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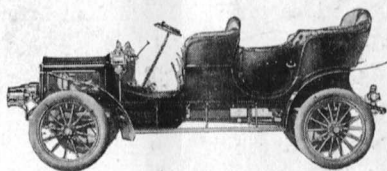
# INSTRUCTIONS FOR WHITE STEAM TOURING CAR

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THE WHITE COMPANY  
CLEVELAND, OHIO, U. S. A.



# *The* White Steam Car



Cleveland, Ohio, U. S. A.

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## Chassis

No. 179	Condenser
No. 166	Condenser overflow
No. 3E	Exhaust connection    Engine to condenser
No. 170	Fan support
No. 174	Fan grease cup
No. 7E	Engine
No. 8E	Engine air pump
No. 9	Valve opening exhaust from high pressure cylinder
No. 10	Valve closing high pressure exhaust from low pressure steam chest
No. 11	Valve admitting steam from high pressure to low pressure side of steam chest
No. 180	Foot pedal operating simpling valves
No. 13T	Throttle
No. 128	Water tank
No. 14 <sup>1</sup>	Suction hose to pump
No. 14 <sup>2</sup>	Compression pipe to generator
No. 29B	Water pipe to generator
No. 181	Generator
No. 28A	Handle to hand by-pass valve
No. 17A	Hand water pump
No. 18A	Cap for cleaning water tank
No. J	Air check
No. A	Fuel tank
No. B	Cap to fuel tank, covering place of filling
No. C	Hand air pump
No. 42A	Steam pipe
No. 31A	Live steam connection to operate water regulator
No. 182	Throttle wheel
No. 183	Steering wheel

Chassis

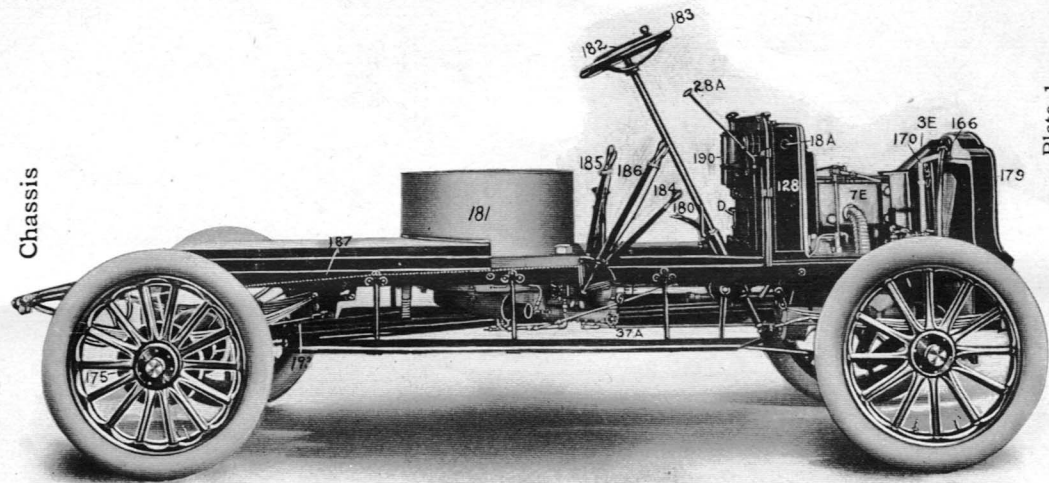


Plate 1

## Chassis—Continued

No. 184	Emergency gear lever
No. 185	Reverse lever
No. 186	Brake lever
No. 187	Brake cables
No. 175	Brake drums
No. 188	Grease cups
No. 189	Engine lubricator
No. 190	Cylinder lubricator
No. 191	Casing containing emergency gears, driving gears, compensating gears
No. 37A	Blow off valve
No. FF	Main burner valve
No. D	Main fuel shut off valve
No. 193	Side distance rods
No. 194	Driving shaft
No. 195	Torsion rod
No. 196	Rod from lever to emergency gear
No. 4A	Casing around fly wheel and engine brake drum
No. 197	Grease cups
No. 198	Rear universal joint

## Driving Mechanism

The motion of the engine crank shaft is conveyed to the rear axle through a hollow steel shaft (194, plate 3) and two universal joints (198, plate 3. The first joint is hidden by the fly wheel casing). Except in case of emergency the drive is direct through a bevel pinion and gear and bevel compensating gearing. When the emergency gear is in, the pinion is not driven direct but through a reducing gear. (See page 47.)

# Top View of Chassis

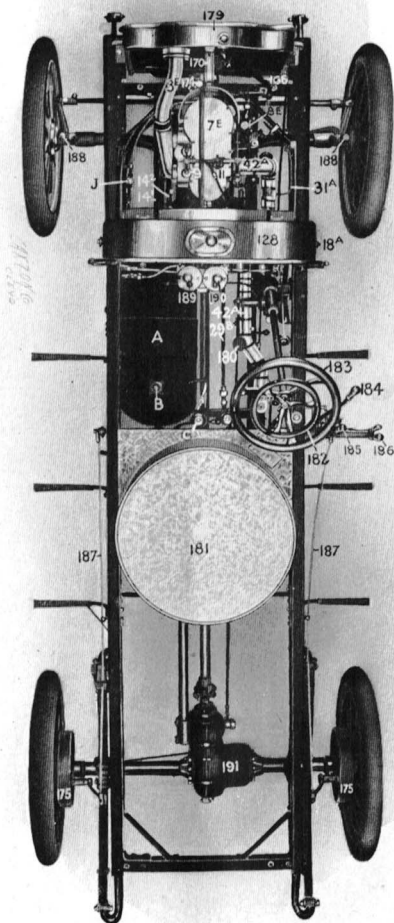


Plate 2

## Lubrication

The lubrication is principally automatic. The cylinder and crank case are fed from the automatic oiler on the dash board. This oiler is driven by a belt from the crank shaft and care should be taken to see that the oiler shaft is running. This can readily be seen by looking down between the oiler and the dash board. The oilers can also be worked by hand. On each oiler is a hand plunger; give this a turn to the left to open it and work the plunger up and down when oil will be forced either into the crank case or cylinder, depending on the pump used. It is well after a car has been standing for a week or more without use to pump oil into the cylinder before starting. An extra oiler full of crank case oil should be pumped into the case every 200 miles. IT IS MUCH BETTER TO LUBRICATE TOO MUCH THAN NOT ENOUGH.

The oil in the rear axle gear case should be renewed for each 1,000 miles of travel. There are two plugs in the gear case. The oil should be poured into the top one until it runs out of the one near the bottom. When empty, this will require nearly one quart of oil. The front wheels, steering pins, rear axle trunnions, driving shaft joints, ESPECIALLY THE FRONT SQUARE JOINT AND CONDENSER FAN BEARINGS, SHOULD BE GREASED FOR EVERY 200 MILES OF TRAVEL.

In filling all grease cups, great care should be exercised to prevent any dust or grit getting into either the cup or grease, and it necessary to see that the oil channels are open and the grease forced into the bearings to insure perfect lubrication.

Bottom View of Chassis

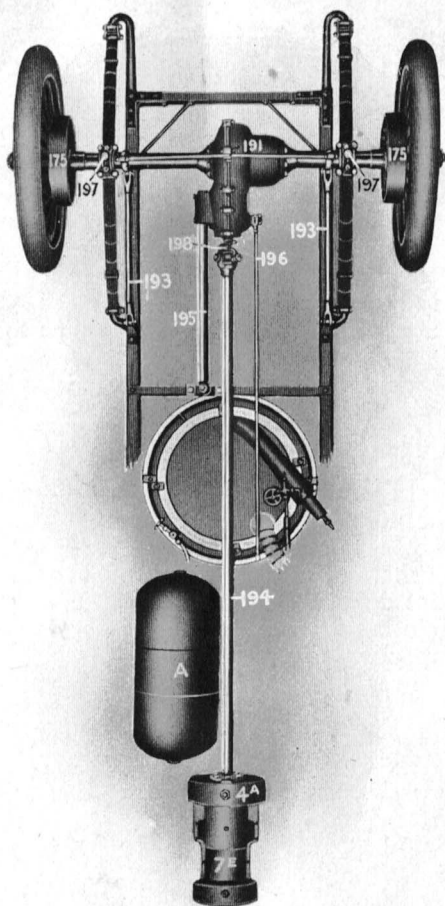


Plate 3

## Fuel and Air Connection

A	Gasoline tank
B	Plug for filling fuel tank
C	Hand air pump
D	Main shut off valve in main fuel supply pipe
E	Air pressure gauge
J	Check valve in engine air supply pipe
6r	Engine air pump
47	Regulating lever engine air pump
48	Cap covering suction check valve engine air pump
43	Cap covering delivery check engine air pump
18B	Delivery pipe engine air pump to fuel tank
L	Try cocks on fuel tank
M	Extension of main fuel supply pipe to bottom of
fuel tank	
N	Check valve hand air pump connection to fuel
tank	
O	Main fuel supply pipe
P	Union
Q	Fuel supply pipes containing wicking filters
R	Pilot light adjusting valve
S	Pilot light supply valve
T	Flush valve to pilot light
U	Pilot light
V	Main burner
W	Vaporizer
X	Fire regulator cap
Y	Fire regulator casting
N	Holes for cleaning passages in fire regulator
casting	
FF	Main burner valve
PP	Union
NN	Main burner induction tube
OO	Vaporizer nozzle
RR	Vaporizer union
TT	Vaporizer nozzle cleaner
XX	Connection to main steam pipe
YY	Connection to last coil of generator



## Fuel Connections

Fuel is supplied to the burner through pipe O (plate 4.) In case of weak fire or a complete stoppage of fuel, first see that the nozzle of the vaporizer OO (plate 4) is clear. To do this, press in and pull out the cleaning pin TT. If the fuel does not come freely, put out all fire in or around the car, shut off valve D and open the main burner valve FF. Break the union RR. Open valve D and if there is a good flow of fuel from the broken union it shows that the stoppage is between the union and the nozzle, that is, in the vaporizer. If there should not be much flow from the broken union it would show that the stoppage was between the union and the tank, and it would be necessary to go to the next union PP. In this way, trying the different unions in their order, RR, PP and P, the stoppage can be located and the cause removed. The pipe at Q contains candle wicking. This acts as a strainer to the fuel and should be cleaned once a season. Care must be taken to replace the wicking in the same way and quantity as it came out. Common soap is the best thing to use to make the fuel joints tight.

To clean the vaporizer, see that the main burner valve FF is closed. Break union RR and pull the vaporizer out through the door in the generator casing. Remove the screws and pipes and run a drill through the various passages. Be sure to remove all dirt; otherwise it will clog again quickly.

## To Fill the Fuel Tank

See that the main fuel valve D is closed and that there is no fire in the sub-burner, main burner, or near the car. Remove the cap B. If there is any pressure in the tank as shown by the air gauge E, the cap should be loosened and the air pressure allowed to escape before the cap is removed. Fill through the hole B until the tank is as full as desired. The wire screen should not be removed as it is there to strain the fuel. Put the cap back in its place and screw it down tight so there will be no leak when the air pressure is on.

To raise the pressure in the tank, open the hand air pump C by pressing the plunger down hard and turning to the left. This opens a valve at the bottom and by working the plunger up and down air is forced into the tank until the 30 lbs. pressure is acquired. The air pump is then shut off by pressing down hard and turning to the right as far as it will go. This pump must be turned off after using or the pressure in the tank will soon fall below 30 lbs. When working the plunger the small hole in the top must be kept tightly covered by the hand or the air under the plunger will escape through it and not be forced into the tank. The hole passing down through the plunger is to prevent the plunger from being locked up so that the valve in the bottom could not be opened. As soon as the engine is started the pressure in the tank is maintained by means of an air pump connected to the engine.

## To Light the Sub-Burner

To light the sub-burner it is assumed that the fuel tank has been filled, the pressure pumped up to 30 lbs., (Page 13) and the main fuel valve D has been closed.

See that the sub-burner valves T S R are all closed, open the main fuel valve (D plate 4) which allows the fuel to come through the pipe O (plate 4) to the sub-burner (U plate 4). Open valve T (plate 4) carefully until enough fuel has run into the drip cup at the bottom of the sub-burner to fill it. Light this and let it burn about one minute. Open valve S (plate 4) two or three turns and valve R (plate 4) slightly. Valve S controls the supply of fuel to the sub-burner and valve R controls the height of the flame. The fuel is admitted through the valve T only at starting to warm the sub-burner vaporizer as in a plumber's lamp, and the valve S must be opened before this raw fuel in the drip cup all burns away so that there will be a flame to light the fuel admitted through S. The sub-burner flame can be seen by looking through the mica in the generator casing. As soon as the raw fuel burns out of the drip cup the flame should burn blue and the sub-burner cone become red hot.

## To Fill the Water Tank and Generator

The tank is filled by removing the lid (No. 128 plate 2) and running water into it (the tank) in any way that it is convenient until it is full. Ordinary care should be taken to get as good water as is convenient and not allow dirt to get into the tank.

To fill the generator open the hand pump (Plate 5 No. 17A) by pressing the plunger down hard and turning to the left. This opens a valve at the bottom, and by working the plunger up and down water is forced into the generator. See that the throttle is closed and continue to pump until water comes through the blow off valve (No. 37A plate 1) in the main steam pipe or until the steam gauge shows pressure which will be the case if the blow off valve is shut. Except in case all the water has been drained out of the tank and generator, it will be found that after standing the generator will siphon full of water and no hand pumping is necessary. If the generator does not siphon full there will be enough in it so that steam can be raised sufficient to run the engine free and the pumping will then be done by the engine. In case water should get between the plunger of the hand pump and the valve at the bottom when that valve is closed, it will be found impossible to force the plunger down to open the valve, and it is then necessary to unscrew the stuffing box and let the water out at the top. It does no harm to run with the valve at the bottom of the hand pump open all the time.

## To Start the Car

Fill the fuel tank and pump the air pressure to 30 lbs. (Page 13).

Fill the water tank and pump the generator full. (Page 15).

Light the sub-burner. (Page 14).

After the sub-burner has been lighted two minutes the vaporizer W (Plate 4) will have been heated sufficiently to vaporize the fuel for the main burner. Turn on the main burner by opening the valve FF. This allows the fuel to flow through the fire regulator Y into the vaporizer W. At first, should the vaporizer not become thoroughly heated a few drops of the raw fuel may drip from the nozzle of the vaporizer OO. If this drip is continuous, the main valve FF should be closed and the vaporizer allowed to get hotter. It is advisable in starting that the main burner be opened and closed intermittently four or five times, the interval of opening being about two seconds. By this means any sudden rush of fuel is avoided before the vaporizer gets to proper temperature. Everything starting satisfactorily, leave the main burner valve open one-quarter of a turn and watch the steam gauge closely. This is important as the steam pressure runs up very quickly and a moment's inattention when the fire is first turned on may result in an excessive pressure and cause the safety valve to blow off. As soon as the pressure reaches 300 lbs. blow off the surplus water collected in the pipes through the blow off valve

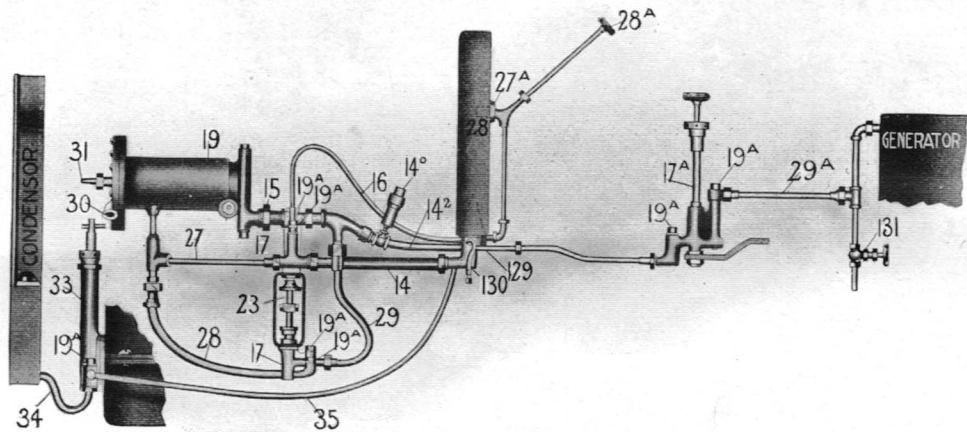
No. 37A (Plate 1). As soon as steam comes from this valve you are ready to start the engine. Put the emergency gear lever in the neutral point No. 184 (Plate 1) so that the engine will run free; throw reverse lever on top notch; press the starting pedal (No. 180 plate 1) down as far as it will go and open the throttle (No. 182 plate 1). This should be done carefully and if the steam pressure gets up to 500 lbs. before the car gets to running, shut the fire off by hand until the pressure drops to 300 lbs. again. The first steam that goes into the engine will be condensed in the cylinders and the water must be given a chance to work out, so do not rush the starting. The engine will run jerkily until the water is out, after which it will go smoothly. As soon as this occurs, take your foot off the starting pedal and let the engine run for a few seconds, then shut the throttle and throw in either gear that is desired; press down the starting pedal; open the throttle and the car will move off; take your foot from the starting pedal, after engine has made one or two complete revolutions, open the main burner valve FF at least a full turn and if you are doing speed work open it as far as it will go.

When starting the car after stopping for a time but when the sub-burner is not put out, the main burner valve should be opened slowly as before and if the car has been standing long enough for the engine to get chilled it should be run free until warmed up again. In case the generator has not had time to siphon full while the car is stopped it may be found necessary to let the engine run free until it has pumped some water into the generator.

## Water Connections

- 128 Water tank
- 129 Water tank strainer
- 130 Strainer yoke
- 14 Suction hose
- 17 Engine water pumps
- 19 Water regulator
- 27 By-pass pipe and suction for lower power pump
- 28 Suction hose for lower power pump
- 14° Compression chamber
- 14<sup>2</sup> Compression pipe
- 131 Blow off valve for top of generator
- 33 Condenser pump
- 35 Condenser pump delivery pipe
- 16 Hand by-pass pipe
- 19A Check valves
- 17A Hand water pump
- 27A Hand by-pass connection into water tank
- 23 Engine water pump plunger
- 29 Compression pipe from lower power pump
- 15 Water regulator union
- 28A Hand by-pass valve
- 34 Hose connecting condenser to engine pump
- 30 Connection to oiler and steam pressure gauge
- 29A Connection hand pump to generator
- 31 Steam connection from water regulator diaphragm to main steam pipe.

Water Connections



## Engine Numbers

- No. 1 High pressure cylinder
- No. 2 Low pressure cylinder
- No. 3 Exhaust pipe
- No. 3' Exhaust pipe screws
- No. 4 Engine casing
- No. 4' Crank case
- No. 5 High pressure piston stuffing box
- No. 6 High pressure valve stuffing box
- No. 7 Low pressure valve stuffing box
- No. 8 Low pressure piston stuffing box
- No. 9 Valve opening exhaust from high pressure  
cylinder
- No. 10 Valve closing high pressure exhaust from low  
pressure steam chest
- No. 11 Valve admitting steam from high pressure to  
low pressure side of steam chest
- No. 12 Engine girts
- No. 13 Fly wheel
- No. 14° Compression chamber
- No. 14' Suction hose
- No. 14<sup>2</sup> Compression pipe
- No. 15 Unions in the water connections
- No. 16 Pipe connection to hand by-pass
- No. 17 Upper power pump
- No. 17 Lower power pump
- No. 18 Power pump frame
- No. 19 Water regulator
- No. 20 Pump lever pin
- No. 21 Pump lever
- No. 22 Pump block
- No. 23 Pump plunger
- No. 24 Screws attaching pump frame to engine casing

Engine—Back View

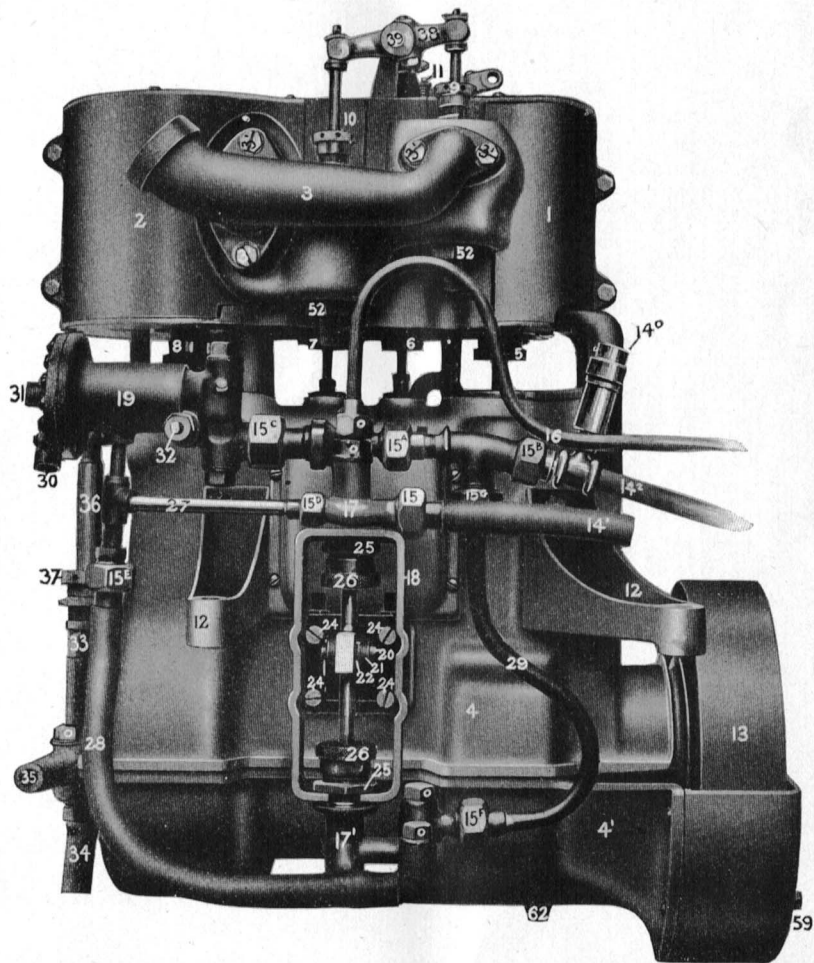


Plate 6

## Engine Numbers—Continued

- No. 25 Upper power pump lock nut
- No. 25 Lower power pump lock nut
- No. 26 Upper power pump stuffing box
- No. 26 Lower power pump stuffing box
- No. 27 Pipe connecting upper power pump—suction side—to the water regulator and lower power pump
- No. 28 Suction hose of lower power pump
- No. 29 Compression pipe of lower power pump
- O Check valves
- No. 30 Steam gauge and oil connection to water regulator
- No. 31 Steam connection to water regulator diaphragm to main steam pipe
- No. 32 Water regulator adjusting spindle
- No. 33 Condenser pump
- No. 34 Condenser pump suction hose
- No. 35 Condenser pump discharge hose
- No. 36 Condenser pump plunger
- No. 37 Condenser pump stuffing box
- No. 38 Simpling valve rocking lever—valve end
- No. 39 Simpling valve rocking lever shaft
- No. 40 Simpling valve rocking lever—spring end
- No. 41 Simpling valve lever spring
- No. 42 Main steam connection to high pressure steam chest
- No. 43 Engine air pump connection—delivery side
- No. 44 Engine air pump yoke
- No. 45 Engine air pump yoke bolt
- No. 46 Gauze covering engine air pump suction
- No. 47 Regulating lever of engine air pump
- No. 48 Valve chamber suction check of engine air pump

Engine—Front View

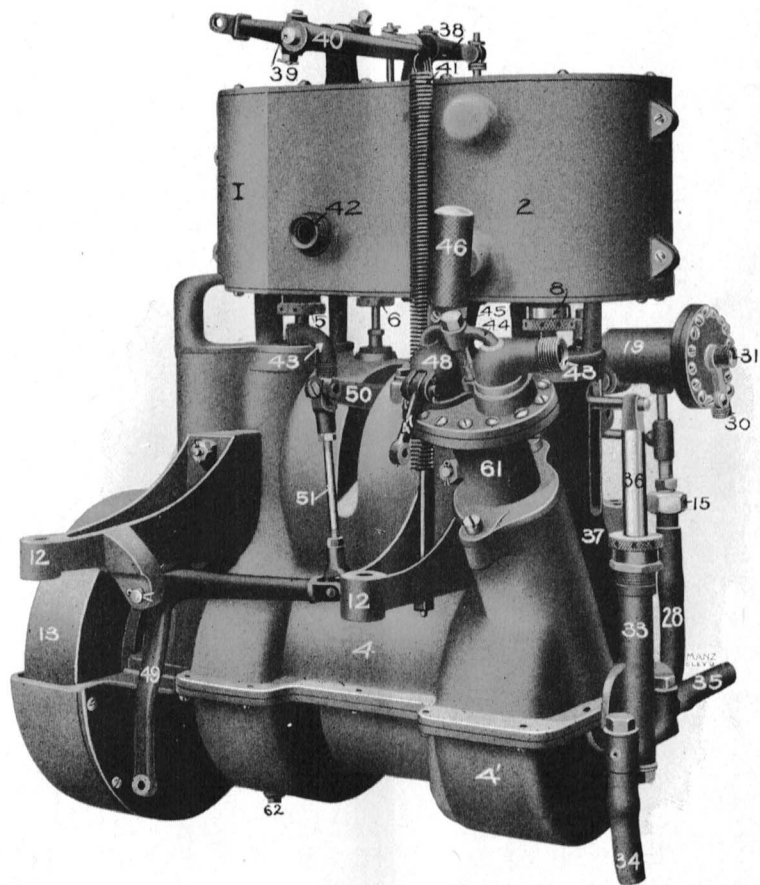


Plate 7

### Engine Numbers—Continued

- No. 49 Bell crank connection to reverse arm
- No. 50 Reverse arm
- No. 51 Rod connecting bell crank to reverse arm
- No. 52 Caps beneath simpling valves
- No. 53 Hole for crosshead pin
- No. 54 Expanding ring for engine brake
- No. 55 Spring for contracting brake ring
- No. 56 Engine universal joint square
- No. 57 Bolts holding fly wheel and universal joint to  
crank shaft
- No. 58 Engine brake dog plate
- No. 59 Bolt for securing engine brake dog
- No. 60 Screws fastening crank oiler wheel
- No. 61 Engine air pump
- No. 62 Plug for draining crank case

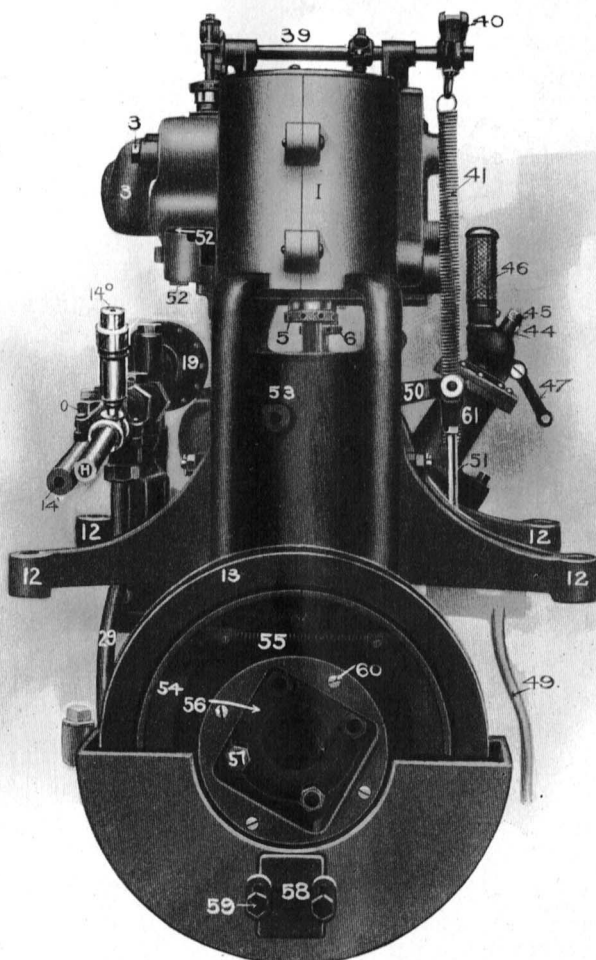
## Engine

The engine is built on the principle of a vertical marine type, compound engine with slide valves. All engine text books give a full description of such a compound engine, and for details for the principle, valve setting, etc., refer to such a book.

In order to start at any position that the engine may be in it is necessary to admit high pressure steam into the low pressure cylinder as the high pressure piston is liable to be on its dead center. This is accomplished by means of the three valves, 9, 10, 11 (Plate 6, Plate 9). See page 30 for description of their action.

The engine crank is ball bearing throughout. (See page 31.)

# Engine—End View

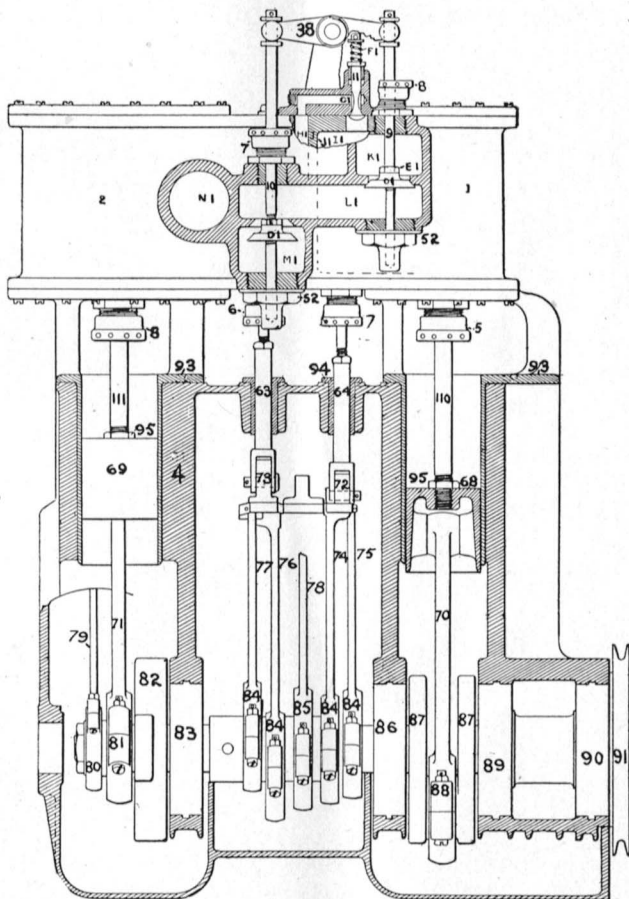


## Simpling Valves

- 11 Valve admitting steam from high pressure to low pressure side of steam chest
- 9 Valve opening exhaust from high pressure cylinder
- 10 Valve closing high pressure exhaust from low pressure steam chest
- D1 Valves
- E1 Lock nuts
- F1 Spring
- G1 Passage connecting high pressure steam chest with low pressure steam chest
- H1 Low pressure steam chest
- I1 High pressure steam chest
- J1 Wall dividing high pressure steam chest from low pressure steam chest
- K1 Exhaust passage to air
- L1 Passage connecting high pressure exhaust to low pressure steam chest
- M1 Opening into low pressure steam chest
- N1 Low pressure steam exhaust
- 38 Rocking lever
- 6-7-5-8 Stuffing boxes
- 52 Simpling valve plugs

In the position shown in the diagram, Plate 9 the engine is running compound; valves 11 and 9 are closed and 10 is open. The steam in the high pressure steam chest I1 passes into the high pressure cylinder and is exhausted into the passage L1 and goes through the open valve 10 into the low pressure steam chest H1 through the passage M1.

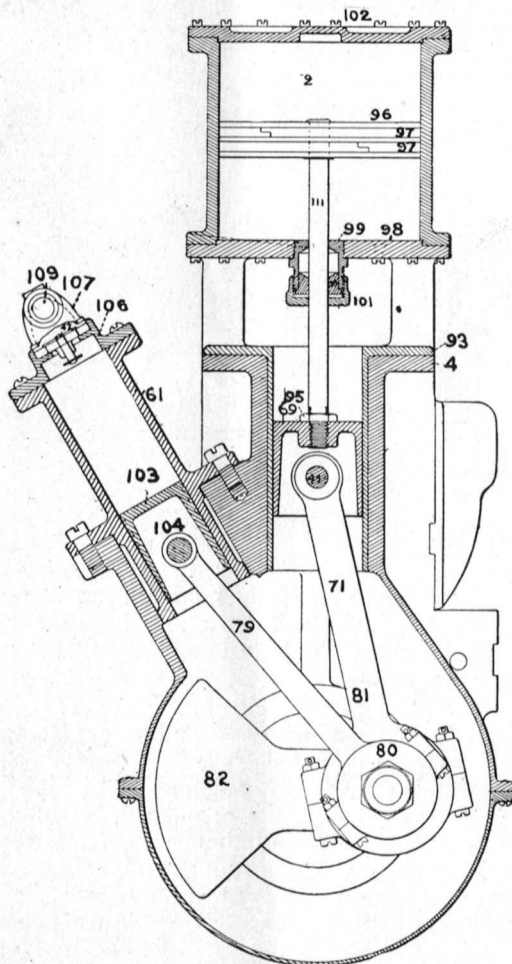
# Engine—Cross Section



## Engine Cross Section Numbers

No.	1	High pressure cylinder
No.	2	Low pressure cylinder
No.	110	High pressure piston rod
No.	64	High pressure valve stem guide
No.	63	Low pressure valve stem guide
No.	111	Low pressure piston rod
No.	68	High pressure crosshead
No.	69	Low pressure crosshead
No.	70	High pressure connecting rod
No.	71	Low pressure connecting rod
No.	72	High pressure valve link
No.	73	Low pressure valve link
Nos.	74-75	High pressure valve eccentric rods
Nos.	76-77	Low pressure valve eccentric rods
No.	78	Pump eccentric rod
No.	79	Air pump connecting rod
No.	80	Air pump connecting rod crank cap
No.	81	Low pressure connecting rod cap
No.	82	Counter balance—low pressure
No.	83	Main crank bearing
No.	84	Valve eccentrics
No.	85	Pump eccentric
No.	86	Main crank bearing
No.	87	Counter balance—high pressure
No.	88	High pressure connecting rod cap
No.	89	Main crank bearing
No.	90	Main crank bearing
No.	91	Oiler belt wheel
No.	4	Aluminum engine casing
No.	93	Brass liners for crosshead guides
No.	94	Valve stem guide bushings

Engine—Cross Section, End View



## Engine Cross Section—Continued

No.	95	Piston rod nut on crosshead
No.	96	Piston
No.	97	Piston rings
No.	98	Cylinder bottom
No.	99	Stuffing box
No.	100	Stuffing box gland
No.	101	Stuffing box cap
No.	102	Cylinder cover
No.	103	Air pump piston
No.	61	Air pump cylinder
No.	104	Wrist pin
No.	106	Air pump cylinder cover
No.	107	Air pump check cap
No.	108	Air pump check valve
No.	109	Air delivery connection

## Simpling Valves

As previously explained, it is often necessary in starting a compound engine to admit high pressure steam to the low pressure cylinder, as in case the high pressure crank is on the dead centre. This is accomplished by the three valves, 11, 9, 10 (plate 9).

When the foot presses the starting pedal down the rocker lever shaft is made to turn and valves 11 and 9 are opened and valve 10 is closed.

The engine is now running simple. The high pressure steam in 11 passes through the open valve 11 into the low pressure steam chest H1 and thence to the low pressure cylinder. The exhaust from the high pressure cylinder into L1 passes through the open valve 9 into the passage K1 leading to the exhaust pipe. The valve 10 is closed, pre-

venting the high pressure steam in H1 from passing into L1 and so into the exhaust pipe from the high pressure cylinder.

A spring returns these valves to their normal position when the foot is taken from the starting pedal. Thumping in an engine which runs quietly when the starting pedal is down, but thumps immediately the engine begins to run compound, generally means that these valves are not properly seated. This may be due to the fact that the engine is cold and they move stiffly. The motion of the engine will generally bring them up to their seats. If it is more serious than that they should be looked at and made to come to their seats, for the engine will not run smooth unless valves 11 and 9 seat properly when running compound.

## Engine Crank

The crank shaft is fitted with ball bearings throughout, 83, 86, 89 and 90, plate 9 and 11, are the four main crank bearings, 83, 86 and 89 are main journal bearings. The bearings are unusually large for the size of engine, hence the wear on them is very slight. The connecting rod and eccentric bearings are all made in halves and can be taken apart by removing the bolts that hold the bearings together. If necessary to adjust them it can be done by filing away the surface where the halves join, thus allowing the ball race to fit closer to the cone. The surface must be filed parallel to make a good fit and the bearing adjusted so that it will not be too tight. When the crank is taken out of the engine *great care* must be used in replacing it to see that it is not pulled out of line when screwing up the caps that hold the main bearings in place. This is important, for if pulled out of true the engine will not run well, and the strain of running unevenly will eventually break the shaft.

## Engine Crank Numbers

No. 63	Valve stem connection
No. 64	Valve stem connection
No. 113	Link lever
No. 113 <sup>1</sup>	Link lever
No. D2	Link block
No. 68	High pressure crosshead
No. 69	Low pressure crosshead
No. 70	High pressure connecting rod
No. 71	Low pressure connecting rod
No. 72	High pressure valve link
No. 73	Low pressure valve link
No. 74	High pressure valve connecting rod
No. 75	High pressure valve connecting rod
No. 76	Low pressure valve connecting rod
No. 77	Low pressure valve connecting rod
No. 79	Air pump connecting rod
No. 80	Air pump connecting rod cap
No. 81	Low pressure connecting rod cap
No. 82	Counterbalance low pressure
No. 83	Main crank bearing
No. 84	Valve eccentrics
No. 85	Pump eccentrics
No. 86	Main crank bearing
No. 87	Counterbalance high pressure
No. 88	High pressure connecting rod cap
No. 89	Main crank bearing
No. 90	Main crank bearing
No. 103	Air pump piston
No. 104	Wrist pins

# Engine Crank

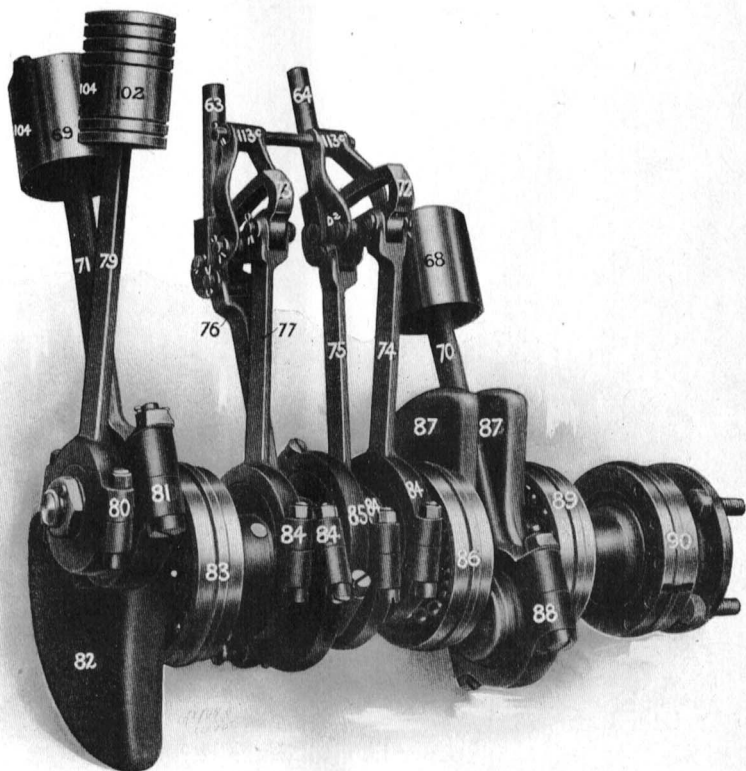


Plate 11

## Power Water Pump

- 14 Suction hose
- 14-2 Compression pipe
- 15 A, B, C, D, E, F, G, Water connection unions
- 16 Pipe connections to hand by-pass
- 17 Lower power pump
- 18 Power pump frame
- 19 Water regulator
- 20 Pump lever pin
- 21 Pump lever
- 22 Pump block
- 23 Pump plunger
- 24 Screws attaching frame to Engine Casing
- 25 Upper and lower pump lock nut
- 26 Upper and lower pump stuffing box
- 27 Pipe connecting upper pump—suction side—to  
water regulator and lower pump
- 28 Suction of lower pump
- 29 Discharge pipe of lower pump
- 30 Steam gauge and oil connections to water regu-  
lator
- 31 Steam connections to water regulator diaphragm  
to main steam pipe

## Power Water Pumps

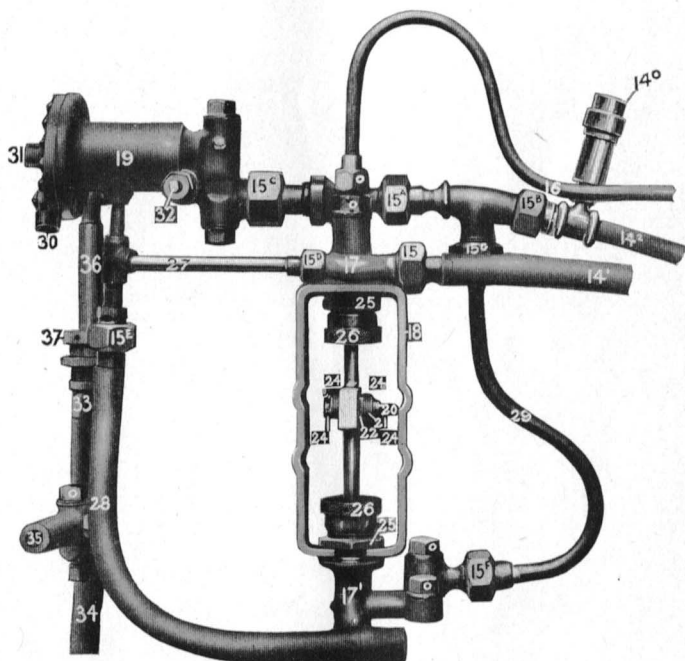


Plate 12

## Water Power Pump

The pump 17, plate 5, 6 and 12, draws water from the tank through 14<sup>1</sup>. The pump 17<sup>1</sup> draws water from the tank through 14<sup>1</sup>; 27, 28. Both pumps are driven from the same eccentric by the same rocker lever. Both pumps deliver water to the generator through 14<sup>2</sup> and are automatically bypassed by the water regulator. When desired, the pump 17, can be made to deliver its water to the tank by opening the hand by-pass valve 28A, plate 5, situated in the pipe 16, which leads from the top of the suction check valve of pump 17.

The lift in the ball checks of these two pumps should be 1-32 of an inch. They will pump water if the lift is more or less, but at 1-32 of an inch lift the pumps are most efficient. It is desirable on the hand pump to have a little more lift than this to prevent choking in the main water supply pipe to the generator. The nipple connecting pump 17, to the water regulator contains a small strainer to prevent foreign matter getting into the by-pass valve and clogging it. This strainer should be looked at occasionally and cleaned if necessary.

To reseal the ball check valves, remove the bronze ball and insert a steel ball of the same size in its place. Rap this steel ball smartly down on the seat once or twice, and the seat will be as perfect as when new.

## Hand By-Pass

There is a hand by-pass valve to the upper power water pump. Open this valve to return the water from the upper pump to the tank independently of the water regulator. Close this valve to use the upper pump in connec-

tion with the lower pump. Both pumps are then discharging into the generator, and are governed by the action of the water regulator. Best results are obtained by leaving this valve open as much as possible, especially on good roads and at high speeds. The steam will also be found to be more constant with the valve open. Close the by-pass valve in cases when the steam pressure is low at slow speeds.

## Power Air Pump

- No. 43 Discharge pipe
- No. 44 Valve chamber clamp
- No. 45 Valve chamber clamp screw
- No. 46 Wire gauze strainer for inlet valve
- No. 47 Regulating lever
- No. 48 Inlet valve chamber cover
- No. 61 Pump cylinder

The power air pump is connected to the engine and driven direct from the crank shaft at its outer end. The plunger is of amply length to ensure long service. The inlet and outlet valves are situated at the top and are so constructed that they can be easily removed, it being only necessary to slacken one bolt which passes through a yoke holding down both valve chambers. The inlet valve is protected by a fine wire screen, preventing dirt from being drawn into the pump and forced into the fuel tank. The pump is in action at all times when the engine is in motion, but is prevented from delivering air to the tank, the suction valve being kept from its seat by lever No. 47-Plate 7. When pressure is needed the foot plunger should be forced down as far as possible, which makes the suction valve operative. It must be kept in that position until the air pressure has reached the required amount.

To clean the valves, remove valve chambers No. 43, Plate 7 and No. 46, Plate 7, by taking off the yoke No. 44, Plate 7; lift out the valves, clean them and the seats thoroughly, being sure that the light springs work the valves quickly; place valves in their original position and clamp the valve chambers down tight.

## The Generator

Figs. o, o, o, o, o, o, o, o, o, o, and o, generator coils

FF Main burner valve stem

SS Support for vaporizer

V Main burner

Y Fire regulator

LL Valve connection to seat

NN Mixing tube

U Sub-burner

TT Cleaning plug for nozzle

BB Spreaders to hold coils in position

W Vaporizer

Q Contains wicking to strain gasoline

RR Union

T, S, and R Sub-burner gasoline valves

X Fire regulator screw cap

Z Clean out caps on regulator

XX Steam pipe containing fire regulator

# The Generator

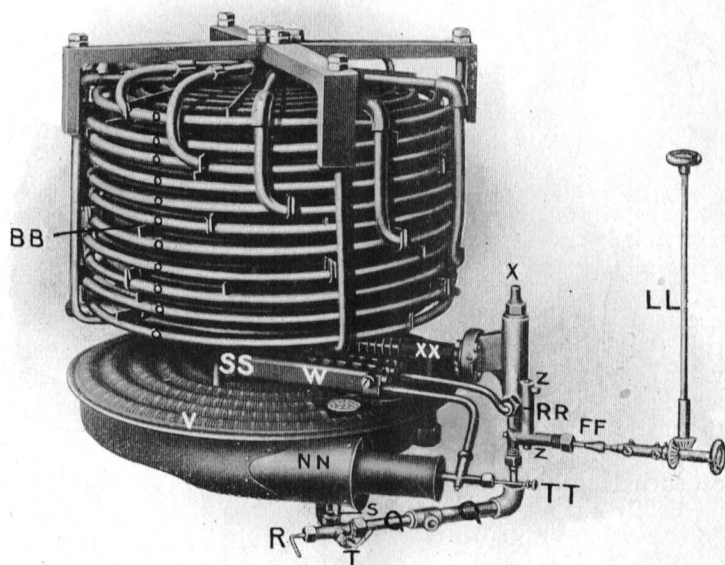


Plate 13

## Throttle

- 114 Throttle casting
- 115 Nickel seat
- 116 Throttle stem
- 117 Union nut
- 118 Throttle sleeve
- 119 Throttle arm
- 120 Throttle lever
- 121 Stuffing box nut
- 122 Stuffing box gland
- 123 Projection on valve
- 124 Valve
- 125 Connection to engine
- 126 Connection to generator
- 127 Passage through throttle seat

The principle on which this throttle is constructed is that the steam in its passage through the throttle should be controlled at a different point than the valve seat. By this principle the seat does not get the wear in throttling the steam and consequently will never leak when closed. It is accomplished by having an extension (123) Plate 14 at the end of the throttle spindle 116 which projects up from the valve seat 124 into the passage 127. 123 is nearly a fit for 127 and has a beveled point. When the throttle is open, as in the plate, 124 is drawn away from the seat by the action of the threads on the throttle stem when it is turned, but 123 is of such length that it is not drawn out of 127, and immediately the valve has left the seat the throttling is all done by the position of 123 in 127, obviating the wear on the seat itself.

Care must be taken in setting the throttle so that the lever 120 is in such position that when connected to the throttle wheel it can be shut. And also when shut it can

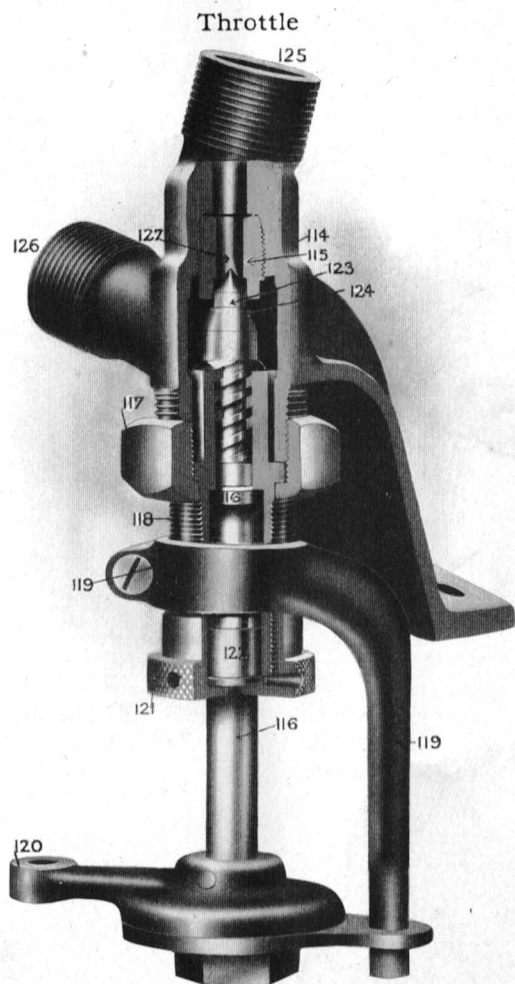


Plate 14

### Throttle—Continued

be opened to the largest extent that is possible considering the length of the arc through which the lever 120 moves. There must be movement enough to draw 123 out of 127 or it will be impossible to get enough steam into the engine to run at top speed. The movement will be found to be sufficient when the position of the throttle closed is such that lever 120 is at the extreme end of its arc of movement.

To set the throttle: Loosen 117 and move 119 until the desired position is reached. 119 should not be loosened on 118 for this purpose, but they should be considered as one piece. 118 carries the threads in which the spindle 116 works, and which controls the movement of the throttle valve, and by moving the position of the threads the position of 120 is changed for the corresponding same position of the throttle valve.

To grind the throttle: Loosen the screw clamp on 119 and turn it to the right on 118 about quarter of a turn. Tighten the clamp 119 and loosen 117 and move 120 to the right to 119. By this means the valve stem 116 projects farther through the sleeve 118, and the valve comes up against the seat before the sleeve 118 comes up to its seat. Turn 116 and 118 together by holding 119 and 120 together and the valve at 124 will move on its seat without being drawn away from it, and the seat can be ground without removing the entire throttle from the car. By undoing the nut 117, the stem can be taken from the car and pumice put on the seat to grind it.

### Fire Regulator

The Fire Regulator should be adjusted to operate between 360 and 370° C. The adjustment should never be made without a thermometer and our branch offices will test the Fire Regulator free of charge when desired.

## To Set Water Regulator

Disconnect the union 15d, plate 6. Pull pipe 27, slightly to one side and plug the end of 17, to stop the escape of water. By disconnecting pipe 27 it will be seen that the lower pump 17<sup>1</sup>, will not draw any water until the water regulator opens, consequently the hand by-pass valve 28A, plate I, must be closed or neither of the pumps will be discharging water. Now run the engine free and when the steam pressure reaches 370 pounds the water regulator should open and discharge water from the end of pipe 27, plate 6. If water comes before the steam pressure reaches 370 pounds, turn off the fire so that the steam pressure will fall, and turn the adjusting worm spindle 32, to the left a full turn. Raise the pressure again with the engine running and take notice where it by-passes. Continue this until the right pressure is reached. If the pressure at which the regulator by-passes is high, continue in the same manner except the adjusting spindle should be turned to the right instead of to the left. It will be found that the opening and closing points of the regulator are not the same, but the difference should not be more than 15 to 20 pounds. That is, when the regulator is set to open at 370 pounds it should close at 350 or more. If water continues to discharge from pipe 27, after the regulator is closed, it is possible that valve 141, plate 15, has not seated and a sharp rap on union 15c, plate 6, will generally remedy the trouble. If not, the regulator should be taken out and the by-pass valve 141, plate 15, ground. To do this, take out the water regulator by breaking the unions 15c, 15d, 15e, 30 and 31 plate 6, and with a small screw driver and some powdered pumice grind the valve to its seat.

## Water Regulator

- 132 Main casting water regulator
- 133 Water regulator cover
- 134 Diaphragm
- 135 Plugs
- 136 Diaphragm shifting pad
- 137 Plunger
- 138 Spring
- 139 Lock nut for plunger adjustment
- 140 Lever
- 141 Valve
- 32 Spring adjusting worm
- 142 Spring adjusting nut
- 143 Spring adjusting pad
- 144 Valve seat
- 145 Connection for main water delivery to generator
- 27 By-pass
- 31 Steam connection
- 30 Connection for oiler and steam gauge

The steam pressure through 31 presses against the diaphragm 134, causing 136 to move and compress the spring 138, then the spindle 137 pushes against the lever 140 which in turn causes the valve 141 to leave its seat. The water that is being pumped flows around 141 and out of the regulator at 27. When the steam pressure falls so that the pressure of the spring on the inside exceeds the pressure of the steam on the outside of the diaphragm, the spring returns to its normal position and the valve 141 comes back to its seat, thus closing the by-pass.

In case of a broken diaphragm, the regulator must be taken out, as described in page 43. Turn spring adjusting spindle 32, to the right until tension on spring 138 is entirely relieved, after which remove all the screws in the flange. This allows the front end 133, Plate 15, to be taken off and frees the diaphragm.

## Water Regulator

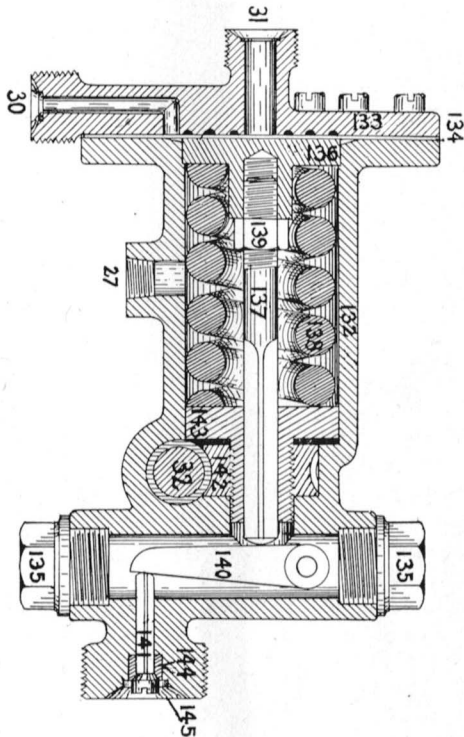


Plate 15

This end plate should be marked so that it can be put back in the same position. Put in the new diaphragm. Put on the front end and screw firmly together, taking care to tighten all the screws evenly or it may crack the diaphragm at the outset.

When the seat has been badly worn, or in replacing a valve stem, the stem 137 should be readjusted so that pad 136 will be in line with the face of flange and the diaphragm 134 in a straight line when 141 is seated. All tension should be removed from spring 138.

## Emergency Gear

- 146 Driving spindle
- 147 Emergency gear spindle
- 148 Driving spur gear
- 149 Spur gear
- 150 Internal spur gear of 149
- 151 External spur gear of 149
- 152 Large spur gear on emergency spindle
- 153 Small spur gear on emergency spindle
- 154 Driving pinion
- 155 Rear driving spindle bearing
- 156 Rear axle bearing
- 157 Front driving spindle bearing
- 158 Oil cup
- 159 Roller bearing
- 160 Lever groove
- 161 Lever groove

In cut the emergency gear is shown in mesh. The power from engine is transmitted by shaft 146 through gear 148 to 152, thence through double gear 152, 153 to 151. When in this position the engine makes two revolutions to one of the bevel pinion 154. Internal and external gear 151 and bevel pinion 154 are one piece. For the direct drive 148 is moved into 150, locking 146 and 154 together. The same movement of the lever that slides 148 into 150 slides 152 and 153 out of mesh and they remain idle until the emergency gear is again used. To run the engine free, move gear lever to center lock. When in this position it is entirely out of mesh and allows the engine to run free without transmitting power to rear axle.

The oil cup 158 catches the splash in gear case and a small pipe leads the oil to bearing of 154 and 149, insuring perfect lubrication.

## Emergency Gear

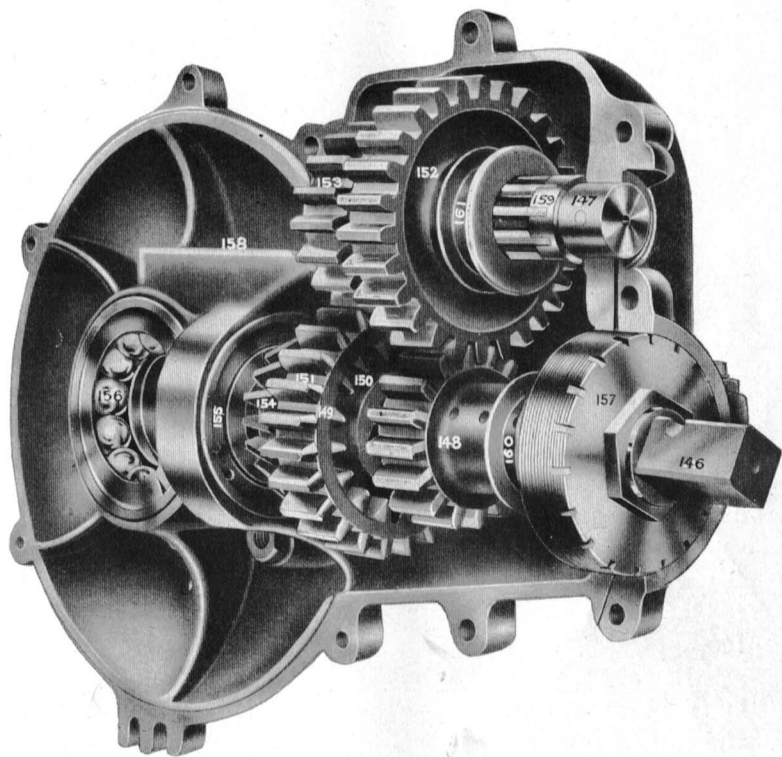


Plate 16

## Condenser

162	Top of condenser
163	Side of condenser
164	Bottom of condenser
165	Condenser flanged tubes
166	Condenser overflow pipe
167	Drain cock
34	Suction hose to condenser pump
168	Connection for exhaust pipe from engine
169	Condenser fan
170	Frame for condenser fan
171	Grooved belt wheel
172	Grooved belt wheel
173	Square end for driving shaft connection
174	Grease cup

The construction of this condenser is such that the exhaust steam 168 and the overflow pipes 166 enter the same chamber.

An automatic valve checks the overflow except when necessary to relieve the pressure momentarily as in starting, yet causes no undue back pressure.

To clean the condenser, disconnect the exhaust pipe at 168, and Fan bracket 170 at the top, and the overflow Pipe 166.

Remove the exhaust chamber 162 and the bottom 164 by taking out the screws, thereby leaving the tubes exposed and free to be cleaned perfectly without removing the condenser from the car.

# Condenser

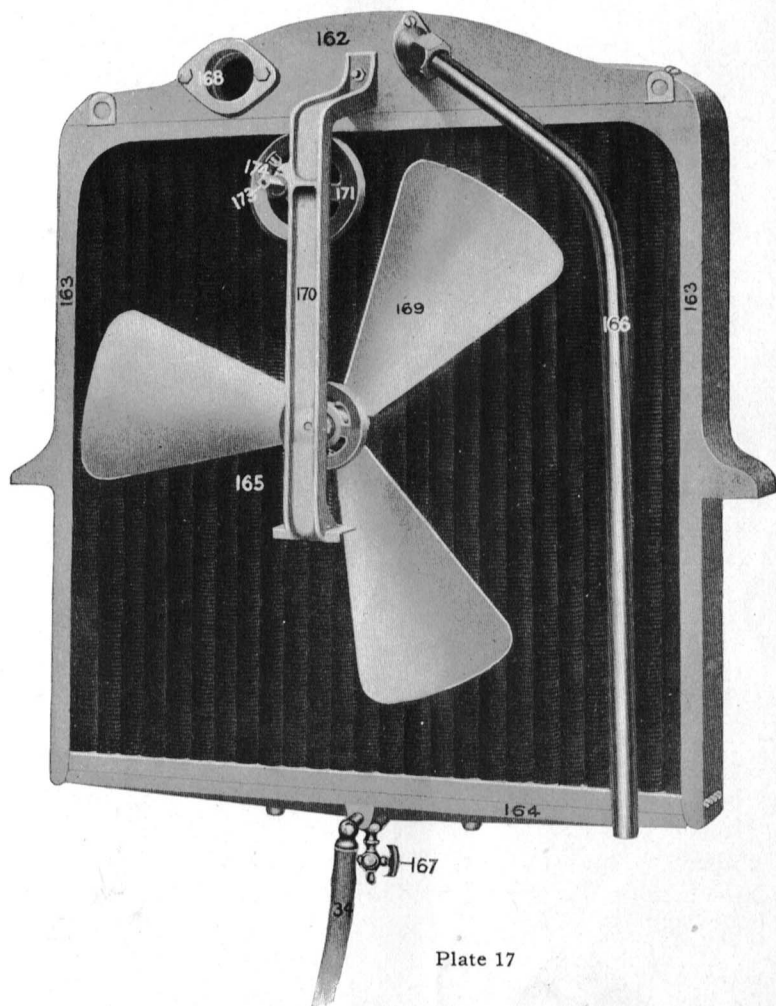


Plate 17

## Rear Wheel Brake

- 175 Brake drum
- 176 Expanding brake ring
- 177 Brake ring spring
- 178 Expanding ring turn buckle

## Brakes

The brake in the engine fly wheel and the brake on the rear wheels are made similar.

In the wheel brakes the drums "175" are held in place by seven bolts passing through the hubs. The internal expanding brake ring is in two pieces, held together at the top by the brake spring "177" which prevents the ring from binding when not in use. At the bottom it is held together by a turn buckle "178".

The brakes can be adjusted without removing the wheel by turning the turn buckle 178 so that it expands or contracts the expanding brake ring 177 as desired. Adjustment should be made on both brakes so that they will be as nearly equal as possible. Care should be taken to see that the brake cord has a free movement and that it pulls the same on both brakes. It is advisable about every two weeks to put some light oil inside the brake drum; this prevents excessive wear of brake shoes or cutting without interfering with the braking power. Heavy oil must not be used as it gums up and has not the desired effect.

## Rear Wheel Brake

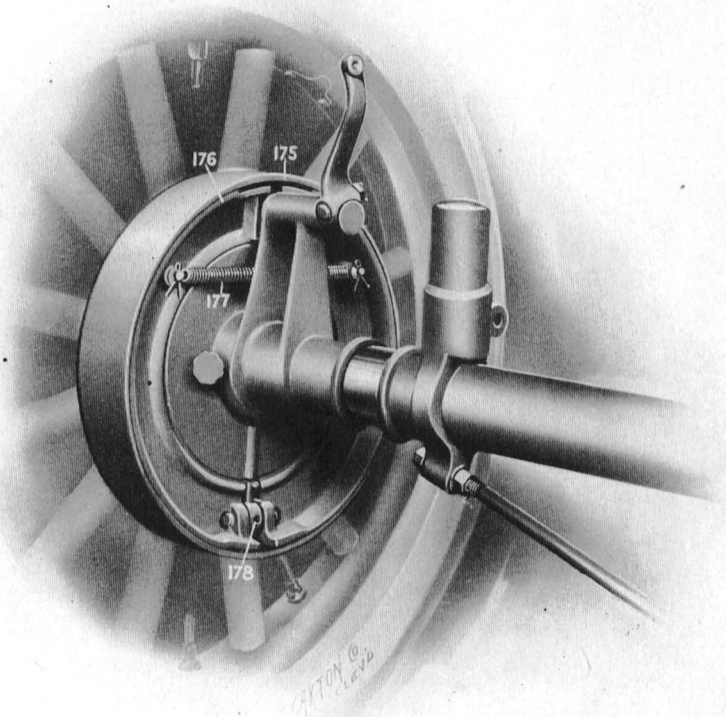


Plate 19

## To Get Good Results from the White Car

To get the best results care should be taken to keep the machinery clean and well lubricated; the stuffing boxes packed and the joints in the pipes all tight.

Use an air pressure of about 40 lbs. for city running, and 50 to 60 lbs. for speed or country touring.

Keep the hand by-pass valve to power pump open in good roads and for speed.

Do not crowd the car at the start as the engine will warm up quicker if it is not crowded. After it becomes thoroughly warmed up, the car can be run to its capacity.

To get the full power from the car it is necessary that the fire should over balance the water. To maintain this an operator must be sure that the fire closes off automatically every few minutes. This insures that the engine is getting dry superheated steam, and it is only then that best results can be obtained. If the fire does not close automatically every few minutes, the speed should be slackened until it does shut off. When the fire stays on continuously it is a sign that the water supply has overbalanced the fire and there is more water coming into the generator than the fire is capable of turning into dry superheated steam, and consequently the steam will become less hot and less efficient.

Car must not be left standing with main burner turned on. It is advisable to turn off main burner some distance before a stop to insure low pressure on leaving the car.

It is advisable when through using the car to blow off the generator from the top. This is done by opening the blow off valve 131, Plate 5.

## To Drain the Car

This *must* be done when the car has steam up and all parts are warm.

Remove the strainer 129, Plate 5, from Water Tank and see that no water gets into it as the Tank drains. Break connection at bottom of Pipe 29, Plate 5, open drip cock at bottom of Condenser, and run the engine free at a good rate of speed for about half a minute, keeping the fire on. Open the Blow off valve No. 131, Plate No. 5, and at the same time work the hand Pump as fast as possible while all the steam is being exhausted from the Generator. Continue hand pumping for about half a minute. Then close the fuel supply valve, and remove the balls from all check valves.