CANADIAN PACIFIC RAILWAY.

CAR DEPARTMENT.

INSTRUCTIONS

FOR THE

CARE AND USE OF STEAM HEAT, PINTSCH GAS,

AND

Compressed Air Water Raising System on Passenger Equipment.

ISSUED OCTOBER, 1907.

W. E. FOWLER,
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Description of, and Instructions how to use and care for the various systems of Heating in use on Passenger Equipment.

1. GOLD DUPLEX, Canadian Pacific Standard, heating water by both steam and fire, having double circulating coils, "Gold" regulating valve, and automatic drips.

2. COMMINGLER. Another system of heating water by steam and fire. The Commingler is a small boiler in which the water of circulation is heated by having steam mingled or mixed with it.

3. BAKER HEATER, with train pipes. This refers to a car with Baker Heater, heating car by hot water circulation only, having a steam train pipe which has no connection with car Heater.

4. BAKER HEATER without train pipe, same as No. 3 but without steam train pipe.

5. STRAIGHT STEAM, with heaters. This refers to a car heated by steam from train pipe and by stoves, the stoves having no connection with circulating system.

6. STRAIGHT STEAM, without heaters. This refers to a car heated by steam from train pipe, with no other means to heat car.

7. HEATERS WITH TRAIN PIPE. This refers to a car without any piping inside of car, which depends entirely on stoves for heat, but has train pipe for conveying steam to other cars in train.

8. HEATERS WITHOUT TRAIN PIPE. Heated by fire only, having no steam train pipe to convey steam from one car to another.

DIRECTIONS FOR HANDLING STEAM HEAT ON TRAINS.

When train is made up, all steam hose coupled and trainline valves opened wide on all cars, the steam can then be turned on from Engine (not less than 60 lbs.).

When it issues from the rear end hose, close rear train pipe valve, allowing only sufficient steam to escape to prevent train pipe and hose from freezing. To regulate heat inside of cars fitted with Gold System, open steam valve inside heater rooms, and when steam escapes from drips under floor of cars, close drip valve down and allow condensation to be relieved by automatic attachment on each drip. On Commingler System, open trap and dial cock, and if overflow pipe is clear, condensation will commence to escape shortly after steam is turned on. When condensation appears, regulate the amount of steam required (which is 15 lbs.) by dial clock. On cars fitted with direct steam, open steam inlet valve from train pipe on each side of car, and after steam circulates in radiating pipes on side of car, and escapes at drip, shut drip valve, leaving sufficient opening for condensation to escape to prevent pipes from freezing.

CHANGING ENGINES.

When approaching points where engines are to be changed, the trap and dial cock on cars fitted with Commingler system must be closed, to prevent water syphoning from expansion drum into train pipe. When this has been done, the rear train pipe valve must be opened (which should be done when train is about one mile from station), also shut off on engine, so hose can be safely uncoupled. If train is over six cars in length, and engine is to be cut off, the steam valve inside of cars should be closed on

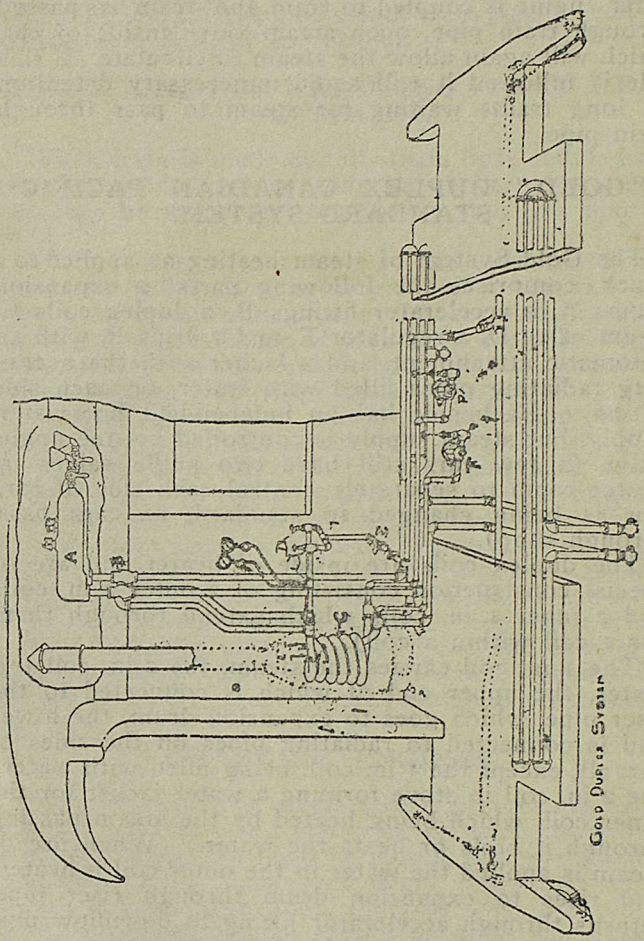
the Gold or Straight Steam Systems, to facilitate the passing out of the steam through the train pipe. After engine is coupled to train and steam has passed through train pipe, open steam valve inside of car, which will again allow the steam to circulate. If this rule is followed it will avoid unnecessary detention on long trains waiting for steam to pass through train pipe.

"GOLD" DUPLEX CANADIAN PACIFIC STANDARD SYSTEM.

The Gold System of steam heating as applied to a coach, comprises the following parts: 2 expansion drums A, 2 accelerator fittings B, 2 duplex coils C, steam valve D, a regulator E, and 2 drips F, with an automatic attachment, and a heater with the necessary radiating pipes filled with water, on each side of car. Each side has an independent hot water supply, but steam supply is controlled by one angle valve (a few cars still have two angle valves in heater room to separately control each side of car, this is being changed to standard, as cars pass through shop).

The duplex coils are inside of heater and are of special construction consisting of 2 outer 2 in. coils and 2 inner 1 in. coils which extend through them (or a coil within a coil).

The 1 in. coil carries the steam, the 2 in. coil the water, the upper end of which is connected to the riser pipe, which goes to expansion drum, the lower end is connected to radiating pipes on the sides of car, all, except the 1 in. coil, being filled with water, the 2 in. coil in stove forming a water jacket for the inner coil, which being heated by the steam passing through it boils or heats the water. When fire or steam is applied the water in the outer coil is heated, and rises to expansion drum through riser pipe, returns through accelerator fitting to downflow pipe circulating to pipes on side of car, then returning to bottom part of coil where it is again heated, and continues its former movements.



Gold Dubler System

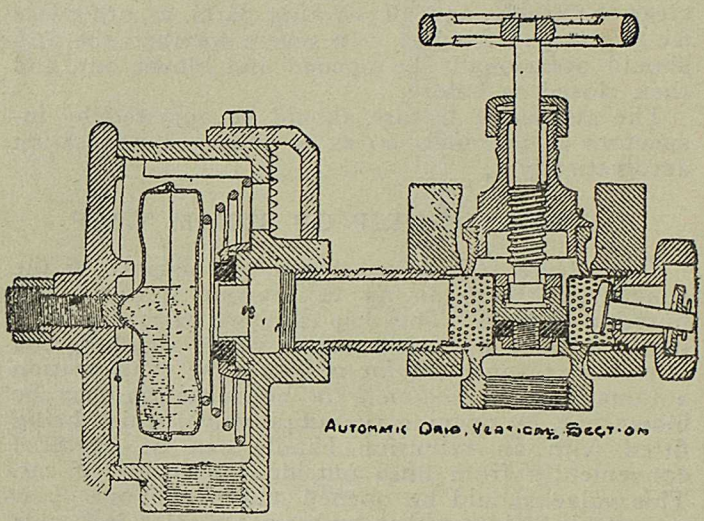
When steam is used for heating, it is taken from the train pipe under the car, a branch pipe being connected from it to the heater room. The steam is passed through two strainers "J" to prevent any foreign substance interfering with valves, the pressure being governed by a regulator "E," which is usually adjusted for 20 lbs. Passing the regulator, the steam then goes to angle valve which distributes the steam to the two inner coils, and passing through the coils goes out through the extension pipe, to the drip. The drip is placed on outside of car so as to clear the trucks and all working parts, as otherwise ice might give trouble. In severe weather, the drip should occasionally be opened and blown out, and then closed as before.

The automatic feature should be adjusted by inspectors at terminals so as to relieve condensation automatically.

AUTOMATIC DRIP OF STEAM TRAP.

This steam trap is constructed to dispose of the condensed steam so as to prevent freezing and bursting of pipes. This drip is in two parts, one having a special tee with angle valve attached, the other an arrangement for relieving the condensation automatically. Sediment or condensation may be blown out, by opening the angle valve, which being fitted with an extension handle can be operated conveniently from both outside and inside of car. This valve should be opened and blown out occasionally in cold weather by trainmen, also left wide open when leaving car at Terminal points, or when car is taken out of service. There is also a gravity relief trap attached to special tee, which is always open when there is no steam in the drip pipe, the construction of it causing it to tilt, and release the condensation automatically as required. The thermostatic trap is attached to the tee, with inlet at the end and outlet at the bottom. Steam on entering the trap first comes in contact with the diaphragm which is held in position by ribs on the

side of the trap and which, with the assistance of a spring, prevents the diaphragm from resting on its seats when required to be open. This tank or diaphragm is filled with a fluid that expands when heated by the steam. The diaphragm comes in contact on one side with the adjusting screw, and on the other with a composition seat, which when the diaphragm is expanded and seated, prevents any more steam from escaping. The steam being thus shut off, condensation again occurs, and the trap, owing



to a ventilating feature, which cools the liquid inside of diaphragm causes it to contract and move back into the other position, again allowing the condensation to be relieved. In other words, steam coming in contact with diaphragm and expanding it, causes it to press against the seat and prevent steam from escaping, then contraction, caused by ventilation and cooling and assisted by the spring, again opens it, permitting condensation to escape.

INSTRUCTIONS FOR ADJUSTING TRAP.

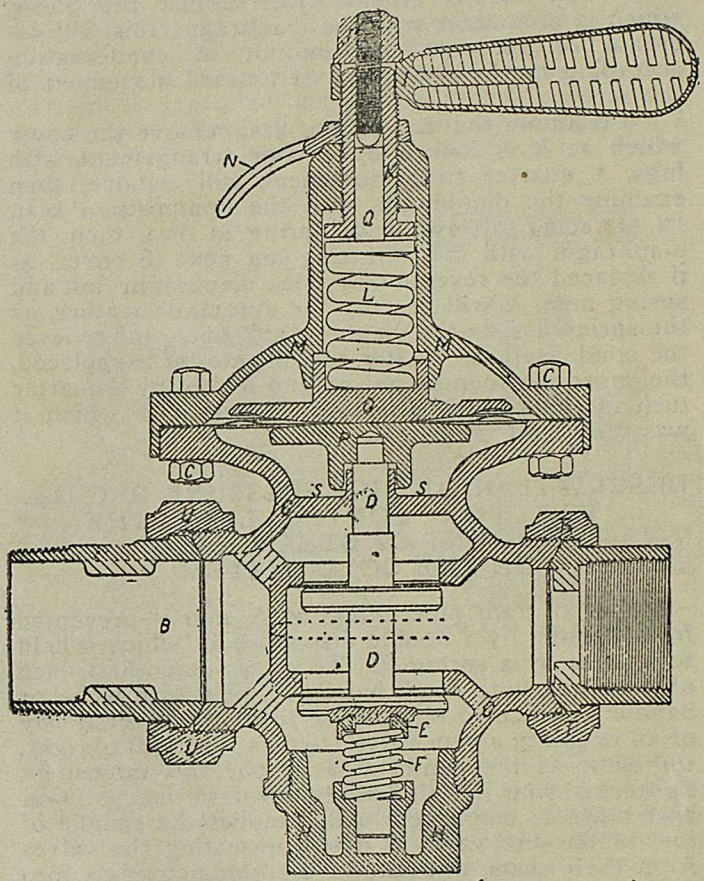
First, slack off the lock-nut on the cover of the trap, then with a screw driver adjust the screw, which is in contact with the diaphragm, this will decrease or increase the amount of condensation according to the downward or upward movement of the screw.

To examine the diaphragm, first remove the cover which as it is locked by a cam arrangement with lugs, a quarter turn movement will remove, then examine the diaphragm, also the composition seat. In replacing, always place spring in first, then the diaphragm with the adjusting lug next to cover, as if replaced the reverse way, viz., diaphragm first and spring next, it will destroy the automatic feature, as the spring assists the diaphragm to open, and relieves the condensation. After the diaphragm is replaced, the cover can then be put on and locked by a quarter turn in the reverse direction from that in which it was moved to remove it.

DESCRIPTION OF THE PRESSURE REGULATOR FOR CONTROLLING THE AMOUNT OF STEAM USED ON THE GOLD SYSTEM.

Steam at train pipe enters at A, and is prevented from passing by a double disc valve D, which is held to its seat by a spring F. To set valve D, first slack off lock-nut, with small handle N, then turn wheel or handle I, which to open valve turns the reverse way of an ordinary steam valve (that is from left to right, the same as the hands of a watch) this movement tightens spring L, and presses down on flanges O on both sides of diaphragm which moves the spindle of the double disc valve D down, unseating the valves from their seats, and allows the steam to pass into outlet B.

As soon as steam in chamber S is equal to the tension from which spring L is set, it will raise diaphragm and compress spring L, which will allow



Pressure Regulator (Left Hand)

double disc valve D to seat and prevent any more steam from passing through. The valve D can be withdrawn for inspection by removing nut H, by first relieving the tension of spring L, by turning handle I, then remove nuts C, when done M can be removed and examination made of the diaphragm and the groove in which the lower valve sets. This device acts as a water seal and prevents any chattering noise which is often heard on other regulators.

THE GOLD IMPROVED TEMPERATURE REGULATOR.

This regulator will supply any pressure between two and fifty pounds. Complete movement is obtained by one turn of the handle.

Located on the dial, as shown on top view, are figures representing the pressure of steam in inner coil. The handle acts as a pointer and locks at the places indicated.

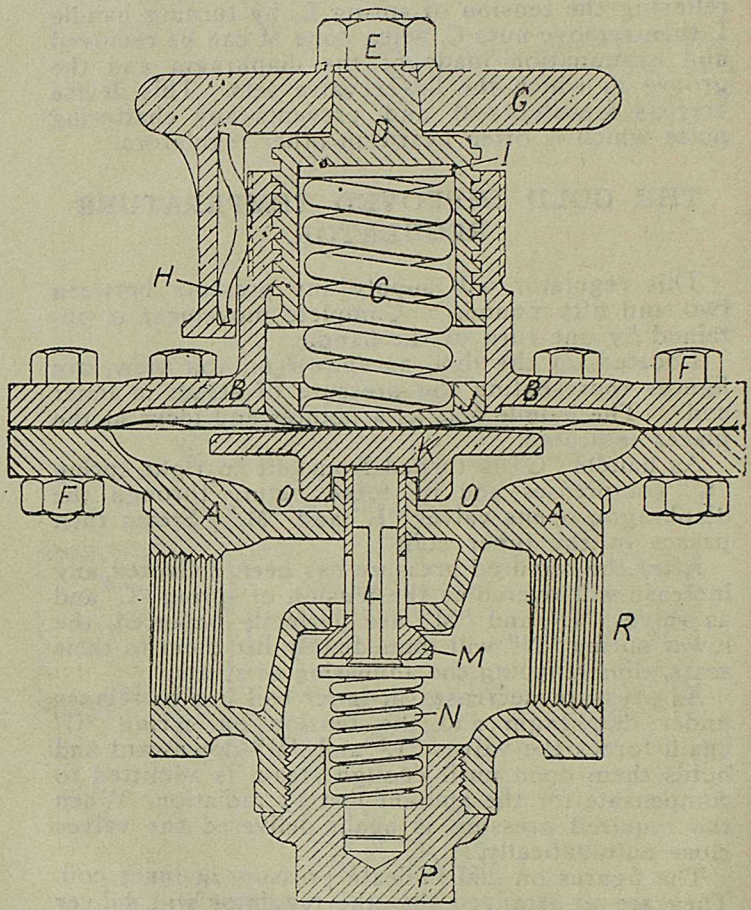
As handle "G" is turned from left to right, spring "C" compresses and its force, acting through the diaphragm, opens valves "L" and "M." Steam then passes to the inner coil.

After the required pressure has been delivered, any increase will overcome the tension of spring "C" and as valves "L" and "M" are perfectly balanced, the lower spring "N" will immediately lift them to their seats, thus stopping the admission of steam.

As pressure decreases in inner coil it also relaxes under diaphragm and the tension on spring "C" again forces the valves "L" and "M" downward and holds them open until enough steam is admitted to compensate for the amount lost by radiation. When the required pressure is again delivered the valves close automatically.

The figures on dial indicate pressure in inner coil. They are so arranged that the regulator will deliver 5-10-20-35 or 50 pounds.

When handle "G" is turned clear back to the stop, valve will then supply only 2 pounds pressure.


E
G
D
I
H
C
B
J
B
F
F
K
A
O
O
A
R
M
N
P

PARTS OF GOLD'S IMPROVED TEMPERATURE REGULATOR.

A—.Body of Regulator.
B.—Dome of Regulator.
C.—Top Spring.
D.—Adjusting Screw.
E.—Top Nut.
F.—Bolts and Nuts for Dome and Body.
G.—Tee Handle.
H.—Indicator Spring.
I.—Washer.
J.—Top Flange.
K.—Bottom Flange.
L.—Auxiliary Valve Spring.
M.—Main Valve Spindle.
N.—Bottom Spring.
P.—Bottom Plug.
R.—1 inch Inlet.
S.—1 inch Outlet.

COMMINGLER SYSTEM.

In this system, steam is carried from train pipe to stove room, by the usual pipe, the amount of steam being controlled by a dial cock, which admits steam to commingler, where it mixes with the water through a special perforated fitting, which is so constructed as to prevent any unnecessary noise. The steam heats the water, and causes it to circulate through a riser pipe to drum, from there it follows the downflow pipe, and completes a circulation in pipes on sides of car, then returns to the Commingler where it is again mingled with the steam and continues its former movements. This steam adds more water to the circulation than required, the surplus being taken care of by an overflow fitting, placed inside of drum at a suitable height to allow of correct expansion. The overflow is also regulated by the trap valve in the overflow pipe, the opening of which is made small to allow some to escape, and still retain water at the correct level in drum.

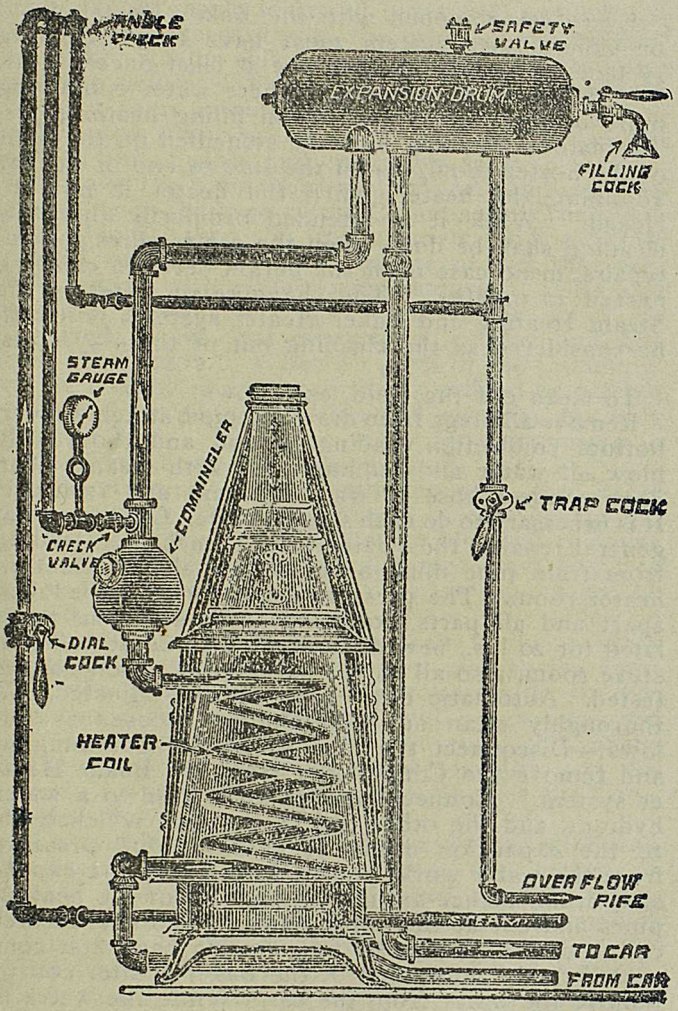
In supplying steam to this system, the dial cock should only be opened enough to give 15 lbs. of steam, which is ample if the apparatus is in good order, water will circulate with 10 lbs. of steam, giving a circulation of 30 ft. a minute. Any excess pressure of steam is a waste, and will force the water to a false level in the drum and out of the overflow, causing a shortage of water and the side opposite from the heater will get cold. Should this occur shut the overflow or trap cock and allow the water of condensation to accumulate in the drum and at the same time, reduce the pressure of steam by closing off dial cock until gauge registers between 10 and 15 lbs.

When using fire with hot water systems the fire pot must be kept about two-thirds full of hard coal, stove size, and the fire must not be allowed to go out in freezing weather.

In order to prevent the fire falling out of the heater in case of an accident, the safety grate over the fire must be kept fastened at all times, except when putting in coal.

The fire must be regulated by the upper and lower doors and the draft regulated by the lower door. The upper and lower doors must not be opened at the same time. If the car is too warm, shut the lower door and open the upper. If car is cold shut the upper door, and open the lower door.

Heaters must be kept free of ashes, both under grates and around coal boxes. If fire is burning well, and the return pipe to the heater is warm, while the pipes at the other end of car are cold, cool down fire and have water tested at first opportunity. If the car has been newly filled with water, circulation may be stopped by excessive compression of air in expansion drum, which may be released by opening trap or funnel cock for a few seconds.



COMMINGLER SYSTEM

Every car equipped with the Baker Heater, Gold or Commingler system must have the circulating system thoroughly cleaned out at least once a year. This is especially necessary where water containing more or less dirt is used when filling heater pipes. The date of cleaning must be stencilled on the door of the heater room, or, on the side or end of the car adjoining the heater, when the heater is not enclosed. While it is intended ordinarily that this cleaning shall be done when the car requires general repairs, in no case must the period between cleaning exceed 12 months. The changing of water in the Steam Heating and Baker Heater systems is not to be considered as the cleaning out of these systems.

To clean out the Gold, as follows:

Remove all plugs from draw off pipe, attach hose to bottom connection leading to coil and thoroughly blow all water and sediment out with steam, when done connect hose to water hydrant and recharge. It is necessary to do each side separate. Cars requiring general repairs, the strainers on branch pipe leading from train pipe must be examined also strainer in heater room. The pressure regulator must be taken apart and all parts examined and tested and regulated for 20 lbs., new discs applied to angle valve in stove room, also all valves packed and steam gauges tested. Automatic drip examined and adjusted. To thoroughly clean out Commingler, proceed as follows:—Disconnect the pipe above the Commingler, and remove the Commingler from the Baker Heater system. Connect one end of a hose to a water hydrant, and the other end to the pipe which leads to the expansion drum, so that the full pressure from the water works can be forced into the expansion drum, thence around through all of the heating pipes and out at the upper end of the Baker Heater coil, a discharge pipe or hose having been first connected to the upper end of the Baker Heater coil to remove the water from the car. While the water is circulating through the pipes in the car, tap them lightly with a hammer to ensure that the dirt and

scale on the inside is jarred loose and washed out. This is very necessary at the cross-over pipes and the Baker Heater coil, as dirt is most liable to lodge at these points. The water should be allowed to flow for some minutes after tapping is finished, to make sure that the dirt and scale is thoroughly washed out of pipes and expansion drum.

To take the Commingler apart, first unscrew the large plug in the base of the Commingler. The steam nozzle must then be taken apart and carefully cleaned, and any pieces of rubber or dirt that may have lodged within the nozzle removed. The pipe carrying steam into the Commingler must be inspected to see that everything is clean and free from obstruction. When all parts of the Commingler are cleaned, it can again be assembled by placing the copper screen in position and screwing the plug into the base. It is then ready for remounting in its position above the Baker Heater.

In connecting the Commingler with the Baker Heater system, it must be placed as close to the top of the Baker Heater coil as possible, and the pipe from the top of the Commingler must pass direct to the expansion drum. The overflow pipe must be carried up into the expansion drum, and under no circumstances must it be less than 10 inches from the connection of the Commingler pipe to the overflow pipe connection. If the connections are not kept this distance apart there will be an excessive loss of water through the overflow pipe, on account of the upper end of the overflow pipe being in the mound of water which forms directly over the Commingler pipe.

The overflow pipe must also be disconnected and the overflow cap withdrawn from the expansion drum. This cap must be examined carefully to see that the opening of about 3-16 of an inch through it is not closed by dirt or other obstruction.

The trap cock must also be inspected and tested. When closed, it must be perfectly tight, and when open, the hole through it to just permit a wire of ⅛ of an inch in diameter to pass through freely When

testing this cock it must be subjected to water pressure of about 250 lbs. for at least 20 minutes. Warm water must be used, and the cock must be perfectly tight under these conditions. The Dial cock which is located in the steam pipe must then be inspected and tested. This cock must also be perfectly tight at the same pressure, and under the same conditions, as given for the trap cocks. If these two cocks are not tight, and cannot be tightened with a slight tightening up of the flange bolts, they must be removed for refitting, and cocks which are tight applied in their positions.

Both the ¾ in. check valve and the small check valve at the top of the relief pipe must be inspected to see that they will open freely, that they will close tight, and that they are free from dirt.

The Strainer No. 60 J, which is placed in the pipe which carries steam from the train pipe to the Commingler, must also be removed by first removing the plug in the strainer casing, and the strainer and casing thoroughly cleaned, and the openings in it freed from all obstruction.

At every regular shopping of car the safety valves on Heater drums must be tested, and set to release at 200 lbs. pressure.

On cars which have the Baker system only, the piece of pipe connecting the top of the coil to the expansion drum must be removed, and the pipes must be cleaned out thoroughly.

After the parts have all been connected in their proper positions, the Baker Heater system must be filled from a hydrant by means of a hose attached to one of the drain cocks or plugs under the car, the other drain cock or plug being left open; when water runs freely from this open cock or plug, it must be closed, and more water supplied until it runs freely out of funnel cock, and, if a Commingler system also through overflow pipe, the hose must then be connected to opposite drain cock or plug, and water again turned on until it overflows freely, in order to drive out any air which may have lodged in pipes. These instructions must be strictly observed when

filling pipes on a car from which for any reason whatever the water has been withdrawn.

The successful operation of the Baker Heater system under fire, and the Commingler system under fire or steam, requires that all pipes be kept at all times clean and free from obstruction.

DIRECT OR STRAIGHT STEAM SYSTEM.

This system of heating, as applied to a coach, uses steam direct from the train pipe to the radiating pipes on each side of car. Each side is independent, having an angle valve which controls the inflow of steam to the radiating pipes. The discharge of the condensation or drip is controlled by an angle valve which is connected to the bottom pipe of the radiating coils, unless an automatic drip is used. This angle valve should be occasionally opened, and condensation blown out in severe weather.

When a car is taken out of service, or arrives at a terminal, the steam must be blown out by Trainmen or Inspectors, and the car can be stored away, with no danger to the heating system from frost, and when required for service again, the car can be heated in a few minutes by steam entering direct to radiating coils, there being no water to heat and circulate.

To reduce the temperature in a car with this system, the steam on one side of car can be shut off, taking care first to open drip valve to allow the steam to escape, then leaving the drip valve open, close the valve that admits steam from the train line, thus preventing any further supply from entering. Coaches having toilet rooms on ends of cars, however, require care that when the steam is shut off, the toilet rooms do not get so cold as to freeze the water pipes that are used for toilet purposes. The temperature of the car can also be regulated by only partially opening the inlet valve, say, one or two turns which in mild weather will furnish all the heat required.

CATECHISM ON STEAM HEATING APPARATUS OF PASSENGER TRAINS.

Q. 1. How many systems of steam heat are used on Passenger trains on C. P. R.?

A. 1. Three. The Gold Duplex. The Straight or direct steam and the Commingler.

Q. 2. What is the Gold Duplex system?

A. 2. It is a hot water system, the water being heated by specially constructed duplex coils, the steam passing through the inner coil, and the water circulating in the outer 2 in. coil.

Q. 3. What is the direct or straight steam system?

A. 3. It is a system of heating where steam enters the radiating pipes on both sides of car, direct from the engine, conveyed through connections from the train pipe and no water of circulation is used.

Q. 4. What is the Commingler system?

A. 4. It is a hot water system, the water being heated by steam supplied from engine. The steam is mingled with or infused into the water by means of a Commingler of special construction, which prevents any noise in operation.

Q. 5. What advantage has steam over fire, on a Passenger train?

A. 5. Safety to passengers and coaches, and economy of operation.

Q. 6. How is steam conveyed from the Engine to each car?

A. 6. By means of a train pipe, which connects each car with the engine, and by a branch leading from the train pipe to the inside of car, it is connected to the different systems of radiating pipes.

Q. 7. How are cars heated, when steam cannot be obtained from the engine?

A. 7. If steam cannot be obtained from the engine, for any cause, the train pipe must be blown out as per rule for terminal points, steam hose

uncoupled between cars and fires lighted in Baker Heaters.

Q. 8. What is a Baker Heater?

A. 8. It is a stove in which part of the circulating pipe is placed in the heater in the form of a coil, so that when fire is made in the stove, the water in the coil is heated and circulation set up to the drum and radiating pipes inside of car.

Q. 9. What makes the water circulate?

A. 9. Gravitation and heat. The two circulating pipes are connected with an expansion drum which is placed on the roof of the car. One pipe is called the riser, and the other the downflow. The riser pipe connects the upper part of the coil in the stove to the expansion drum; the downflow pipe runs from drum to floor of the car where it is passed four times the length of car and connects to the lower end of the coil in the stove. These pipes and the expansion drum are filled with water, and when fire is applied to stove, the coil is heated sufficiently to boil the water, which then rises to the expansion drum. The water in the downflow pipe, being now heavier than that in the riser pipe, will move downward, forcing the water through the pipes in the car, and returning through the coil in the stove where it is again in contact with heat of fire.

Gold System.

Q. 10. Is the above described process of circulation the same when using the Gold system?

A. 10. Yes. The process of circulation is the same on both Commingler and Gold systems of car heating.

Q. 11. If pipes on one side of car heated by the Gold system are hot, and the opposite side cold, where would we look for the trouble?

A. 11. To stove room, first to see if steam valve is

full open. If found O.K. try drip valves to see if they are not frozen or shut too tight, if drip valves are working properly, the side that is not heating must be short of water and the expansion drum will indicate this when tested by the filling cock on drum.

Q. 12. What would cause one side to heat and the other not?

A. 12. As each side is independent, one drum having sufficient water, would not help the opposite side to circulate, and the only remedy is to raise the water to the correct level in both expansion drums.

Q. 13. What is the lowest circulation level of the Gold system?

A. 13. As this system is fitted with an accelerator fitting placed below the expansion drum, it is possible to get circulation, if the water is below the expansion drum, but it must always be above the level of the accelerator fitting, or circulation will stop.

Q. 14. Has this system any advantage over the ordinary way of fitting cars?

A. 14. Yes, it gives a quicker circulation, also requires only one pipe to be attached to expansion drum, as the water returns inside of the accelerator fitting, to the downflow pipe, and again circulates through the pipes on the side of car.

Q. 15. What causes shortage of water in circulating pipes?

A. 15. The principal causes are draw off plugs under the car, safety valves, or the filling cock connected to drums leaking.

Q. 16. How is it possible to replace this water in the expansion drum of the Gold system?

A. 16. By means of the funnel cocks, which are connected to the expansion drums pouring in as much water as possible.

Q. 17. Is it possible to fill the drum too full by this method?

A. 17. No, as the filling cocks are connected to the drums on the centre line, the water will only flow to that level.

Q. 18. Can this drum be filled any other way?

A. 18. Yes, by removing the safety valve, and pouring water direct into the drum, being sure to open funnel cock at the same time so that drum will not be overcharged; water flowing out of funnel cock, indicates sufficient water in expansion drum.

Q. 19. What bad effect would be had by overcharging the drum?

A. 19. It would prevent a circulation of water, and the pipes would remain cold.

Q. 20. What is the use of an expansion drum?

A. 20. The circulating or expansion drum being placed at the highest point of heating system, is used as a reserve storage for water, to supply any leaking that may occur in the circulating pipes.

Q. 21. By opening the drip, is it possible to blow any water out of the Gold system expansion drum?

A. 21. No; the drip is connected to the inner or steam coil, and the expansion drum to the outer or water coil.

Q. 22. Can we condense any water for the Gold system expansion drum by closing the drip?

A. 22. No; this can only be supplied through the funnel cock, which is attached to the drum.

Q. 23. What is the use of the regulator on the Gold system?

A. 23. It regulates or controls the amount of steam entering each car being ordinarily set for a pressure of 20 lbs., and as only 20 lbs. of steam is needed to heat any one car all over 20 lbs. is retained in the train pipe, and supplied to other cars in the train, by this means it is possible with but 60 lbs. of steam in train line to heat a train of 10 to 12 coaches.

Q. 24. Are trainmen allowed to operate this Regulator valve?

A. 24. This Regulator valve is set by inspectors at terminals, and should not be interfered with by trainmen. If a less amount of steam is required, the angle valve in heater room can be partly closed, leaving a sufficient amount to pass through and blow out of drips.

Q. 25. What temperature should be maintained in Passenger cars?

A. 25. About 70 degrees, with proper ventilation, which latter is very important.

Q. 26. If steam is passing out of drip on the Gold system, is it a sure indication that car is working O.K.?

A. 26. No; it is possible for drip to work O.K. but unless the water circulation is in order, this system will not work satisfactorily.

Q. 27. How can we tell when the car is working properly?

A. 27. By feeling the radiating pipes in car; if all are hot, the water circulation is in good order.

Q. 28. If all efforts fail to get car to heat properly, and water in pipes is liable to freeze, what should be done?

A. 28. Open draw off cocks under car, and the funnel cocks in the drums and allow the water to drain out, unless the funnel cocks on drums are opened water cannot escape. If pipes are already frozen, and water will not run off, break an elbow or return bend inside of car so as to save as much pipe as possible. On the Gold system it is necessary to drain both sides, and to do that right, open the four draw off cocks or plugs under the car; then open the funnel cocks on both drums.

Q. 29. What is the correct temperature of a sleeping car at night?

A. 29. Between 60 to 65 degrees, but the temperature of the car cannot be regulated as quickly as the steam is reduced or increased by the angle valve. The temperature of the car depends on the pipes on sides of the car, which being filled with water cool off and heat up slowly, so that time must be given to permit the cold water to heat up, or the hot water to cool off as required.

Commingler System.

Q. 30. Where is the Commingler placed, and how is it constructed?

A. 30. The Commingler is placed in the riser pipe, close to upper end of the coil, so that the water in passing from the Baker Heater to the expansion drum passes up through the Commingler. The steam port in the Commingler is connected to the branch from the train pipe. The steam that passes into the Commingler discharges into the water, in a series of small jets, which prevents any noise while steam is heating the water.

Q. 31. Why does the water not run back into the train pipe from the Expansion drum?

A. 31. The incoming steam pipe is carried above the water level in the expansion drum before it enters the Commingler. A check valve is also placed in this pipe which prevents the water returning through the Commingler. Trap and dial cocks are also closed.

Q. 32. What is the small cross pipe and relief check for, which is placed between the overflow and steam pipe?

A. 32. This is a relief pipe which allows air to enter the main steam pipe when steam is shut off from the Locomotive and breaks vacuum which otherwise forms in the train pipe, beneath the car.

Q. 33. If a Passenger car with the Commingler system gets cold, what should be done?

A. 33. Examine the dial and trap cocks to see that they are open.

Q. 34. If both are open, what then?

A. 34. Feel the steam pipe in the heater room, which conveys steam to car, if hot, and the steam gauge indicates pressure, next feel the overflow pipe, which should also be hot if unobstructed.

Q. 35. If the overflow pipe is not very hot, what is the cause?

A. 35. If the overflow pipe is cold, it is blocked at some point.

Q. 36. What effect would this have?

A. 36. The expansion drum would fill with water and no steam could get into the Commingler.

Q. 37. What should be done to remedy the trouble?

A. 37. The trap cock's handle should be turned from "Open" to "Open," as the obstruction is most likely to occur in the small hole in the trap cock. By reversing the direction of the handle, dirt that is lodged in the hole will probably be removed.

Q. 38. Can we tell while the train is running if the overflow pipe becomes clear?

A. 38. Yes; the pipe would get hot.

Q. 39. What should be done if it remained cold?

A. 39. Reverse the cock again and again, and tap it lightly.

Q. 40. What if all these efforts fail?

A. 40. Drain the water out of expansion drum to the level of the funnel cock, then close the trap and dial cocks, and light a fire in the heater.

Q. 41. If in another car which is also cold, dial and trap cocks are open, and steam and overflow pipes hot, what should be done?

A. 41. Feel the pipe under the Commingler and if hotter than the down pipe, the water has stopped circulating due to the system being short of water. The remedy is to close the trap cock and condense the steam, thus filling up the circulating system.

Q. 42. How long does it take to condense enough water?

A. 42. It depends upon how much is lost, and upon the weather. It may only take 10 minutes.

Q. 43. Suppose circulation did not start, what should then be done?

A. 43. Stop at the next station and open the drain plugs or cocks in the cross-over pipe under the car, first thawing out the cocks then give a sharp blow out, and if mud comes out, close them quickly and try to get circulation again. The mud may have caused all the trouble, and would account for the system becoming short of water. If this fails leave all the drain cocks open slightly, shut the trap cock, and use dry steam, and make the car as comfortable as possible under the circumstances.

Direct Steam System.

Q. 44. Is it possible to shut off one side of car using the direct steam system?

A. 44. Yes; each side is independent, and if pipes on one side are not required, open the drip for that side and blow out steam, then close down on the steam inlet valve, and use pipes on opposite side.

Q. 45. How should a car with this system be treated when brought to a terminal point, or set off on the road?

A. 45. Open the drips inside of car, and blow out, while steam is on. When pipes are blown out dry, car can be safely left, without danger of freezing.

Q. 46. Why is it important to blow steam out of pipes on the Direct Steam system before cutting engine off train?

A. 46. As this system uses steam direct from engine and there are no other means to heat the car, all condensation must be thoroughly blown out before detaching engine from train, so that condensation will not be frozen in pipes.

Q. 47. What series of cars are equipped with this Direct Steam system?

A. 47. Fruit and Express cars, and some coaches on Local trains.

Q. 48. What advantage has this system?

A. 48. Simple in operation, and when car is taken out of service, steam is blown out, no heater being required, when called into service again, it is ready for operation by supplying steam.

Q. 49. How can the steam inlet valve be known from the drip?

A. 49. The inlet valve is always connected to the upper heating pipe and the drip to the lower pipe.

Instructions for the Care and Operation of Steam Heated Passenger Equipment when in Trains.

ENGINEERS will turn on steam when train is ready, regulating the amount by the regulator, leaving angle valve from boiler open wide enough so that the fluctuation of boiler pressure will not affect train line pressure, see that steam gauge registers the correct amount of steam and that safety valve is adjusted to blow off at the correct pressure (not less than 60 lbs.) and never shut off steam from train, unless first notifying the trainmen to that effect, so that trainmen will have sufficient time to prepare the train for any emergency. TRAINMEN will examine trains before leaving terminals, as to condition of all valves, ascertain the amount of steam that is supplied from engine and be familiar with the location of all valves on train, as when it leaves, the care of the apparatus is with the trainmen, and they are responsible for the same until it is turned over to a relief crew, or the train is brought into a terminal point. Trainmen must not leave a divisional or terminal point until the condition of drips is known and steam has passed through the entire

train and issued out of rear, and train line end valve set to allow sufficient steam to escape to prevent train line from freezing. Care must be exercised in opening and closing valves on train pipe or the drip valves not to force them when cold, as it strains the inside parts and often causes the spindle to break; these valves can be easily operated when the steam softens the packing.

CAR FOREMEN AND INSPECTORS

Will see that regulators on cars and engines are working properly and are adjusted before leaving, also that steam gauge registers the correct amount, and is in good order; that all valves are packed, and no steam escaping; also that the Automatic drip is adjusted to relieve the condensation, and not allow any unnecessary waste of steam from same; that the expansion drum has been tested and filled to proper level with water, and place of testing marked with chalk on outside of drum casing; that there are no leaks from draw off cocks or plugs that would cause the circulation to stop; also that a spare set of steam hose is carried inside of Baggage car on each train.

When filling car heater pipes with water, attach hose to cock under car connecting to the bottom pipe. This will force the air through the pipes in the expansion drum and when pipes are filled, the water will fill the drum and run out of funnel cock, which indicates that the system is filled. After car has been filled, it must be watched to see that all air is out of pipes and water remains in drum up to the level of the funnel cock and then place tag on stove "Ready for Fire."

BLOWING OUT CARS.

Instead of attaching hose to drum and blowing down both pipes, attach hose to draw off cock connecting to the shortest connection to expansion drum, then open the other draw off cock or remove

plugs so that water can be forced out, by supplying steam to one and forcing the water out through the other opening until steam escapes, then change the hose to the other cock, and blow steam through the reverse way until it escapes again. Before disconnecting hose feel all pipes inside of car to see that steam has circulated through the entire system. On the Gold system both sides of car must be blown out separately in this manner, as each side is independent. After car is blown out, open funnel cock on expansion drum to admit air into pipes and place tag on stove "Make no fire, no water in pipes."

All water tanks must also be thoroughly drained by opening drain cocks which will be found under each washstand and at each hopper.

Duner hopper levers must be blocked up so that pan will be in down position.

Rex hopper pans must be dropped.

It is not advisable to place a Passenger car on a freight train with water in pipes and fire in stove.

It is not advisable for Passenger or Baggage car sent sealed on a Passenger train with steam working on car, as Trainmen must have access to give proper attention.

Q. How must a Sleeping, Dining, or equipped Tourist car be made ready to send to shop?

A. By lighting a good fire in stove but never remove water out of pipes as this class of car in cold weather must never be without heat inside of cars.

Approved,

W. E. FOWLER,

Master Car Builder.

Instructions to Foremen and Inspectors for the use of Pintsch Gas Equipment at Terminal Points.

When a gas car arrives at a terminal, the lamps should be thoroughly cleaned and carefully looked over, and if any parts are found to be defective, repairs must be made promptly. After testing, and replacing all defects close cock at each lamp separately, then close main cock in gent's toilet room, using gas key furnished for that purpose.

See Trainmen's Rule posted in toilet room in regard to turning off lamps first, then shut off main cock. Also that mantle lamps must be turned on full, or turned off entirely.

Lampmen and Inspectors must report immediately if a car is found with lamps turned on and main cock turned off in toilet room, and report made to Car Foreman or Master Car Builder.

The small pipes under the car connecting the tanks, regulator, and filling valves are made of ¼ in. extra heavy iron pipe with brass flanges soldered on to connect the pipes together. A small lead washer is used between the faces of the flanges to make a tight joint, slot headed bolts used to draw the flanges together.

Should a leak be discovered in these flanges, the leak may be stopped by tightening the slot headed bolts in the brass flanges with a screw driver. If leak does not then stop, remove old and apply new washer.

Should it become necessary to disconnect these pipes to re-solder a joint or to replace a washer, the gas will have to be shut off at tank valves. This may be done by removing cap from tank valve which will expose stem of tank valve, turn these stems to the right until valves are closed, using same kind of brass key as in toilet room.

After these connections are repaired, turn on the gas at tank valves, replace valve caps and see that all joints are tight.

Never use a light to locate leaks. Depend on the

sense of smell or use soap suds, applied with a brush.

If a filling valve should be found to be leaking it may be stopped by being turned down tighter by brass key from toilet room. These valves are left hand, to shut them off turn them to the left.

Should a filling valve leak so badly that it cannot be repaired the gas must be turned off at the tanks, and the Foreman notified.

Instructions to Trainmen for the Care of Pintsch Gas Car Equipment.

Read instructions to trainmen in regard to lighting lamps and emergency outfit which is posted in toilet rooms.

Before the gas is turned on at the main cock in the toilet room see that all lamps in the main part of the car and the bracket lamps in the passageways and toilet rooms are turned off. After the gas has been turned on at the main cock in the toilet room, all lamps may be lighted.

Should one of the lamps be leaky or defective, turn it off and report it at the next terminal point to the Car Foreman, or the man in charge of the lamps.

Should lights fail when there is gas in the tanks, thaw out the gas regulator under the car with steam or hot water.

Should a leak be discovered in any part of the car **the Gas MUST be shut off at once at the main cock in the toilet room.**

Should a leak occur in the filling valve under the car or in the connections between the gas tanks, the gas must be turned off at both tanks. To do this, take brass key from toilet room, **using large socket** to unscrew caps of tank valves. After these have been removed, the stems of the tank valves will be exposed, then use the small socket of the key to shut off valves turning them to the right.

Torches or Lamps of any kind **must not be used** while working around the connections and tanks under the car, and any employee looking for a leak **with a light** will be discharged.

In turning off the light turn off each lamp separately. After that is done turn off the gas at the main cock in the toilet room.

Should the odor of gas be detected in any part of the car, report it promptly to the Car Foreman, Inspector, or man in charge of lamps, at the next terminal point.

Trainmen must use discretion in regard to using the light during their respective runs. In first class and second class coaches where there are four or five centre lamps in the body of the car it will be sufficient to have **Two Lamps burning after 11 p.m.** The balance should be shut off entirely. In sleeping cars lamps should be turned out in the main body of the car, as per general instructions.

After 12 o'clock midnight the lamps in sleeping car smoking rooms should also be **turned out.**

A travelling special agent will inspect the lighting of the cars and give instructions to trainmen which should be followed.

Approved,

W. E. FOWLER,
Master Car Builder.

Description of Compressed Air Water Raising System for Passenger Equipment Cars.

This method of forcing water from a tank located under car, is done by compressed air obtained from the air brake system. In the first design of this system the air was taken direct from train pipe, but objection was taken to this method, owing to the fact that any defect in the check valve located between the reducing valve and the combination cock, or any defect in the rubber seated check valve in the governor, would allow the air that was stored in the special reservoir to flow back into train pipe when brakes were set, and would release brakes on the train, but as nothing can be allowed to interfere with the working of the brakes this method was abandoned for the present system of taking supply of air from the auxiliary reservoir, so that the feed port of triple will regulate the flow of air from the train pipe, the air supply is regulated by a governor, situated between the auxiliary reservoir and the special air reservoir used in connection with the water supply tank under car.

This governor is set at 60 lbs., and it will not operate until the pressure in the auxiliary reservoir reaches that point (60 lbs.); this pressure will raise the diaphragm, unseat the valve, and allow air, at same pressure as carried in auxiliary reservoir, to flow to special air storage used in connection with the water raising system.

It is very important that governor be set at exactly 60 lbs. Any variation from this will give trouble, as a governor set at 50 lbs. would improperly receive air from auxiliary before sufficient pressure had accumulated to operate air brake, and if governor is set for 70 lbs., it would fail to open, and no air would enter the special reservoir, with the result that water could not be raised in car. The special reservoir acts as a storage for the system, and as the water in the water tank is supplied to the car, it is replaced by air from the air reservoir, the air passing through a reducing valve located in pipe connection between

the reservoir and water tank. The reducing valve is set at 15 lbs., and is located inside of box around the water tank to prevent freezing. This pressure (15 lbs.) is sufficient when admitted on the top of water tank, to force the water through the pipe located inside of tank about 3 in. from the bottom, to any point inside of car. Any increase of pressure above 15 lbs. will cause the water, when faucet is opened in toilet rooms, to splash out of bowls.

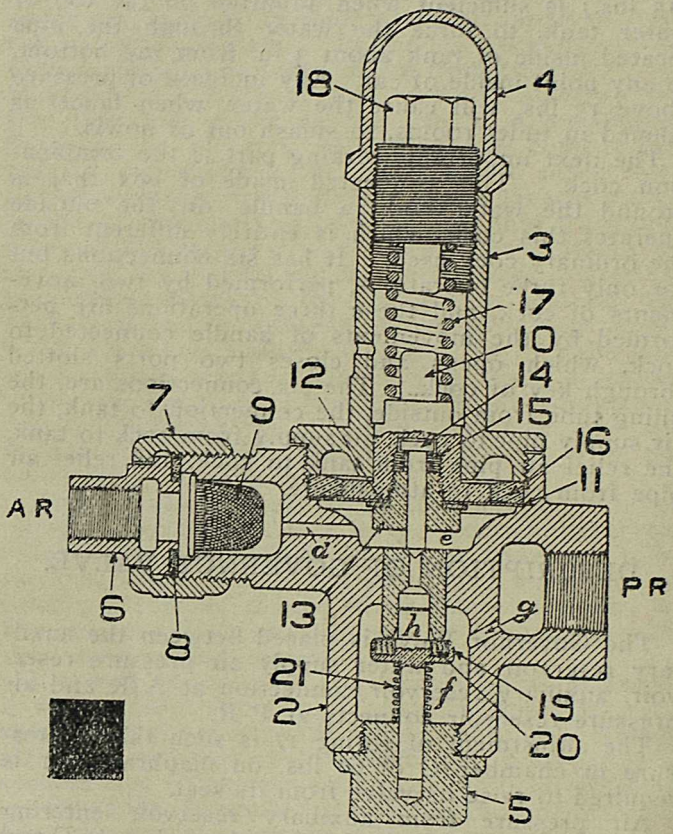
The next important working part is the combination cock. This is located inside of box that is around the water tank; a handle on the outside operates this cock, which is entirely different from the ordinary cock used. It has six connections, but for only three operations, performed by two movements of cock, and these three operations are performed by the movements of handle connected to cock, which opens and closes two ports slotted through key of cock. The six connections are, the filling tube from outside, the connection to tank, the air supply pipe to cock, air supply from cock to tank, the relief air pipe from tank to cock, and relief air pipe from cock to atmosphere.

DESCRIPTION OF GOVERNOR VALVE.

The Governor Valve is placed between the auxiliary reservoir and water supply air pressure reservoir, auxiliary reservoir connection at A R and air pressure reservoir connects at P R.

The adjustment of spring 17 is such that a pressure in chamber C of 60 lbs. on diaphragm 11 is required to raise its valve from its seat.

Air pressure from auxiliary reservoir entering valve at A R reaches chamber E through port D and as it approximates 60 lbs. diaphragm 11 and its valve are lifted, and valve 19 is forced from its seat, permitting the pressure to pass to chamber F and through port G to the air reservoir of the water system.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Reference No. of Parts:

2	Valve Body.	12.	Piston.
3	Body Cap.	13	Piston Ring.
4	Check Nut.	14	Piston Nut.
5	Cap Nut.	15	Cotter.
6	Union Swivel.	16	Diaphragm Ring.
7	Union Nut.	17	Adjusting Spring.
8	Gasket.	18	Adjusting Nut.
9	Strainer.	19	Supply Valve.
10	Piston.	20	Rubber Seat.
11	Diaphragm (2 pieces).	21	Supply Valve Seat.

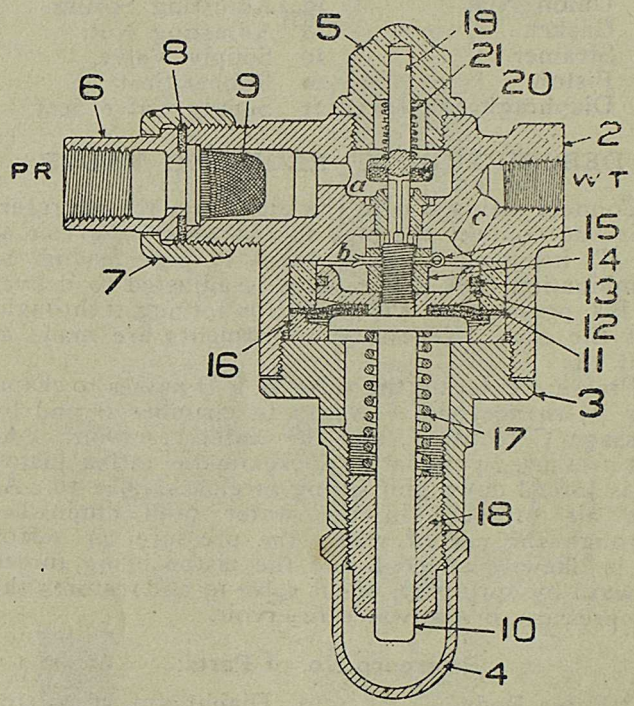
DESCRIPTION OF REDUCING VALVE.

Connect fitting 6 with the pipe from the air reservoir and connect the pipe to the water reservoir at W T, inserting a check valve, in pipe leading to combination cock. The valve is adjusted to deliver 15 lbs. pressure on the water for forcing it throughout the car. Necessary adjustments are made at Nut 18.

Pressure entering the valve at P R passes to chamber A, thence past valve 19 to chamber B and by passage C to W T, and the water reservoir. As the pressure in the latter approximates 15 lbs. piston 12 is forced down and spring 21 closes valve 19. As the air pressure in the water tank diminishes through the use of water, the pressure on piston 12 is likewise affected, and the piston being forced upward by spring 17, opens valve 19 and restores the air pressure in the water reservoir.

Reference No. of Parts:

2	Valve Body.	10	Diaphragm, complete.
3	Body Cap.	16	Diaphragm Ring.
4	Check Nut.	17	Adjusting Spring.
5	Cap Nut.	18	Adjusting Nut.
6	Union Swivel.	19	Supply Valve.
7	Union Nut.	20	Rubber Seat.
8	Gasket.	21	Rubber Valve Spring.
9	Strainer.		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W T
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4

DIRECTIONS FOR OPERATION.

To fill tank with water, move handle from horizontal to vertical position, with end of handle pointing down to track, in this position the filling pipe is opened; insert a water hose (which has been connected to water supply) in the 1½ in. pipe and the water will flow into tank. When the filling pipe is opened, the air exhaust pipe from tank is opened to the atmosphere, which allows air to escape from the water tank and water to enter. The air supply pipe to tank is also closed, while the handle is in this position, so that with one movement of the handle the following three operations are performed. First, exhausting air from water tank to atmosphere; second, cutting off air supply to water tank; third, opening the filling tube, allowing the tank to be filled with water. After tank is filled, which is indicated by water running out of air exhaust pipe, or backing out of filling tube, move handle back to a horizontal position, which again performs three operations—First, cutting off the water supply pipe; second, closing the air exhaust pipe; third, opening air supply pipe, which latter will admit air above the water and the service is again ready for use. The closing of the cock after the tank is filled, is very important, as otherwise the air cannot enter the water tank and distribute the water to pipes inside of car.

TROUBLES—THEIR SYMPTOMS AND CURES.

Should air pressure escape, but no water be obtained when the faucet is opened, water tank is empty, refilling will remedy.

Should no air pressure and no water escape when faucet is opened, first examine the cut out valve, located inside of car directly over water tank. On sleeping cars, this can be found in Section 4, and can be operated, when berths are made up, by an extension handle, which allows the valve to be opened or closed from aisle of car.

On Tourist cars the valve is located on left side of car facing the kitchen end under the third seat from same end. It is very important to be able to locate this valve as in case of any leak in water service inside of car, this valve can be closed which will cut off the entire water supply of car. If this cut out valve is opened inspector must look farther for cause of no water, and open drain cock on reservoir, to see if air has passed through governor from auxiliary reservoir, as if brakes are cut out it also cuts off water supply. If there is no air in special reservoir, governor must be examined to see if ten sion on spring is not in excess of auxiliary reservoir pressure, which would prevent governor from opening. If these are found correct examine reducing valve, inside of tank casing, to ascertain if valve is opened, so as to allow the 15 lbs. pressure of air to enter water tank.

In cold weather, the air supply pipe from air reservoir to water tank, at the point where it enters the box, is part most likely to freeze, as when the air pressure is reduced in reservoir, the water will back up to this air pipe (if check valve is in bad order) and as the water reaches the pipe exposed to the atmosphere, it will freeze at this point, but can be easily thawed out in a few minutes by using hot water or steam.

When a weak flow of water is obtained at faucets, examine reducing valve first, then other parts, as instructed in preceding paragraphs.

Too strong a flow of water, causing splashing, is caused by too high pressure on water tank, and indicates that reducing valve needs adjusting.

If combination cock turns too hard, take off nut at end, remove the key and grease it; then replace the key, but see that groove in end of it corresponds with the way ports are located, also that the handle is placed so as to operate it correctly.

Reducing valve, governor, check valve and strainer must be cleaned, examined and tested every time air brake is cleaned, to keep them in proper working order.

TESTING EACH VALVE.

To test governor on car, supply air to auxiliary reservoir, and allow pressure to accumulate until it reaches 60 lbs.; then cut out brake with this pressure in auxiliary, and set the spring on governor till the valve opens, and the pressure passes through governor to the supply reservoir.

To test reducing valve, attach air gauge to ¼ in. cock, then charge water supply air reservoir, remove lock-nut or cap from reducing valve and regulate screw until the pressure indicates 15 lbs., previously allowing time, however, for the water tank to charge, as the feed is very slow, often requiring from 5 to 10 minutes, according to the volume of water in tank, the more water, the less time, as the space for air is smaller.

Great care must be given to the governor, especially to the rubber seated valve on bottom, which by removing plug can be easily taken out with the spring attached. This rubber seated valve is the dividing line between the two reservoirs, and should seat of valve become defective, will allow air from both reservoirs to enter the brake cylinder when brake is applied, and causes such an increase of braking power as might cause wheels to skid.

When car is cut off from engine, and air pressure is quickly lost it may be caused by this same rubber seated valve, as if defective it allows the air to leak into auxiliary reservoir and out of air brake release cock, carrying off supply of air required for raising the water into car.

If leak is found inside of car, and is liable to wet carpet or interior of car, and cut-out valves cannot be operated, the water supply can be cut out from the outside, when train is stopped, by turning handle of combination cock down in same position as described to fill tank with water, as in this position, the air is exhausted out of water tank, and air supply is cut off, which prevents the water from rising into car.

TO CLEAN OUT AIR PRESSURE SYSTEM WATER TANKS.

Open 1½ in. angle valve connected to bottom of tank and insert water hose in filling tube and flush out with good pressure of water.

For shop cleaning remove flange from end of tank and scrub out tank thoroughly, and flush out with good supply of clean water.

To drain water tank. To drain tank open 1½ in. angle valve on bottom of tank, then move operating handle to horizontal position to cut out air supply.

To drain tank on cars fitted with gravity water supply. Care must be taken that all water is drained from overhead tanks; a drain cock will be found located under each washstand and at each hopper. On Duner hoppers block up lever so that pan will be in down position. Rex hoppers, see that pan is dropped.

NOTE.

If these instructions are carefully carried out, there should be no trouble with the water-raising system; or if by neglect or accident, trouble has been caused, it may be readily located and remedied by following these instructions.

Close attention on the part of all concerned must be given to these instructions, and they must be rigidly carried out.

Approved,

W. E. FOWLER,
Master Car Builder.

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