. 104.

(A) Low-Pressure Turbine of the "Mauretania." with Top Half of Turbine Casing Raised.

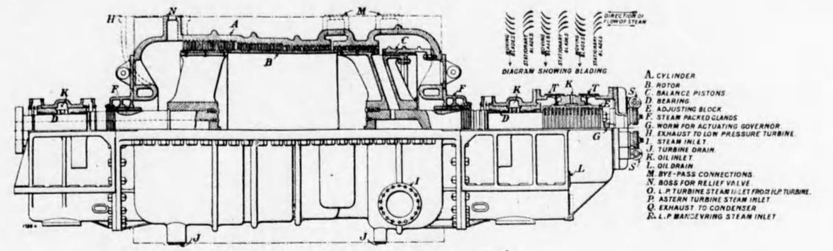




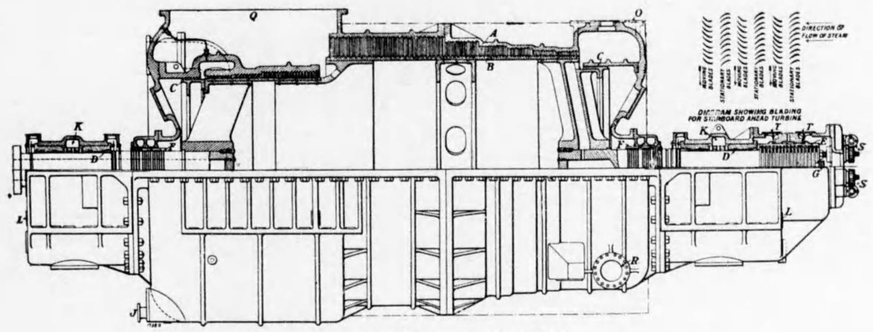
(B) General Arrangement of Turbine Machinery in the "Mauretania."

Fig. 105.

(A) The Turbines of the "Tenyo Maru."



The High-Pressure Turbine.



Low-Pressure and Astern Turbine.

(B) The Japanese Pacific Liner, "Tenyo Maru."

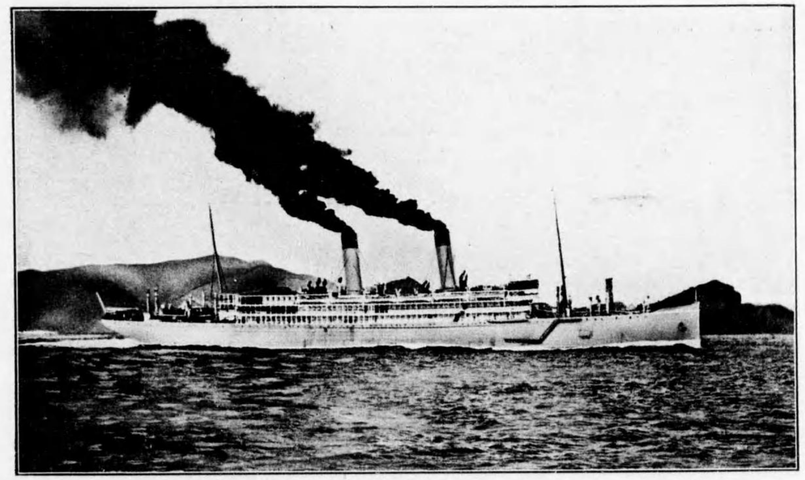
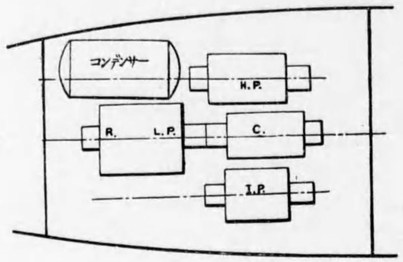


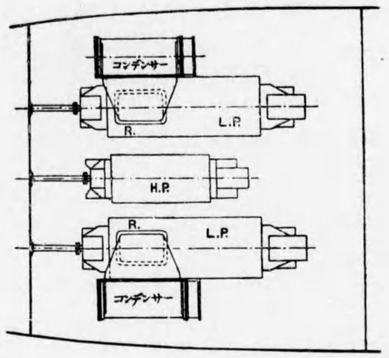
Fig. 106.

Several Arrangement of Turbine Cylinders of Parsons Turbine.

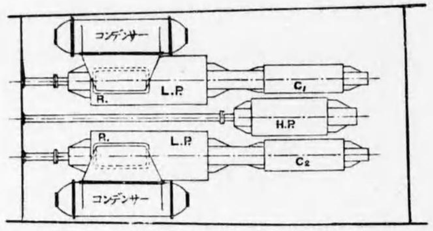
(A)



(B)



(C)



(D)

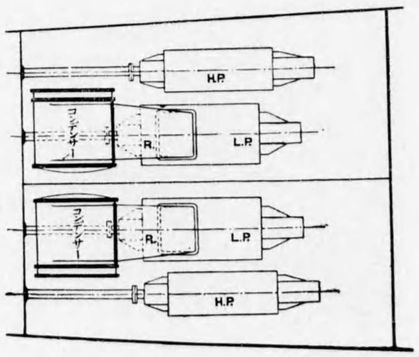


Fig. 107.

Diagram showing Increase of Steam Energy Utili ed by Combination of Reciprocating Engine and Turbine.

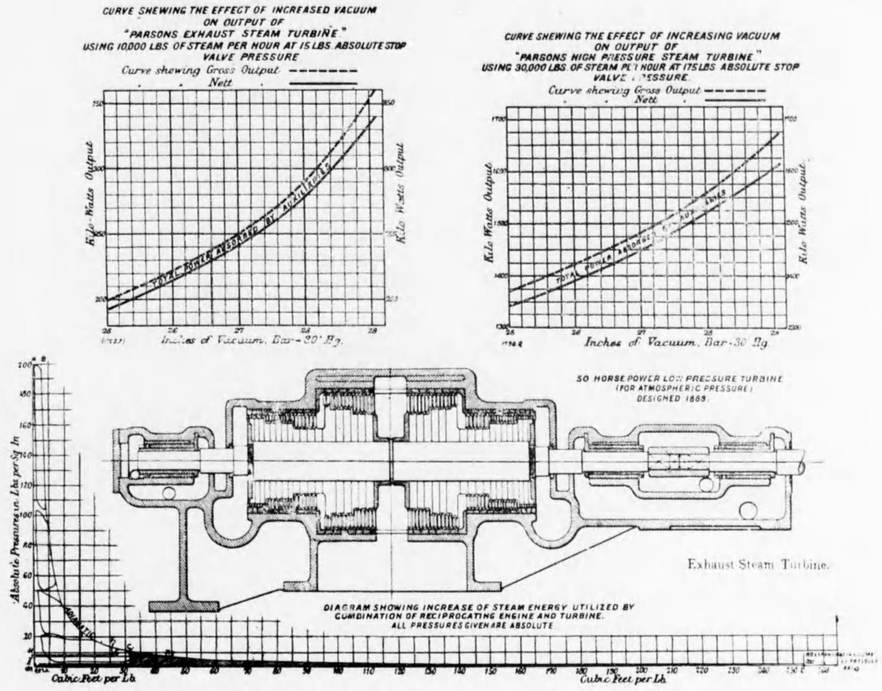


Fig. 108.

Diagram of Results of "Otaki's" Trials.

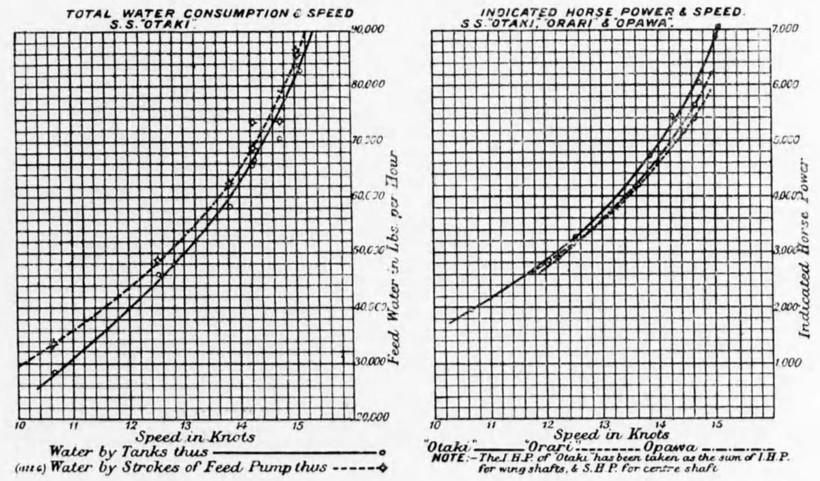


Fig. 109.

General Arrangement of Machinery of "Otaki"

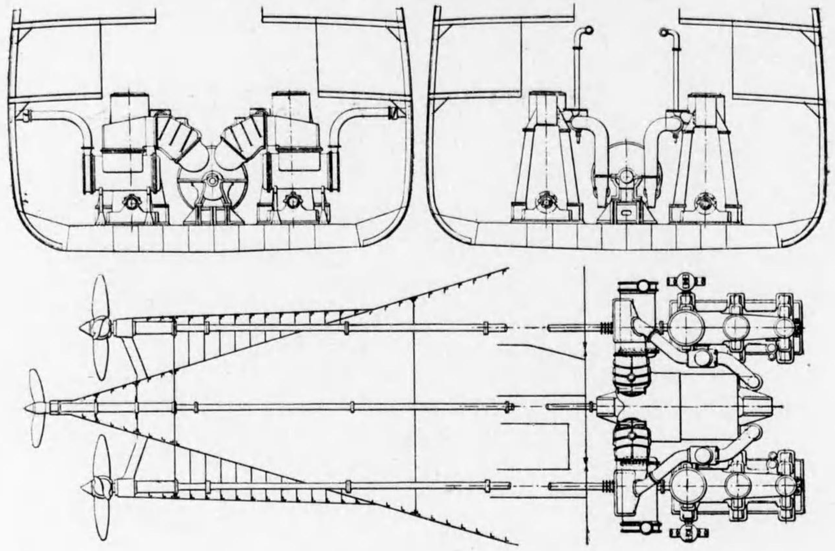


Fig. 110.

Shut-off Valve in Turbine Eduction Pipes.

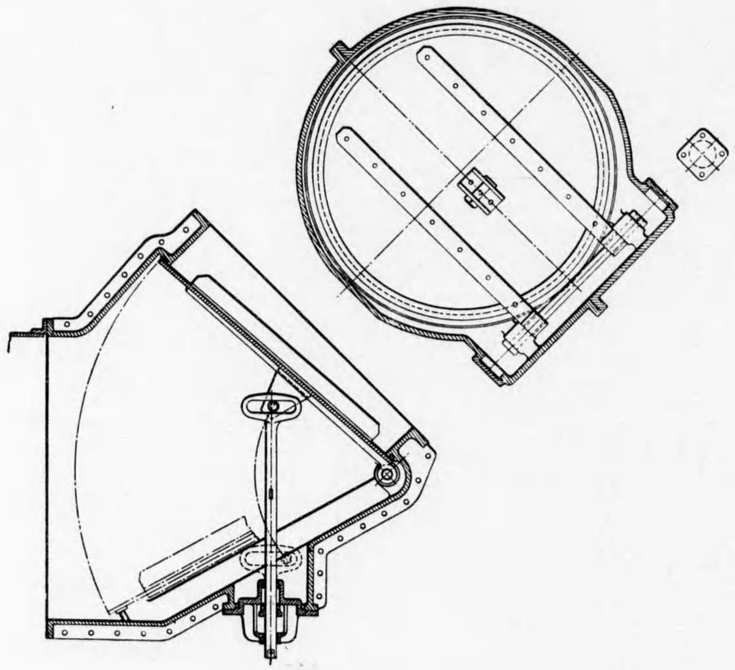
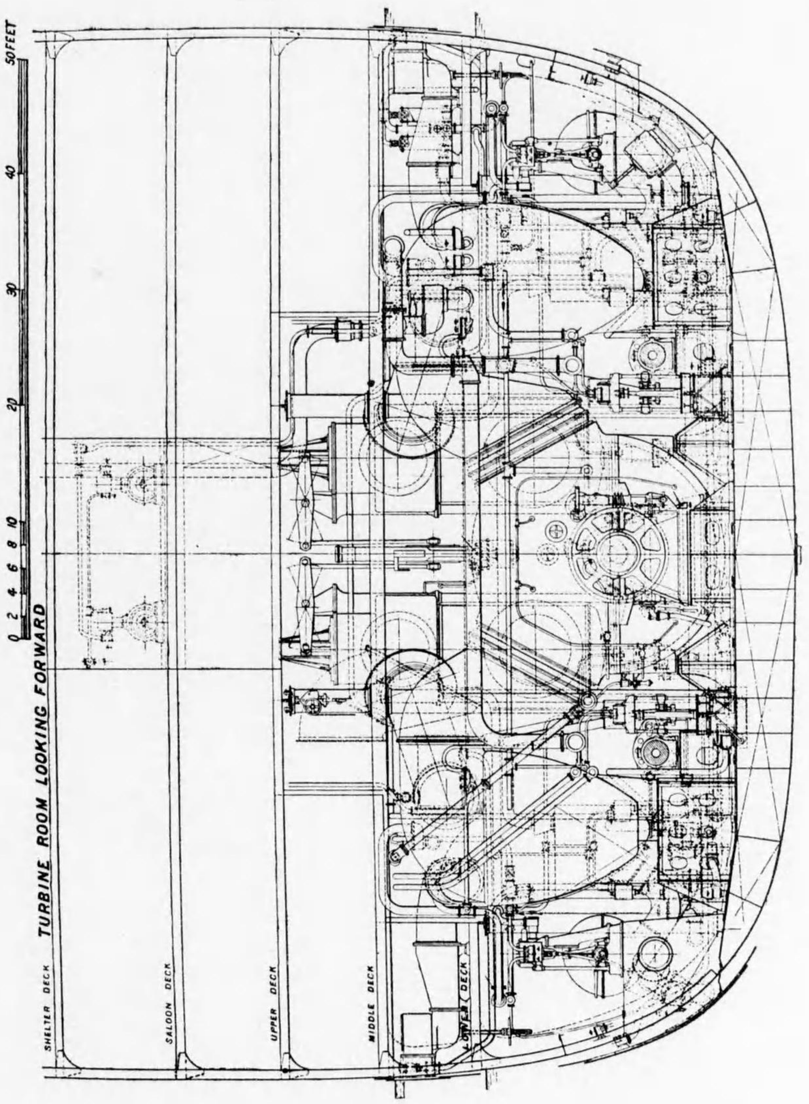


Fig. 111.

Cross Section through Turbine Room.



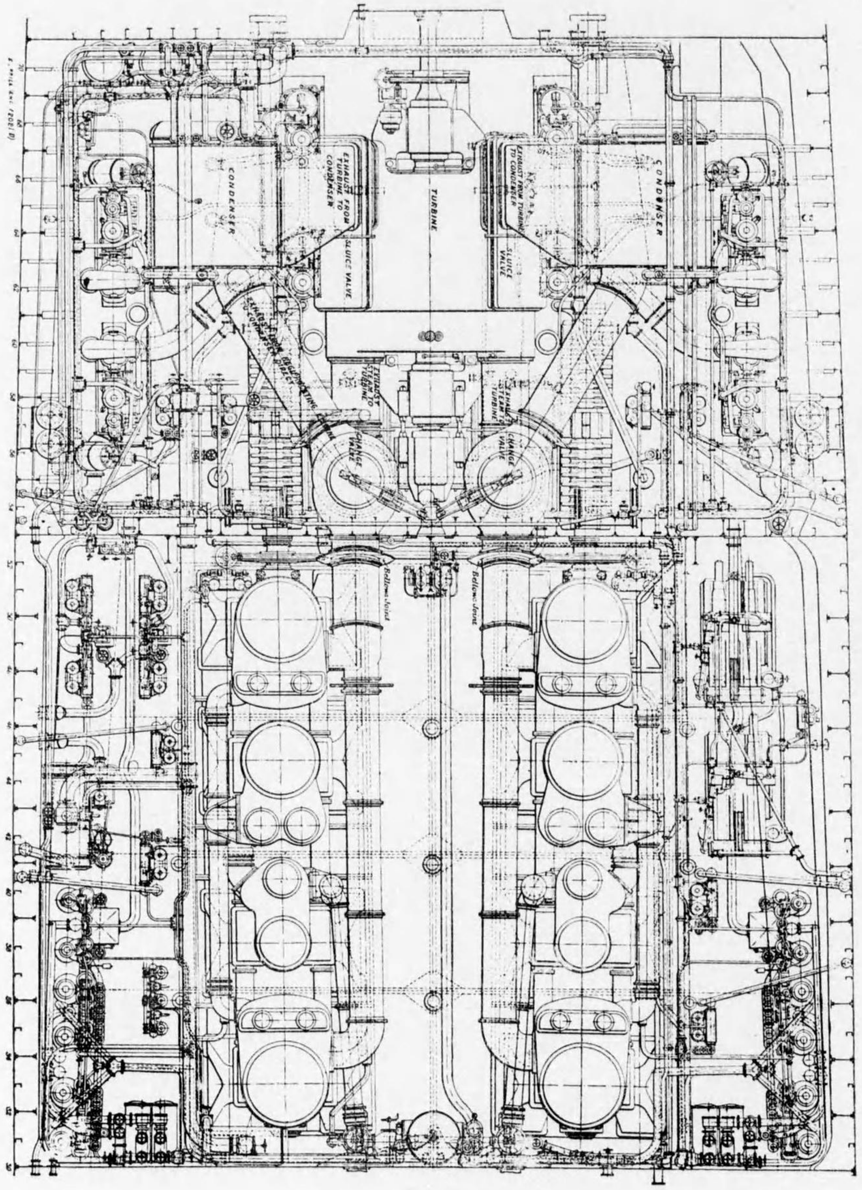
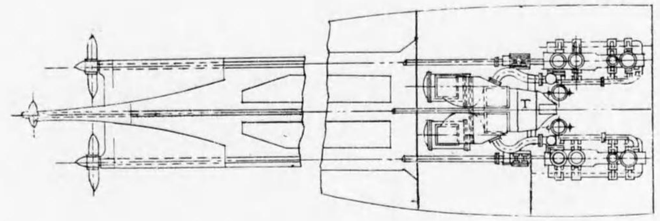


Fig. 112.
General Arrangement of Combination Machinery in the "Olympic"

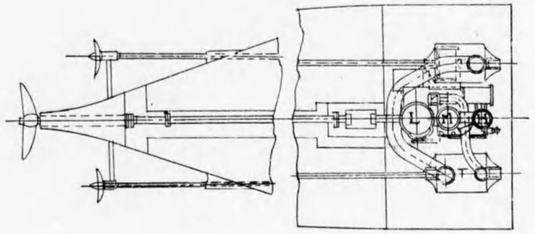
Fig. 113.

Several Arrangement of Piston Engine & Turbine in Combination System.

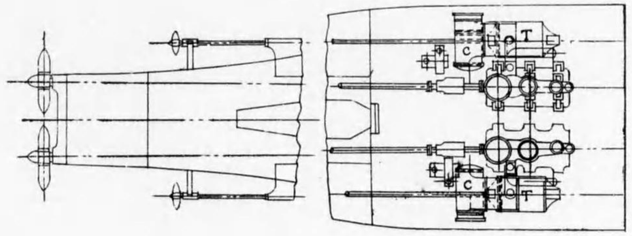
(A)



(B)



(C)



(D)

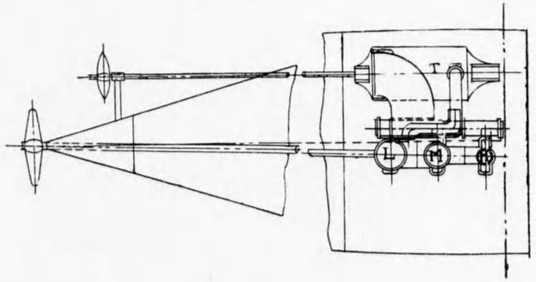


Fig. 114.

(A) Experimental Instion of Turbine and Gearing for 22-ft. Launch.

View of Launch under Steam.

(B) Geneeral Arrangement of Turbine & Gearing for 22-ft. Launch.

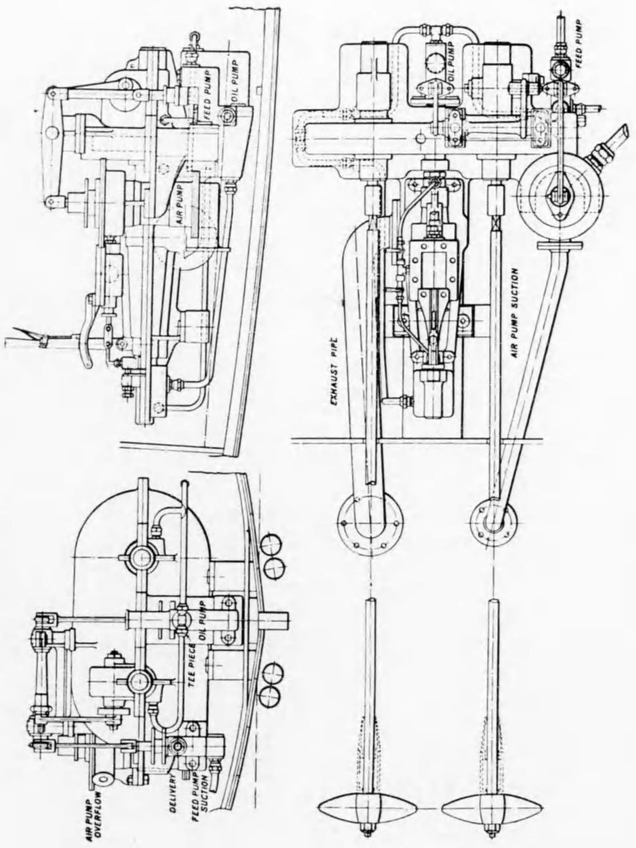


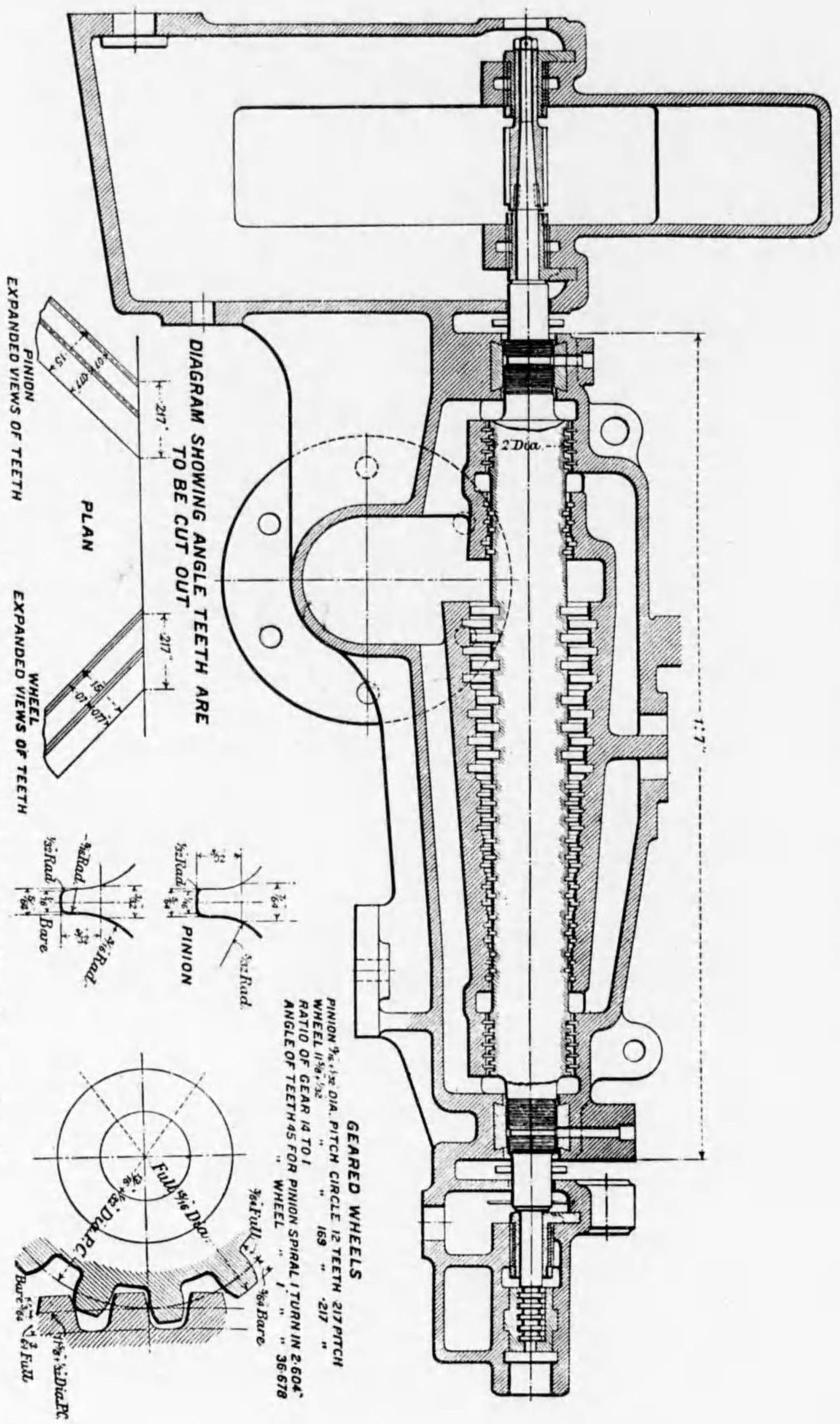
Table I

連結式推進機關を据付けたる汽船の實例

船名	船體の大さ				往復機關の大さ						「低壓タービン」の大さ			軸の廻轉數		船の速さ、ノット
	長さ	幅	深さ	噸數	H.P	I.P	LP	L.P	衝程	馬力I.H.P	胴徑	根羽の長さ	軸馬力	エンジン軸	タービン軸	
Otaki	464′-6″	60′	60′	7,420	$24\frac{1''}{2}$	39″	58″		39″	2×1,200	7′-6″	$4\frac{3''}{4}$ 乃至 $12\frac{11''}{16}$	1,120	100	215	14.6
Laurentic	550′-4″	67′-3″	45′-6″	14,892	30″	46″	53″	53″	54″	2×4,000	—	6″ 乃至 10″	4,600	83	220	17.0
Olympic	850′	92′	54′-3″	46,359	54″	84″	97″	97″	75″	2×15,000	12′-0″	18″ 乃至 $25\frac{1''}{2}$	16,000	75	165	21.0
Britannic	900′	94′	64′-3″	50,000	54″	84″	97″	97″	75″	2×16,000	12′-6″	16″ 乃至 $26\frac{1''}{2}$	18,000	77	170	21.0
香取丸	490′	91′	36′-6″	10,512	27″	42″	66″		48″	2×3,500	11′-1″	$3\frac{1''}{4}$ 乃至 9″	4,000	92	191	16.7

(C)

Details of Turbine and Geared Wheels in 22-ft Experimental Launch.

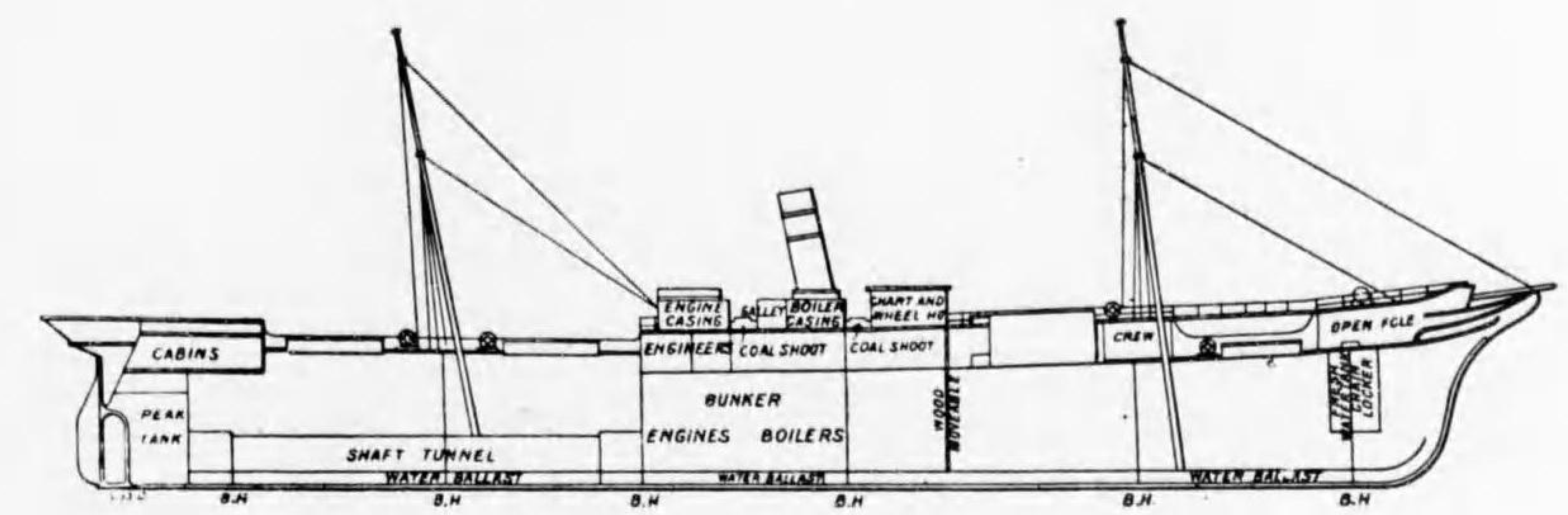


Details of Turbine and Geared Wheels in 22-ft. Experimental Launch.

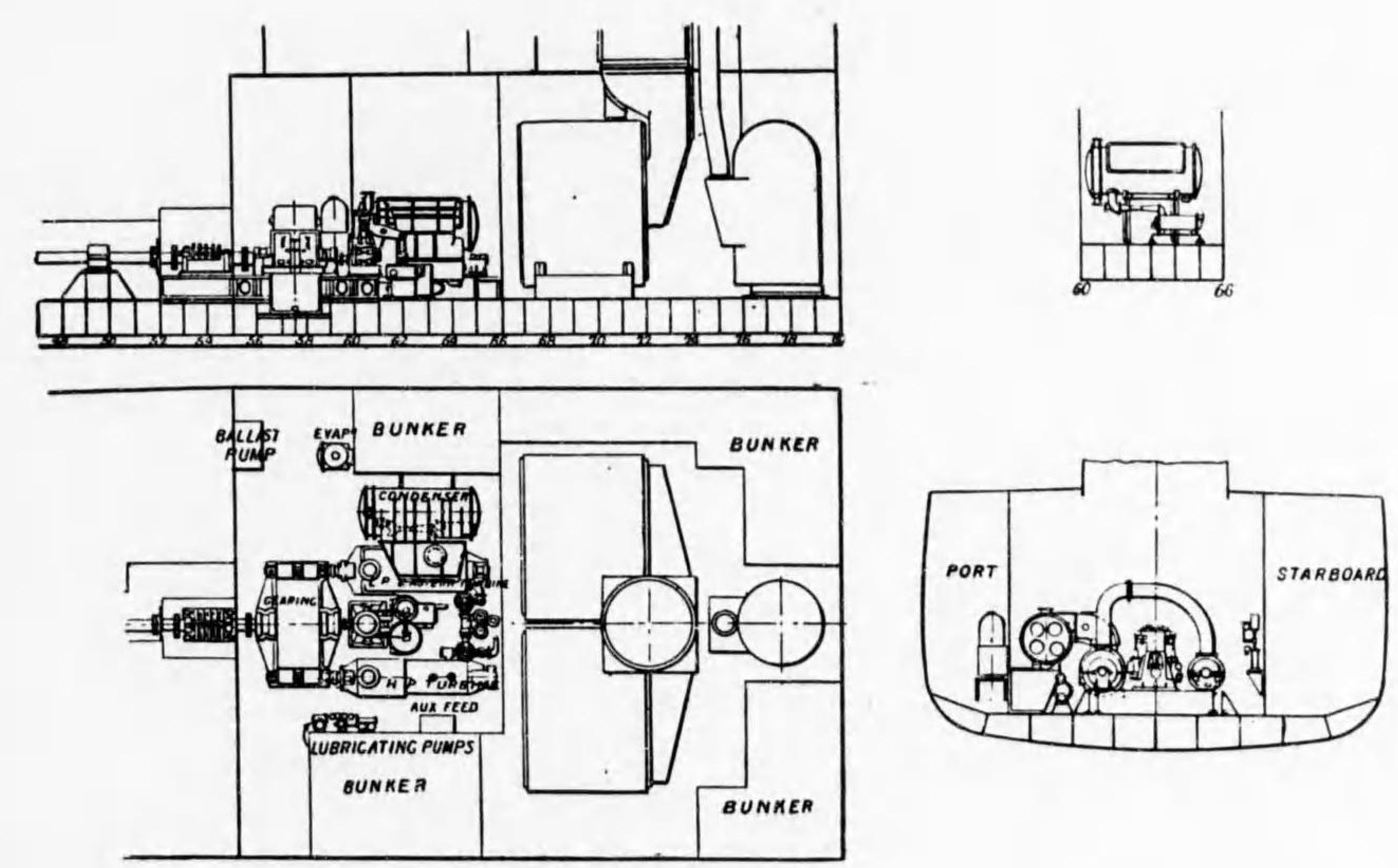
Fig. 115.

General Arrangement of Geared Turbine Machinery in S.S. "Vespasian."

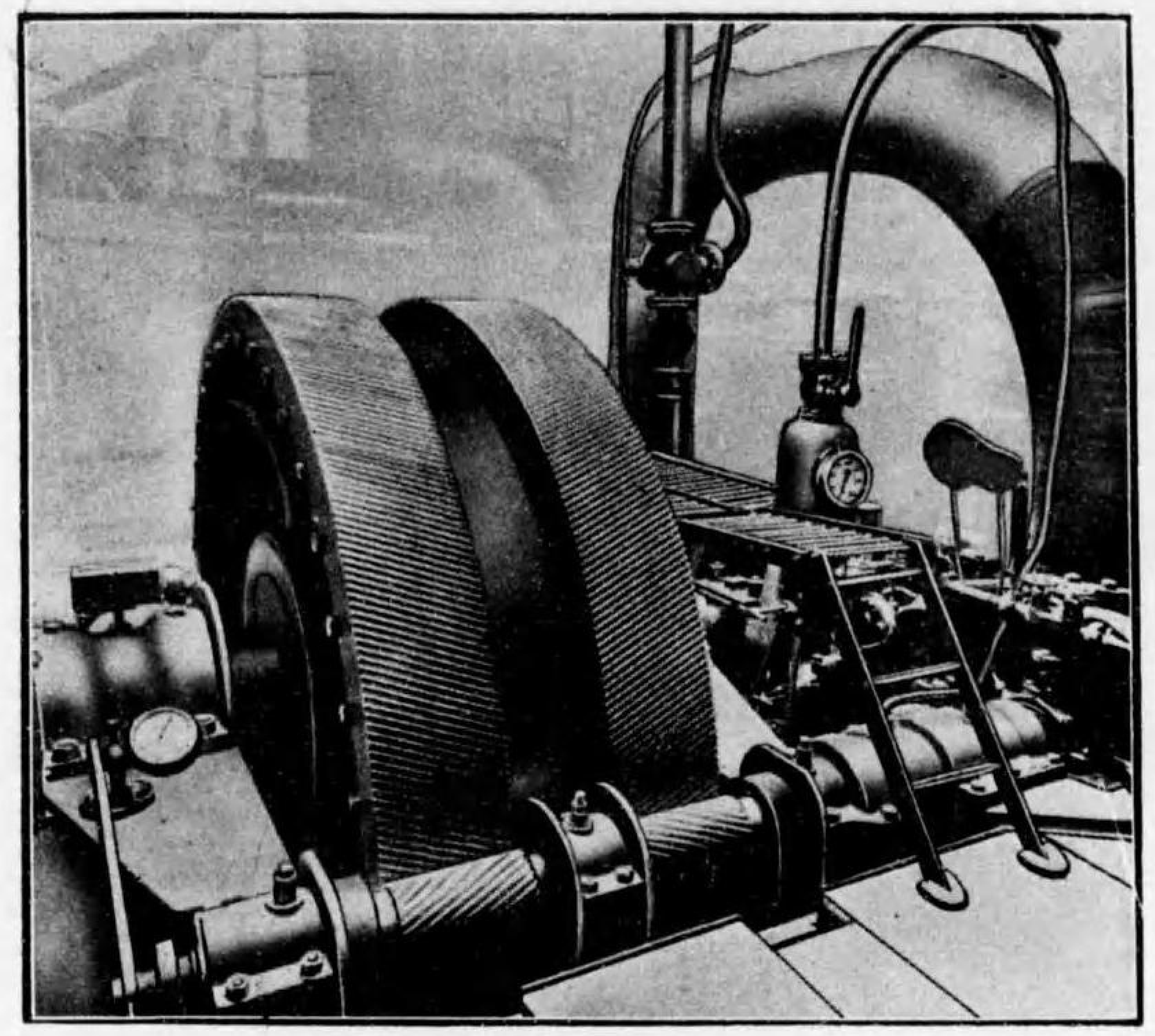
(A)



(B)



(C) The Gear of S.S. "Vespasian."



View of Gear in Ship

(D) Details of Gear.

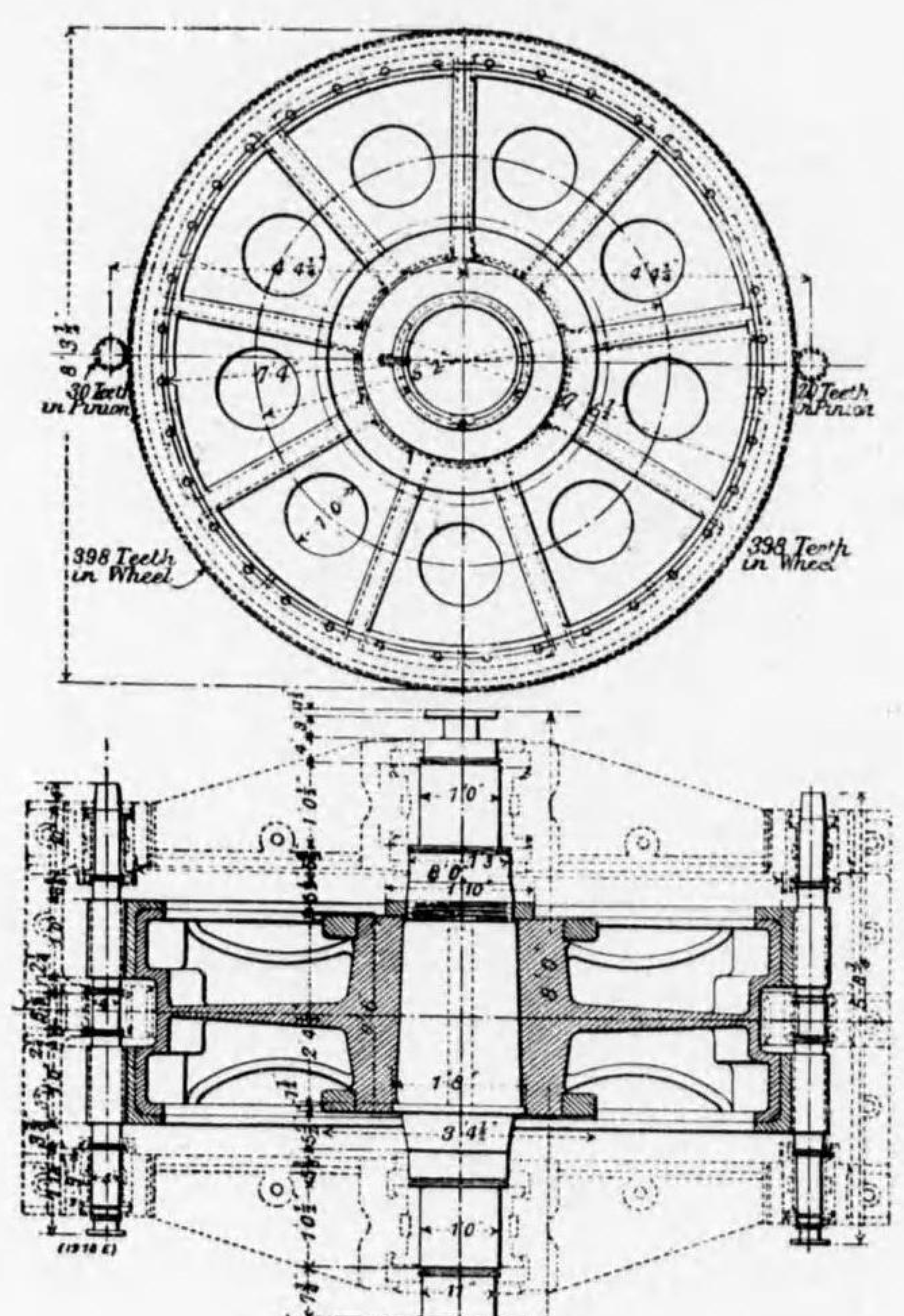


Table II 歯車減速装置（附タービンヲ据附ケタル汽船）

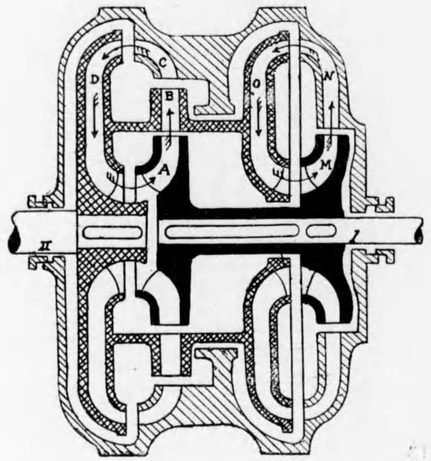
船名	排水噸數又ハ總噸數	螺旋數	總馬力 S.H.P.	速力	回轉數 H.P.タービン	回轉數 L.P.タービン	回轉數 大歯車軸	齒數 H.P.小齒車	齒數 L.P.小齒車	齒數 大歯車	齒ノ角度	周圍心距	心距圓ノ直徑 H.P.小齒車	心距圓ノ直徑 L.P.小齒車	心距圓ノ直徑 大齒車	減速比 タービン	減速比 タービン	記事
牛貨物船A號	10,000	2	4,500	17.5	1,500		120				45°					12.5		ドラヴアル式歯車減速装置
驅逐艦(2)		2	5,500													8		同上
コロンビア號					3,600		300									12.0		カーチス式歯車減速装置
チヤーミヤン號	10	2	10		1,400		100	12		169	45°	0.217″	$\frac{13}{16}''+\frac{1}{32}''$		$11\frac{5}{8}''+\frac{1}{32}''$	14.1		パーソンス式歯車減速装置
ヴエスパシアン號	● 4,250	1	1,000	10.5	1,500	1,500	75	20	20	398	20°	0 7854″	5″	5″	$99\frac{1}{2}''$	19.9		同上
ケーンロス號 / ケアンロス號	● 10,000	1	1,600	10.5	1,700	1,700	65	21	21	550	45°		$5\frac{1}{2}''$	$5\frac{1}{2}''$	131″	26.2		同上
ノーマニア號 / ハントニア號	● 1,900	2	6,100	20.0	1,905	1,335	300									6.35	5.45	同上
パリイ號	1,774	2	14,000	25.0	2,610	1,848	435									6	4.25	同上
キングオリ號	1,850	2																
トランシルヴアニア號		2	8,000	20 75	2,210	1,617	300	30	41	221	44°-$22\frac{1}{2}''$	0.815″	$7\frac{3}{4}''$	$10\frac{5}{8}''$	$51\frac{1}{2}''$	7.37	5.39	パーソンス式歯車減速装置(遊動型)
タスカニア號			11,000	17.6	1,700	1,700	136	33	33	413	44°	0,9139″	9.6″	9.6″	120″	12 5	12.5	パーソンス式歯車減速装置
シューザドペノスエイア號 / シューザドモンテヴイデオ號		2	5,800	19.0	2,320	1,630	267				約 45°		6.233″	8.831″	54.275″	8.7	1.6	同上
安洋丸	9,533	2	7,850	15.3	3,240	1,185	110	27	31	550	約 45°	0.822526″	7.069″	8.117″	114″	20.4	10.8	同上
豐岡丸	7,375	2	5,510	14.5	2,473	2,257	110	21	23	472	約 45°	0.8185″	5.4718″	5.9928″	122.9842″	22.48	20.52	同上
富山丸	7,386	2	6.000	14.5	2,477	2.263	110	21	23	473	44°-23′-7	0 8159″	5.454″	5.973″	122.843″	22.52	20.57	同上
パルチモア號	● 4,413	2	6,000	20.0	1,500		300	35		176	30°	1.25″	14″		70″	5		ノルヴイルーマカルピン式歯車減速装置
油槽船十四隻	● 12,650	2	2,500	11.5	3,600	3,600	70				30°					51 43		二重歯車減速装置
サクロサ號	5,788			11.0	2,300		75									30.6		「カーチス」式二重歯車減速装置
ネプチユーン號	● 19,440	2	5,400	14.0	2,003		115									17.37		ウエスチングハウス歯車減速装置
ペンシルヴアニア號	● 27,500	4	1,600		1,733		120						4.811″		69.474″	14.44		同上(巡航タービン附)
メルヴイル號			4,000		1,350		110	21		258			7 794″		95.55″	12.27		同上
マナイ號		2	10,000	16.5	2,070	2,070	129									15.95		同上
パシフイツク號	● 12,500		2,400	13.1	3,500		90				27°					38.8		アルタイスト式歯車減速装置
ラブリ號			2,600	11.0	3,500		90				27°					38.8		同上
ネヴアダ號	● 27,500	4	1,750		3,000		135				27°					23.85		同上(巡航タービン附)
ヴドワード號	8.151		4,500		3,450		93									37		同上
ラケンパーク號																		
アリゾナ號			2,000		2,500		200	21		260			6.351″		78.520″	12.41		同上(巡航タービン附)
常盤丸	7,262	2	5,070	14.6	2,530	2,344	112	21	23	473	約 45′	0.8159″	5.454″	5.973″	122.845	22.52	20.57	パーソンス式歯車減速装置

● ハ排水噸數

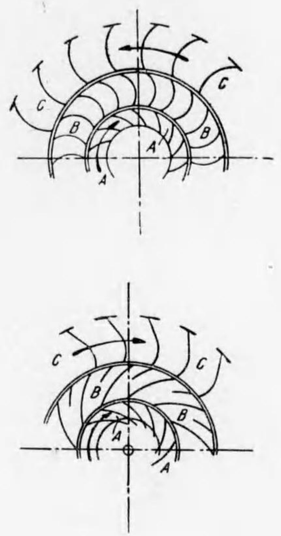
Fig. 116.

Fottinger Transformator.

(A)



(B)



(C)

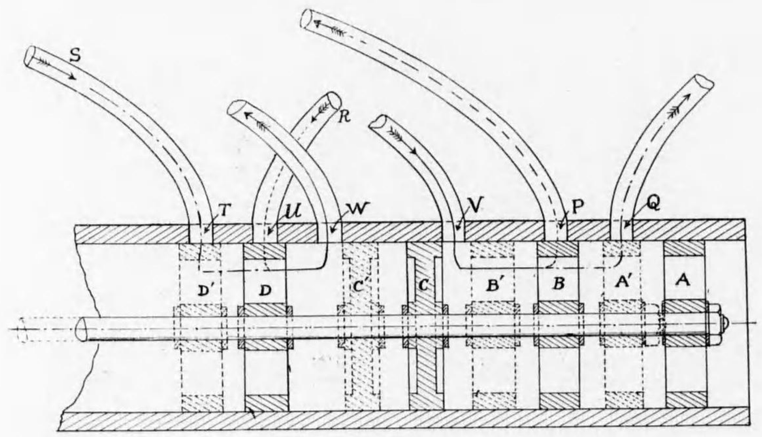
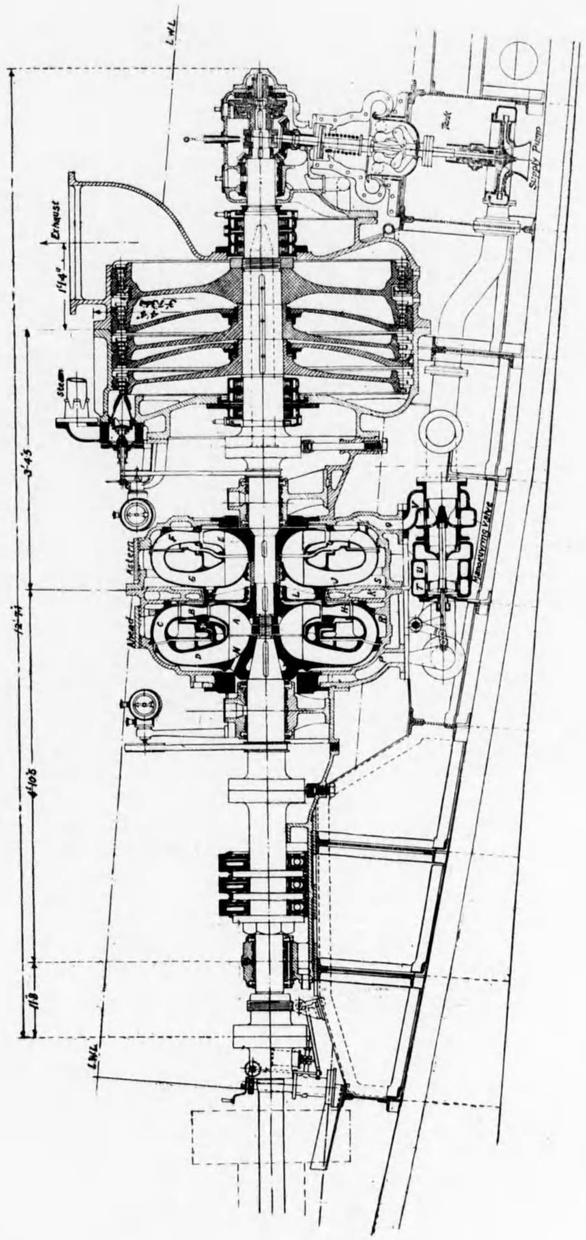


Fig. 117.

Fottinger Transformator. Turbine and Transmitter.



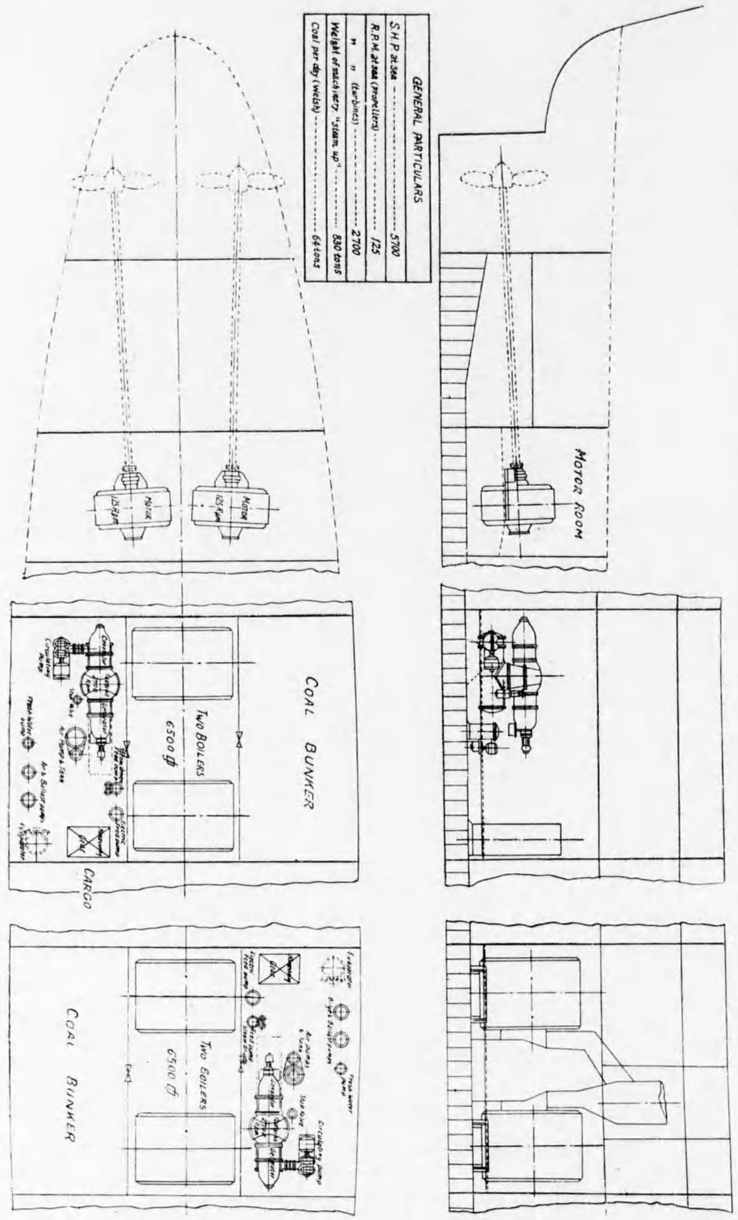


Fig. 118.

Arrangement of Machinery Twin Screw Steamer, Ljungstrom Turbo-Electric Drive System.

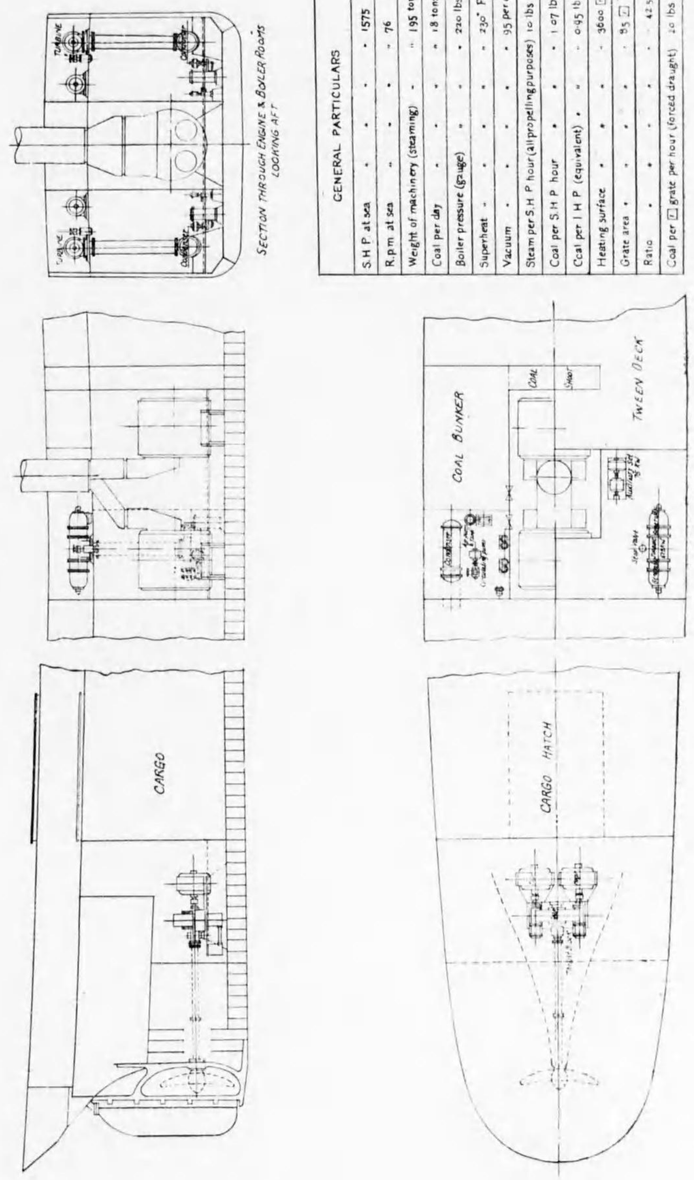


Fig. 119.

Arrangement of Machinery for 6500 to 7000 tons Deadweight Steamer (10 to 10 ½ knots), Ljungstrom Turbo-Electric Drive System.

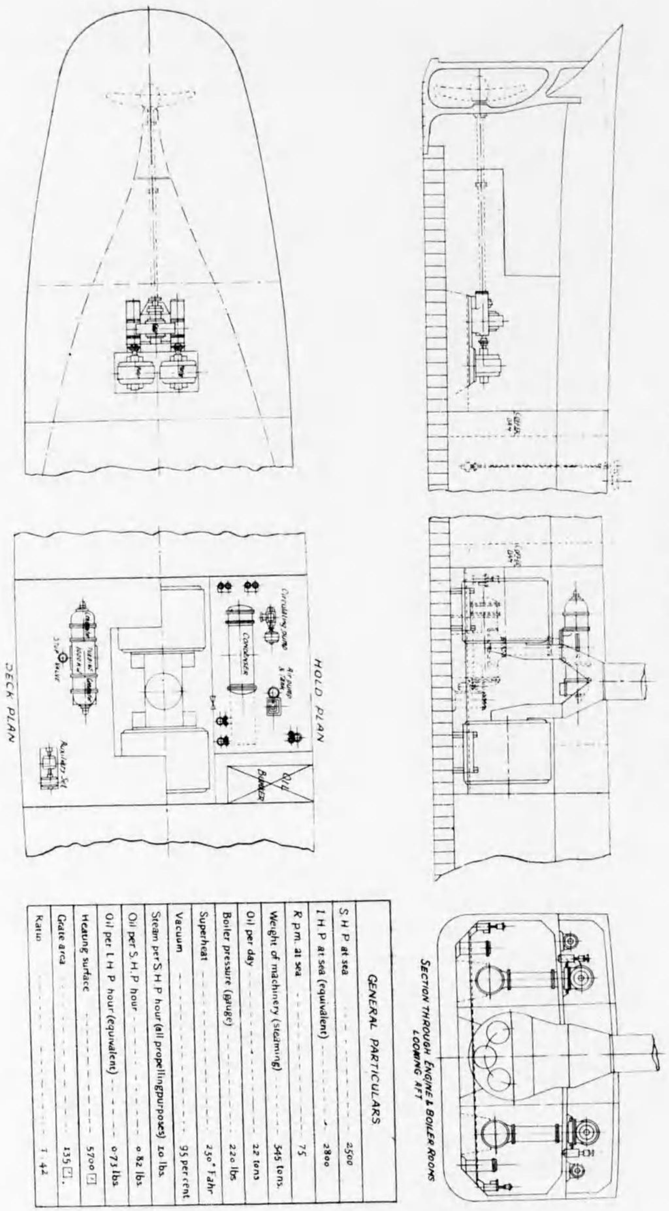


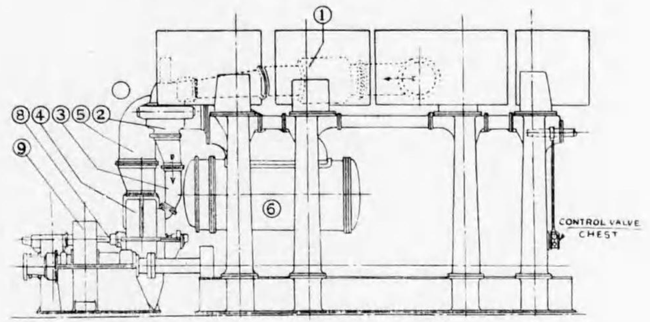
Fig. 120.

Arrangement of Machinery for 2500 to 2800 S. H. P. (Equivalent) Oil Tank Steamer, Ljungstrom Turbo-Electric Drive System.

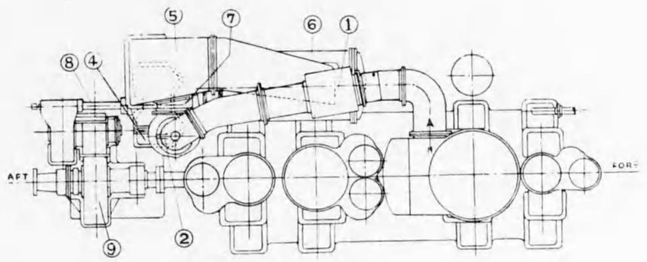
GENERAL PARTICULARS	
S H P at sea	2500
I H P at sea (equivalent)	2800
R p.m. at sea	75
Weight of machinery (steaming)	345 tons.
Oil per day	22 tons
Boiler pressure (gauge)	220 lbs
Superheat	230° Fahr
Vacuum	25 per cent
Steam per S H P hour (all propelling purposes)	20 lbs.
Oil per S H P hour	0·82 lbs
Oil per I H P hour (equivalent)	0·731 lbs
Heating surface	5700 □
Grate area	135 □.
Ratio	1·42

Fig. 121 (A)

Bauer-Wach Exhaust Turbine system.



(B)



1. Oil strainer to extract oil from the exhaust steam from the L.. P. cylinder.
2. Change over valve.
3. Exhaust steam pipe.
4. Exhaust turbine.
5. Turbine exhaust pipe.
6. Condenser.
7. Shaft connecting the turbine to the pinion.
8. Main gear wheel.

Fig. 122. (A)

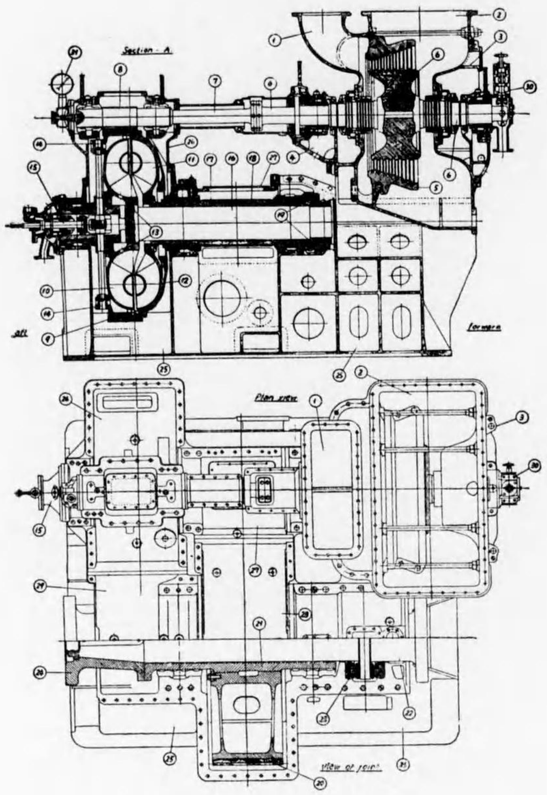
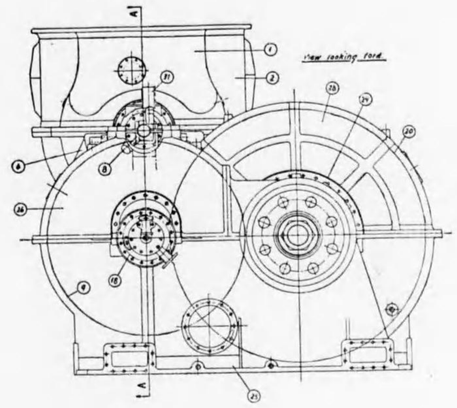


Fig. 122. (B)



1. Turbine inlet casing
2. Turbine exhanst casing
3. Turbine cover with forward bearing stool
4. Aft turbine bearing stool
5. Guide blade carrier
6. Turbine drum with shaft
7. Turbine transmission shaft
8. Turbine pinion
9. Turbine gearwheel
10. Vulcan coupling primary half
11. Vulcan coupling secondery half
12. Coupling cover
13. Coupling filling holes
14. Coupling emptying chambers
15. Coupling servomotor
16. Primary coupling shaft
17. Secondary coupling shaft
18. Main pinion
19. Thrust bearing for main pinion
20. Main gearwheel
21. Main gearwheel shaft
22. Propeller thrust shaft
23. Propeller thrust bearing
24. Connecting Piece between main gearwheel shaft, propeller thrust shaft and intermediate shaft
25. Gear case
26. Turbine pinion bearing stool
27. Cover for main pinion
28. Cover for main gearwheel
29. Cover for connecting piece
30. Turbine quick cutoff valve
31. Tachometer

Fig. 123.

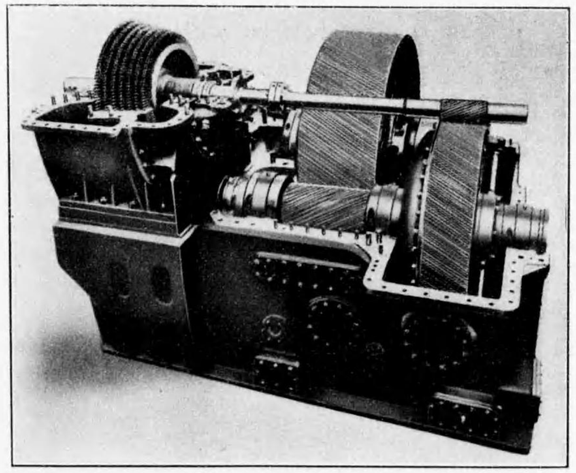
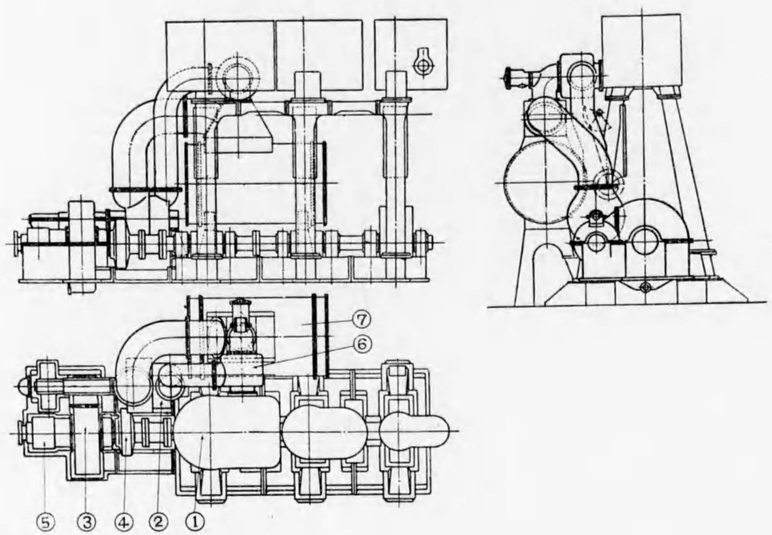


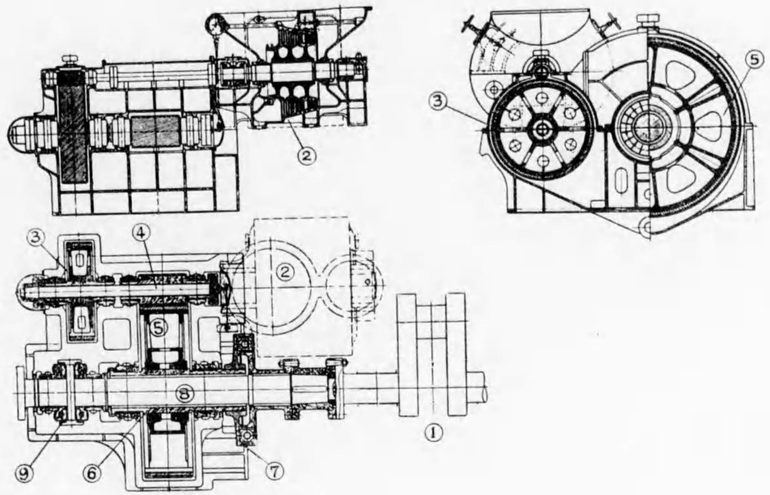
Fig. 124.

Brown-Boveri Exhaust Turbine system.



1. Reciprocating engine.
2. Exhaust-steam turbine.
3. Double-reduction gear.
4. Flexible coupling.
5. Propeller thrust bearing.
6. Change-over valve.
7. Condenser.

Fig. 125.



1. Crankshaft of reciprocating engine.
2. Exhaust-steam turbine.
3. First reduction gear.
4. Torsion shaft.
5. Second reduction gear.
6. Hollow shaft.
7. Flexible coupling.
8. Propeller shaft.
9. Propeller thrust bearing.

Fig. 126.

Mechanical flexible coupling.

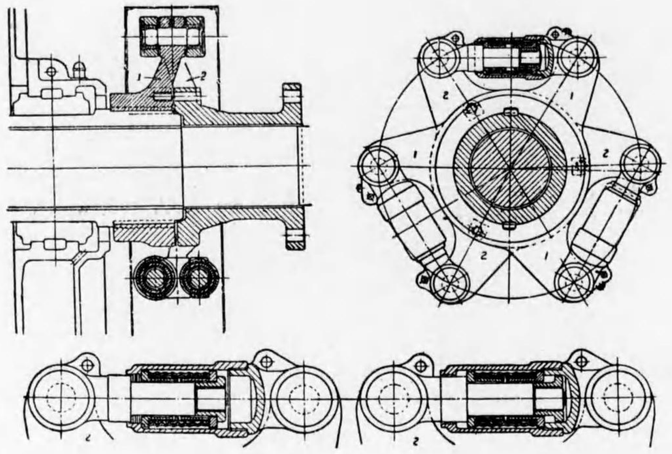
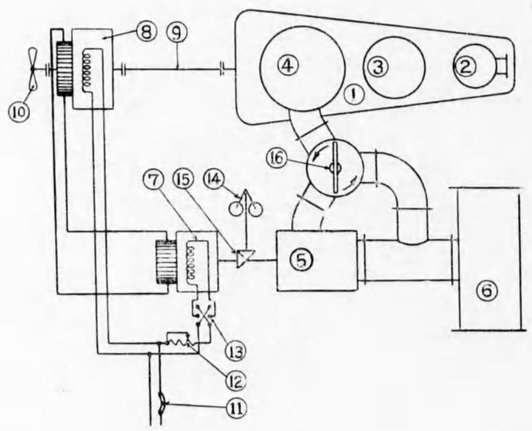


Fig. 127.

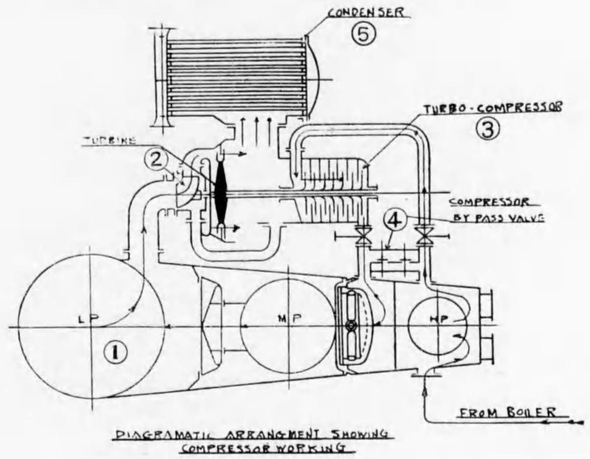
Exhaust Turbo-electric system.



1. Triple expansion engine.
2. H. P. cylinder.
3. M. P. cylinder.
4. L. P. cylinder.
5. Exhaust steam turbine.
6. Condenser.
7. Electric generator.
8. Electric motor.
9. Intermediate shaft.
10. Screw propeller.
11. Circuit breaker.
12. Rheostat.
13. Reversing switch.
14. Centrifugal governor.
15. Bevel gear.

Fig. 128.

Götaverken Exhaust Turbo-compressor system.



DIAGRAMATIC ARRANGEMENT SHOWING COMPRESSOR WORKING

1. Reciprocating engine.
2. Exhaust turbine.
3. Compressor.
4. Compressor bye-pass valve.
5. Condenser.

Fig. 129.

Exhaust Turbo Compressor.

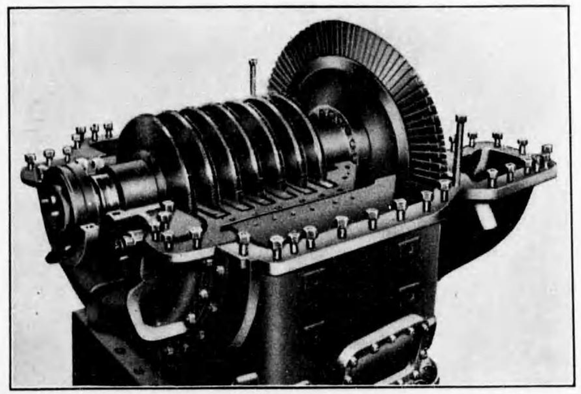


Fig. 130.

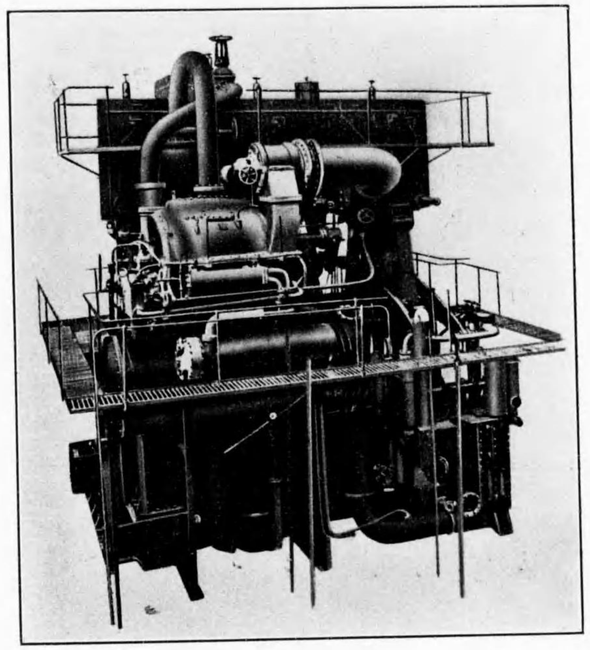


Fig. 131.

Desagalier's spherical boiler (year 1718).

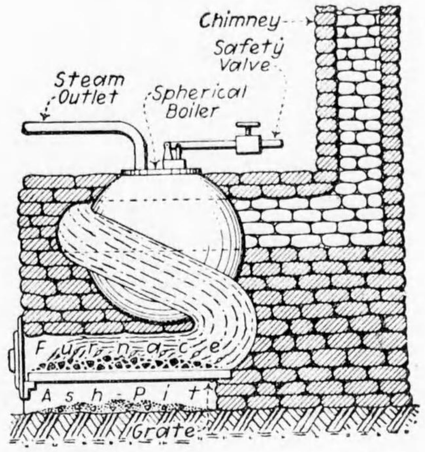
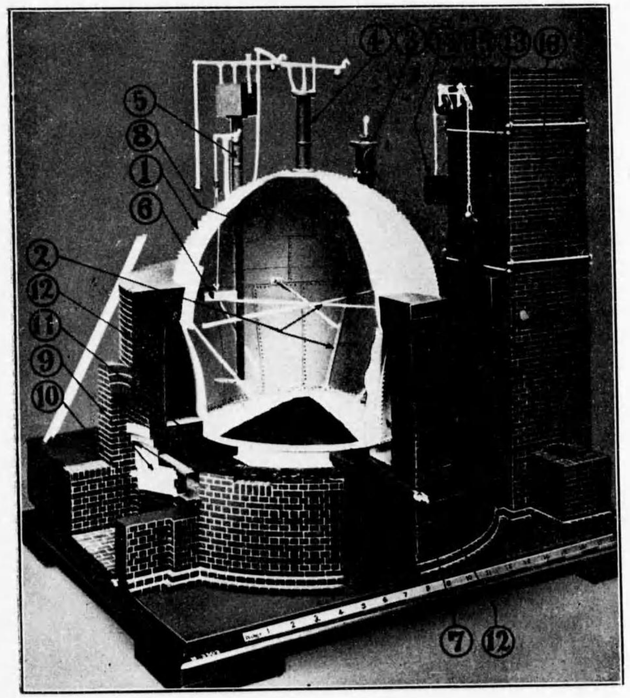


Fig. 132. Haystack boiler.



1. Boiler shell.
2. Stay.
3. Steam stop valve.
4. Safety valve.
5. Feed water inlet.
6. Float of water gauge.
7. Blow valve.
8. Man hole.
9. Furnace door.
10. Ash pit.
11. Furnace.
12. Flue.
13. Funnel damper.
14. Balance weight of funnel damper.
15. Fulley and chain of funnel damper.
16. Funnel.

Fig. 133.

Watt's wagon-top boiler.

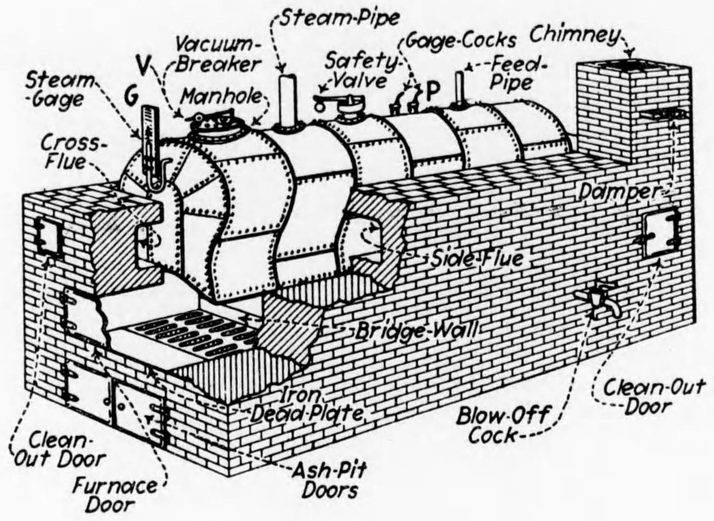


Fig. 134.

The egg-end or cylinder boiler (year 1790).

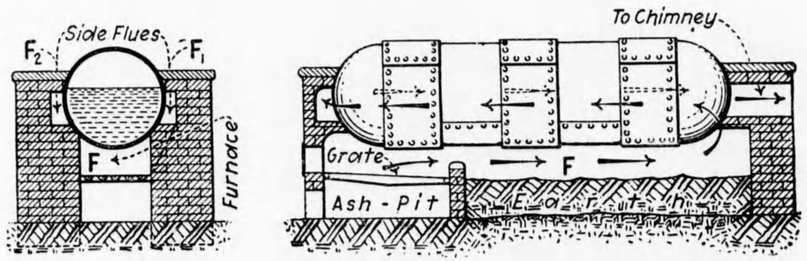
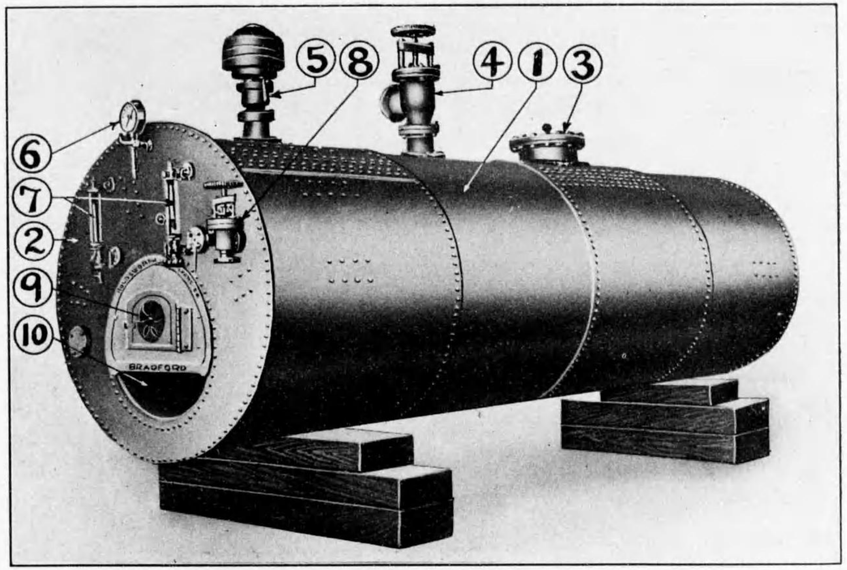


Fig. 135. Cornish boiler.

(A)



1. Boiler shell.
2. End plate.
3. Man hole and door.
4. Steam stop valve.
5. Safety valve.
6. Pressure gauge.
7. Water gauge.
8. Feed water check valve.
9. Furnace door.
10. Ash pit.

(B)

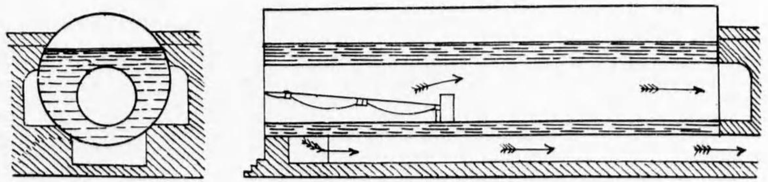
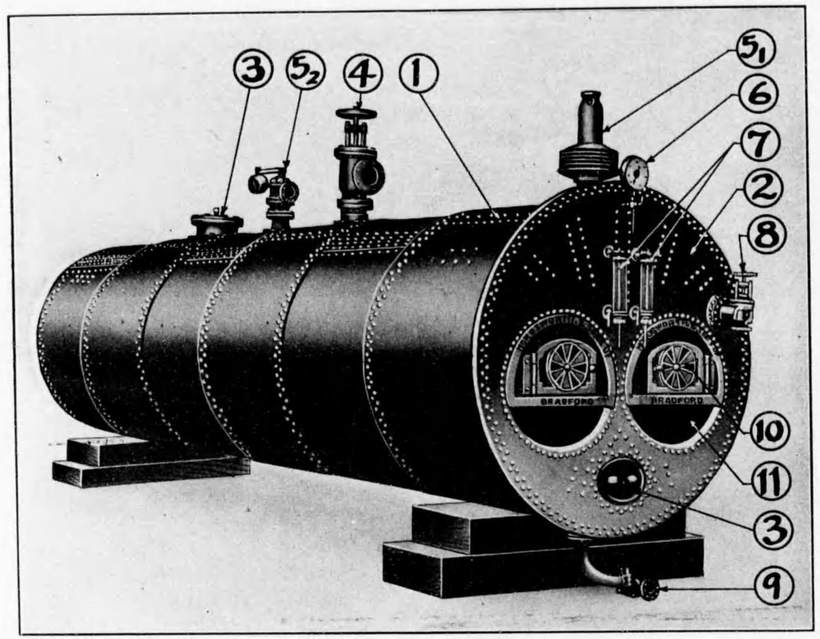


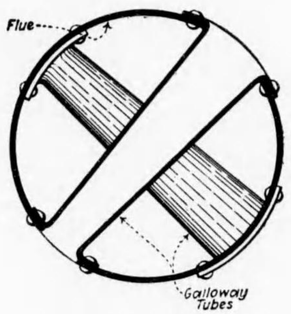
Fig. 136. Lancashire boiler.

(A)



1. Boiler shell.
2. End plate.
3. Man hole and door.
4. Steam stop valve.
5₁. Safety valve.
5₂. „ „
6. Pressure gauge.
7. Water gauge.
8. Feed water check valve.
9. Bottom blow valve.
10. Furnace door.
11. Ash pit.

(C)



(B)

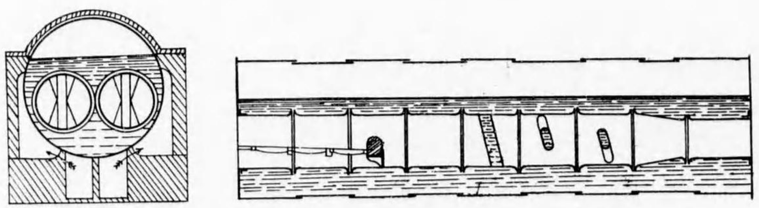
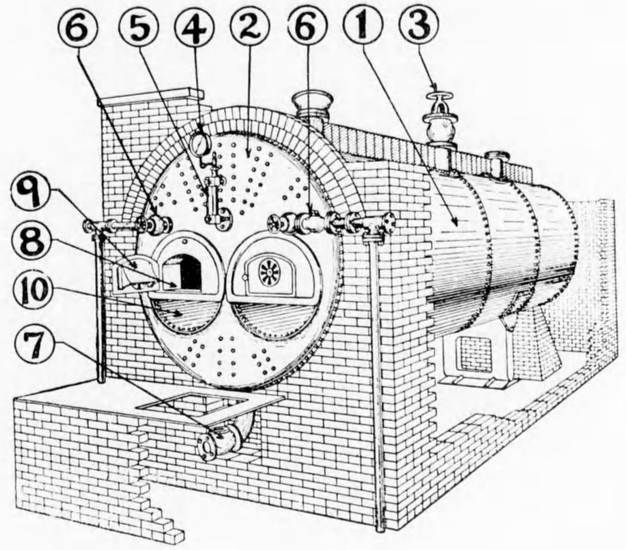
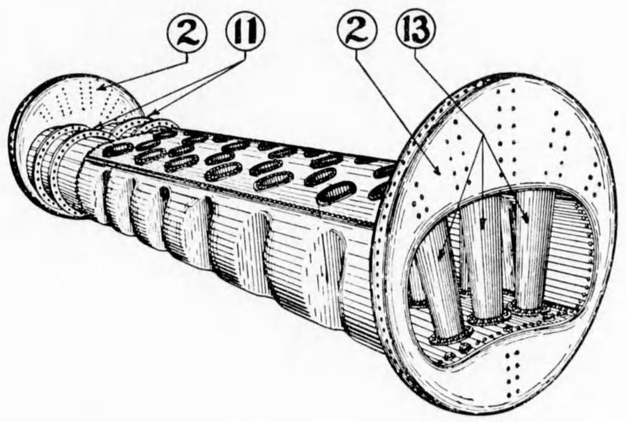


Fig. 137. Galloway boiler.

(A)



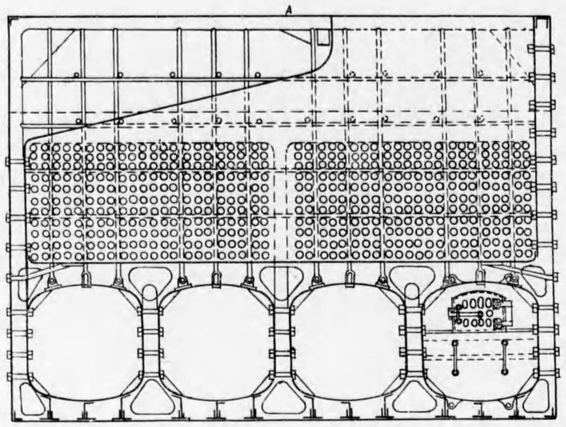
(B)



1. Boiler shell.
2. End plate.
3. Steam stop valve.
4. Pressure gauge.
5. Water gauge.
6. Feed water check valve.
7. Bottom blow valve.
8. Furnace mouth.
9. Furnace door showing baffle plate.
10. Ash pit.
11. Furnace flue.
13. Galloway tube.

Fig. 138. (A)

Rectangular Boiler.



(B)

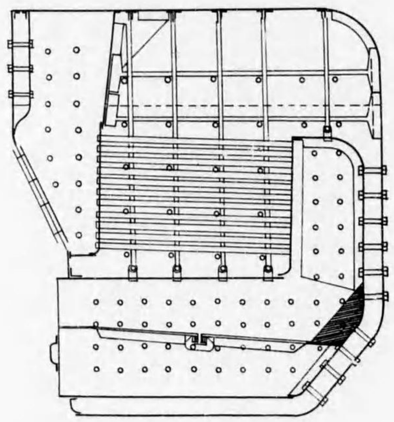


Fig. 139.

Oval boiler.

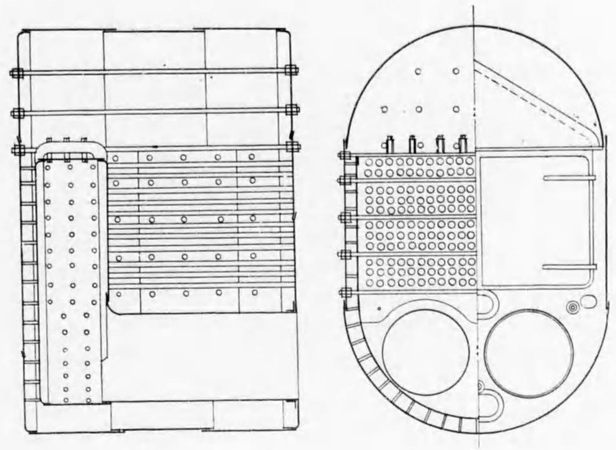
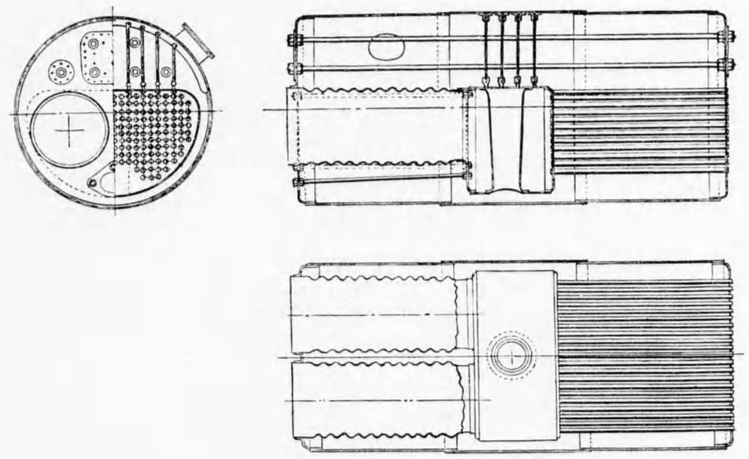


Fig. 140.

Gunboat or throngh tube boiler.



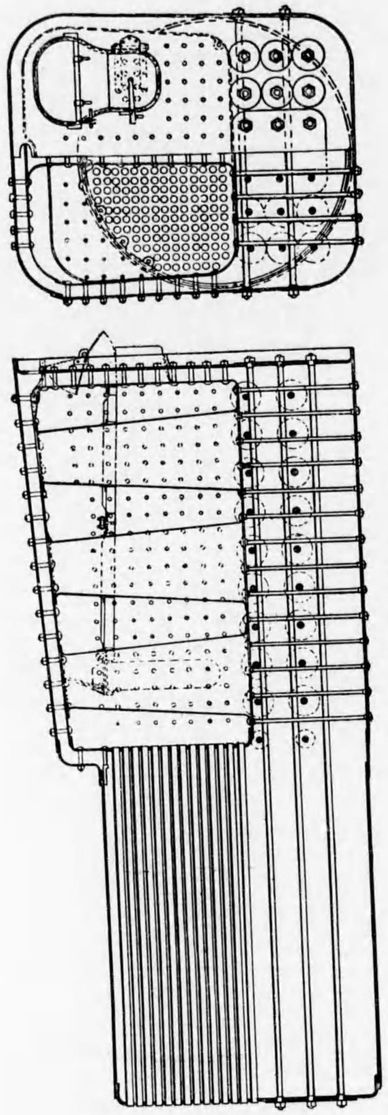


Fig. 141.

Marine locomotive boiler.

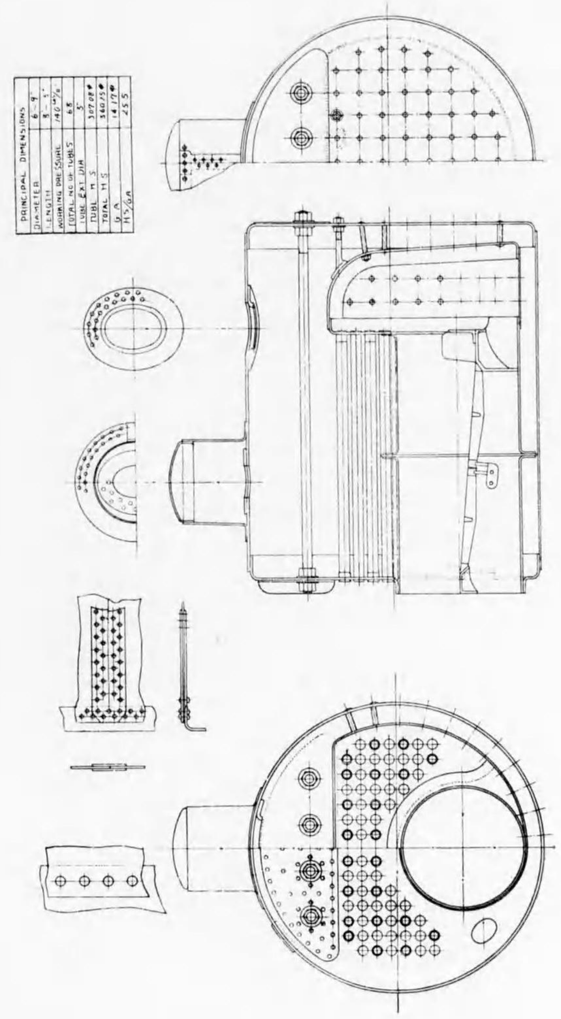


Fig. 142.

Single furnace marine Scotch boiler.

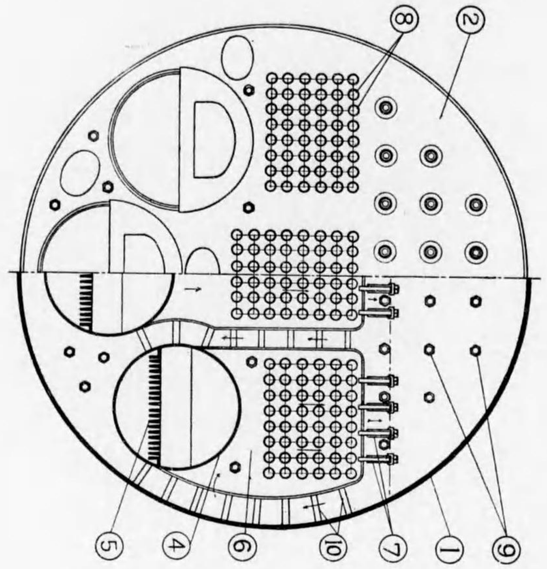
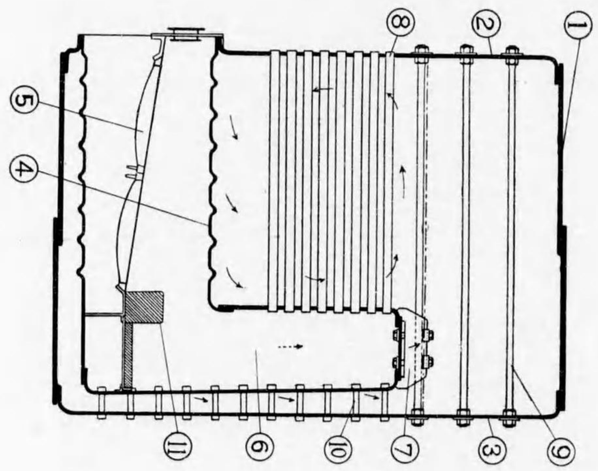


Fig. 143.

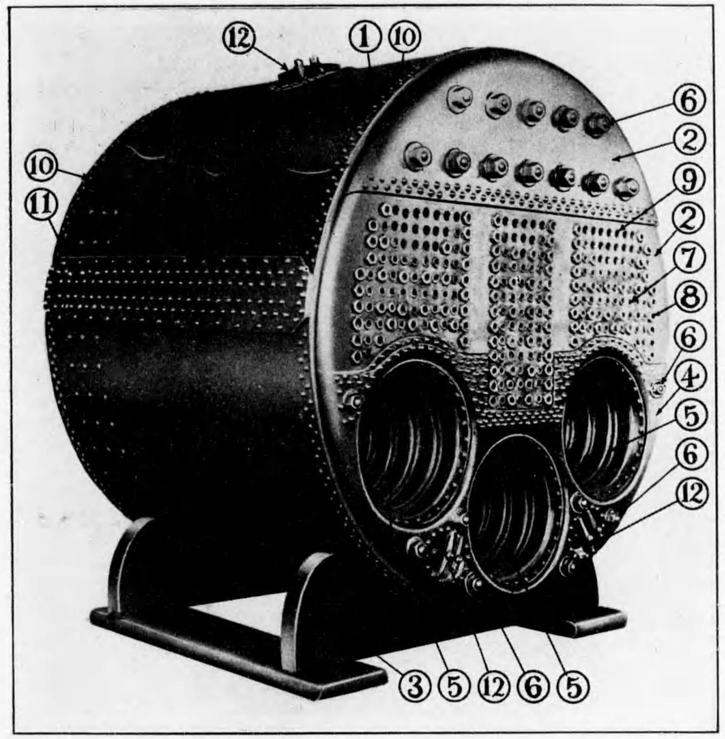
Single-ended marine cylindrical boiler.



1. Shell plate.
2. Front end plate.
3. Back end plate.
4. Corrugated furnace.
5. Fire bar.
6. Combustion chamber.
7. Girder stay.
8. Smoke tube.
9. Main stay.
10. Small stay or screw stay.
11. Fire bridge.

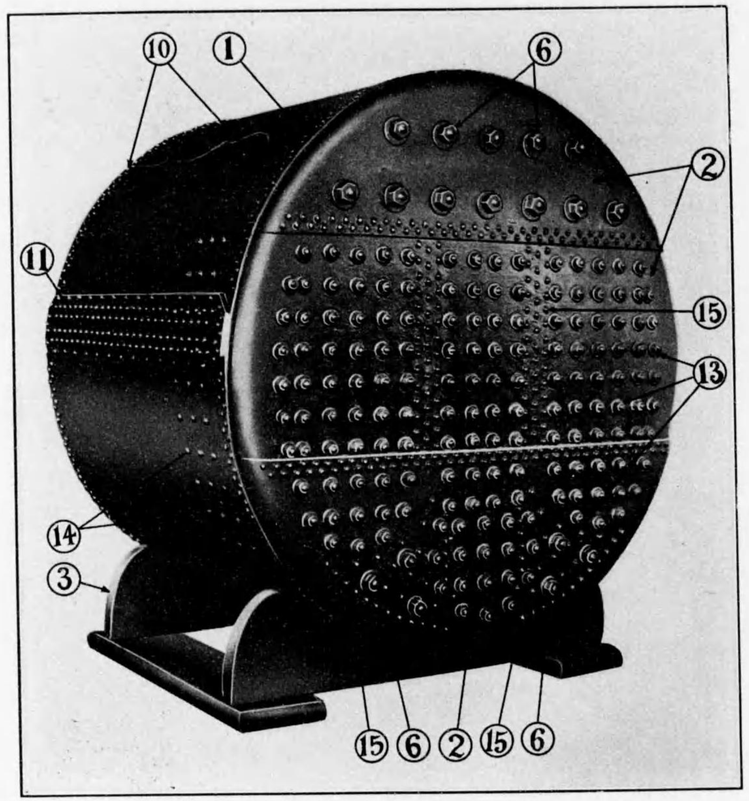
Fig. 144. (A)

Marine Scotch boiler.



1. Shell plate.
2. End plate.
3. Saddle.
4. End plate for furnace.
5. Corrugated furnace.
6. Nut of main stay.
7. Smoke tube.

Fig. 144. (B)

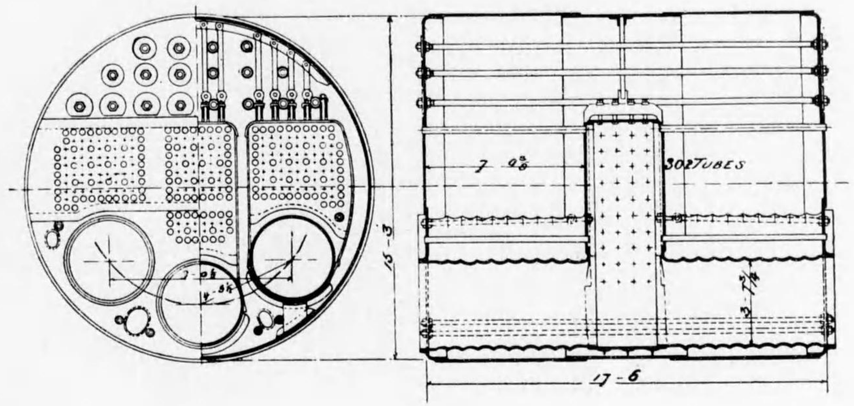


8. Stay tube.
9. Tube plate; end plate for tubes.
10. Circumferential joint.
11. Longitudinal joint.
12. Man hole, door and dog stay.
13. Nut of small stay.
14. Rivetted head of small stay.
15. Rivet of doubling plate.

Fig. 145.

Double-ended marine cylindrical boiler.

(A) Common combustion chamber.



(B) Separate combustion chamber.

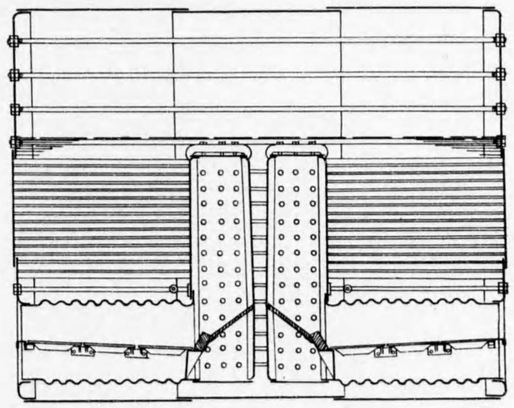
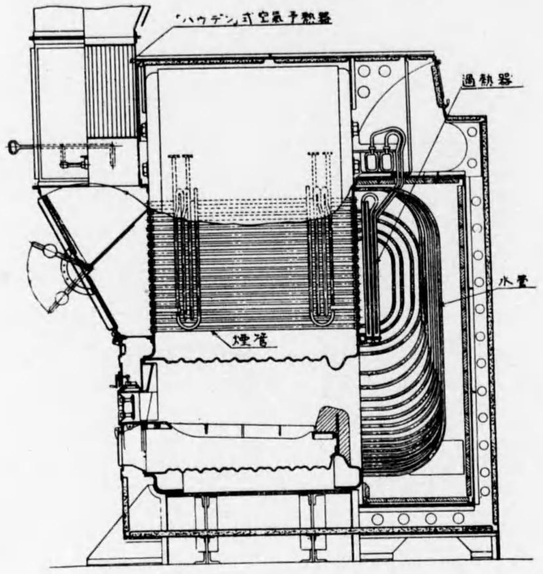


Fig. 146.

Howden-Johnson boiler.



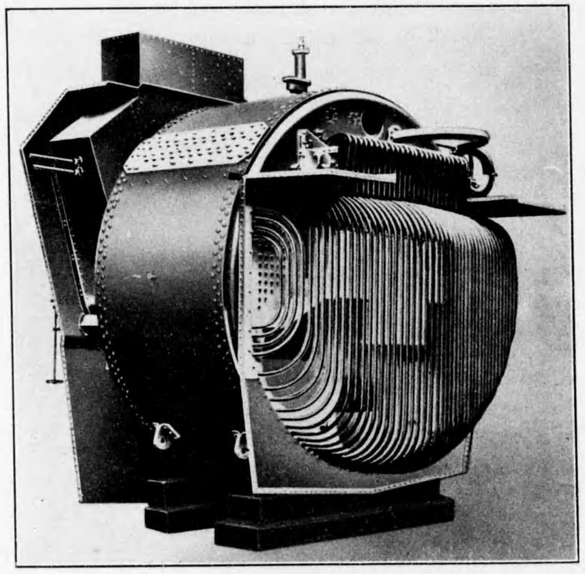
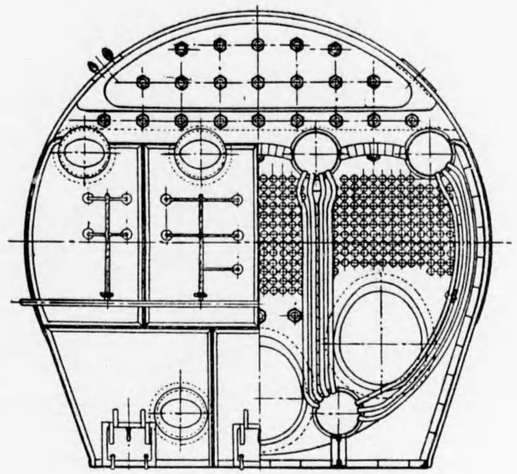


Fig. 147. (A)

Three-furnace Prudhon-Capus. boiler.



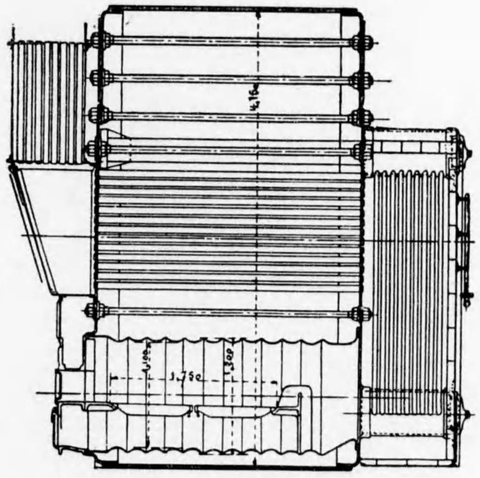
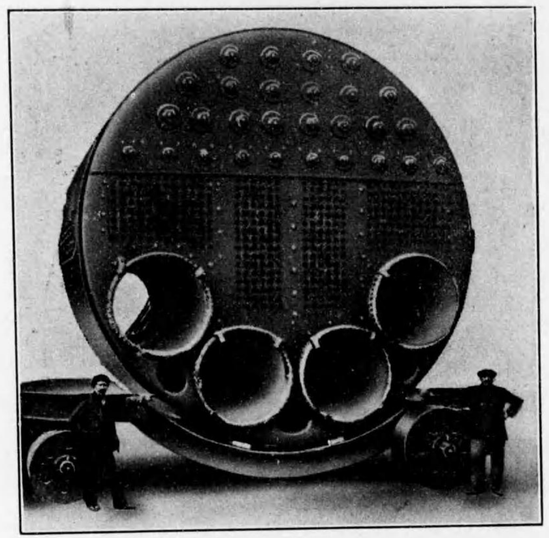
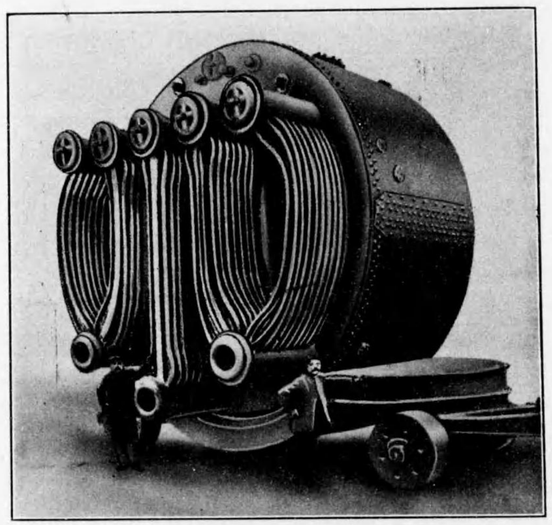


Fig. 147. (B)

Four-Furnace Prudhon-Capus Boiler.



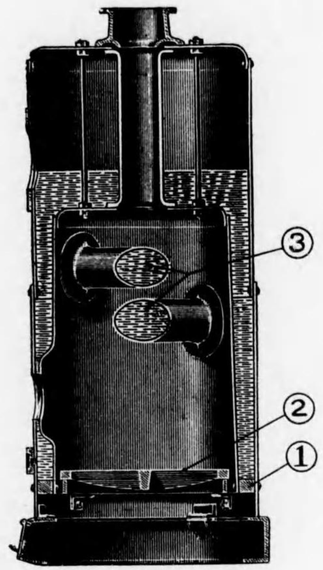
Front View.



Back View showing Water Tubes.

Fig. 148.

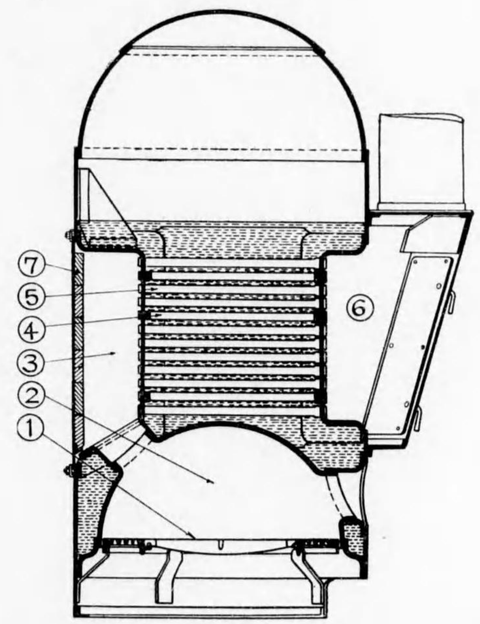
Vertical cross tube boiler.



1. Ogee ring.
2. Fire grate.
3. Cross tube.

Fig. 149.

Cochran vertical boiler.



1. Fire grate.
2. Fire box.
3. Combustion chamber.
4. Stay tube.
5. Plain tube.
6. Smoke box.
7. Brick work.

(A)

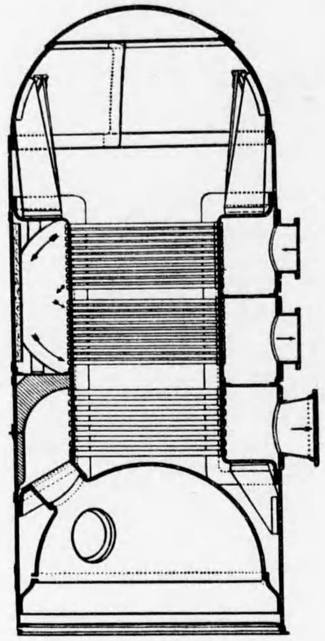


Fig. 150.

Exhaust boiler.

(B)

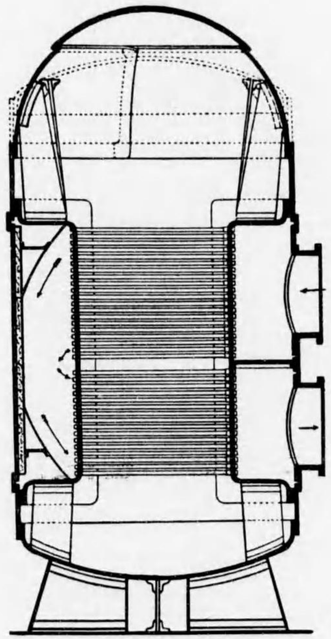
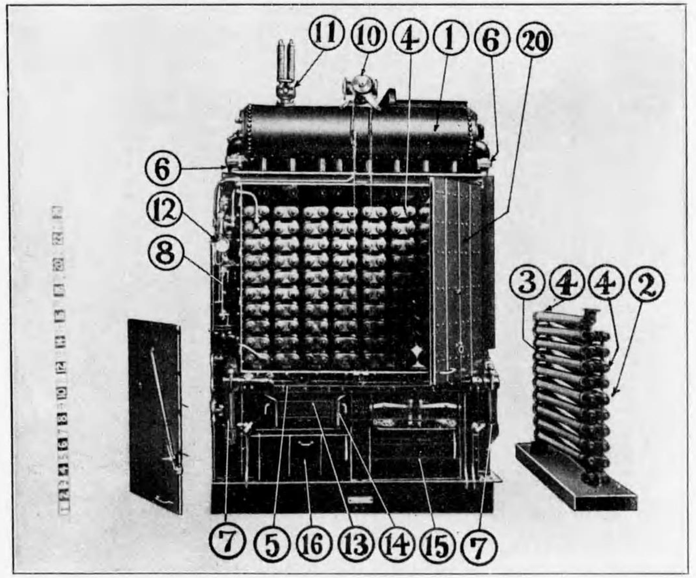


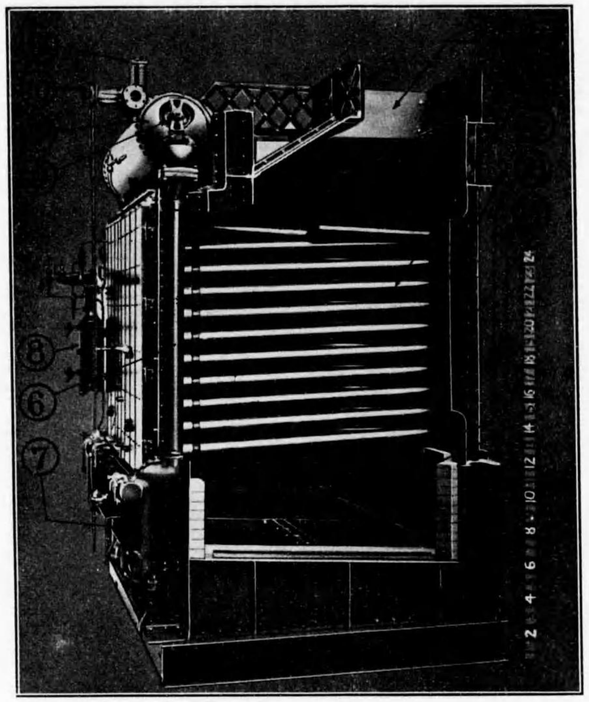
Fig. 151. (A)

Belleville boiler.



1. Steam drum.
2. Element.
3. Water tube.
4. Junction box.
5. Feed water collector.
6. Down comer.
7. Sediment chamber.
8. Water gauge and feed water regulator.
9. Man hole, man hole door and dog stay.
10. Steam stop valve.

Fig. 151. (B)

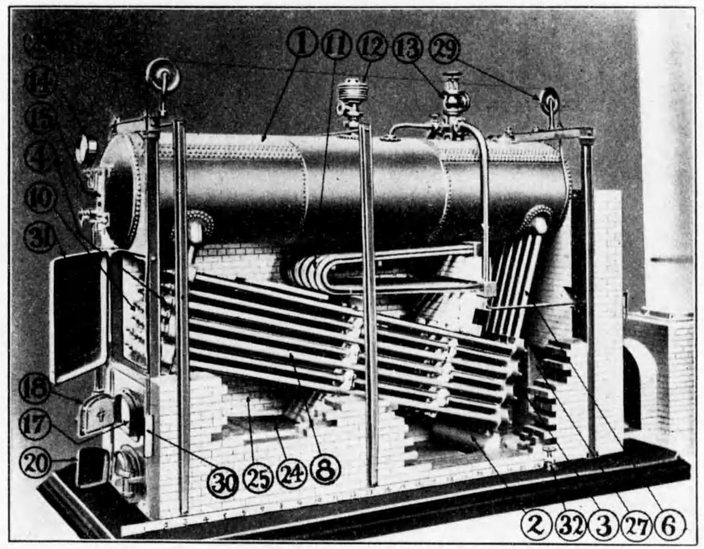


11. Safety valve.
12. Pressure gauge.
13. Furnace.
14. Furnace door.
15. Ash pit.
16. Ash pit door.
17. Fire grate.
18. Furnace.
19. Uptake.
20. Smoke box door.

Fig. 152. (A)

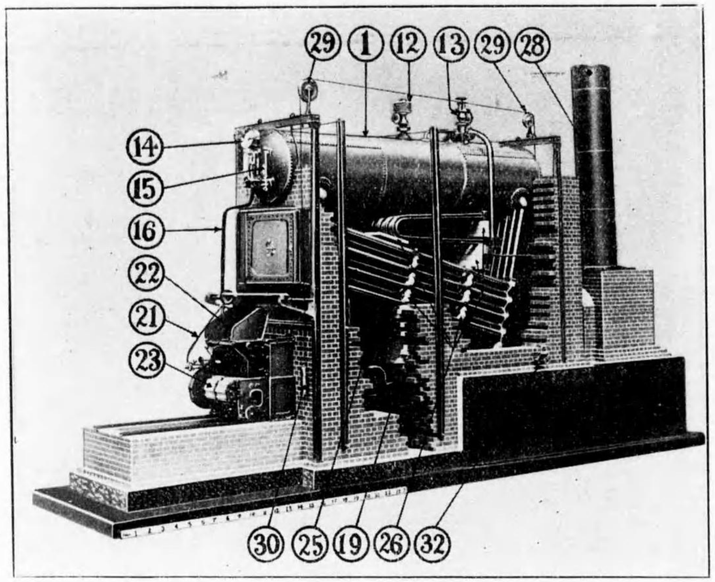
Babcock & Wilcox boiler.

(Long drum or land type.)



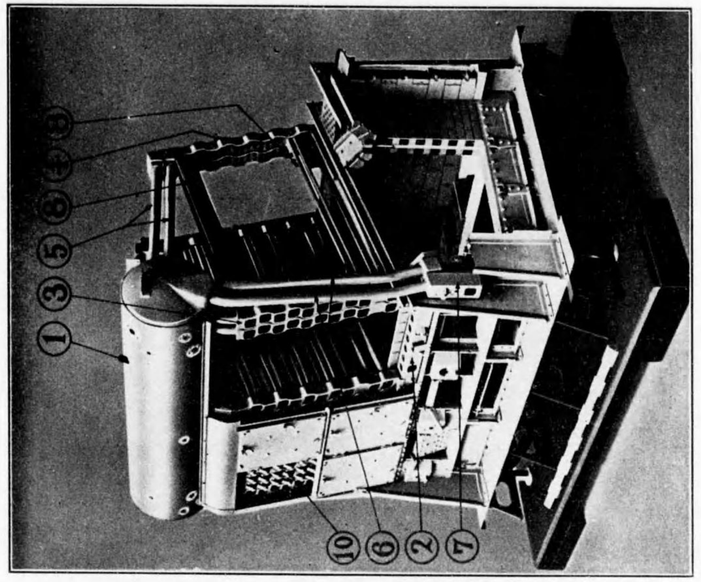
1. Steam drum.
2. Water drum.
3. Down cast header.
4. Up cast header.
6. Down cast tube.
8. Water tube.
10. Dog and hand hole door.
11. Super heater.
12. Safety valve.
13. Steam stop valve.
14. Pressure gauge.
15. Water gauge.
16. Water gauge pipe.
17. Furnace.
18. Furnace door.

Fig. 152. (B)



19. Ash pit.
20. Ash pit door.
21. Mechanical stoker.
22. Hopper of mechanical stoker.
23. Chain grate of mechanical stoker.
24. Fire grate.
25. Furnace.
26. Smoke baffle.
27. Smoke flue to funnel.
28. Funnel.
29. Pulley and rope of funnel damper.
30. Balance weight of funnel damper.
31. Smoke box door.
32. Blow valve.

Fig. 153. (B)

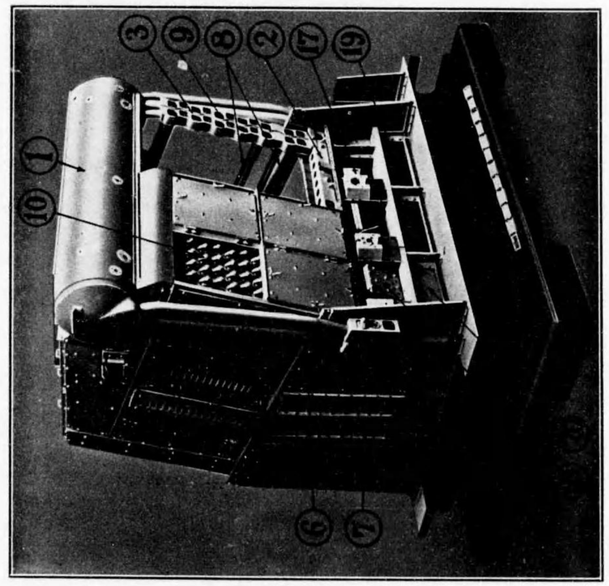


17. Furnace.
18. Furnace door.
19. Ash pit.
20. Ash pit door.

Fig. 153. (A)

Babcock & Wilcox boiler.

(Cross tube or marine type).



1. Steam drum.
2. Water drum.
3. Down cast header.
4. Upcast header.
5. Return tube.
6. Down comer.
7. Sediment collector.
8. Water tube.
9. Hand hole.
10. Dog and hand hole door.

Fig. 154.

B. & W. High pressure boiler.

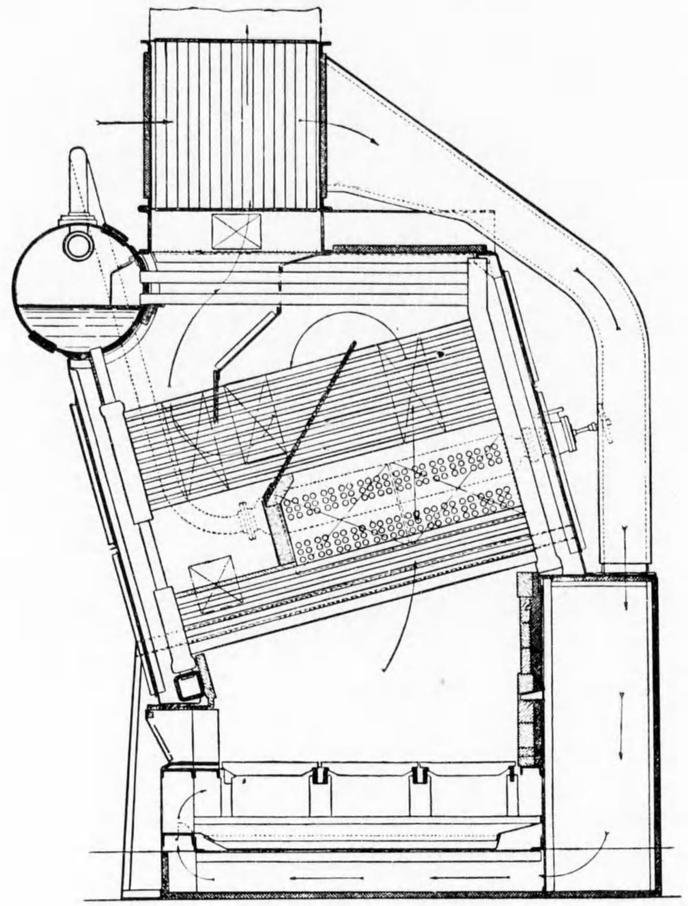
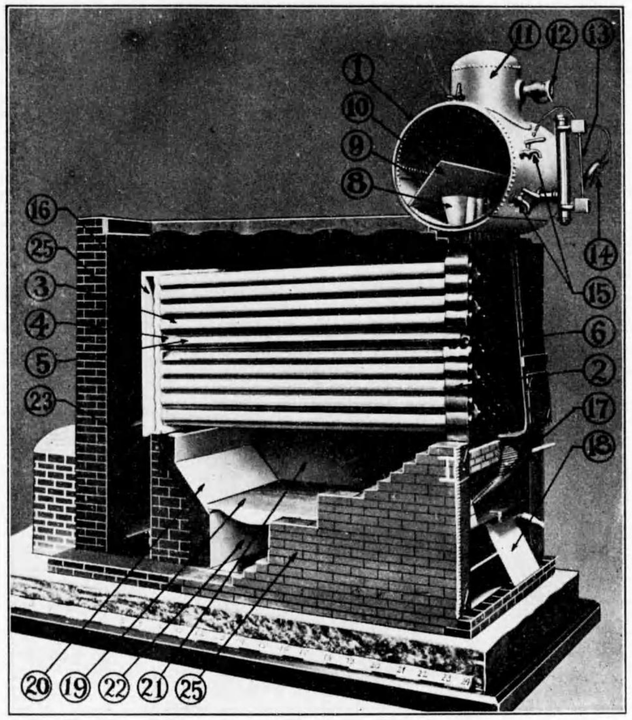


Fig. 155. (A)

Niclausse boiler.



1. Steam drum.
2. Header.
3. Field tube.
4. Generator tube.
5. Circulating tube.
6. Header.
7. Mud drum.
8. Circulation guide.
9. Setting chamber.
10. Division plate.
11. Steam dome.
12. Steam stop valve.
13. Water gauge.
14. Pressure gauge.
15. Test cock.
16. Smoke baffle.
17. Furnace door.
18. Ash pit door.
19. Fire grate.
20. Fire bridge.
21. Furnace.
22. Ash pit.
23. Smoke flue.
24. Uptake.
25. Boiler casing.

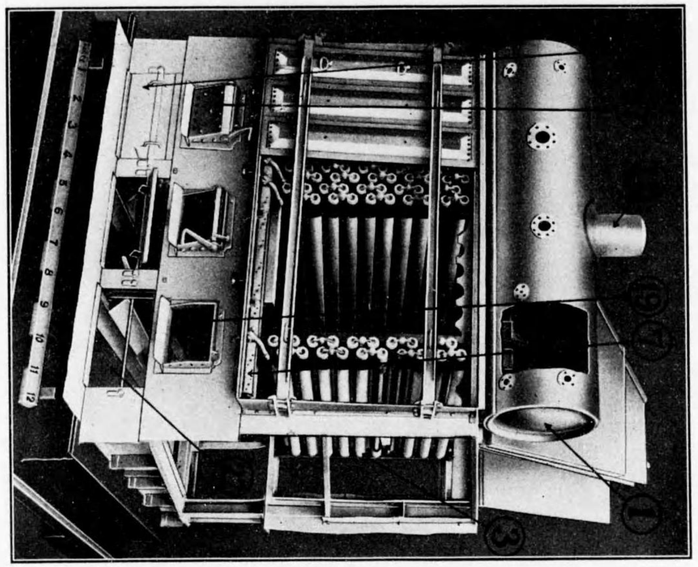


Fig. 155. (B) Niclausse boiler.

1. Steam drum.
2. Header.
3. Field tube.
7. Mud drum.

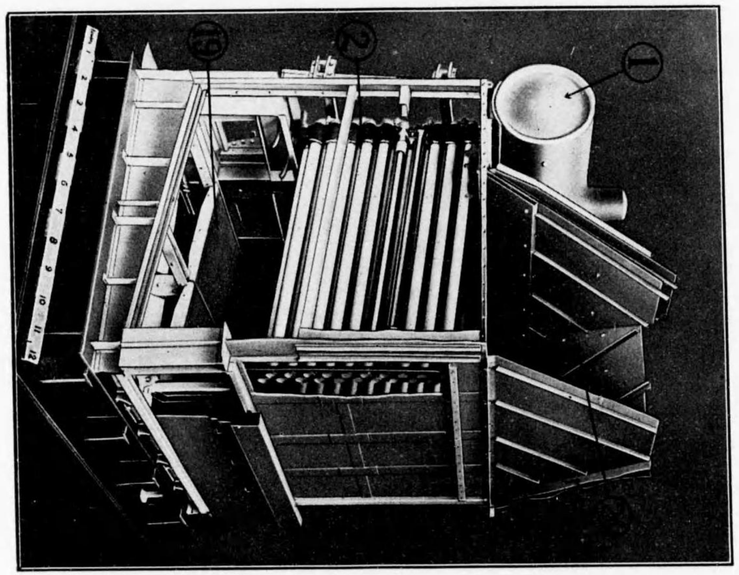
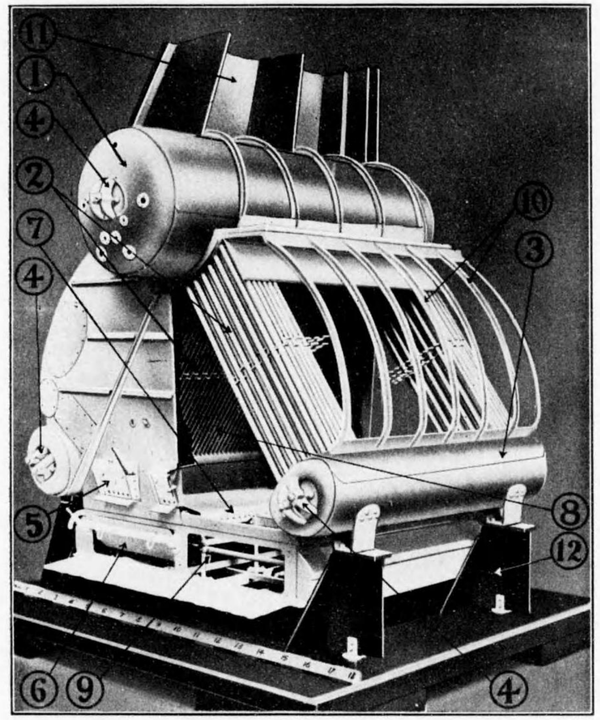


Fig. 155. (C)

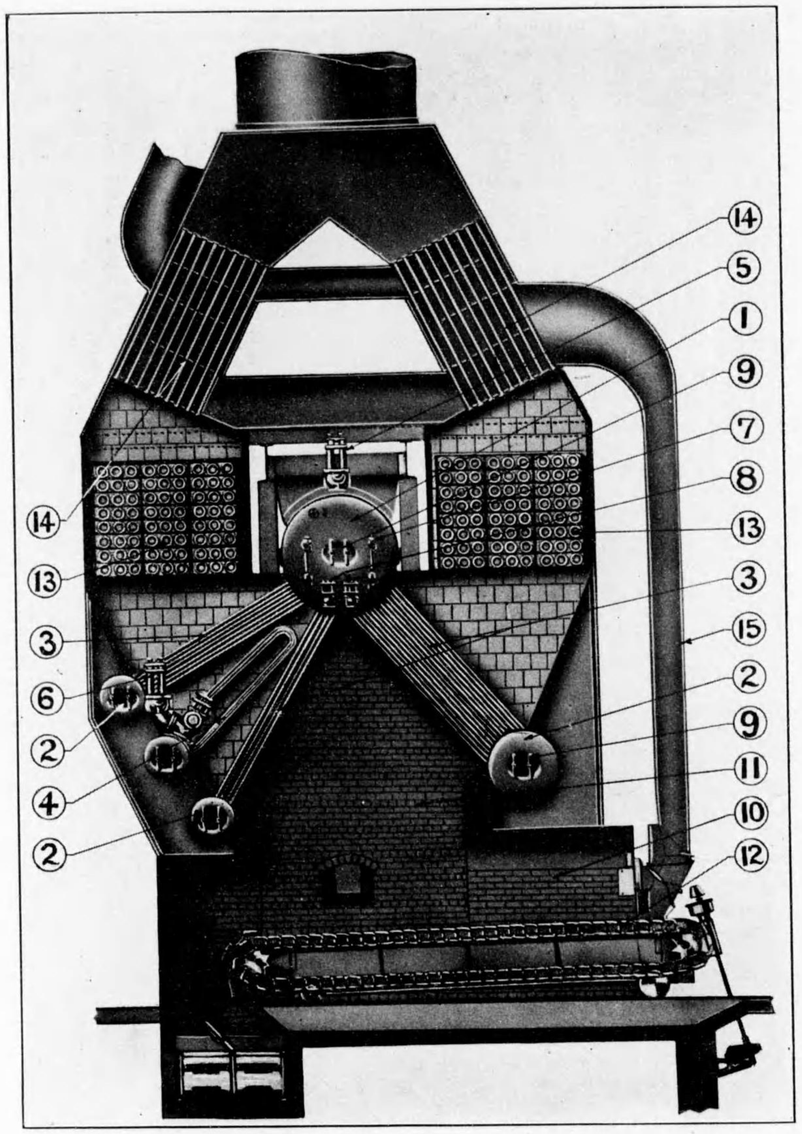
11. Steam dome.
17. Furnace door.
18. Ash pit door.
19. Fire grate.
22. Ash pit.
21. Uptake.

Fig. 156. (A) Yarrow boiler.



1. Steam drum.
2. Water tube.
3. Water drum.
4. Man hole, door and dog stays.
5. Furnace door.
6. Ash pit door.
7. Fire grate.
8. Furnace or combustion chamder.
9. Ash pit.
10. Frame of casing.
11. Uptake.
12. Boiler saddle.

Fig. 156. (B) Yarrow boiler.



1. Steam drum.
2. Water drum.
3. Water tube or generating tube.
4. Superheater.
5. Safety valve.
6. Safety valve of superheater.
7. Water gauge.
8. Feed water check valve.
9. Man hole, door and dog.
10. Furnace.
11. Combustion chamber.
12. Chain grate stoker.
13. Feed water heater.
14. Air heater.
15. Air passage.

Fig. 156. (C)

Yarrow boiler for 1,000 lbs. per sq. in. working pressure.

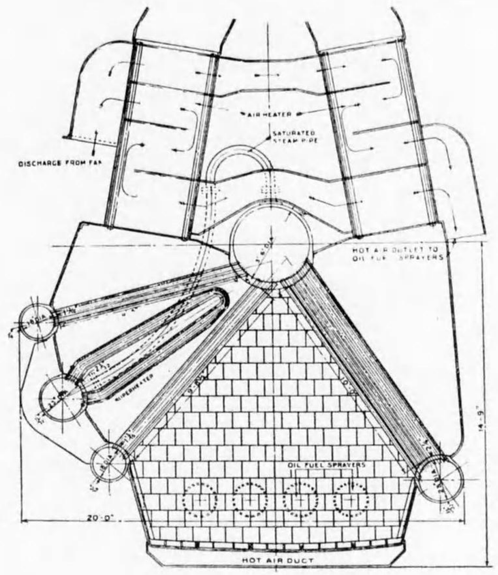
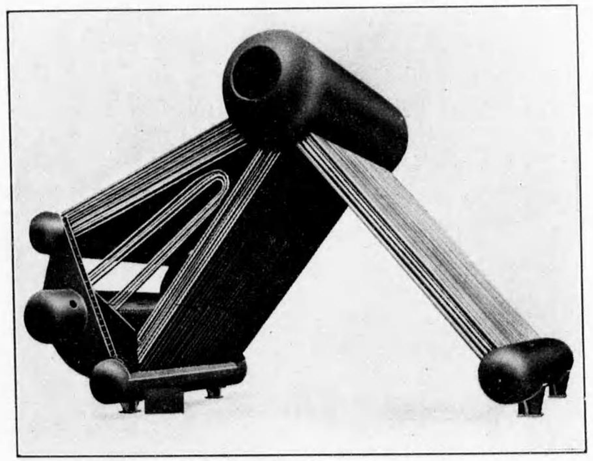


Fig. 156. (D)

Yarrow boiler in coarse of construction.



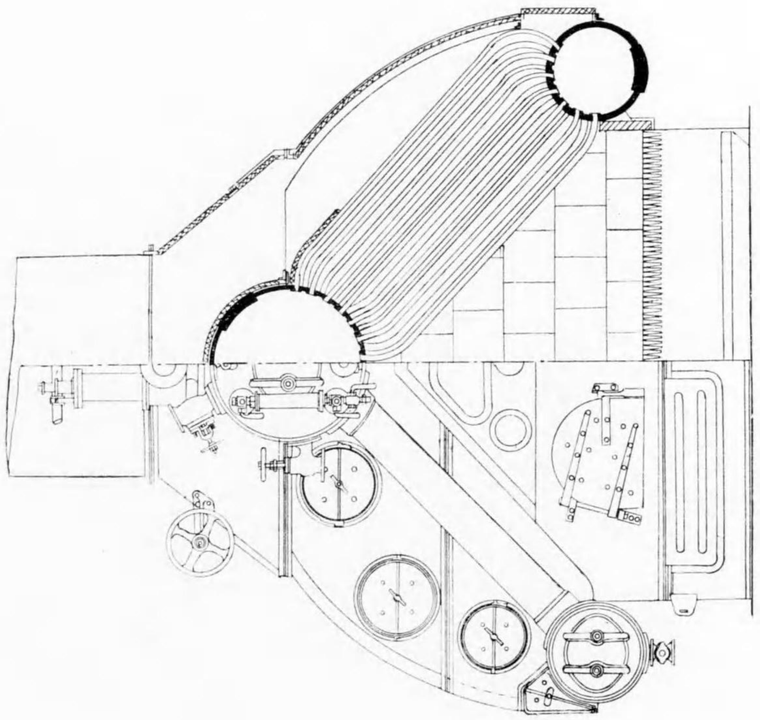
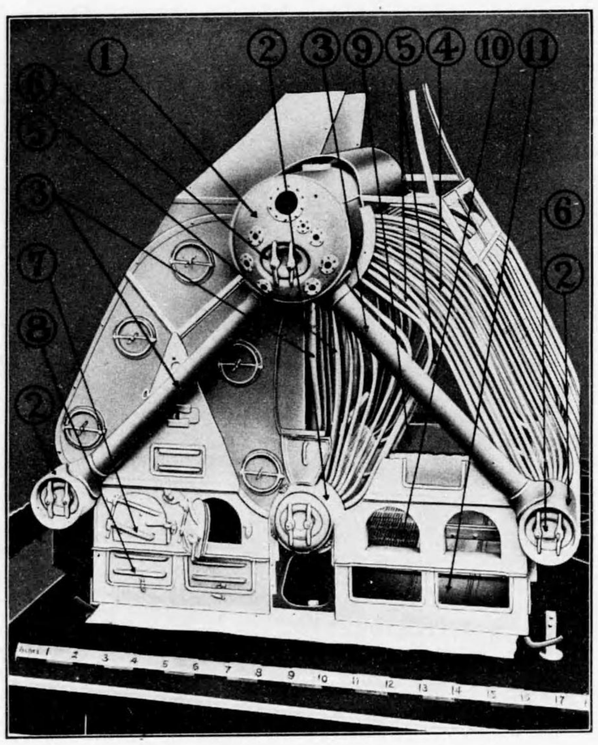
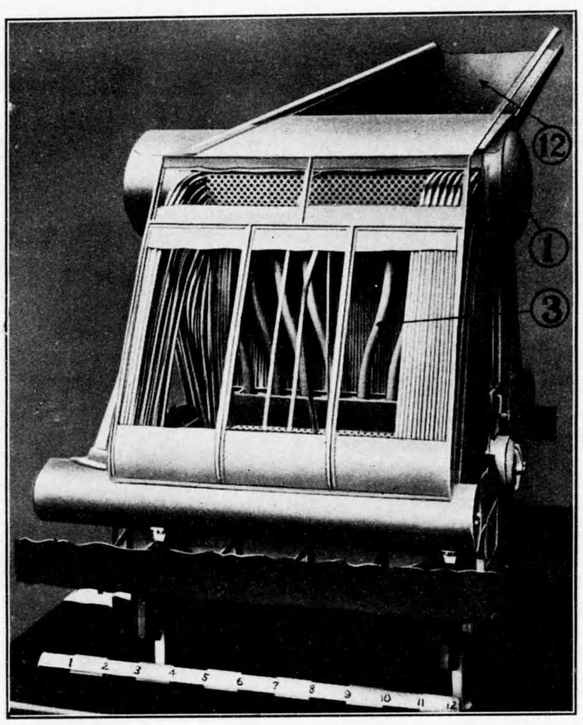


Fig. 157. (B)
Improved Thornycroft Boiler.

Fig. 157. (A) Thornycroft boiler.

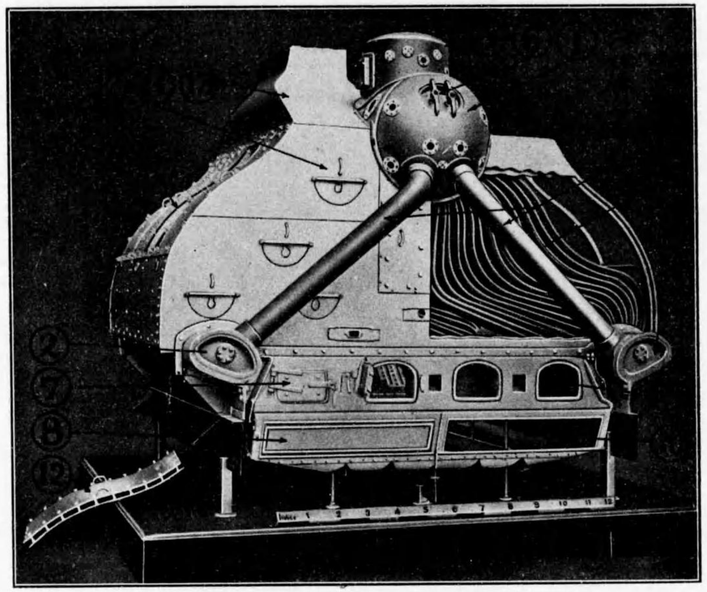




1. Steam drum.
2. Water drum.
3. Down comer.
4. Water tube or generating tube.
5. Water wall.
6. Man hole, door & dog stays.
7. Furnace door.
8. Ash pit door.
9. Fire bridge.
10. Fire grate and furnace.
11. Ash pit.
12. Uptake.

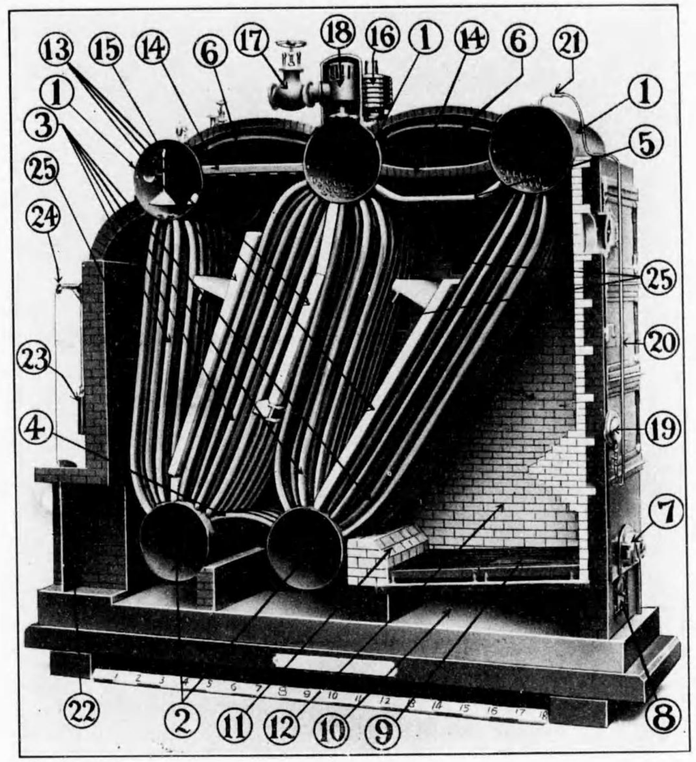
Fig. 158.

Reed boiler.



1. Steam drum.
2. Water drum.
3. Down comer.
4. Generating tube or water tube.
5. Steam dome.
6. Man hole, door and dogs.
7. Furnace door.
8. Ash pit door.
9. Furnace.
10. Ash pit.
11. Soot door.
12. Casing door.
13. Uptake.

Fig. 159. Stirling boiler.



1. Steam drum.
2. Water drum.
3. Generating tube or water tube.
4. Lower communication tube.
5. Upper communication tube.
6. Steam communication tube.
7. Furnace door.
8. Ash pit door.
9. Fire grate.
10. Ash pit.
11. Fire bridge.
12. Furnace and combustion chamber.
13. Smoke baffle.
14. Ceiling of combustion chamber.
15. Feed water regulator.
16. Safety valve.
17. Steam stop valve.
18. Internal separator.
19. Pressure gauge.
20. Pressure gauge pipe.
21. Pressure gauge cock.
22. Funnel damper.
23. Ballance weight of funnel damper.
24. Pulley and rope of funnel damper.
25. Soot hole.

Fig. 160.

Takuma's Boiler.

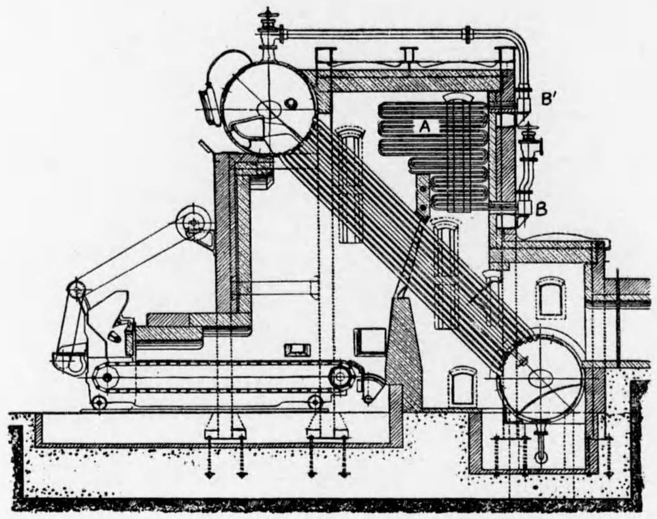


Fig. 161.

三菱陸用三胴罐

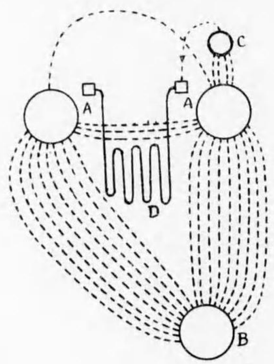
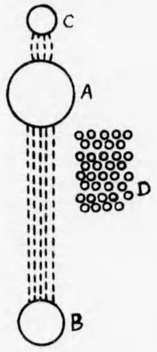
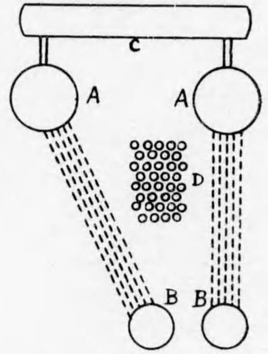


Fig. 162. Garbe boiler.

Single bunk.



Double bunks.



A. Steam drum.
B. Water drum.
C. Steam collector.
D. Superheater.

Fig. 163.

三菱舶用三胴罐 (大阪商船株式會社汽船 黒龍丸鴨緑丸据付)

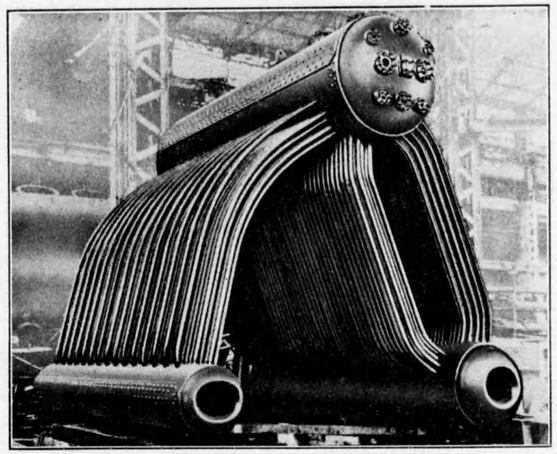
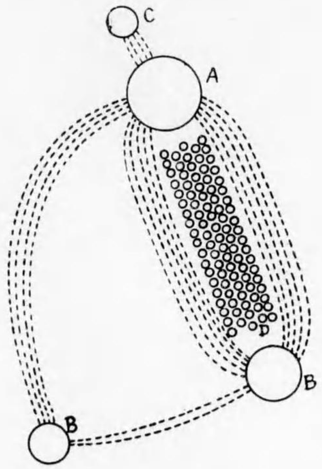
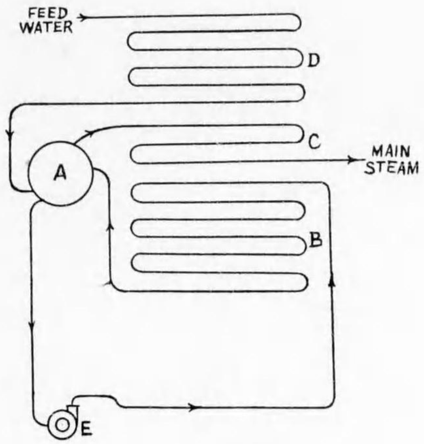


Fig. 164. Wagner bailer.



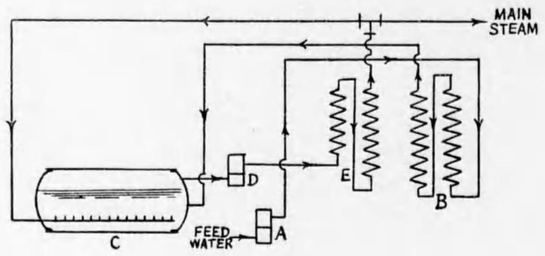
A. Steam drum.
B. Water drum.
C. Steam collector.
D. Superheater.

Fig. 165. La-Mont boiler.



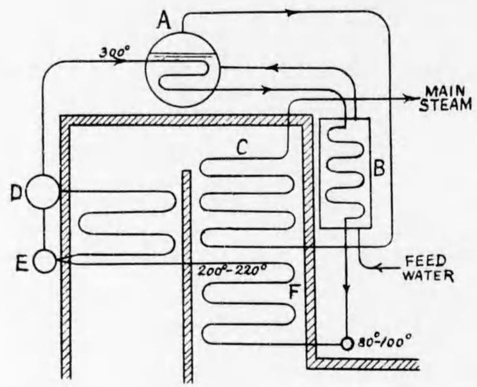
A. Steam drum.
B. Evaporating tube.
C. Superheater.
D. Economizer.
E. Water circulating pump.

Fig. 166. Löffler boiler.



A. Feed pump.
B. Economizer.
C. Evaporating drum.
D. Steam circulating pump.
E. Superheater.

Fig. 167. Schmidt-Hartmann boiler.



A. Boiler drum.
B. Feed preheater.
C. Superheater.
D. Steam drum.
E. Water drum.
F. Economizer.

Fig. 168. (A)

Benson boiler.

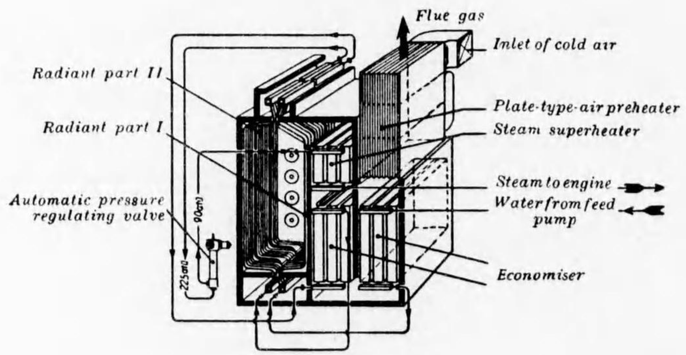
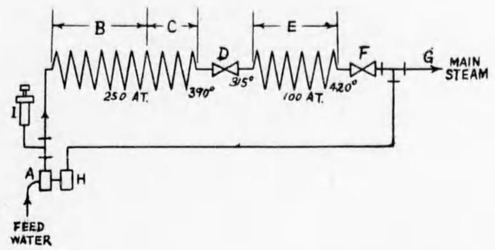


Fig. 168. (B)



A. Feed pump.
B. Economizer and evaporating tube.
C. Primary superheater.
D. Throttling valve.
E. Secondary superheater.
F. Stop valve.
G. Main steam pipe.
H. Steam turbine.
I. Pressure regulator.

Fig. 169.

Tube System of Sulzer Mono-Tube Steam Generator.

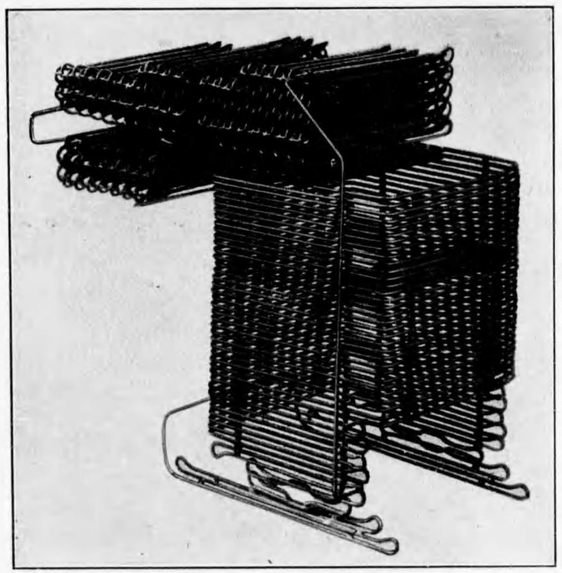
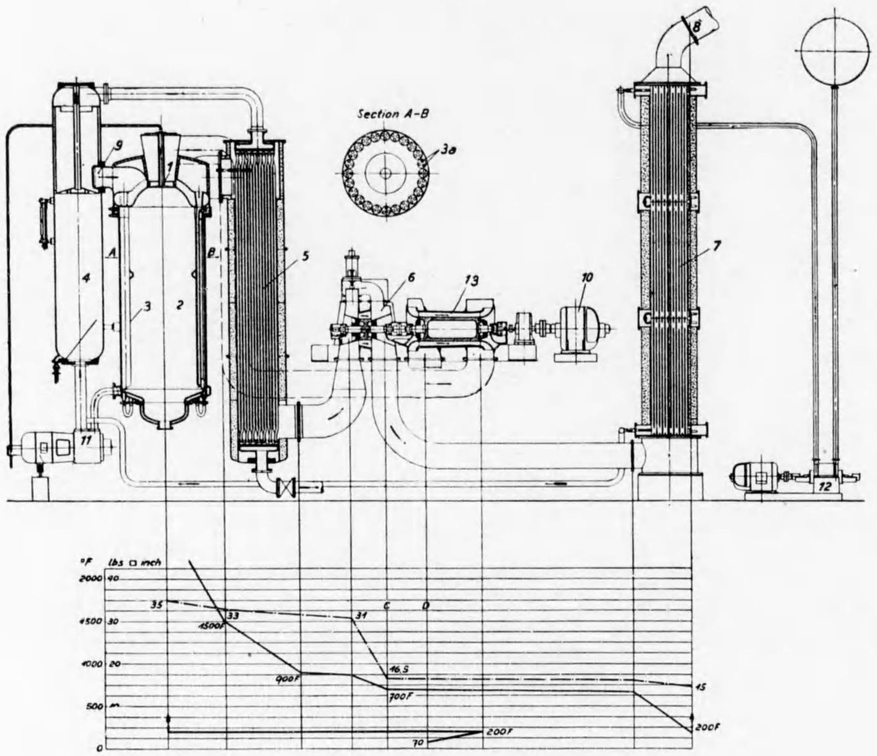


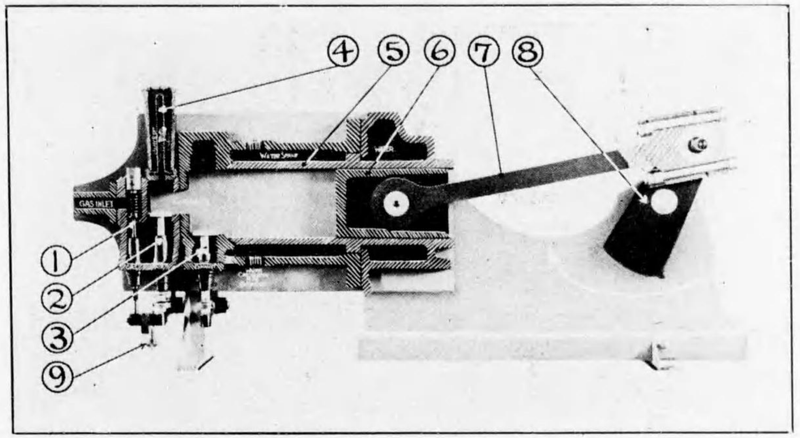
Fig. 170.

Velox steam generator.



1. Oil burner.
2. Combustion chamber.
3. Evaporating tube.
4. Centrifugal steam separator.
5. Superheater.
6. Gas turbine.
7. Economizer.
8. Uptake.
9. Mixture of steam and water outlet.
10. Electric motor.
11. Water circulating and fuel pump.
12. Feed water pump.
13. Turbo-compressor.

Fig. 171.

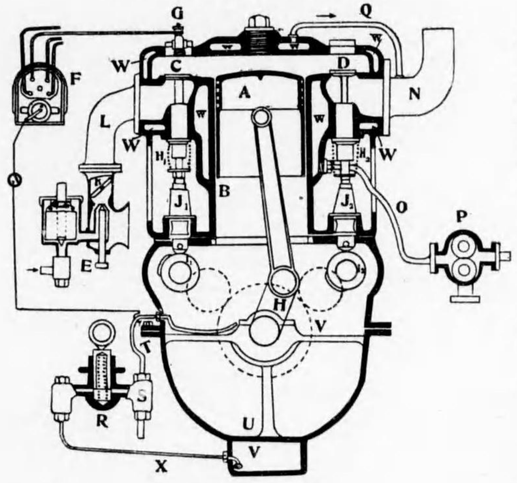


4 Cycle gas engine.

1. Gas inlet valve.
2. Air inlet valve.
3. Exhaust valve.
4. Hot tube.
5. Cylinder.
6. Piston.
7. Connecting rod.
8. Crank.
9. Governor.

Fig. 172.

Four cycle gasoline engine.



A. Piston.
B. Cylinder.
C. Inlet valve.
D. Exhaust valve.
E. Carburetter.
F. Magneto.
G. Spark plug.
H. Crank.
H_1,H_2. Spring.
I_1,I_2. Cam.
J_1,J_2. Push rod.
K. Throttle valve.
L. Inlet pipe.
N. Exhaust pipe.
O. Delivery pipe.
P. Circulating pump.
Q. Cooling water outlet pipe.
R. Lub. Oil pump.
S. Escape valve.
T. Lub. oil pipe.
V. Crank case.
W. Water jacket.

Fig. 173.

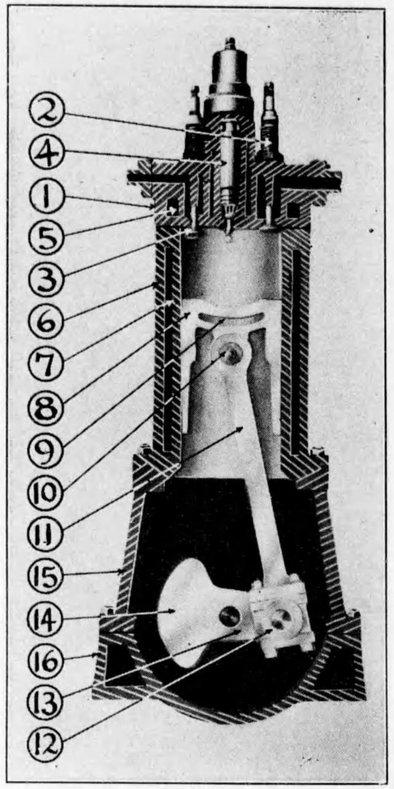
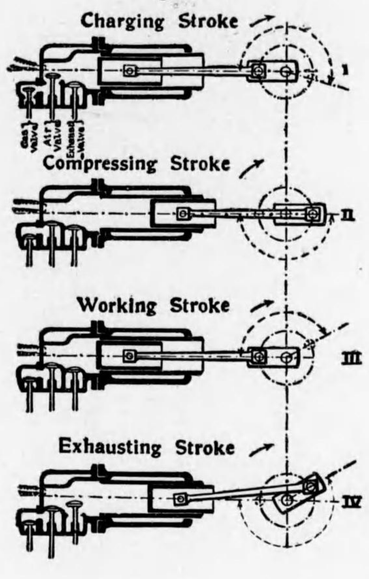


Fig. 174.



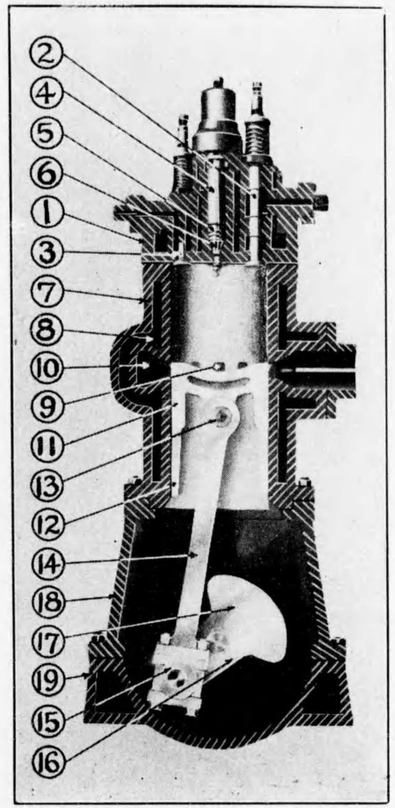
Four stroke cycle.

4 Cycle diesel engine.

1. Cylinder cover.
2. Exhaust valve.
3. Air inlet valve.
4. Fuel valve.
5. Water space.
6. Cylinder.
7. Cylinder cooling space.
8. Piston.
9. Piston cooling space.
10. Piston pin.
11. Connecting rod.
12. Crank brass.
13. Crank web.
14. Balance weight.
15. Crank case.
16. Bed plate.

Fig. 175.

2 CYCLE DIESEL ENGINE.



1. Cylindey cover.
2. Starting air valve.
3. Scavenging valve.
4. Fuel valve.
5. Atomizer ring.
6. Sprayer cone.
7. Cylinder.
8. Water space.
9. Exhaust port.
10. Exhaust belt.
11. Piston.
12. Piston skirt.
13. Piston pin.
14. Connecting rod.
15. Crank brass.
16. Crank.
17. Balance weight.
18. Crank case.
19. Bed plate.

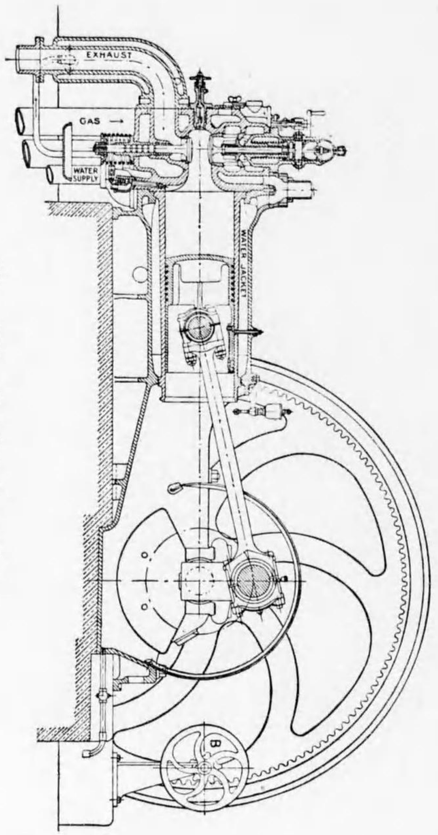
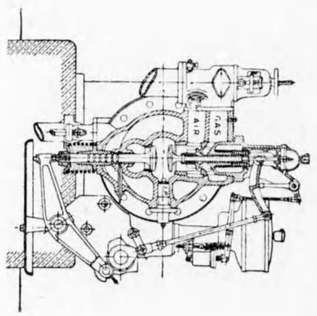


Fig. 177. Crossley gas engine.



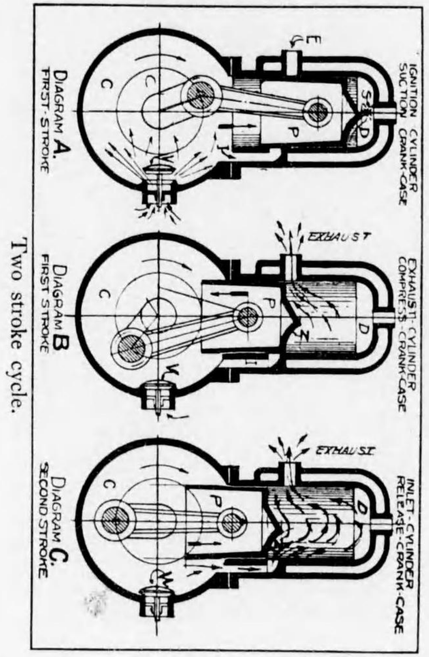
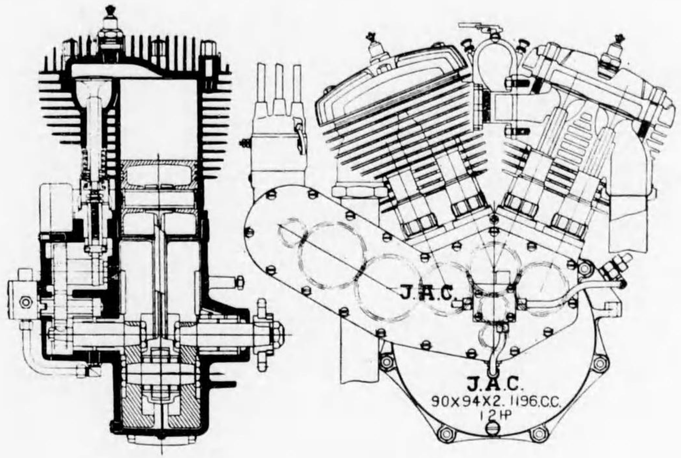


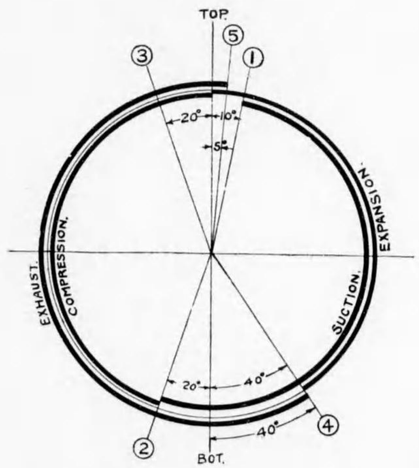
Fig. 176.
Two stroke cycle.

Fig. 178.



J.A.C. 1200 c.c. Motor-cycle engine.

Fig. 179.



Valve timing diagram of gasoline engine

1. Inlet valve opens.
2. Inlet valve closes.
3. Ignition.
4. Exhaust valve opens.
5. Exhaust valve closes.

Fig. 180. (A)

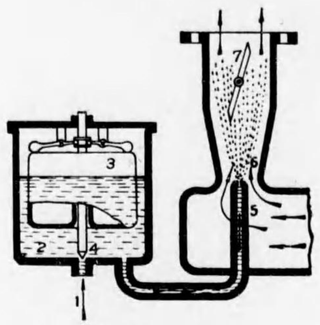
1. Piston.
2. Connecting rod.
3. Crank.
4. Fly wheel.
5. Silent gear.
6. Timing gear.
7. Cam.
8. Inlet valve.
9. Suction manifold
10. Exhaust manifold.
11. Gear lub. oil pump.
12. Starting motor.
13. Distributer.
14. Spark plug.

Automobil gasoline engine.

Fig. 180. (B)

9. Suction manifold.
10. Exhaust manifold.
12. Starting motor.
13. Distributer.
15. Generator.

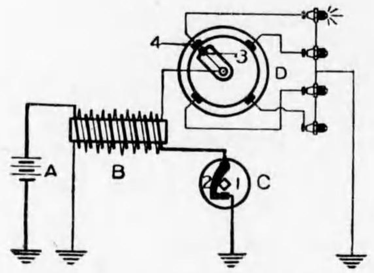
Fig. 181.



1. Fuel supply.
2. Float chamber.
3. Float
4. Needle valve.
5. Nozzle.
6. Choke pipe.
7. Throttle valve.

Simple carburetter.

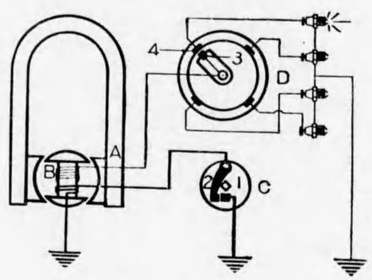
Fig. 182.



Accumulator and coil ignition.

A. Battery.
B. Induction coil.
C. Contact breaker.
D. Distributor.

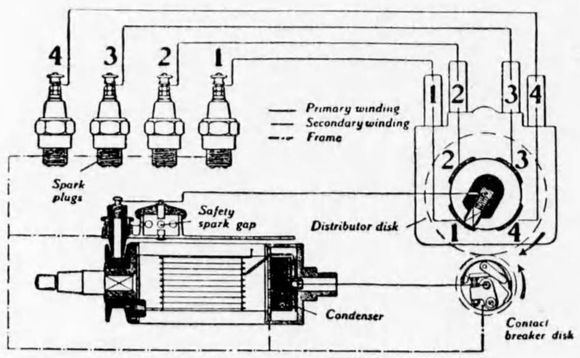
Fig. 183.



High tension magnet ignition

A. Magnet.
B. Winding.
C. Contact breaker.
D. Distributor.

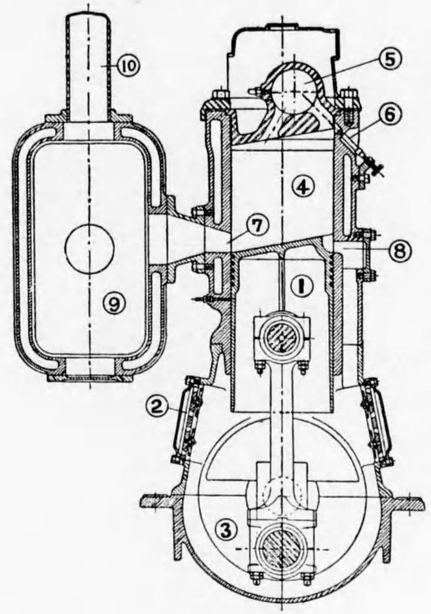
Fig. 184.



Bosch high tension circuit.

Fig. 185. (A)

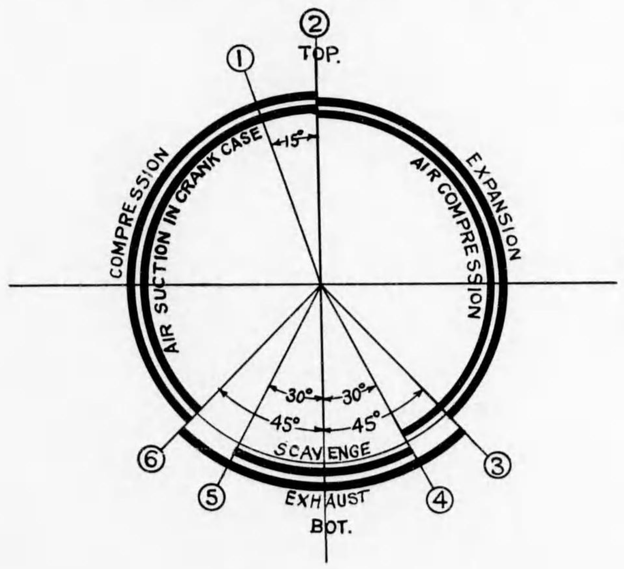
Bolinder hot bulb engine.



① Piston.
② Air inlet valve.
③ Crank case.
④ Cylinder.
⑤ Hot bulb.
⑥ Fuel nozzle.
⑦ Exhaust ports.
⑧ Scavenge ports.
⑨ Silencer.
⑩ Exhaust pipe.

Fig. 185. (B)

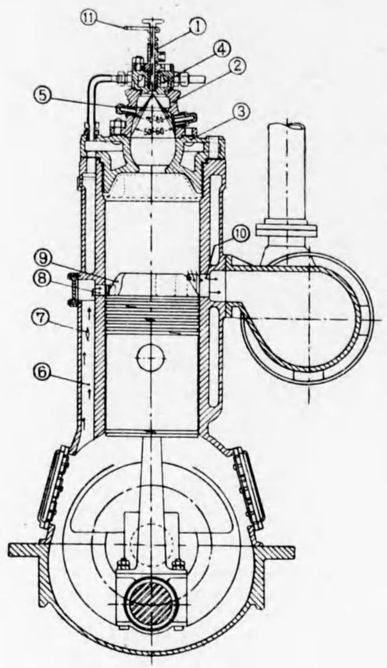
Port opening diagram of Hot-bulb engine.



① Fuel injection begins..
② Fuel injection finish.
③ Exhaust ports open.
④ Scavenge ports open.
⑤ Scavenge ports close.
⑥ Exhaust ports close.

Fig. 186. (A)

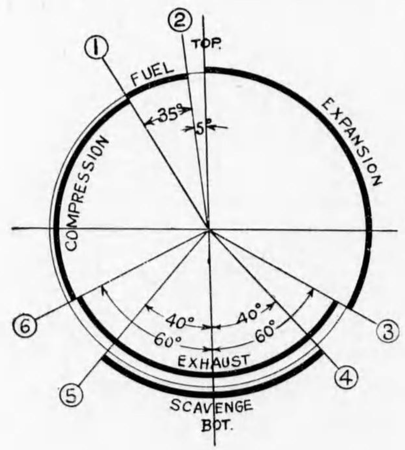
Bolinder semi-diesel engine.



① Nozzle.
② Hot bulb.
③ Cylinder cover.
④ Nozzle cooler.
⑤ Plug.
⑥ Air passage.
⑦ Air damper.
⑧ Scavenge ports.
⑨ Air guide.
⑩ Exhaust ports.
⑪ Nozzle regulator.

Fig. 186. (B)

Port opening diagram of semi-diesel engine.



① Fuel injection begins.
② Fuel injection finish.
③ Exhaust ports open.
④ Scavenge ports open.
⑤ Scavenge ports close.
⑥ Exhaust ports close.

1. Fuel nozzle.
2. Starting valve.
3. Test cock.
4. Scavenge air control handle.
5. Fuel injection pump.
6. Speed controle. handle.
7. Thrust bearing.
8. Reversing gear.
9. Reversing handle.
10. Exhaust pipe.

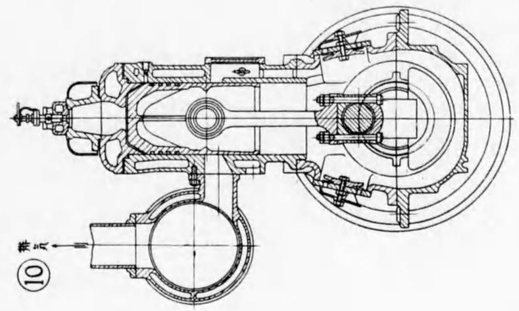
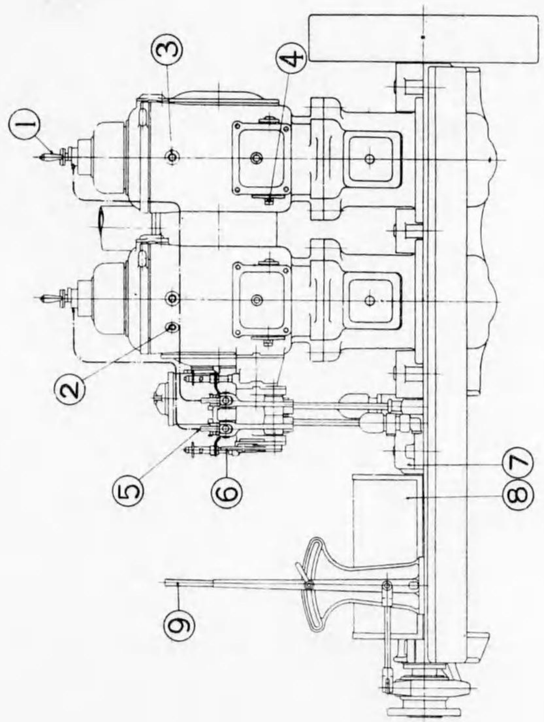
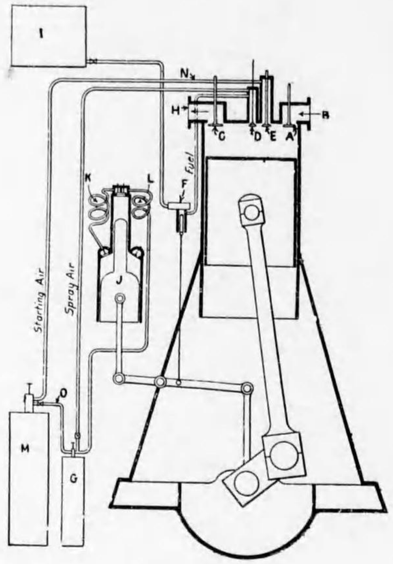


Fig. 187.



Niigata 50 H.P. semi-diesel engine.

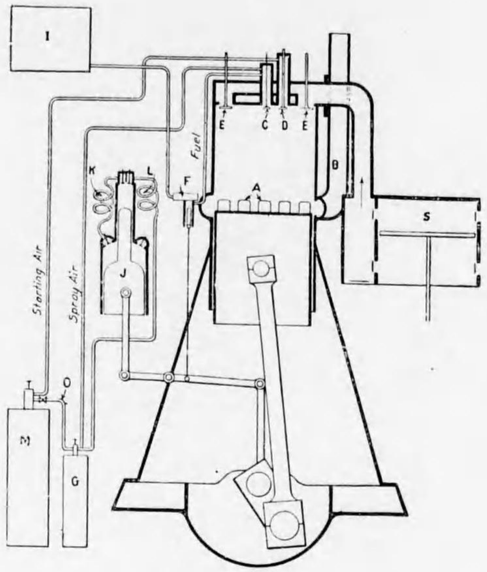
Fig. 188. (A)



Diagramatic sketch of
a four-cycle engine.

A. Air inlet valve.
B. Air inlet.
C. Exhaust valve.
D. Fuel valve.
E. Starting valve.
F. Fuel pump.
G. Injection air bottle.
H. Exhaust outlet.
I. Fuel tank.
J. Air compressor.
K. Inter cooler.
L. After cooler.
M. Starting air reservoir.
N. Starting air pipe.
O. Equalizer pipe.

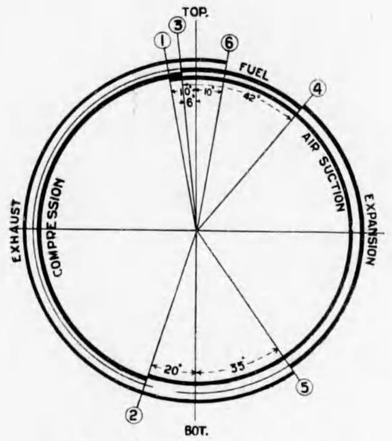
Fig. 189. (A)



Diagramatic sketch of
a two-cycle engine.

A. Exhauat ports.
B. Exhaust pipe.
C. Fuel valve.
D. Starting valve.
E. Scavenge air valve.
F. Fuel pump.
G. Injection air bottle.
I. Fuel tank.
J. Air compressor.
K. Inter cooler.
L. After cooler.
M. Starting air reservoir.
O. Equalizer pipe.

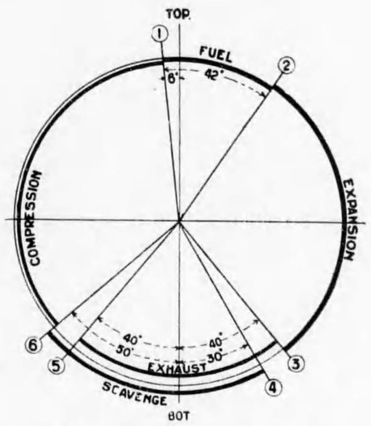
Fig. 188. (B)



Valve Timing Diagram (4 Stroke Cycle)

① Inlet valve opens.
② Inlet valve closes.
③ Fuel valve opens.
④ Fuel valve closes.
⑤ Exhaust valve opens.
⑥ Exhaust valve closes.

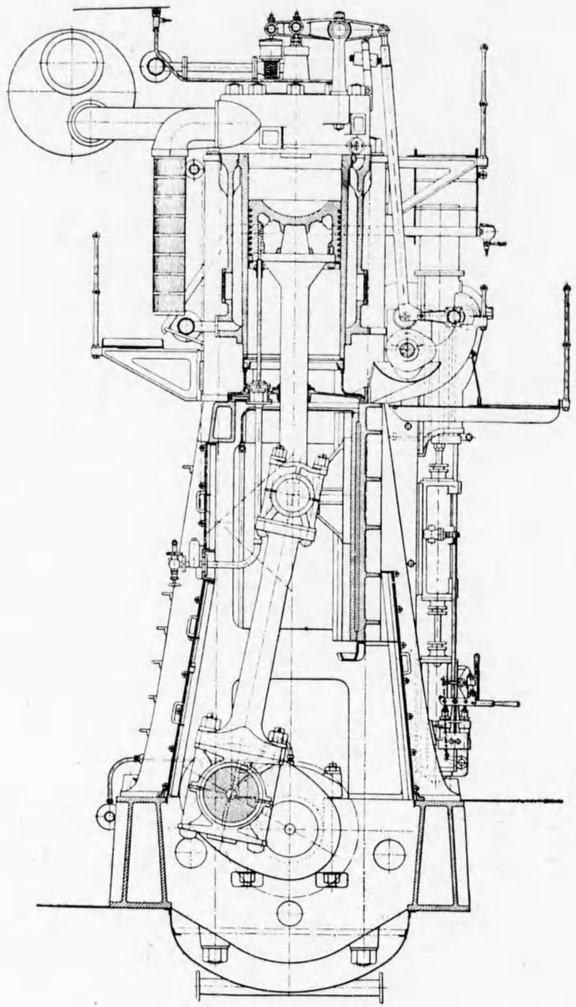
Fig. 189.(B)



Valve Timing Diagram (2 Stroke Cycle)

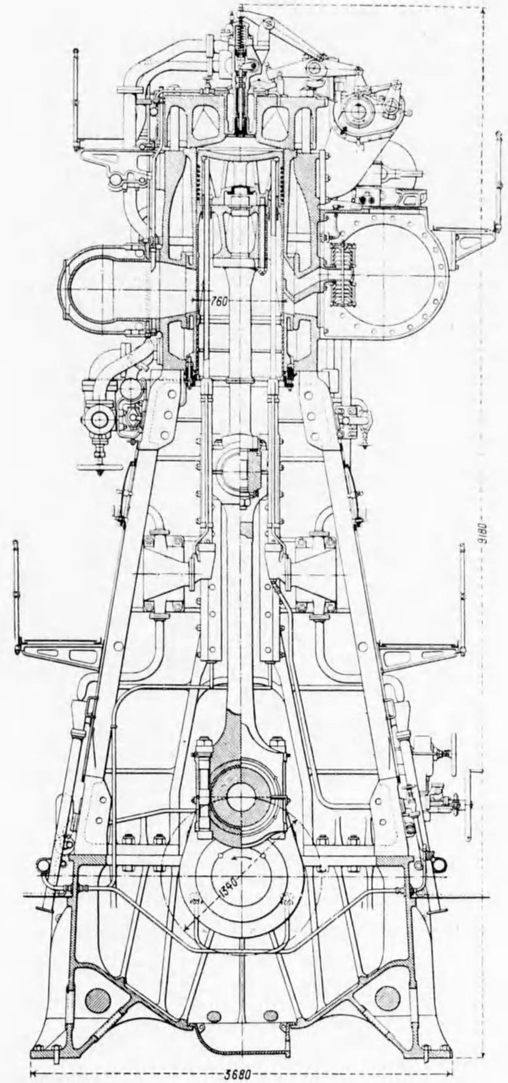
① Fuel valve opens.
② Fuel valve closes.
③ Exhaust ports open.
④ Scavenge air is admitted.
⑤ Exhaust ports close.
⑥ Admision of scavenge air ceases.

Fig. 190.



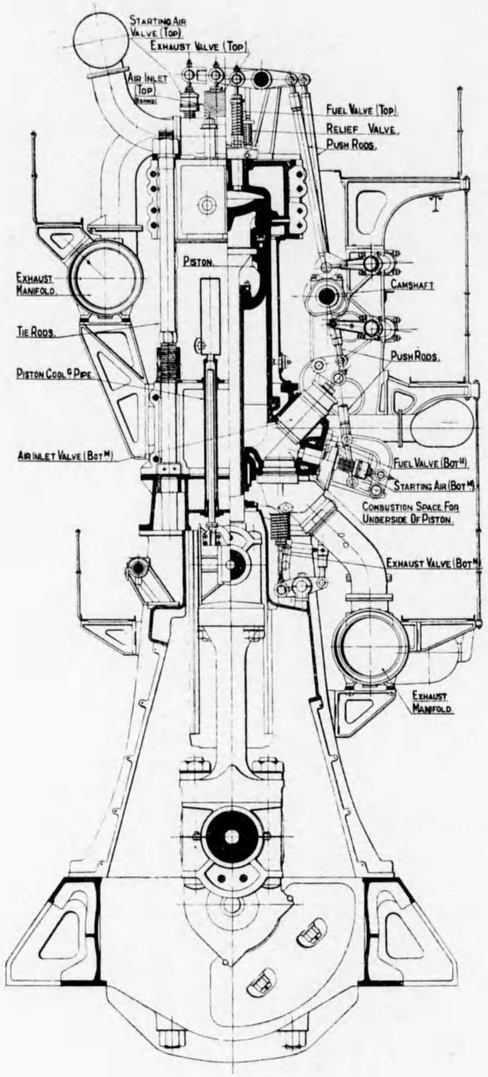
B. and W. four-cycle single acting diesel engine.

Fig. 191.



Sulzer two-cycle single acting diesel engine.

Fig. 192.



B. and W. four-cycle double acting diesel engine.

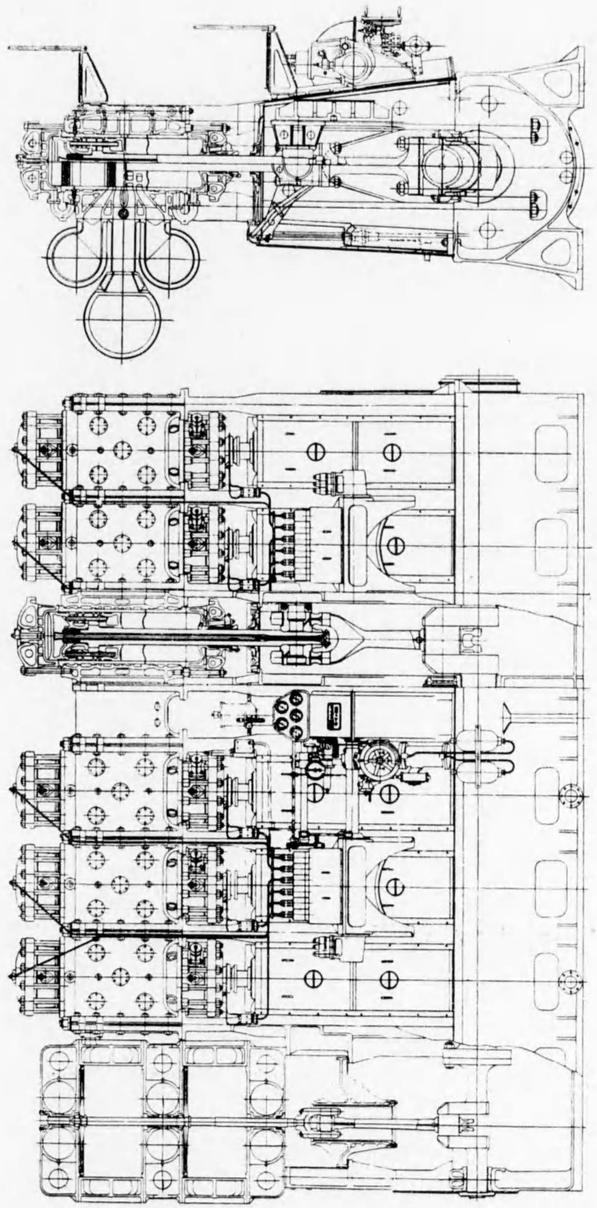
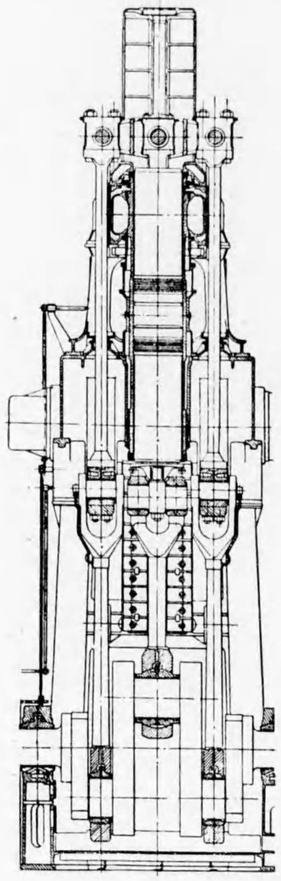


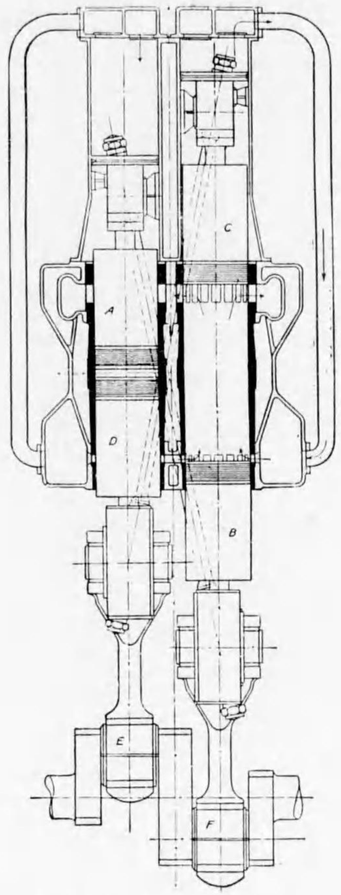
Fig. 193. M. A. N. two-cycle double-acting diesel engine.

Fig. 194.



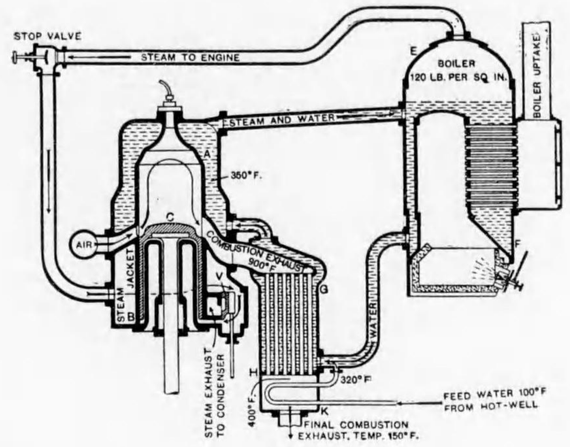
Doxford opposed piston engine.

Fig. 195.



Cammel-Laird fullagar engine.

Fig. 196.



The still combined internal combustion and steam engine.

The still combined internal combustion and steam engine.

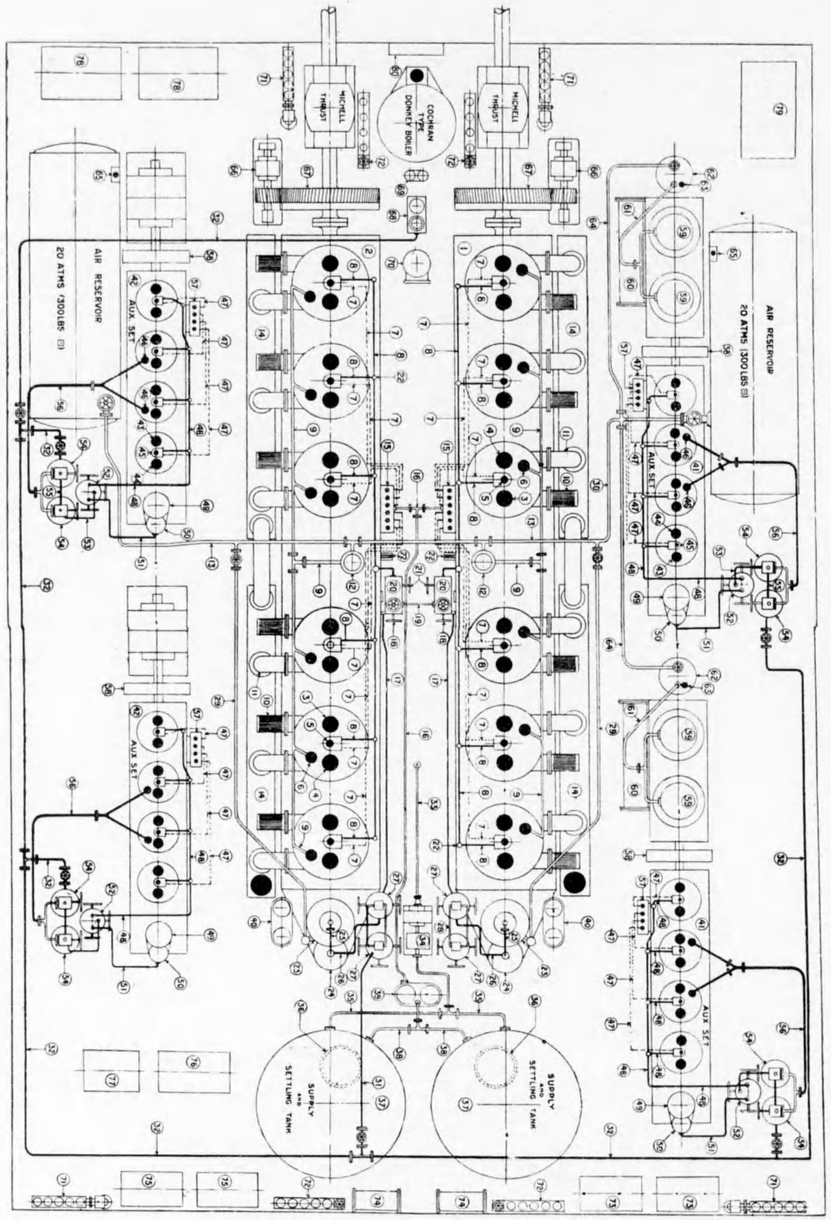


Fig. 197. Engine-room plan of the motor ship

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昭和十三年七月五日三版印刷
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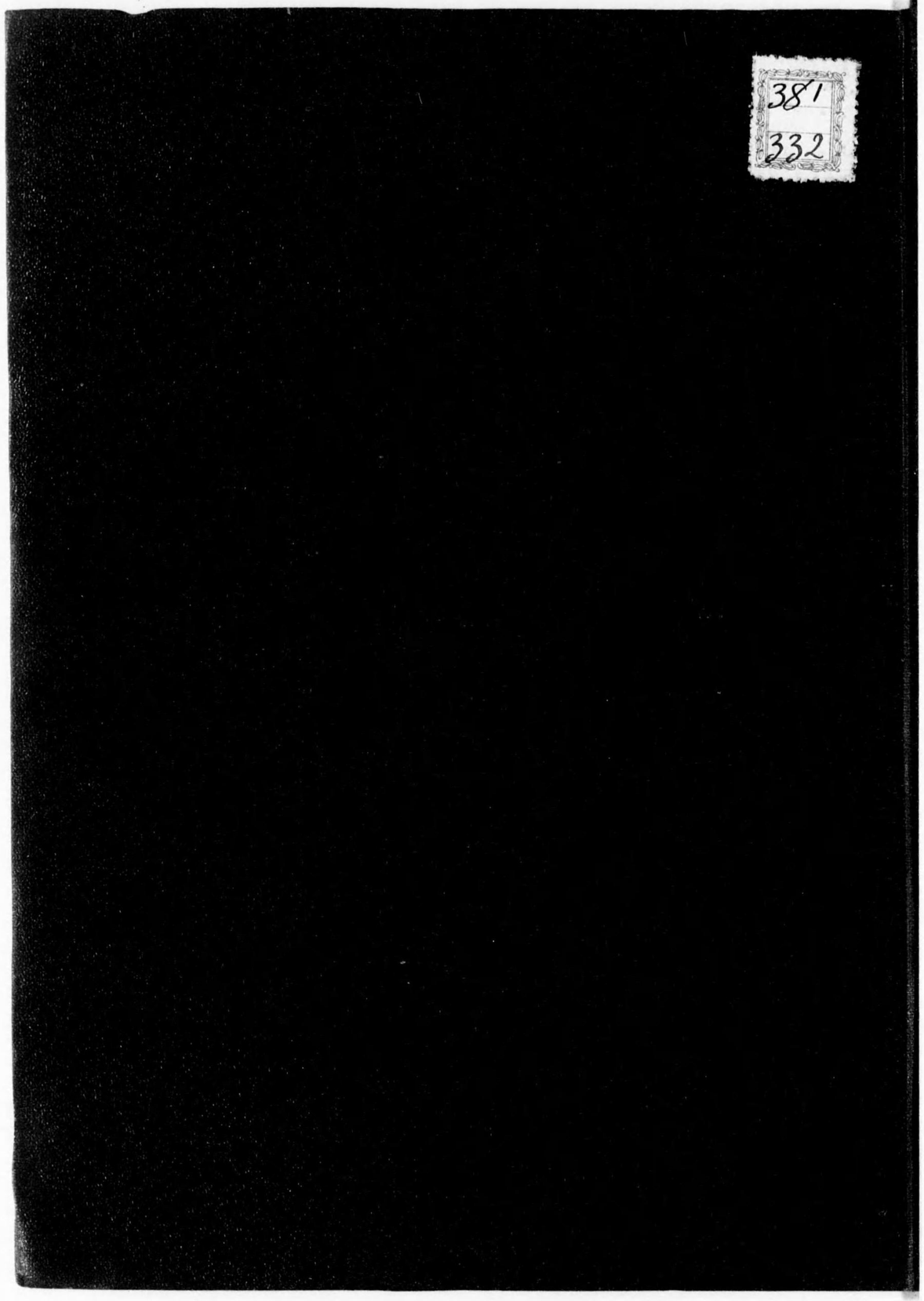

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