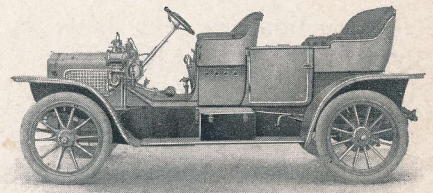
INSTRUCTIONS

FOR

The White Steam Cars

M AND O MODELS



CLEVELAND, OHIO, U. S. A.

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THE BRITTON PRINTING CO., CLEVELAND, O.

The instructions in this book apply equally to the 20 H. P. Model O and the 40 H. P. Model M car. The 20 H. P. Model O car has been given the preference when any difference occurs. The differences, except as to the size of the parts, are so few and of such a nature that no difficulty should be experienced in understanding thoroughly both cars from this one book.

Index to Plates

Index

Chassis, Side View

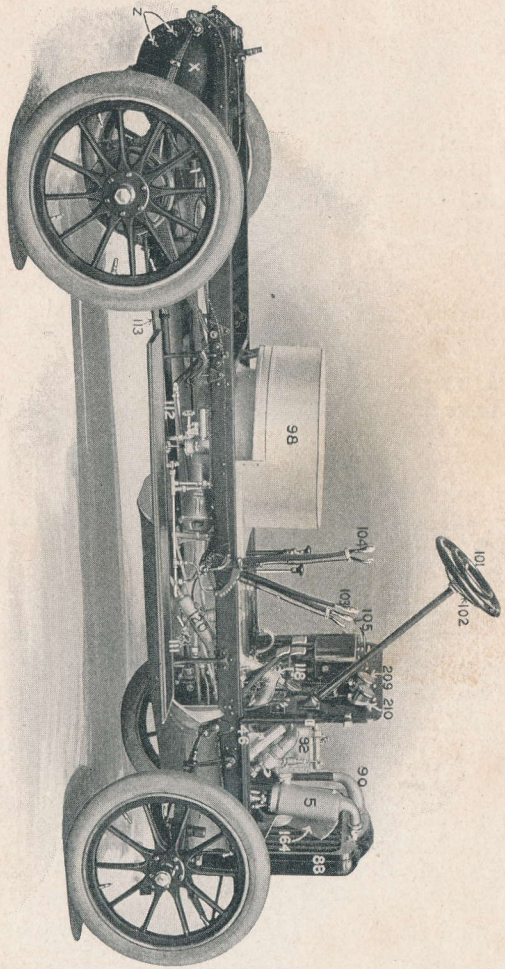


Plate 1

Fuel Connections

Plate 3

The fuel tank is divided into two compartments, X and X2, plate 2. Compartment X contains the main fuel supply and feeds to the burner through valve AB and pipe A. Compartment X2 is designed to contain an emergency supply of fuel, to be used in case tank X is exhausted. Fuel from this emergency tank X2 flows through valve AB2 and joins the main fuel supply line A at E.

Fuel passes through pipe A, plate 3, then through fuel strainer B. From the strainer, fuel passes through pipe H, valve J, pipe K, valve L, pipe M and pipe HA to vaporizer N. The gas is discharged from the vaporizer through pipe NA and nozzle O into burner induction tube R. Warming up valve G is supplied through pipe I. This valve is only used when it is necessary to get steam to start the engine running, and opens up a straight path for the fuel to the burner without fuel passing through any of the regulators. It is operated entirely by hand and care must be taken to see that the valve is shut tight when not used for warming up, and when being used that it is not left open long enough to get a red hot generator. Ordinarily two minutes is the time.

Air pressure is delivered to both fuel tanks through pipe AD. Where AD enters tank X2 an air shut off valve 45 is provided. When running on tank X, valve AB2 should be closed, but valve 45 may be left open. It is presumed that emergency tank X2 is kept filled.

Chassis, Top View

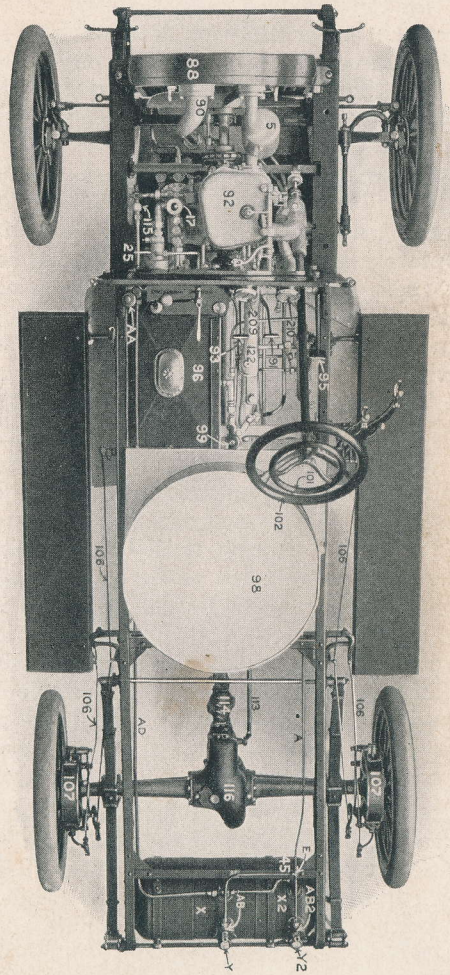


Plate 2

Should fuel in tank X be exhausted turn off valve AB, so that air cannot enter fuel line A from this empty tank. Then turn on valve AB2, opening up emergency supply to burner. See that valve 45 is open so that air pressure may be maintained on this tank.

To Fill Fuel Tank

See that the main valves AB, AB2 and all drain and try cocks, plate 2, are closed, and that no fire is in the sub-burner, main burner or near the car. Loosen cap Y, and allow the air pressure to escape before the cap is entirely removed. Fill through the opening Y, but do not remove strainer. Put cap back into place and screw down tight to prevent leak.

The air pressure on emergency tank X2 may be utilized to deliver fuel to the burner for starting car after filling tank X. This may be accomplished by closing air valve 45 so that the air pressure will not escape from X2 when cap Y on tank X is removed. When tank X is filled open valve AB2 and start car on fuel from tank X2. No pressure will register on the air gauge after valve 45 has been closed and cap Y loosened or removed. As soon as engine can be started, pump air pressure to fifty pounds. Now close emergency fuel valve AB2 and open main fuel valve AB and you will again run on fuel from main fuel tank X. It is advisable to run with air valve 45 open, except when starting on the emergency fuel tank.

To raise air pressure in tank when it has been exhausted from both tanks X and X2 and there is no steam to run engine air pump, press the plunger in pump AA, plate 2, down hard, and turn to the left to open valve in the bottom of the pump. Move plunger up and down its

full length of stroke until 30 pounds pressure has been attained. When pumping keep the palm of the hand over hole in top of plunger to prevent the escape of air. The pump should be locked down when not in use. To do this press plunger down and turn to the right to close the valve.

In the main fuel line A where it leaves the tank there is the main shut-off valve AB. This valve AB contains a ball check arranged in such a way that should there come a rapid rush of fuel through the valve, such as would result from an accident, it would carry the ball to its seat and automatically shut off the fuel flow. In order then to get any further flow of fuel it will be necessary to unseat the ball. The valve stem of this valve has a projection on the end so that when valve is closed the projection will force ball from its seat and thus allow the free passage of fuel when valve is again opened.

Tank X2 is equipped with a similar valve, AB2, which gives the same protection while run on the emergency tank, and is operated in exactly the same manner.

To Light Sub-Burner

To light the sub-burner it is assumed that the fuel tank has been filled, the pressure pumped up to 30 pounds, and the main fuel valve AB, plate 2, has been closed.

See that sub-burner valves D and F, plate 3, are all closed, open the main fuel valve AB, plate 2, which allows the fuel to come through pipe A, plate 3, to the sub-burner V.

See that valve F is open at least one turn. Open door W and hold a lighted match inside. Now open the

supply valve D slightly, closing it again at once, leaving it open about a second. Continue opening and closing this valve until sufficient gasoline runs into the drip cup, where the match is, to light. By opening and closing valve D keep sufficient fuel in the drip cup to burn well and warm up the sub-burner. As soon as the sub-burner gets hot enough to vaporize the gasoline, fuel will cease to run into the drip cup as it has now become a gas and will pass up through pilot light grate and burn in the main fire box. Now open valve D at least one turn and leave open. As soon as the gasoline in the drip cup is all burnt out this flame should burn blue and soon heat the grate to red hot. This can be seen by looking through the hole in the boiler casing. As soon as the sub-burner gets warmed up the flame should be adjusted by means of valve F. This valve regulates the strength of the flame and should be turned up or down until the proper flame is obtained. A steady blue flame that does not roar is the proper flame.

In case the sub-burner goes out, but is still hot enough to vaporize the fuel, it can be lighted by putting a match through hole in the casing without using the drip cup.

To shut off sub-burner, close valve D, and open valve F wide. This frees the passages in the sub-burner from gas and helps to keep them clear and open.

To remove the sub-burner it is only necessary to unscrew the union in pipe MA, plate 3, then give the inside of the sub-burner a turn with the hand to unfasten the bayonet lock and the whole inside comes out, leaving the sub-burner casing still in position. In this way the sub-burner can be changed very quickly and easily if necessary.

To Clean Sub-Burner

Should the flame of the sub-burner not be sufficiently strong with valve F two full turns open, work valve F back and forth to loosen the obstruction if around the orifice. Should you fail to get a proper flame after opening valve F three or four full turns, the sub-burner should be cleaned.

To remove sub-burner, see that valve D is closed and that fire in pilot light is out. Unscrew union on pipe MA; turn sub-burner to the left and pull down. Take apart, each piece having been marked so as to be easily assembled. Use small drill that is furnished with tool kit for cleaning. When assembling, be sure the joints are made tight, but be careful not to strip small screws by too great a strain. After being assembled, blow any dust it may contain through the stuffing box at F, then replace valve stem.

In replacing sub-burner cone P, be sure slotted part is underneath.

To Clean Vaporizer

To clean the nozzle O, plate 3, unscrew and remove any foreign matter. Sometimes there may be a closing in of the holes in the nozzle O, due to a slight deposit of carbon, though the holes may appear clean. It is advisable to run a drill through them occasionally, care being used to get exactly the same sized drill as is marked on the nozzle. The holes must not be scraped out, for if the holes become enlarged or out of shape the burner will not work properly. Replace and should the fuel not feed freely, the vaporizer must be taken out.

Remove the vaporizer door. Then remove the lower part by unscrewing the nut and pull down. Unscrew

To Clean Vaporizer—Continued

upper union on pipe HA and take out vaporizer. Note the position of end support, and the pipes, so that they may be replaced in their original position. Now take apart and with the large drill furnished with tool kit, clean thoroughly.

In replacing screws and support be sure copper gaskets are under each.

Be careful support enters support post U, plate 3.

When cleaning vaporizer, fuel strainer B should also be cleaned and water let out at water trap by removing plug at bottom of strainer casting B.

Burner

Plate 3

The burner is of the Bunsen type, the gasoline vapor drawing back in through the mixing tube R sufficient air to make good combustion. It has been found that different specific gravities of gasoline require different proportions of air in order to give the best results. The lower specific gravities, such as 65 to 70 (Baume scale) requiring more air than the higher specific gravities, such as 70 to 76. The air supply may be regulated by the air shutter S on the mixing tube, opening the vents for more air and vice versa. In cases where the air shutter does not provide ample adjustment, the holes in the nozzle can be enlarged or contracted to meet the requirements. A greater opening in the mixing tube is required in high altitudes where the air is less dense in order to get the same conbustion.

As a general proposition, too much air causes the fire to burn very blue and to raise up off the burner, so that

Generator, Burner and Fuel Connections

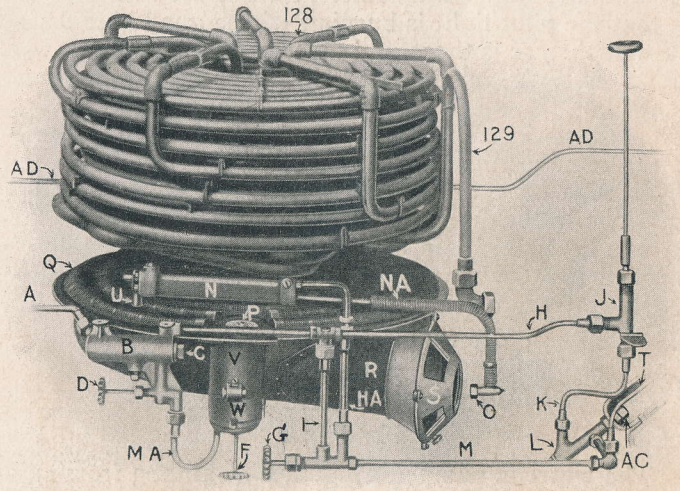


Plate 3

there is considerable space between the flame and the burner. Too little air causes the fire to burn with a red and yellow flame. The proper flame is a blue flame, a medium between the light and heavy flame as described above. Too light or too heavy a flame causes the burner to light back to the nozzle, and is sometimes accompanied by howling. Howling seldom occurs with a light fire, but usually comes from a heavy fire or from insufficient vaporization. In case of insufficient vaporization first of all see that the pilot light is burning with a good blue flame, and that the car is thoroughly warmed up. If the vaporization is still insufficient, the vaporizer should be changed.

In the usual course of events, it is very seldom necessary to readjust the fire after the quality of the fuel and the altitude have been once determined. The ordinary variations in the quality of the fuel and the ordinary differences in the altitude will not have any appreciable effect, and it is only where the quality of the gasoline changes greatly or the difference in altitude is considerable that any adjustment will be found necessary.

Water Connections

Plate 15

The water is pumped by pumps 22 and 23 from supply tank 96 through hose 18 and is delivered through pipe 19 to flow motor 120. The main supply entering at 123 and the auxiliary supply from thermostat through pipes 100 and 130 entering at 163. Water leaves flow motor at 124, flows through pipe 83 to feed water heater 5 and pipe 127 to generator, entering generator at 128. The hand water pump No. 99 connects with water tank 96 through pipes 126 and 121.

To Fill Water Tank and Generator

Remove the cover of tank 96, plate 2, and fill in any manner that is convenient. Be careful the water is as clean as possible.

Now pump water to generator.

Press plunger of pump 99 down hard and turn to the left once or twice to open valve in bottom of pump. See that throttle is closed, and valve 111, plate 1, open. Work plunger up and down its full length of stroke until water runs from valve 111, indicating sufficient water in generator. Close valve 111 and lock pump by pressing plunger down hard and turn to the right to close valve.

In case water should get between the plunger and bottom of pump when valve is closed, it will be found impossible to force plunger down far enough to unlock valve. Unscrew stuffing box to let the water out at the top, press the plunger down and open the valve, then replace the packing and screw up the stuffing box.

To Clean Water Tank

The water tank 96, plate 2, should be flushed every two days. Do this after a run. The water will be warm and oil will flush out much better.

To flush, remove flush plug at rear end of water tank, place hose in forward part of tank and turn on water. This allows the water flowing back through the flush plug to carry all the oil along with it. This flush plug is placed half way up the tank and is protected by a pocket on the inside so that the tank will remain nearly full while flushing, thus giving the oil a good chance to rise to the top and float off.

To Clean Water Tank—Continued

Clean tank strainer often. To do this remove plug at bottom of tank, and draw off water. Then take out strainer by reaching down in tank, and giving a turn to the left. In replacing strainer be sure it is securely fastened.

To Start Car

Fill the fuel tank X, plate 2, and pump the air pressure to 30 pounds by means of hand air pump AA.

Fill the water tank 96 and pump generator full.

Light the sub-burner V, plate 3.

After the sub-burner has been lighted about five minutes the vaporizer N will have become heated sufficiently to vaporize the fuel for the main burner. Now start the main burner by opening slightly the warming up valve G. This allows the fuel to flow from the main fuel line into the vaporizer N, through pipe HA, without passing through any regulator. Should the vaporizer not be thoroughly heated a few drops of raw fuel may drip from the vaporizer nozzle O. If this drip is continuous close valve G, and allow the vaporizer to get hotter. It is advisable in starting to open and close valve G 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 thoroughly heated. With the main fire started satisfactorily, leave valve G open about a quarter of a turn and watch the steam gauge closely. This is important, as the steam pressure runs up very quickly and any inattention when the fire is first turned on may result in excessive pressure and cause the safety valve to open. As soon as the pressure reaches 300 lbs. blow off

Dash, Side View

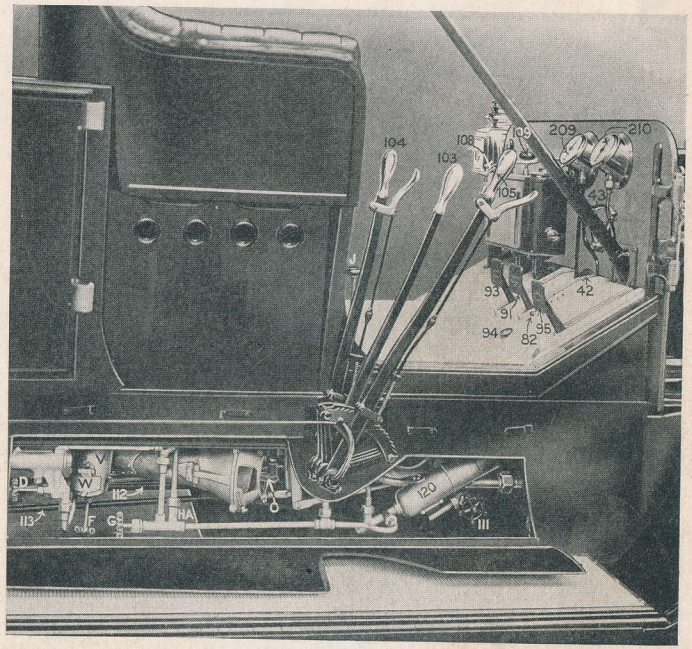


Plate 4

To Start Car—Continued

the surplus water collected in the pipe through the blow-off valve 111, plate 4. As soon as steam comes from this valve, close it and allow the steam pressure to reach 300 lbs. Now turn the warming up valve G, so that there is not over twenty pounds showing on the vaporizer pressure gauge 209. See that your gear lever 103 is in the central or neutral position, so that the engine can run without moving the car, open cylinder relief cocks by throwing lever 43, plate 5, to the left hand position under air gauge 209, then push the starting pedal, 93, all the way forward, open up the throttle a little and WORK THE WATER OUT OF THE ENGINE EASILY AND CAREFULLY, by working the reverse lever back and forth from forward to reverse position until the engine starts running. Now close valve G and open valve J. Admit just enough steam to the engine to keep it running until the water is out, when it should run smoothly. Until all water is out, the engine will run jerkily, and do not force it by opening the throttle too much, but give the water a good chance to work out gradually. Throw cylinder relief cock lever over to the right hand position under steam gauge 210. Now transfer foot from the starting pedal to cut off pedal, and press this forward so that engine will get steam the full stroke for about half a minute, then remove foot from cut-off pedal and run the engine two or three minutes so as to get well heated. Pump air pressure to 50 lbs, which is normal working pressure, and adjust sub-burner to this pressure. The car is now ready to start. Should the pressure go above 300 lbs. in the generator while warming up before the engine is running, the warming up valve G should be closed. THIS WARMING UP VALVE G MUST NOT BE LEFT OPEN MORE THAN TWO MINUTES, because it allows the fuel to run to the burner

Dash, Top View

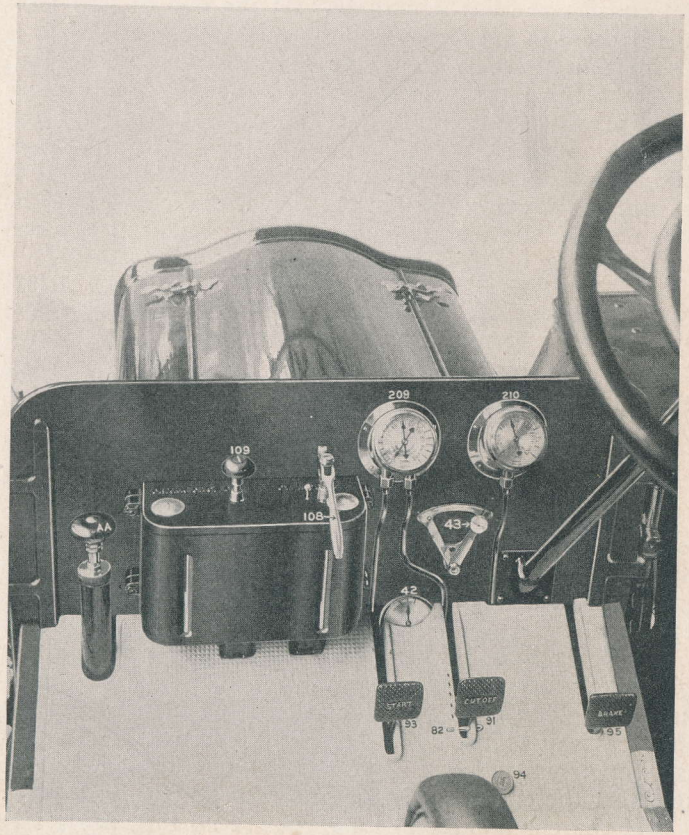


Plate 5

To Start Car—Continued

independent of the regulation and after two minutes it will cause a red hot generator. At the end of two minutes if there is not steam enough to start the engine it is a sign that there is no water in the generator, and to leave the fire on any longer would not cause any more steam pressure, but would heat the generator red hot and do harm. Shut off valve G and pump water into the generator by hand and start as previously explained. It is essential in starting up that the driver make sure that he does not use the warming up valve G so as to get a red hot generator.

CARE SHOULD BE TAKEN NOT TO RUN THE ENGINE TOO RAPIDLY WHEN RUNNING IDLE, AS SUCH RACING OF THE ENGINE DOES NO GOOD AND IS INJURIOUS AND SHOULD BE RUN IN FORWARD MOTION SO FAN WILL DRAW AIR THROUGH CONDENSER.

To start the car, shut the throttle and throw in either gear that is desired. Push forward the starting pedal 93, open the throttle and the car will move off. As soon as the car has moved a few feet take your foot off the starting pedal. It is advisable to run with valve J full open and to close it only when standing still and when leaving the car.

When starting the car after stopping for a time, but when the sub-burner is not put out, if there is steam pressure enough to start the engine running idle, it will not be necessary to use the warming up valve G. In that case, open valve J and start the engine running, but do not start the car until the engine runs smoothly.

If the car has stood long enough so that the steam pressure has gone, it will be necessary to use the warming up valve G, and under these conditions it must be used very carefully and not left open more than two minutes.

Engine—Pump Side View

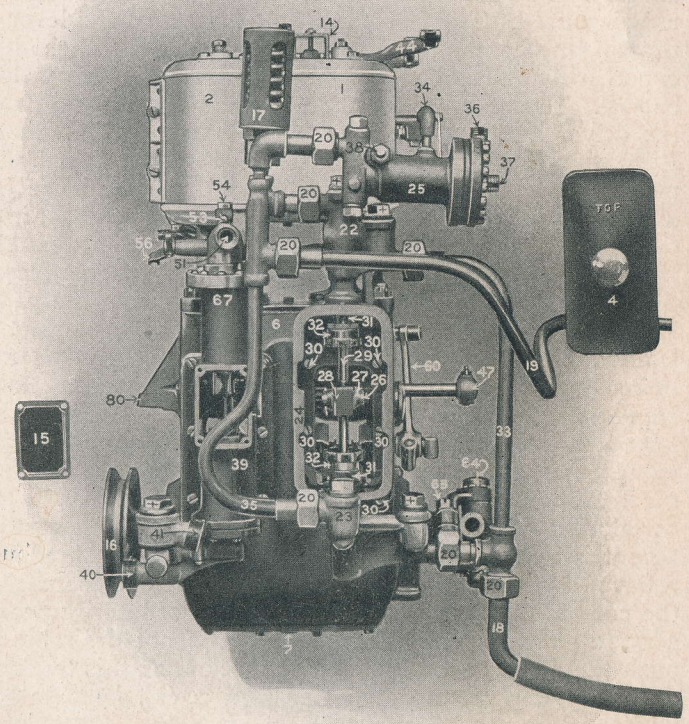


Plate 6

Cut-off Pedal

No. 91, Plate 5

The position of this lever determines the cut-off at which the engine is working, or, in other words, how expansively and consequently how economically the steam is being used. The closer to the dash board the lever is the longer steam is admitted to the cylinders and the less expansively the steam is being used, i. e., there is less cut-off. Therefore, when the pedal is pushed away from the driver by his foot the steam is not cut off so short. By means of a pin across the slot in the floor board, this pedal can be held in any position desired and the car should be run with the pedal as far from the dash, i. e., on as great a cut-off or linked up as much as possible, without getting a rough running engine. By this means the engine is always running linked up unless the pedal is pushed forward, and is consequently running economically both in steam and fuel. The engine can be run linked up or on greater cut-off when running fast, and consequently for country touring the pedal can be allowed to come further away from the dash than in city work, care being taken not to cause a rough running engine. When a hill or a piece of bad road is met and the car slowed up, if the engine begins to vibrate, indicating that it is linked up too much for that speed, it should be relieved by pressing this pedal forward, thus increasing the cut-off. Only a slight movement is ordinarily necessary to get the desired result and it is not desirable to push the pedal to the limit of its motion, as this tends to drain the generator and better results can be obtained without doing so.

This lever can be set in such a position that it would not be necessary to touch it under any circumstances, but

Engine—Valve Side View

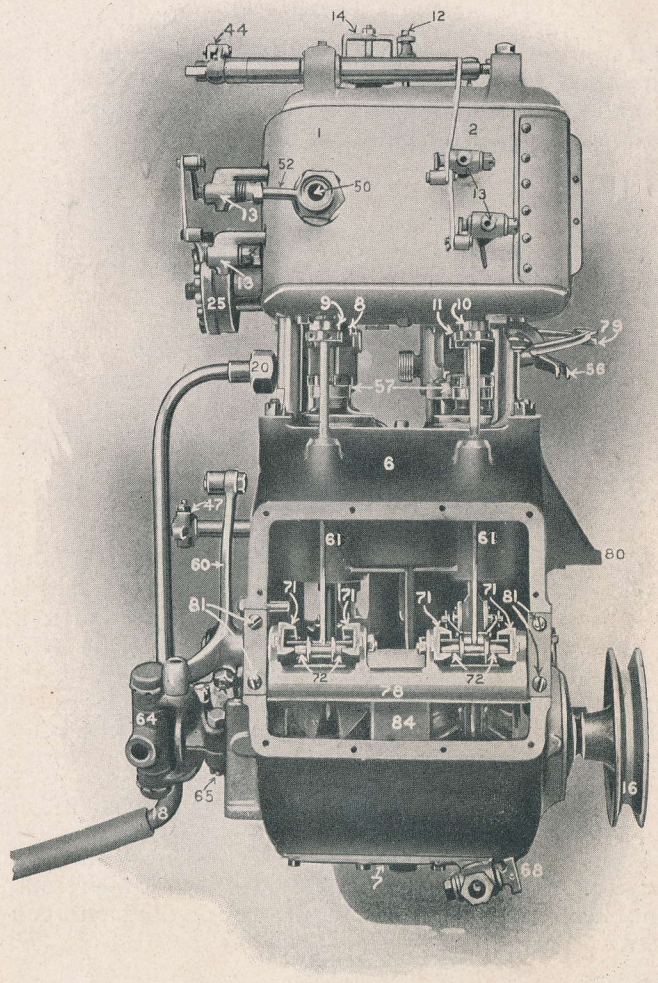


Plate 7

this would mean very little cut off and result in using an unnecessary amount of steam and fuel. The best results are obtained by running with as short a cut-off as possible and using the foot to hold the pedal forward temporarily when a longer cut-off is necessary.

Engine

The engine is of compound marine type with a high and a low pressure cylinder, both with piston valves, operated by the Joy valve gearing. Ordinarily steam from the boiler is only admitted to the high pressure cylinder in a compound engine, but 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 may be on its dead center. This is accomplished by means of the simpling valves 12 and 14, plate 7.

When starting, the first steam that enters the cold cylinders is condensed, and relief cocks No. 13 should be opened by throwing lever 43, plate 5, to left hand position until water is all out. The engine must be started slowly and given a chance to warm up. Opening the throttle too much, so as to admit a great deal of steam when the cylinders are cold, without opening the relief cocks, will result in damage to the engine.

In plate 8, the valves are in the position for engine to run compound. The steam in high pressure steam chest passes into high pressure cylinder, then exhausted through passage, and through valve 12 into low pressure steam chest; then through low pressure cylinder to condenser.

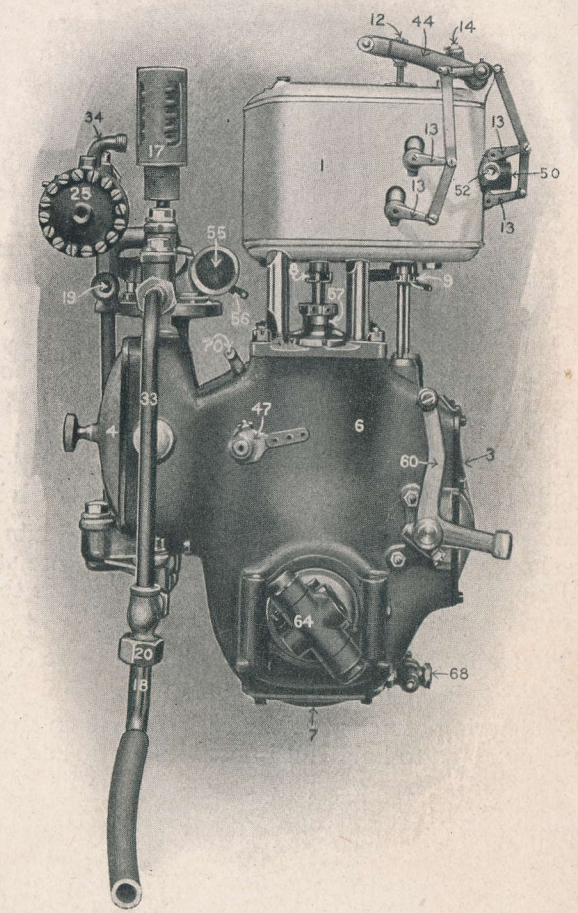


Plate 8

Engine—Continued

To simple engine, pedal 93, plate 5, should be pushed forward. This movement will open by-pass valve 14 and allow steam to pass from high pressure steam chest direct to low pressure steam chest, admitting high pressure steam to both cylinders. At the same time valve 12 is moved so it allows exhaust steam from high pressure cylinder to pass out the exhaust pipe and closes the passage between the high pressure exhaust and the low pressure steam chest, as shown in double page sectional view of engine on pages 36 and 37, where engine is shown with parts cut away so as to show the internal construction in detail as far as possible.

If the engine should thump when compound, but runs smoothly when pedal 93 is forward, it generally means that valve 14 is not seating properly and should be inspected and ground if necessary.

Both high pressure and low pressure piston valves are adjusted in the same manner as any valve of this type in use in steam engines, the lead being equally divided.

These valves give no trouble if properly lubricated. Care should be taken when starting to press the starting pedal No. 93 as far forward as it will go so that the simpling valves come into complete operation.

The roller at end of cut-off lever 60, plate 8, should follow the shoe connected to cut-off pedal 91.

The spring attached to the cut-off lever 60 should be in tension so as to hold roll in contact with shoe.

Crankshaft

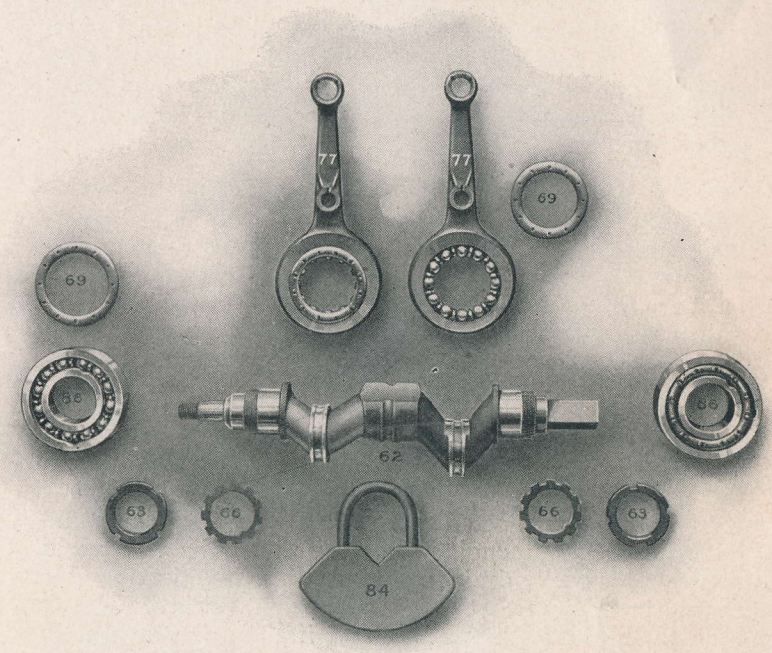


Plate 9

Crank Shaft

Plate 9

The crank shaft is a one-piece forging, No. 62, heat treated and carefully ground to size. It is fitted throughout with ball bearings and carries two main journal bearings, No. 86, and two connnecting rod bearings. These bearings are all annular bearings of large size and fitted with ball separators and, if well lubricated, will wear indefinitely.

The levers, 61, that operate the valves get their motion from the connecting rods 77 and all joints and wearing surfaces are made unusually large and strong to prevent wear. The connections are very direct and the difference in the few levers used is such that there can be no confusion in assembling this valve motion should it be taken apart.

To insure a long life to the crank shaft and valve gearing it is necessary that it be properly lubricated, and at least every five hundred miles the drain cock, 68, in the bottom of the crank case, should be opened and any water that has collected there drained out. This should be done when the engine is cold, as then the water will settle and is easily drained out. At this time the operator should make sure that there is sufficient oil in the crank case to lubricate thoroughly and if there is not, put in enough.

Once a month clean out the oil in the crank case and fill with new. To do this, put a pint or so of kerosene in the crank case and run the engine at moderate speed for five minutes and then open the drain cock and let it all run out. Fill with two quarts of clean oil.

Engine, Valve and Pump Gearing

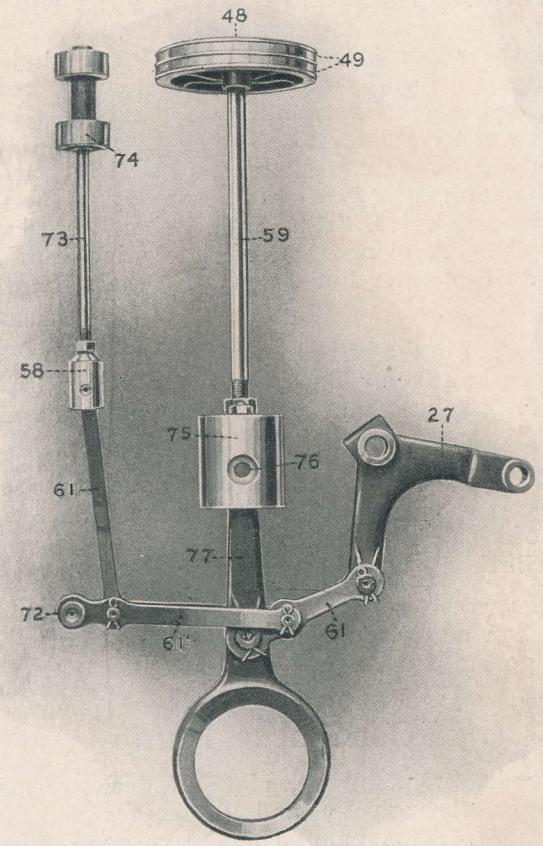


Plate 10

Generator Pumps

Plate 6

There are two pumps that force water into the generator. These are arranged as in plate 6, 22 being called the upper pump and 23 the lower pump. Both pumps are driven by the same rocker lever, and deliver water to the generator, and are automatically by-passed by the water regulator 25. The nipple connecting pumps to the water regulator contains a small strainer to prevent foreign matter getting into and clogging water regulator by-pass valve. This strainer should be cleaned occasionally. A plunger, 17, with a spring back of it is put into the water line to cushion the strokes of the pumps.

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 this setting the pumps are most efficient.

To reseat these check valves remove the bronze balls and insert a steel ball of the same size. Place a drift or piece of pipe on the ball and rap once or twice, and the seat will be as perfect as new.

The water from the pumps passes through pipe 19, to the flow motor 120, plate 1, to the feed water heater 5, to the generator 98.

Condenser Pump

Condenser pump 39, plate 6, draws water from condenser through 40 and discharges to the tank through 41. This pump contains a good sized plunger and the valves are of the mushroom type. If there

are no air leaks in the condenser and connections the pump is capable of maintaining some vacuum at moderate speed.

Power Air Pump

The power air pump 67, plate 6, and the condenser pump 39, are driven from the same rocker lever.

The air pump inlet and outlet valves are situated at the top, and are so constructed that they can be easily removed. It is only necessary to slacken one bolt 54, which passes through a yoke 53, holding down both valve clamps. The inlet valve is protected by a fine wire screen 55, plate 8, preventing dirt from being drawn into pump.

When the engine is running the pump piston is in motion, but delivers no air to tank, as lever 56, plate 6, keeps suction check from seat. When pressure is needed, press pedal 94, plate 5, which operates lever 56, plate 6, and allows suction check to seat; keep the pedal 94, plate 5, down until the required amount of air has been pumped.

To clean the valves, take off the yoke, No. 53, which holds the valve chambers in place. Lift out the valves and clean them and the seats thoroughly. Place the valves in their original position and clamp the valve chambers down tight.

Throttle

Plate 11

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 180, plate 11, at the end of the throttle spindle 174 which projects up from valve seat 181 into the passage 184. No. 180 is nearly a fit for 184 and has a beveled point. When the throttle is open, as in the plate, 181 is drawn away from the seat by the action of the threads on the throttle stem when it is turned, but 180 is of such length that it is not drawn out of 184 and immediately the valve has left the seat the throttling is all done by the position of 180 in 184, obviating the wear on the seat itself.

Care must be taken in setting the throttle so that the lever 177 is in such position that when connected to the throttle wheel it can be shut, and also, when shut it can be opened to the largest extent that is possible considering the length of the arc through which the lever 177 moves. There must be movement enough to draw 180 out of 184 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 177 is at the extreme end of its arc of movement.

Throttle

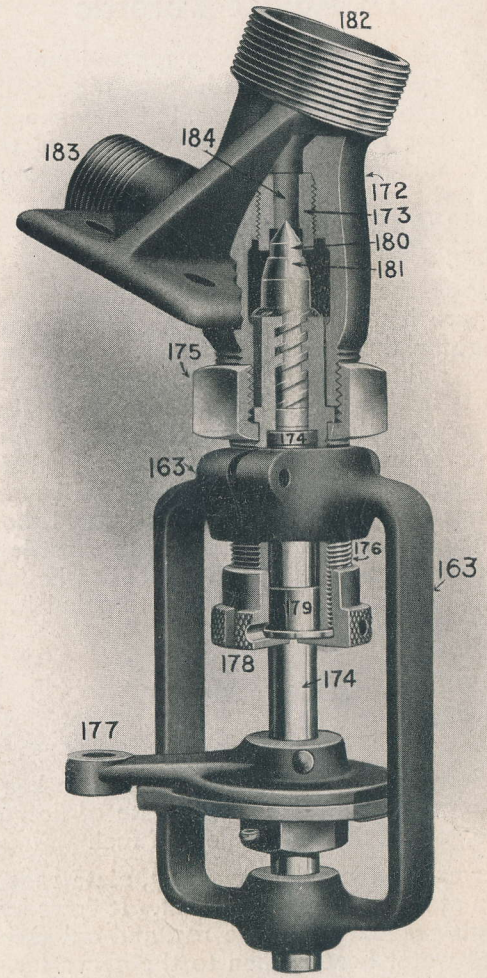


Plate 11

To Adjust Throttle

To set the throttle: Loosen 175 and move 163 until the desired position is reached. No. 163 should not be loosened on 176 for this purpose, but they should be considered as one piece. No. 176 carries the threads in which the spindle 174 works, and which controls the movement of the throttle valve, and by moving the position of the threads the position of 177 is changed for the corresponding same position of the throttle valve.

To grind the throttle: Loosen the screw clamp on 163, and turn it to the right on 176 about a quarter of a turn. Tighten the clamp 163 and loosen 175 and move 177 to the right of 163. By this means the valve stem 174 projects farther through the sleeve 176, and the valve comes up against the seat before the sleeve 176 comes up to its seat. Turn 174 and 176 together by holding 163 and 177 together, and the valve at 181 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 175 the stem can be taken from the car and pumice put on the seat to grind it.

Flow Motor

Plate 12

The flow motor is a device by which, when there is any flow of water through it, the rate of flow of water is made to govern the rate of flow of fuel.

Water enters the cylinder at 123, plate 12, through a connection at back unseen in the cut. It flows by the piston through graduated groove 195, and out through 124 to the feed water heater, then to the generator. As the

Flow Motor—Continued

flow increases piston 191 will be forced down in the cylinder, compressing spring 198; and the more water that enters the cylinder the more the piston will be forced down, and the greater the amount of water passing through the motor will be, until the spring 198 has been compressed to a point where valve 197 is drawn away from its seat, and if the flow or amount of water coming into 123 is any further increased, it passes out through valve 197, and the piston 191 has reached the limit of its action. Attached to the piston 191 is a small piston rod passing out through a stuffing box, 125, and through another stuffing box, AC, terminating in the fuel valve L of the flow motor. In the position in the cut there is no water flowing through flow motor, and piston 191 is at the top of its movement, and valve L is closed and no fuel is passing from K through L and out at M. When there is water flowing through the motor, 191 is moved down and valve L is proportionately opened. This valve is graded in such a way that the more it is opened, the more fuel is fed to the burner, until the maximum movement of the piston 191 is obtained and at that point there will be the maximum fuel flow and consequently the greatest fire under the generator.

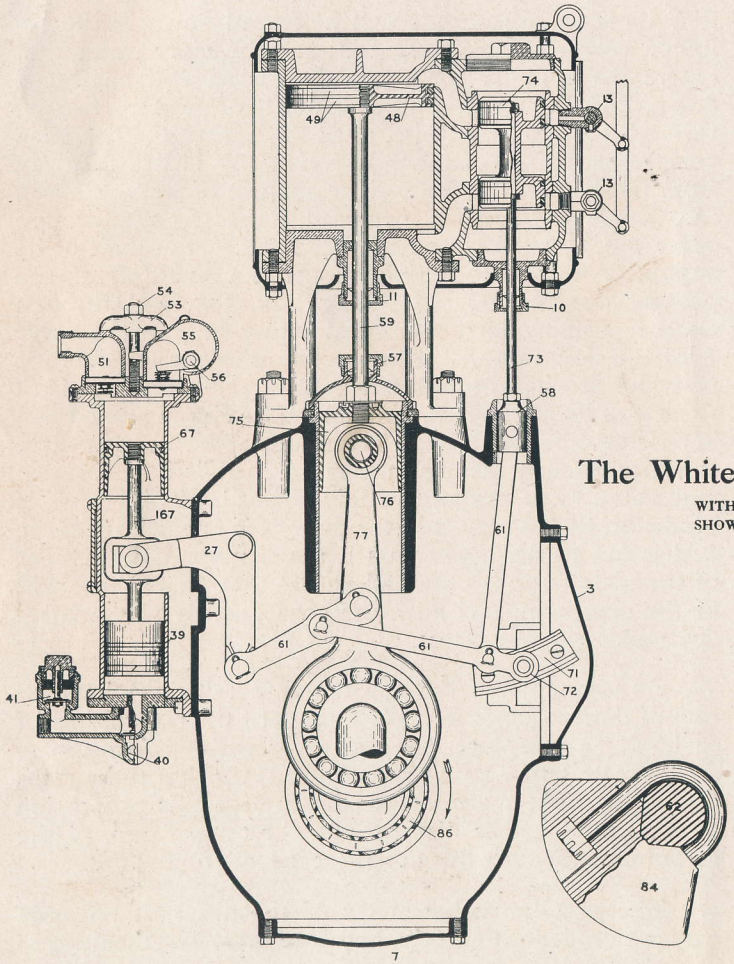
As stated above, the flow motor is a device where the rate of flow of water is made to govern the rate of flow of fuel. It is, therefore, necessary for maintaining a constant steam temperature at varying loads that these rates of flow be rightly proportioned. In case this proportion of water and fuel is disarranged, the temperature of the steam will vary greatly at different loads.

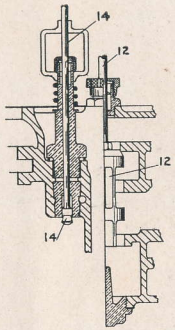
The gasoline valve stems of the different powered cars are graded differently, and care must be taken not to

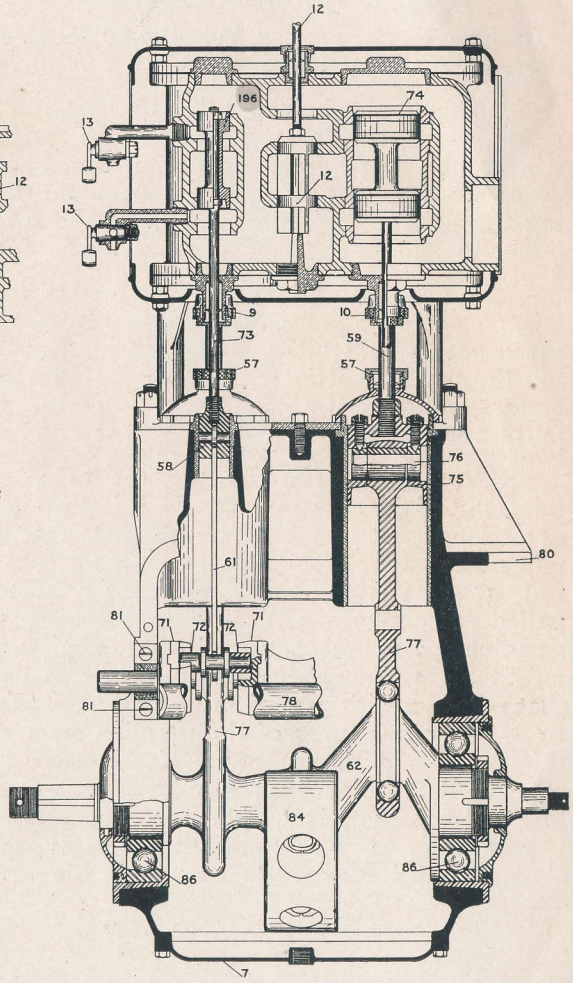
SECTIONAL VIEW OF

The White Model M. & O. Engine

WITH PARTS CUT AWAY SO AS TO
SHOW DETAILS OF CONSTRUCTION







Flow Motor—Continued

mix the fuel valve stems from the 20 H. P. car with the valve stems from the 40.

It should also be noted that in the action of the flow motor, the generator pressure or the pressure under which the water enters the flow motor, has nothing to do with the action of it, as it is the amount of water passing through and not the pressure that causes the flow motor to act.

The union at valve 197 can be readily removed, giving free access to that valve for cleaning. Care should be taken not to tighten the stuffing box nut on 125 and AC too tight or it will interfere with the free action of the motor. When well packed tightening with the fingers is all that is necessary.

If for any reason the gasoline valve stem 193 is taken out of the flow motor, when it is put together again, great care must be taken to make sure that the gasoline valve stem 193 is screwed far enough into the piston rod 192 so that the flow motor piston 191 is pulled down 3-32 of an inch. In other words, screw the gasoline valve stem 193 into the piston rod 192, until the gasoline valve is up against its seat at L. From that point screw it 3-32 of an inch more, or what amounts to it, about five turns of the gasoline stem, and lock in this position with nut 194. If the valve stem is not screwed that distance the proportion of water and gasoline will not be correct, giving too much gasoline, which is very likely to cause a red hot generator when running slow, though it may not be noticeable when running fast.

Flow Motor

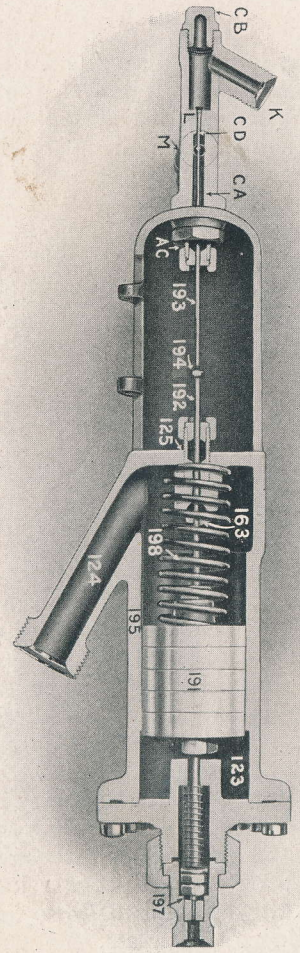


Plate 12

Thermostat

Plate 13

The thermostat is a regulator acted on by the temperature of the steam after it leaves the generator but before it reaches the engine. It has two elements, 122 and 207. No. 122 is an iron tube through which the steam passes forming part of the main steam line between generator and engine—steam entering at 216 and leaving at 217. No. 207 is the rod inside of the pipe fastened securely to the pipe at one end 215 and projecting out of the pipe through a stuffing box, 213, at the other end.

When the steam passes through 122 on its way to the generator, 122 and 207 become heated, 207 being made of a metal that expands more with heat than 122, it increases in length more rapidly than 122. As the elements are fastened together at one end this difference in length is taken care of by projecting through the stuffing box 213. This acts upon the bell crank 205, which in turn raises valve 201 from its seat and allows the passage of water from 200 out at 204, thence to pipe 130, plate 15, and into the delivery side of flow motor at 163 in varying quantities in proportion to the distance that the rod 207, plate 13, pushes the bell crank 205 to raise valve stem 201.

As the elements cool, 207 contracts and allows bell crank to fall, when the spring 206 will cause the valve 201 to come to its seat again. Thus the thermostat accommodates itself to the needs of the generator as is shown by the temperature of the steam.

There are stuffing boxes at 212 and 213 and care must be taken to see that these are properly packed; 213 with asbestos packing, and 212 with water packing. These must be screwed up enough to prevent leaking, but care must be taken that they are not made so tight as to interfere with the working of the parts.

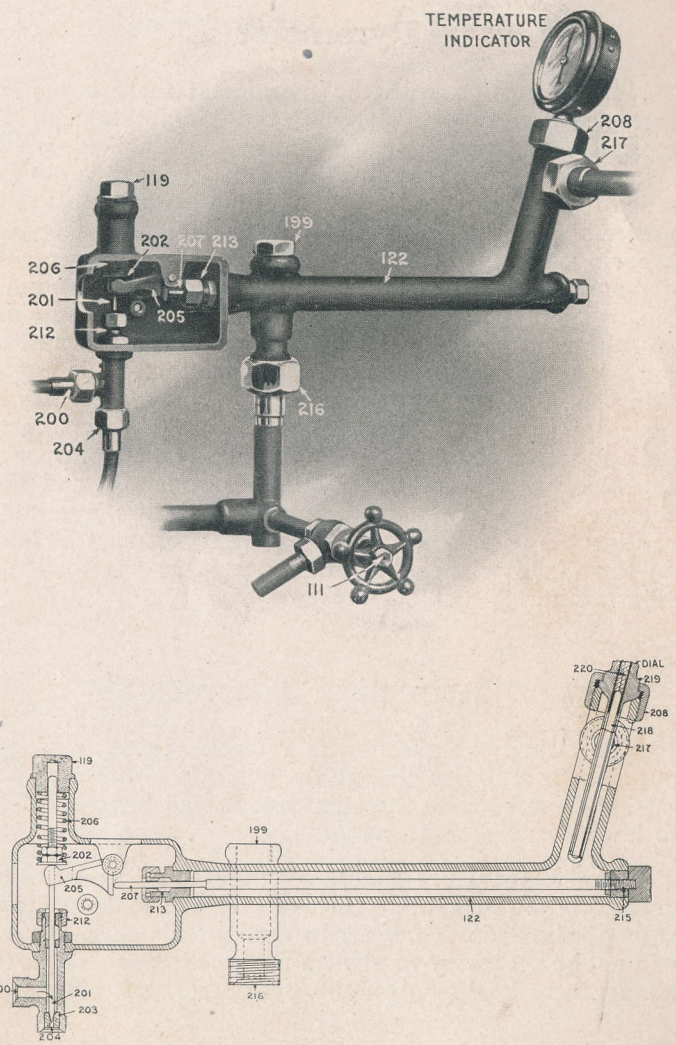


Plate 13

Pyrometer

In connection with the thermostat there is a pyrometer with a gauge showing the temperature of the steam. This consists of two elements, 218 non-expanding element, and 219 expanding element. No. 218 is not fastened to the tube and is capped with a metal cap 220 that projects into the gauge case, where it presses against a spring arrangement connected with a pointer on the gauge face, indicating any movement of the pyrometer. No. 219 is made all in one piece without joint of any kind and the pyrometer has been found to indicate accurately for a long time without need of correction. It is a good thing to check up on it once in a while. This may be done by putting a thermometer into the thermometer hole 199 and running the car until the temperature as shown on the thermometer becomes constant, and then compare the thermometer reading with the pyrometer reading. Any correction on the pyrometer must be made on the dial itself, as the other parts are not made for adjustment.

Adjustment of Thermostat

To adjust the thermostat remove cap 119 and pull out stem 201. Then change the position of the nuts 202, raising them to raise the temperature and lowering them to lower the temperature.

The temperature should average 390 degrees centigrade, and one complete turn of 202 will make a difference of about 60 degrees. In setting this thermostat it will not be necessary to always use a thermometer, as the temperature is shown on the pyrometer, but care must

be taken to run the car on the road long enough to get a constant temperature before any change is made. The temperature cannot be set accurately when the car is standing but should be set when running on the road, which is a very easy matter with the pyrometer always before the driver.

Water Regulator

Plate 14

The water regulator is a simple diaphragm valve actuated by the steam pressure in the generator. This valve is situated in the water line and it acts to either permit all the water thrown by the two water pumps to be returned to the tank, or to permit none of it to be returned, thus causing all the water to flow toward the generator through the other parts of the automatic regulating system; the valve being free or closed depending on the steam pressure.

The steam pressure in 37, plate 14, presses against the four diaphragms 134, causing 136 to move and compress the spring 138. The spindle moves lever 140, which will cause 141 to leave the seat 144. Water from pumps will flow around valve 141 and out of the regulator at 34.

When steam pressure goes below tension for which spring 138 is adjusted, the spindle 137 will return to its normal position, allowing valve 141 to seat and by-pass is closed.

In case of renewing diaphragms the regulator must be taken out. Blow off steam pressure; disconnect at 34, 36, 37 and 145. Be careful not to lose valve 141. Turn

Water Regulator—Continued

spring adjusting worm 38 to the right until the tension on spring 138 is entirely relieved, and remove screws from cover. Cover 133 and plate 97 should be marked so that they may be replaced in their right position. One side of plate 97 is concave, and this side must be next to the diaphragms or the regulator will not by-pass.

When plate 97, diaphragms 134 and cover 133 are being replaced, care should be taken to tighten cover screws evenly. Then turn adjusting worm 38 to the left about two-thirds the number of turns the spring was relieved. This will put tension on spring very near to the pressure required, which is 550 pounds. Now be sure valve 141 is in position and the regulator is ready to be attached.

Make all connections except 34; this is to be left open to show at what pressure regulator by-passes. It will also show any indication of a leak around 141.

Oil must now be pumped around diaphragms. Open blow-off valve 111 and oil valve 118, plate 1. Use cylinder hand oiler 108, plate 5, until oil runs from valve 111, plate 1. Now be sure to close oil valve 118, as the diaphragms are now surrounded by the required amount.

Run the engine free. When steam pressure reaches 550 pounds, the by-pass valve 141 should be open and water discharge at 34. If water is discharged before pressure reaches 550 pounds, turn adjusting worm 38 to the left a full turn or more. Keep doing this until the steam pressure reaches 550 pounds, at which pressure the regulator should by-pass.

By adjusting regulator with 34 disconnected, the condition of valve 141 will be made known. If this valve leaks it should be reseated by grinding with fine pumice.

Water Regulator

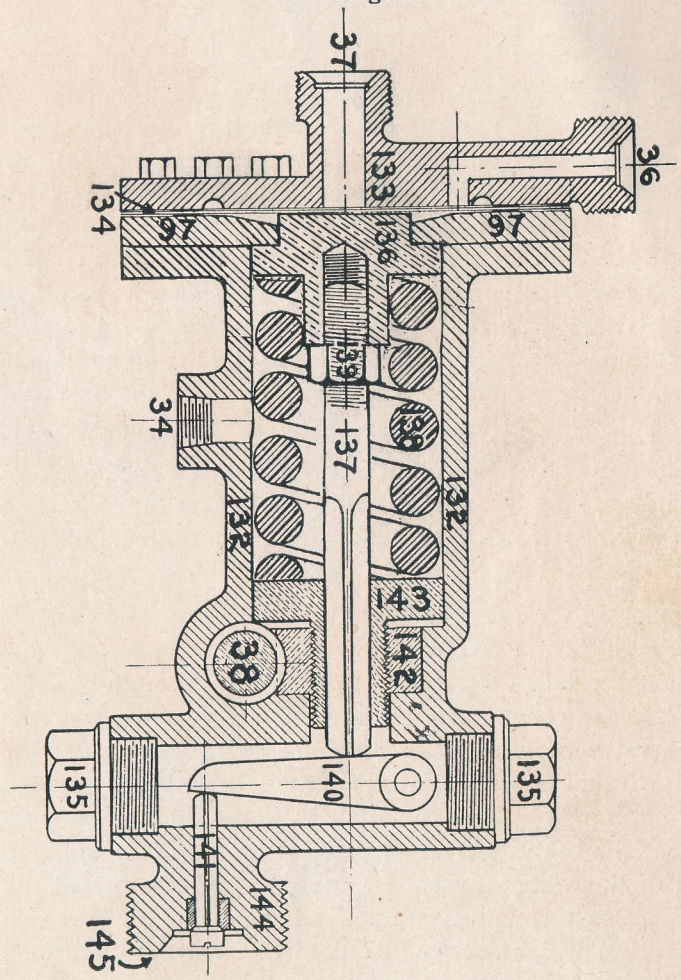


Plate 14

System of Regulation

Plate 15

The feed water pumps 22, 23, the water regulator 25, the flow motor 120 and its adjuncts, the thermostat 122 and its valve (all of which have been described), together with the various pipes which we will now point out, constitute the so-called regulating system, which, in its operation, so controls the water supply to the generator and the fuel supply to the burner as to maintain substantial uniformity of steam pressure and temperature in the generator, whatever may be the conditions in use, and irrespective of any attention from the operator.

The fuel is contained in tank X, plate 2, in which pressure should be about fifty pounds. A feed pipe A, plate 3, going from this tank to the burner M, contains a valve L, by which the flow of fuel is controlled.

The feed water pumps, Nos. 22 and 23, which are connected with the engine, pump water from the tank 96, through pipe to the water regulator 25. Steam from the generator is led to this water regulator through pipe 37. When the steam pressure exceeds 550 pounds, it opens the valve of this water regulator, with the result that all of the water thrown by the pumps is by-passed through pipe 34 back to the tank. When the steam pressure falls below 550 pounds, this valve closes, whereupon all of the water thrown by the pumps goes toward the generator through pipe 19. This pipe divides into two branches which are again united to form the main feed

Water Connections

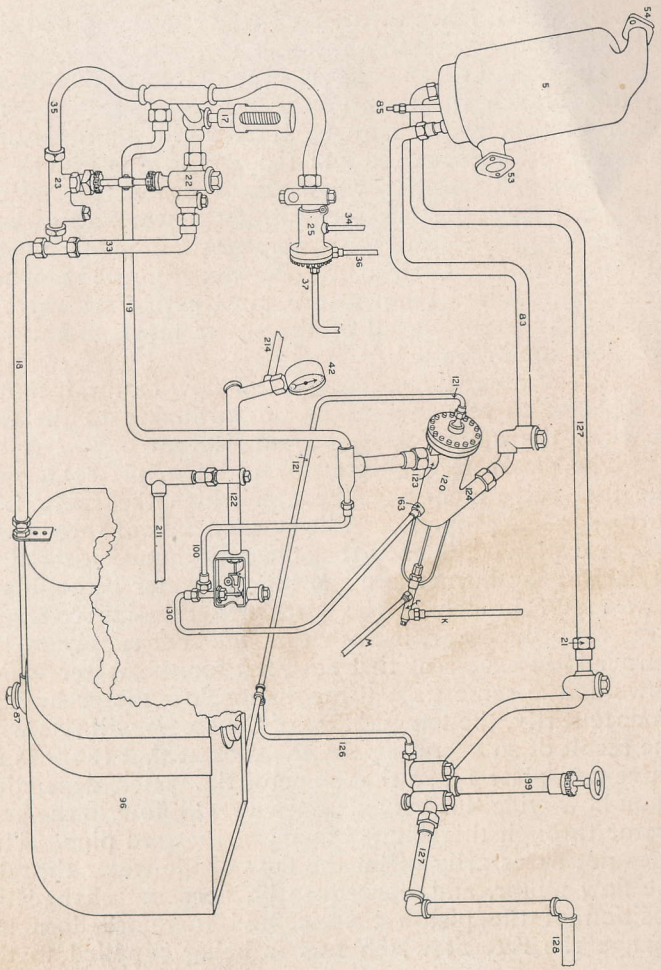


Plate 15

pipe 83, which flows to the feed water heater 5 and then directly to the generator through 127.

The main branch consists of the pipes 19 and 83 and in this branch the flow motor 120 is connected. The other branch, which may be termed the shunt branch, consists of the pipes 100 and 130, and in this branch the thermostatic controller valve 122 is connected. When the water regulator is closed all of the water thrown by the pumps goes toward the generator through one or both of these two branches. Until the steam gets somewhere near the required temperature, the thermostat valve is closed, and therefore all of the water must go through the flow motor branch.

As the water flows through this flow motor, it moves the piston therein a distance proportionate to the rate at which the water flows past said piston.

The piston is connected by rod 192, plate 12, with the fuel valve stem 193, through which the valve L is correspondingly opened. The construction of these parts before explained, is such that the ratio between the flow of fuel to the burner and the flow of water through the flow motor branch of the feed pipe remains constant. This ratio, however, is such that the fuel supply to the burner is in excess of that required for the water which flows at the same time through the flow motor branch. Consequently, the temperature of the steam will rise with the result of so operating the thermostat that it opens its valve 201, plate 13, so that some of the water, depending upon how wide this valve is opened, will flow to the generator through this shunt branch of the feed pipe. This does not necessarily affect the flow of the water through the flow motor, and, consequently, does not change the position of the piston therein, and therefore does not change the rate at which fuel is being supplied to the

burner. But this result has been brought about, viz., the ratio between the water supply to the generator and the fuel supply to the burner, has been changed; because while the fuel supply is not changed, the water supply has been increased by the amount which flows through the shunt branch of the feed pipe. If the ratio between fuel and water is now inexact, as, for example, if the water is in excess, the steam will soon cool, and the thermostat will act to move the valve 201 in the closing direction, thereby reducing the quantity of water going through the shunt branch of the feed pipe, without effecting any change in the rate at which water is flowing through the other branch, or in the rate at which fuel is flowing to the burner. So this thermostat operates, as the temperature of the steam rises above or falls below 390 degrees centigrade, to change the ratio between fuel supply and water supply, by increasing or diminishing the water supply without effecting any change in the fuel supply.

The foregoing describes the operation of the parts when the pumps are going fast enough to throw water in excess of the capacity of the generator. When, however, the pumps are going slowly and throw water at a rate which is less than the capacity of the generator, a slightly different action takes place, because when the water regulator allows any water to flow past it, all of the water thrown by the pumps is being delivered into the generator through the two branches of the feed pipe described. When by the action of the thermostat, the valve 202 is opened, or closed, more or less of that water will go through the shunt branch, thereby making a corresponding change in the volume of water which goes through the flow motor branch. Any change in the rate of flow through the flow motor branch causes a change

in the position of the piston in the flow motor, and consequently a change in the rate of fuel flow. In other words, when the pumps are going slowly, the changes in ratio between water supply and fuel supply are brought about by changes in the rate of fuel supply without changing the rate of water supply. But when the pumps are going at a rate which exceeds the capacity of the generator, these changes in ratio come from changes in the rate of water supply without any change in the rate of of fuel supply. In all cases, however, the required changes in ratio are brought about by the described action of the thermostat.

Returning now to the flow motor, attention is called to the relief valve 197, plate 12. It is clear that one may need a large volume of steam, even when going slowly, to go through heavy roads or up hill. The pumps are of such capacity that they can supply water to the full capacity of the generator, even when the engine is running slowly, as when the car is going about fifteen miles per hour. Therefore, when going at a greater speed, the amount of water thrown by the pumps exceeds the capacity of the generator. When we remember that the action of the water regulator is to either by-pass all of the water thrown by the pumps, or let it all go toward the generator, and when it is also remembered that if too much water goes into the generator it may become flooded and inoperative, it will be understood that some means must be provided to take care of the excess water. The relief valve 197 is provided for this purpose. The faster the rate of flow of water through the flow motor, the farther will the piston therein be moved. When it is moved beyond the position it will occupy when the water supply to the generator is equal to the capacity of the

generator the piston opens this relief valve and all of the excess water is by-passed through pipe to the water tank.

Recapitulation

When the engine is in operation, it operates the feed water pumps. The water regulator either by-passes all of the water thrown by the pumps, as when the steam pressure exceeds 550 pounds, or it allows all of the water to flow toward the generator, as when the steam pressure is less than 550 pounds. That is to say, the water supply is controlled by an "all on" or "all off"—the required variations being due to changes, automatically brought about in the frequency and durations of these "all on" periods. The water flows through two branches, in one of which is a flow motor and in the other a valve controlled by the thermostat. The water going through the flow motor moves a piston therein, which, in turn, proportionately opens the fuel valve. It also opens the relief valve when the rate of water flow into the flow motor exceeds the capacity of the generator, and by-passes the excess water. The ratio between fuel supply to the burner and water supply to the generator is varied by the action of the thermostat on the valve, which increases or decreases the rate at which water flows past that valve through the shunt branch. The practical result of the automatic action of the described parts is to maintain the steam at practically uniform high pressure and high temperature under all working conditions without any hand manipulation of any kind, and without requiring any attention from the operator. All he has to do is to manipulate his throttle so that the engine will get the steam required for the running of the car at the desired rate. The automatic regulating system sees to it that the steam used is immediately replenished without any substantial variations of pressure or temperature.

Rear Axle

The rear axle is ball-bearing throughout, and the casing should contain enough oil to thoroughly lubricate it. It is advisable to look at this about every thousand miles. To do this remove the bottom plug in the casing and see if any oil comes out, and whether it is in good condition. If everything is all right, put in the bottom plug and remove the plug on the side near the bottom and fill with oil through the top plug until it runs out of the side plug, the casing then has the proper amount of oil in it. It is a good thing to clean out all of the oil occasionally, and fill altogether with new oil.

Rear wheels may be removed by loosening and half-turning clamp bolts 171, one on the upper and the other on the under side of each end of axle casing. The wheel, axle end and bearing may then be drawn from casing. To remove wheel from axle end, remove hub cap then lock nuts and draw off.

Brakes

Both the foot brake and the hand brake act on a drum fastened to the rear wheels. The hand brake is an internal expanding brake 187, plate 16, and the foot brake an external contracting brake 186, one acting on the inside and the other on the outside of the drum, No. 185, and put into action by means of continuous steel cables, thus making each set compensating. Adjustments should be made at the turn buckles 189 and 190, and not with the brake cables.

All joints should be kept well lubricated so that they will work freely.

Rear Axle and Brakes

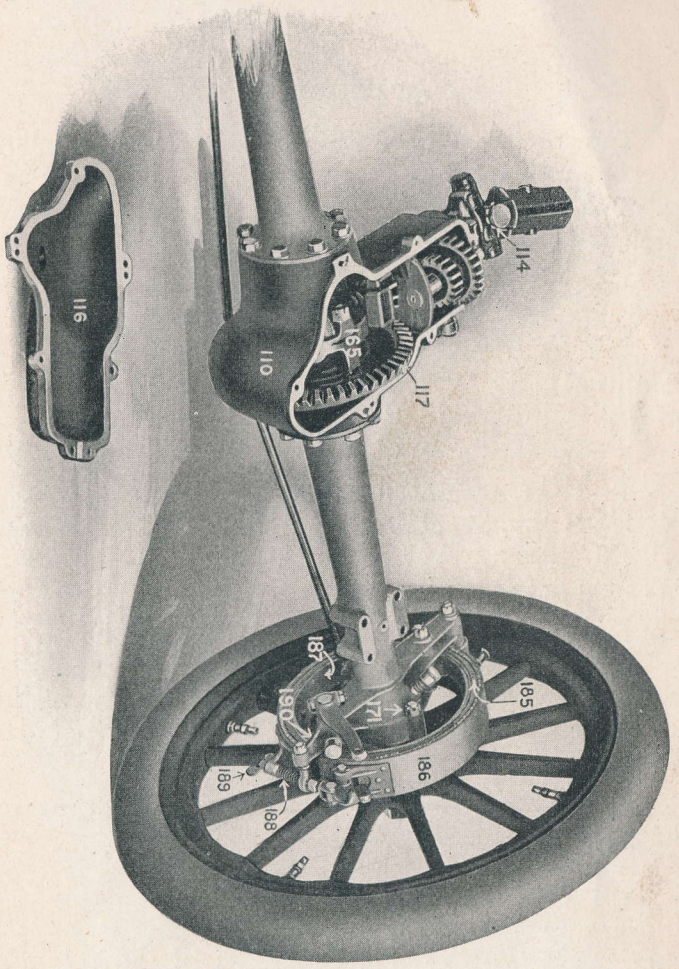


Plate 16

Emergency Gear

The power is conveyed to rear axle through a hollow steel shaft 112, plate 17, and two universal joints 114 and 64. Except in case of emergency, the drive is direct through a bevel pinion and gear, and bevel compensating gear.

In plate 17 the emergency gear is shown in mesh.

The power is transmitted through shaft 146 to gear 148, then through double gears 152 and 153, then to 151 and 154. In this position the engine makes two and one-half revolutions to one of the bevel pinion 154.

Internal gear 150 and external gear 151 are one piece. For direct drive, 148 is moved into 150, locking shaft 146 with piston 154. The same movement of 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 103, plate 4, to center. When in this position, the gears are entirely out of mesh and allow the engine to run without transmitting power to axle.

Oil cup 158, plate 17, catches the splash in gear case, and a small pipe leads the oil to bearing 155.

Emergency Gear

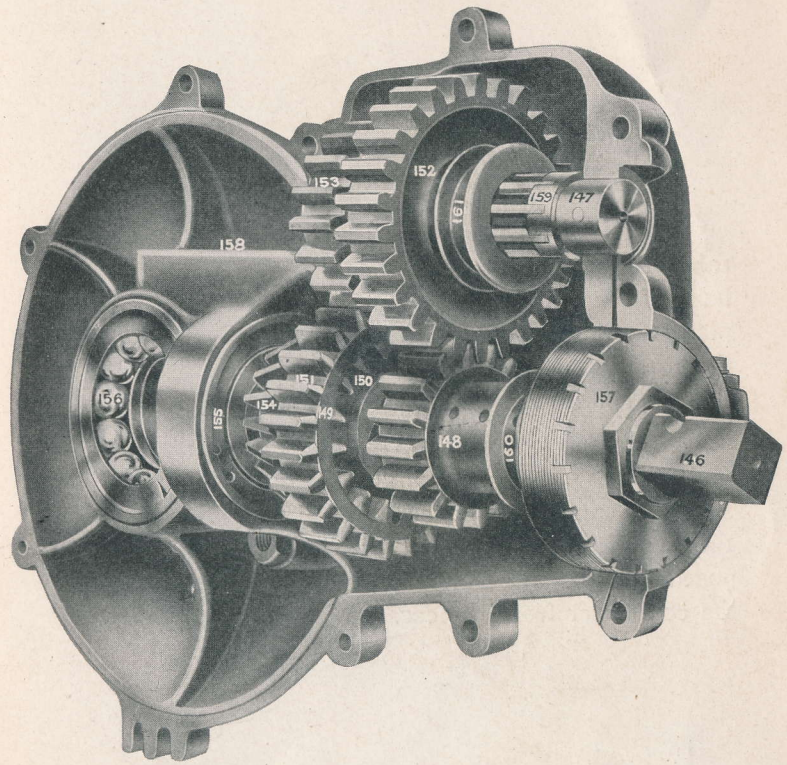


Plate 17

Condenser

Plate 18

The condenser is made up of four rows of flanged tubes connecting a top and bottom chamber The exhaust from the engine enters the top chamber at 162, plate 18, and the condensed water is drawn out through the connection 166. When there is more steam entering the condenser than it can take care of, the excess overflows through 89, which is a check valve that prevents steam overflowing except when there is an excess.

To clean the condenser remove the exhaust chamber 168 and the bottom 169, thereby leaving the tubes exposed and free to be cleaned perfectly without removing the condenser from the car.

Condenser

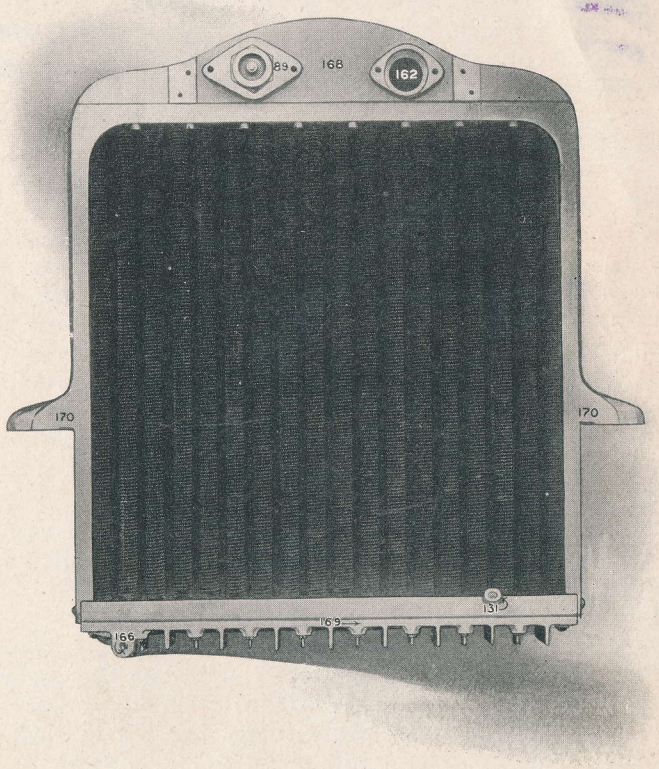


Plate 18

Lubrication

Use too much rather than too little lubrication.

Observe directions on plate 19 carefully and follow closely.

The oilers on dash are set to feed Standard 600-W Mineral oil which is known as D Mobiloil. We use this oil because it can be obtained everywhere and runs very uniform.

A good grade of motor grease should be used in the grease cups and grease gun.

Care should be used to prevent dirt or grit mixing with either oil or grease.

Examine all oil connections for clogging or leaks.

The lubrication of engine is principally automatic, the oiler being driven from the engine by a ratchet. Oilers are also provided with hand plungers Nos. 108 and 109 and should be given a few strokes when starting.

The crank case of engine should be kept free from water. A drain cock 68 is provided for this purpose. This should be opened every thousand miles or oftener and the water allowed to run off until oil starts, then close and replace with new oil.

Should steam gauge needle vibrate, pump oil around pipe line. Open valves 118 and 111, plate 1, and pump with cylinder hand oiler, 108, until oil runs from valve 111. Always close valve 118 when through.

These directions are for ordinary running under ordinary conditions. When the conditions become unusual, as in heavy mud or long, dusty trips, the operator must use his judgment about increasing the lubrication of the exposed parts.

Flush water tank daily and clean thoroughly once a week.

Lubrication

All Oils Containing Acids Must be Avoided

We recommend the Standard Oil Company's "STANDARD STEAM MOTOR OIL" or the Columbia Lubricant Company's "WHITE SPECIAL STEAM OIL" for use in both the crank case and the cylinders of the engine and rear axle casing.

Lubricate places indicated by lines leading from D's daily, by lines leading from U's weekly.

RENEW OIL IN ENGINE CRANK CASE AND REAR AXLE CASING, EVERY ONE THOUSAND MILES.

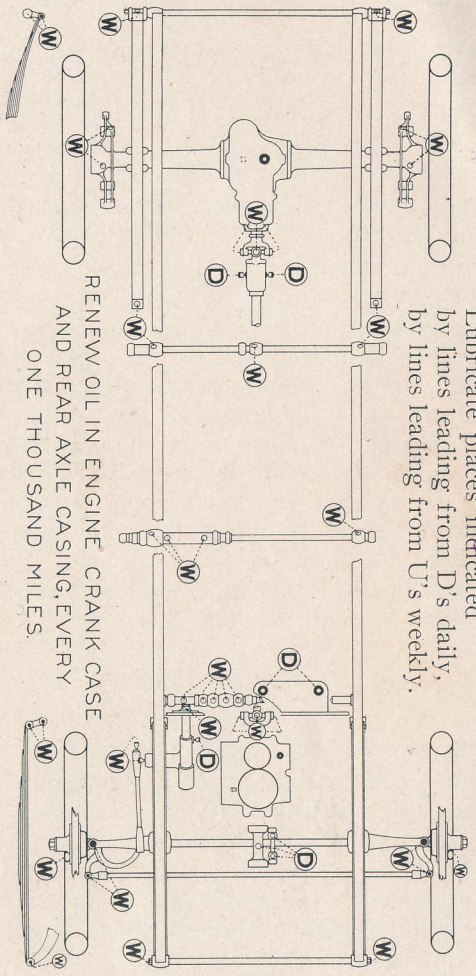


Plate 19

To Drain Water from Car

1 Raise steam pressure and run engine long enough to warm it thoroughly.

2 Disconnect unions at suction side of both water pumps 22 and 23.

3 Disconnect pipe 127 at union 21, plate 15.

4 Disconnect pipe 130 at flow motor and thermostat and remove.

5 Disconnect condenser pipe line at 40 and open pet cock at bottom of condenser.

6 Run engine idle until steam pressure is down to two or three hundred pounds and give hand water pump 99 a few strokes, also pump plenty of oil into cylinders by means of lever 108, plate 5.

7 With engine still running, open blow-off valve which connects to top of generator located back of water tank and reached through hole in running board shield by tool box, then open blow-off valve 111, plate 1.

If the car is to be laid up for a long time it is well to remove balls from all checks.

To Drain by Air Pressure

The car can best be drained by means of air if air pressure is available.

Open drip cock at bottom of condenser and disconnect condenser line at union No. 40. Remove plug from bottom of water tank. Blow air through condenser line by applying at 40.

Remove hose 18 and apply air at union where 18 connects to pumps. Open blow-off valve 111 and water may all be forced through.

To Get Good Results

The instructions in this book should be thoroughly noted.

Care should be taken that all parts are well lubricated; the stuffing boxes packed, and all joints tight.

When the stuffing boxes begin to leak, it is advisable to take them up at once before the steam has a chance to wear a groove in the packing. When repacking remove all old packing then replace with new and watch for leaks until it becomes thoroughly settled. After once getting settled without the steam wearing a passage through it, the box will not have to be repacked for a long time. Don't keep valve stem stuffing boxes too tight as there is only exhaust steam against them.

Use 600-W Mineral or D Mobiloil.

Keep air pressure from 50 to 60 pounds—always above 50 pounds.

Do not crowd the car when starting. Give the engine time to warm up.

Do not try to run 70 miles per hour.

Do not try to make fast time on bad roads.

Do not overload the car; it is designed for five or seven passengers only.

Always close the throttle before applying brakes or reversing the engine.

Always make it a practice to disengage the engine from running gear by means of lever 103 before leaving the driver's seat.

Index to Numbers and Letters

1 High pressure cylinder
2 Low pressure cylinder
3 Valve gear inspection plate
4 Water pump inspection plate
5 Feed water heater
6 Engine casing
7 Crank case inspection plate
8 High pressure piston stuffing box
9 High pressure valve stuffing box
10 Low pressure valve stuffing box
11 Low pressure piston stuffing box
12 Intercepting valve (simpling valve mechanism)
13 Relief cocks
14 Pass-over valve (simpling valve mechanism)
15 Air and condenser pump inspection plate
16 Fan pulley
17 Compression chamber
18 Suction from tank
19 Discharge from pumps to flow motor
20 Unions in water connections
21 Union connecting pipe 127 to hand water pump 99
22 Upper power pump
23 Lower power pump
24 Power pump frame
25 Water regulator
26 Pump block pin
27 Pump lever
28 Pump block
29 Water pump plunger
30 Screws attaching pump frame to engine
31 Power pump lock nuts
32 Power pump stuffing boxes
33 Upper power pump suction pipe

34 Water regulator by-pass pipe
35 Discharge pipe of lower power pump
36 Steam gauge and oil connection
37 Steam connection of water regulator
38 Water regulator adjusting worm
39 Condenser pump
40 Condenser pump suction end
41 Condenser pump discharge end
42 Pyrometer
43 Relief cock lever
44 Simpling valve lever
45 Emergency tank air valve
46 Steering gear casing
47 Lever operating automatic oiler
48 Piston head
49 Piston rings
50 Steam connection to high pressure steam chest
51 Engine air pump discharge connection
52 Cylinder oiler connection
53 Exhaust inlet to feed water heater
54 Exhaust outlet from feed water heater to condenser
55 Engine air pump strainer
56 Air pump regulating lever
57 Crank case stuffing boxes
58 Valve cross-head
59 Piston rod
60 Reverse arm
61 Valve gearing levers
62 Crank-shaft
63 Crank-shaft lock ring
64 Universal joint, engine end driving shaft
65 Bolt holding universal joint to crank shaft
66 Crank-shaft lock washer
67 Engine air pump

68 Cock for draining crank case
69 Ball separator rings
70 Crank case oiler connection
71 Valve slides
72 Valve slide rollers
73 Valve stem
74 Low pressure piston valve
75 Piston crosshead
76 Crosshead pin
77 Connecting rod
78 Valve slide frame
79 Air pump cable guide
80 Engine support
81 Screws holding valve slide frame in engine frame
82 Cut-off pedal adjusting pin
83 Water line from flow motor to feed water heater
84 Counter balance
85 Water drain from feed water heater
86 Main bearing
87 Water tank strainer casting
88 Condenser
89 Condenser overflow
90 Condenser exhaust pipe
91 Pedal regulating cut-off
92 Engine
93 Pedal operating simpling valve
94 Pedal operating air pump valve
95 Pedal operating foot brake
96 Water tank
97 Water regulator washer
98 Generator
99 Hand water pump
100 Pipe from 19 to thermostat
101 Throttle wheel

102 Steering wheel
103 Emergency gear lever
104 Reverse lever
105 Brake lever
106 Brake cables
107 Brakes
108 Cylinder oiler pump
109 Crank case oiler pump
110 Gear case
111 Blow-off valve
112 Driving shaft
113 Emergency gear rod
114 Universal joint (axle end of driving shaft)
115 Air line check valve
116 Rear axle inspection plate
117 Main driving gear
118 Oil valve to water regulator
119 Thermostat valve stem cap
120 Flow motor
121 By-pass pipe to tank
122 Thermostat casting
123 Flow motor inlet from pumps
124 Flow motor outlet
125 Flow motor stuffing box
126 Suction for hand water pump
127 Pipe to generator
128 Generator inlet
129 Discharge to engine
130 Pipe from thermostat to flow motor discharge
131 Feed water heater drain inlet
132 Water regulator main casting
133 Water regulator cover
134 Diaphragms
135 Plug

136 Diaphragm shifting pad
137 Plunger
138 Spring
139 Lock nut for plunger adjustment
140 Lever
141 Valve
142 Spring adjusting nut
143 Spring adjusting pad
144 Valve seat
145 Connection to pump discharge
146 Pinion driving shaft
147 Emergency gear shaft
148 Sliding spur gear on pinion shaft
149 Spur gear
150 Internal spur gear (149)
151 External spur gear (149)
152 Large spur gear on emergency shaft
153 Small spur gear on emergency shaft
154 Driving pinion
155 Pinion shaft rear bearing
156 Rear axle bearing
157 Pinion shaft front bearing
158 Oil cup
159 Roller bearing
160 Shifting lever groove
161 Shifting lever groove
162 Exhaust inlet
163 Flow motor inlet from thermostat
164 Fan
165 Differential gear casing
166 Connection to condenser pump
167 Air and condenser pump plunger
168 Top of condenser
169 Bottom of condenser

170 Condenser side frame
171 Rear axle clamp bolt
172 Throttle casting
173 Nickel seat
174 Throttle stem
175 Union nut
176 Throttle sleeve
177 Throttle lever
178 Stuffing box nut
179 Stuffing box gland
180 Projection on valve stem
181 Valve stem seat
182 Connection to engine
183 Connection to generator
184 Passage through throttle seat
185 Brake drum
186 Foot brake band
187 Emergency brake band
188 Foot brake spring
189 Foot brake turn buckle
190 Hand brake turn buckle
191 Flow motor piston
192 Piston rod
193 Valve stem
194 Valve stem lock nut
195 Graded water groove
196 High pressure piston valve
197 By-pass valve
198 Flow motor piston spring
199 Thermometer well
200 Water inlet of thermostat
201 Thermostat valve stem
202 Valve stem adjusting nut
203 Valve stem seat

204 Water outlet
205 Bell crank
206 Bell crank spring
207 Element of thermostat
208 Union nut holding pyrometer in thermostat casting
209 Air and vaporizer pressure gauge
210 Steam pressure gauge
211 Steam line to thermostat
212 Valve stem stuffing box
213 Thermostat element stuffing box
214 Steam line from thermostat
215 Thread securing thermostat element in casting
216 Steam entrance to thermostat casting
217 Steam outlet from thermostat casting
218 Inside element of pyrometer
219 Outside element of pyrometer
220 Metal cap extension on inside element
A Supply pipe from fuel tank
AA Hand air pump
AB Main fuel shut-off valve
AB2 Emergency fuel tank shut-off valve
AC Flow motor stuffing box
AD Pipe from power air pump
B Fuel strainer casting
C Fuel strainer plug
CA to CD Graded fuel valve stem
CB Flow motor fuel valve plug
D Main sub-burner valve
E T connecting tank X2 into fuel line A
F Sub-burner adjusting valve
G Warming up valve
H Pipe to main burner valve
HA Pipe connecting valve G with vaporizer N
I Pipe to warming up valve

J Main burner valve
K Fuel pipe to flow motor
L Flow motor fuel valve
M Pipe from flow motor fuel valve to vaporizer
MA Sub-burner supply pipe
N Vaporizer
NA Vaporizer discharge pipe
O Vaporizer nozzle
P Sub-burner cap
Q Burner
R Burner induction tube
S Induction tube shutter
T Pipe to vaporizer gauge
U Vaporizer support post
V Sub-burner casing
W Sub-burner casing door
X Fuel tank
X2 Emergency fuel tank
Y Fuel tank cap
Y2 Emergency fuel tank cap
Z Fuel tank try cocks

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When ordering parts specify:

MODEL OF CAR,
NUMBER OF CAR,
NUMBER OF PART,
NAME OF PART,
COLOR (if painted).

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