SOUTHERN PACIFIC COMPANY

(PACIFIC SYSTEM)

RULES AND REGULATIONS

GOVERNING

AIR BRAKES, AIR SIGNALS, HEATING AND LIGHTING PASSENGER CARS, ELECTRIC AND ACETYLENE HEAD-LIGHTS.

EFFECTIVE JULY 1ST, 1903.

No. 7895

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OF THE

SOUTHERN PACIFIC COMPANY

(PACIFIC SYSTEM)

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The rules herein set forth govern the railroads operated by these companies and supersede all previous rules and instructions inconsistent therewith.

Special instructions may be issued by proper authority.

J. H. YOUNG,
Gen'l Supt., Northern District.

H. V. PLATT,
Gen'l Supt., Southern District.

H. J. SMALL,
Gen'l Supt. Motive Power.

APPROVED:
E. E. CALVIN,
Vice-President and General Manager.

AIR BRAKES AND AIR SIGNALS.

1. Every employe whose duties are connected with the air brake must be examined by the inspector of air brakes, or other proper authority, as to its practical working and rules governing same, and is required to visit the air brake instruction car at every opportunity.

2. Roundhouse Foremen must see that drain cocks on air pumps are kept open while locomotives are in roundhouse, and main reservoirs drained each trip.

3. Pumps should be started slowly to allow water made by condensation to escape gradually, and to also prevent pistons from striking the cylinder heads. After accumulating about thirty pounds pressure in main reservoir, speed may be increased, but pump should never be raced. Both steam and air ends of pumps should be kept lubricated with valve oil.

4. The standard train pipe pressure will be 80 pounds. On heavy grades, where freight locomotives are equipped with duplex train pipe pressure control, the high train pipe pressure may be 100 pounds. With the high speed brake, 110 pounds train pipe pressure will be carried on all grades. On low grades main reservoir pressure on both passenger and freight locomotives shall be 130 pounds. On high speed locomotives over all divisions, main reservoir pressure shall be 140 pounds, and on all freight locomotives main reservoir pressure shall be 130 pounds.

Reducing valve on straight air brake should be set at forty-two pounds. Safety valve should be set at forty-five pounds, and must not be used in same brake cylinder with either the Westinghouse high speed reducing, or New York compensating valves.

5. Piston travel for driver brakes on compound locomotives shall be from six to eight inches; simple locomotives with cam driver brakes, one-half to two inches; simple locomotives with equalized brakes, four to eight inches; engine trucks, four to six inches; tenders, six to seven inches. Piston travel on cars, both freight and passenger, five to seven inches.

6. Automatic slack adjusters should be adjusted for seven inches travel. All hand adjustments should be made with these adjusters standing at zero. To replace worn out shoes it is necessary to screw the adjuster stem or handle back. Adjusters should be cleaned and oiled each time brake cylinder receives attention.

On all cars equipped with Acme slack adjusters, if the brakes are adjusted too tightly, or new shoes have to be applied, block up the flat spring on top of connecting rod, and throw the pawl at the top of the dead lever back, which will allow the brake head to drop away from the wheels to give sufficient clearance. When new shoes have been put on, or sufficient shoe clearance has been obtained, it will only be necessary to take out the block under the flat spring and throw pawl at top of dead lever ahead, when two applications of the brake will give the proper piston travel.

7. See that there are no leaks in air pipes or connections, and that air brake apparatus generally is in good working order. All hose

must be given a soap suds test where terminal tests are made.

8. On arrival of freight trains at inspection terminals, before cutting locomotives off train, enginemen will apply brakes with a fifteen-pound reduction. Inspectors will then go over train, noting cars on which brakes do not apply and other defects.

After repairs have been made by inspectors and outgoing locomotive has been coupled to train and the train charged with air to standard pressure, inspection of train shall be made in the following manner:

9. Inspector will attach his gauge to rear of caboose, and signal engineman to set brakes, which must be done with full pressure, making a twenty-five pound reduction. One inspector will then see that brakes are applied on all cars, the other inspector will pass over top of train and turn up all retaining valves, going from rear to head end, and on arriving at head end he will signal engineman to release brakes. Inspector will wait two minutes and then go over train and note all brakes that have released entirely, the inspector on the ground noting these, the man on top will return over train to rear end, turning down retainers, noting those from which air escapes. All cars on which brakes have released while retaining valves were turned up must have packing leathers, retaining valves, or leaky pipes repaired before train is allowed to leave.

Inspection of retainers as above described shall be made only at points designated.

10. After the entire train is coupled up, apply air gauge to rear end of passenger trains, connecting to both train and signal pipes.

When train has been charged to standard pressure, the inspector at rear end will signal engineman to apply brakes, which will be done by making a twenty-five pound reduction. Inspectors will then go over the train, noting the condition of brakes and adjustment, remedying such defects as may be necessary. An inspector will then go to the rear end and make a further reduction of ten pounds by opening the angle cock. He will then signal the engineman by four blasts of air whistle, by signal cord from rear car, to release brakes. Brakes will be released by engineman and the air signal answered by two blasts of the steam whistle. Inspector will then go over the train, noting if the brakes have released, reporting to the engineman and conductor the number of cars in the train and the condition of the brakes.

The train will then be ready to go forward and will be so reported to the proper authority of the station by the inspectors. In case a train is held at station after the regular leaving time, through some cause not known to the inspectors, they must have engineman apply and release brakes just before leaving, and see that brakes work throughout the entire train.

11 With passenger train, when it has attained a speed of 6 to 8 miles per hour, after leaving initial or inspection stations, or any point where locomotives have been changed or the hose separated, also at least one mile from railroad crossings at grade or drawbridges and before descending a heavy grade, without shutting off steam, brakes should be applied sufficiently to ascertain whether they are working properly.

When such test is made the rear brakeman must station himself on the end of rear car having retaining valve and notice if

air escapes from it while brake is releasing; if air escapes he will give engineer proceed signal. If not, train must be stopped, cause ascertained and remedied.

12. When locomotive has been coupled to train, or when two or more parts of the train have been coupled together, all brake and signal couplings must be connected and cocks in train pipes (air and signal) opened, except on rear end of last car, which must be closed.

(Note: There are two styles of cocks on air brake train pipes; one with curved handle, open when handle stands parallel with pipe; the other with straight handle, open when handle stands at right angles to pipe.)

13. In making up trains, examine couplings and signal discharge valves to see if tight. Should a triple valve be found defective, cut it out by closing cock in branch pipe leading to valve, notifying inspector or conductor immediately, who will report same to proper authority. To use signal, pull the cord one full second for each intended blast of whistle, and allow at least six seconds between blasts.

Conductors and enginemen handling train equipped with air whistle signals, must know that the device is in good working order. Trains so equipped must be tested by operating the signal from rear car before leaving a terminal station, and at every other station where locomotive or cars have been detached or hose coupling separated. The purpose of this test is to ascertain if air whistle signal hose is properly coupled and in working order. Do not test air signal by opening stop cock. Always use discharge valve for this test.

14. At summit of all heavy grades designated by special instructions, trains will stop

and rear brakeman will apply the brakes by opening the angle cock at rear end of last car in train gently, allowing only enough air to escape to apply the brakes slowly and firmly, without making an emergency application.

Having thus applied the brakes he will close angle cock, signal the engineman in the manner prescribed for terminal tests, to release brakes and, if brakes are at once released, train can proceed. If the brakes do not release promptly, it indicates there is some obstruction which prevents the air from flowing back through the train pipe. This must be remedied before the train starts. This test must also invariably be made by the rear brakeman at stations at foot of heavy grades, such stations to be designated by the Division Superintendent.

15. Charging and recharging of train line and application of brakes for testing or braking must be done from leading locomotive only and by enginemen, except where otherwise provided for in these rules.

16. Car Inspectors and trainmen must, at every opportunity, look over train carefully for leaks, improper piston travel and other defects.

(Note: Employes when working on a train must protect themselves according to Rules 26 and 26a of Rules and Regulations of the Transportation Department.)

17. When defects, developing on road between repair stations, cannot be remedied without serious delay, cut out brake, card car, and, if necessary, place in rear of train. Air brake on rear car of any passenger train must not be cut out, unless it is absolutely necessary and, if it is cut out, the car must be switched ahead of other air brake cars. To cut out a quick

acting brake, close cock in cross over or branch pipe near center of car. With plain, slow acting brake, turn handle of cock in triple valve to position midway between horizontal and vertical. When brake is cut out, open bleeder cock in auxiliary reservoir until all air escapes, and leave cock open. Do not cut out any brakes unless defective. When brakes are cut out, conductors will so advise enginemen. Conductors of first-class trains will report defects to inspectors. Conductors of freight trains will note defects on air brake defect cards, form 2399, and tack on car.

18. Some passenger and freight car hand brakes work opposite the air brakes. On such cars do not use either brake while the other is applied.

19. In making service stops with a passenger train of eight cars or less with one locomotive, brakes should be released in time for all to be off at instant of stop. With more than eight cars or with two locomotives on train, speed should be reduced by heavy application to about ten miles per hour, a short distance from point of stop, and then brakes released by moving brake valve to full release position for a moment, then returning to lap, and stop made with a second light application, leaving brakes applied until stop is made.

20. On freight trains moving slow near the point of desired service stop, apply brakes by slow continuous reduction, permitting train pipe air to flow from brake valve continuously until after stop is made.

21. For service stop with freight train, make an initial reduction of train pipe pres-

sure according to table in Rule 36, after sufficient time has elapsed for equalization and for slack to run in, apply the straight air brake with a pressure of approximately twenty pounds, and after speed has been reduced to about four miles per hour, make a second reduction of train pipe pressure, this reduction to be made continuous by keeping train pipe air flowing from brake valve until after stop is made.

22. For service stop with train backing, with locomotive on head end of train only, apply brakes with moderate reductions, at same time reducing braking power at head end by bleeding driver and tender brake cylinders, and keep slack in by crowding head end back, working steam until stop is made. When this is done on descending grades, in order to assist in keeping the slack in, trainmen must set hand brakes on rear cars.

With pushers on rear end of train, in addition to the foregoing, enginemen on pushers will cut out their automatic driver brakes and assist in holding up the slack by use of the straight air brake. Where pusher locomotives are not equipped with straight air brakes, automatic driver brakes should be cut out and slack held up by working steam in reverse motion, and in all cases where move is made on descending grade trainmen must set hand brakes on rear cars.

24. When helper engines are picked up on the road and cut in ahead of regular engine, air must be left set by regular engineer, to be released by helper engineer and vice versa when helper is cut off.

25. On heavy descending grades enginemen will keep train under control and observe the following essential points:

Charge train to standard pressure before leaving the summit. Regulate application of brakes so as to maintain uniform speed. In handling freight trains on heavy grades, the "one reduction" method is recommended, making reduction of sufficient amount to hold the train, and in recharging, keep the brake valve in full release position, but if there is danger of overcharging the train, brake valve should not be moved to running position until it has been in full release at least one-half second for each car in train.

26. Engine and trainmen must accustom themselves to frequent observations of air gauges, both when brakes are being used and at other times, noting by varying pressure any irregularity of apparatus, as well as the operation of the brake.

27. If it is found that the brakes are sticking, brake valve should be moved to full release for four or five seconds, then returned to running position. If this does not remove the trouble, stop train, maintaining pressure in main reservoir by placing brake valve on lap. If for any cause the brake is applied suddenly, brake valve should be placed on lap until the train stops and signal to release is given.

28. Locomotive must not be reversed and driver brake used at the same time.

29. When two or more locomotives are coupled, brake must be operated from head locomotive. Stop cock in train pipe under engineman's valve on rear locomotive must be closed and air pump kept working. If pump

of front locomotive fails, brake must be operated from rear locomotive until defect is remedied.

30. Two short and one long blast of the steam whistle thus: oo— is signal that the air on leading locomotive has failed, and for engineman on second locomotive to take control of train, who, as soon as he has obtained control of the air brake, must repeat the signal.

31. Two short blasts of the steam whistle repeated with an interval, thus: oo oo, is leading engineman's signal to second engineman to assist in recharging the train. Engineman on second locomotive should repeat the signal, assist in recharging, and as soon as he knows that train is fully recharged, or increased speed of train shows that brake should be again applied, must close the cutout cock under engineman's brake valve.

(Note: This practice should be resorted to only in case of extreme emergency.)

32. Two short blasts of the steam whistle repeated three times, is signal for brake sticking.

(Note: See Rule 14, Sections *n*, *o* and *p*, Rules and Regulations of the Transportation Department.)

33. Frequent application and release of the brake without allowing sufficient time to recharge the auxiliary reservoirs, reduces its efficiency, and must be avoided; but in handling trains on descending grades, in order to maintain a uniform low speed, application and release should be made as often as necessary.

34. On freight trains the enginemen, after shutting off steam, must allow slack of train to

run in against the locomotive, and then apply the brakes gradually, allowing ample time for slack to close up before further reductions are made. After slack has run in, enginemen should endeavor to keep it so until stop is made, remembering that much of the damage to freight and equipment is due to slack action. Before using steam, ample time must be given for brakes to release and slack to run out. Before using steam on freight trains, enginemen should allow their brake valves to remain in full release position at least one-half second for each car in train.

35. Before using steam on passenger trains, enginemen should allow brake valve to remain in full release position at least one second for each car in train, except where starting heavy ascending grades with two engines on head end of train, when head engineman should release the brakes and start to work steam at once, taking out the slack. After sufficient time has elapsed for brakes to be fully released, second engineman will commence to work steam.

36. Following table shows the approximate reduction required to apply the brakes on rear ends of trains of various lengths:

5	pounds	for	10 cars.
6	"	"	20 "
7	"	"	30 "
8	"	"	40 "
9	"	"	50 "
12	"	"	50 to 75 cars.

37. In the use of straight air brake great care should be exercised to prevent running in and out of slack, with consequent damage to lading and equipment, as referred to in Rule 34.

38. Enginemen must report on roundhouse work book any defects in air brake or signal apparatus.

39. When cars are picked up, trainmen must see that hand brakes are released and air brakes cut in before moving car, and see that piston does not travel less than five inches nor more than seven inches.

40. When cars are set out, release air and apply hand brakes. If hand brakes are defective, tag with air brake defect card, form 2399, erasing the word "air" and block car securely.

41. If a hose should burst, conductors must protect train as per Rule 99 of Rules and Regulations of the Transportation Department, before attempting to release brake. Close both cocks in train pipe at break until hose is repaired.

42. When necessary to release brakes by bleeding, open the release valve on auxiliary reservoir until brake begins to release, and then close.

43. When freight trains are standing on grade where it is necessary to keep brake applied, hand brakes must be set and straight air brake on locomotive or locomotives must be set and the automatic brake released, so as to have full pressure in train pipe and auxiliary reservoir before starting. When trains are standing on descending grade, hand brakes must be set on the front end of the train, and when standing on ascending grade, hand brakes must be set on rear end of train.

44. In case of a complete air failure on grades train must not be moved unless it can

be done with absolute safety and no open telegraph office must be passed with train in such condition without authority from the Superintendent.

If it is considered unsafe to move the train to a telegraph office, it must be placed on first side track and secured by hand brakes, and the engine, with sufficient cars to control it, taken to the next telegraph office.

45. In case the air pump should stop while running on heavy descending grade, the train must be immediately brought to full stop and secured by hand brakes, before engineer begins investigation for the defects, and, in case trouble cannot be located, movement of train must be in accordance with Rule 44.

46. Pressure retaining valves are of two styles, ordinarily located on ends of cars, and are used to retain pressures of fifteen and thirty pounds in brake cylinders to give more time to recharging auxiliary reservoirs.

Before descending grades where retaining valves are to be used, turn handle of retaining valves up (horizontally); at foot of grade turn handles down (perpendicularly).

The larger valve has three positions for the handle; position midway between horizontal and perpendicular is for retaining pressure of thirty pounds in brake cylinder. This position of handle should not be used except on such grades as are specified by local rulings.

When practicable on descending grades, all retainers must be used.

47. With freight trains retainers should be handled as follows:

If train consists of loads, and it is found necessary to turn any retainers down on ac-

count of too much holding power while running in recharge position, start at caboose and turn down every other one until required amount of retaining power is reached. If the train consists of empty cars, every third retainer, more or less, should be turned up throughout the entire train. On a train of loads and empties, where the empties are on the rear of train, all retainers on loads to be turned up and every third one on the empty cars.

On long grades, if retainers are used on only a part of the train, those turned up on the first part of the grade should be turned down later, and others turned up in their places, in order that a few brakes be not compelled to do all the retaining. When turning down retainers to allow trains to start, or to run over flats, trainmen should commence to do so from the rear of train. When trainmen discover overheated wheels, the retainer on that car should be turned down, piston travel taken and same noted on card delivered to inspector at next inspection point, and inspector should examine triple valve and retainer for defect.

48. Trainmen are cautioned to see that wheels are not slid flat by action of retainer when speed is reduced, or when starting from stations or other stops, and will be held responsible for any sliding or flattening of wheels.

49. To apply brakes from train, hold conductor's valve open until train stops, then close tight. Conductor's valve must be used only in emergencies.

50. The Westinghouse high speed reducing and compensating valves are to be adjusted to close when brake cylinder pressure is reduced to sixty pounds, and must receive same attention as given to triple valves and brake cylinders. The raised figures cast on the body indicate the size of cylinder to which they are to be connected. All cars used in high speed brake trains must be equipped with these valves or with temporary safety valves set at sixty pounds. If neither valve can be applied, train pipe pressure must be cut down to eighty pounds on the entire train.

51. On freight locomotives running over grades where triplex governor is used, as all locomotives are equipped with duplex train pipe pressure control, one governor head should be set at normal train pipe pressure of eighty pounds for use on ascending grades and also on descending grades, where train can be handled with eighty pounds of air.

The other governor head should be set at 100 pounds pressure and is for use on descending grades with heavy trains.

The third governor, attached to the main reservoir, should be set at 130 pounds. When descending a grade, if it is found the train does not hold well with eighty pounds train pipe pressure, this governor should be cut out and the 100 pounds train pipe governor cut in immediately.

52. Trains must not start down hill or from any stop on descending grade until full train pipe pressure has been obtained in train pipe and auxiliary reservoirs. If, from failure of pump or other defects, the pressure after starting cannot be obtained in a reasonable time, or maintained, notify crew and secure help from hand brakes.

53. Car inspectors must not permit cars to leave a terminal or repair point without brakes cut in and operative.

54. Car inspectors will see that brakes on passenger and freight cars are cleaned, oiled, tested and stenciled according to Master Car Builders' Rules.

All old stenciling must be erased when new is applied.

55. All air gauges on locomotives and cabooses must be tested and corrected every thirty days and the date of correction stenciled on face.

56. When air or signal hose on passenger trains is not coupled between cars it must, in every case, be coupled to the dummy couplings provided for that purpose, to prevent injury to the hose or admission of dirt to the train pipe.

57. Extra air brake, signal and dummy hose must be carried in baggage cars and cabooses.

58. On descending grades of 2 per cent or over the tonnage per brake will, if necessary, be prescribed by the Division Superintendent; on grades of less than 2 per cent tonnage may be handled without restriction.

STEAM HEAT.

100. The maximum and minimum steam heat pressure to be carried is seventy and forty pounds respectively, length of train and temperature of weather to govern.

When locomotive is coupled to train, where train consists of from 8 to 11 cars, 90 pounds of steam should be turned on, and when train consists of 11 or more cars, 100 pounds of steam should be turned on, in order to force steam through as quickly as possible, to avoid delay. The steam heat valve on rear end of train should remain wide open when steam is

first connected up, until water is drained out, after which same should be closed per Rule No. 102. As soon as steam is through train, cut pressure down to some point between the maximum and minimum allowed, according to the length of train (usually six pounds per car) and temperature of the weather. When turning on steam always open steam heat throttle wide, leaving it wide open; regulating steam pressure with pressure regulator.

101. If locomotive is not steaming freely, do not shut off or partly shut off the steam heat. Keep the required pressure on train at all times regardless of how locomotive is steaming.

102. Trainmen must know that all hose are coupled up and valves at end of car are open, except last car, using steam, which should have rear hose uncoupled and hooked to "S" hook on chain, and valve opened sufficiently to permit slight escape of steam. This is necessary to prevent steam train pipe and hose from freezing. Trainmen must look at this hose frequently, in order to know that valve is open and very little steam escaping.

103. At points where cars are to be set out, close the steam valves on each side of the coupling to be parted, always closing the forward valve first. Uncouple the hose by hand, then leave valves open sufficiently to prevent freezing. The cars set out must have hose uncoupled and valves under platforms and blow-off valve at trap, also the inlet valve, opened wide to drain the pipes of steam and water.

104. Pay particular attention to the "traps" underneath cars in order to know that they are open at all times. A very small amount of steam escaping from end of trap is

all that is necessary to keep up circulation, and prevent traps from freezing.

105. To regulate temperature of cars, equipped with Baker heater with steam attachment, open steam valves slightly in front of train sufficient to heat cars. Increase opening of steam valves toward rear of train. This gives better distribution of steam and prevents head cars absorbing more heat than needed. In no case should it be entirely closed without having the blow-off valve at trap open, as steam trap under car will freeze up and stop the circulation of the steam.

Steam and fire in Baker heater must not be used at the same time, as this will cause an over pressure in the Baker heater pipes and damage the heater. Should there be a fire in Baker heater, steam must not be turned on until the fire has become low and the pipes partly cooled down. When necessary to reduce temperature of car, valve should be partly closed by turning handle of valve until closed, then turn handle back one-half turn or more. Particular attention should be given to the temperature and ventilation of all cars in the train. After passengers have retired in sleeping cars, lower the temperature to about fifty-five degrees.

If steam has to be shut off entirely from car, before shutting off inlet valve, first open the blow-off valve and then shut inlet valve tight. As these valve seats may leak, they should be watched—occasionally open the inlet valve until steam shows at blow-off valve; then close inlet valve.

On cars equipped with vapor system the various levers operating admission valves are intended always to be open wide or closed tight.

Never left part way open. There are no blow-off valves to manipulate. In linen locker of sleeping cars equipped with vapor system will be found complete instructions for operating heating apparatus in that particular car.

106. The inlet valves on sleeping cars will be regulated and operated by sleeping car conductors and porters. The drips and main train valves will be operated by employes of the railroad company.

107. If steam does not escape from opening at end of trap, first ascertain if steam valve in car is open, if steam valve is open and steam does not escape at trap, open relief valve(globe valve) at end of trap and report condition of trap to inspectors at first terminal. Do not open relief valve unless trap is out of order.

108. If, for any reason, cars cannot be supplied with steam within thirty to forty minutes, uncouple all steam hose and hang up in "S" hook, on chain provided for that purpose, and open blow-off valve at trap on each car and start Baker heater.

109. Car Inspectors will see that stuffing boxes of all valves are packed so that there will be no danger of valve opening, or shutting off, after train leaves terminal. See that all traps have the proper opening and that lock nuts are up to place.

As soon as locomotive is coupled on, call for steam, carefully go over train, examine traps, end valves, hose couplings and rear hose. Do not allow trains to leave terminal until steam escapes at rear hose. If a hose coupling leaks, account of defective gasket, close valves on end of cars, part hose and replace gasket with new one.

110. The vapor system is similar in many ways to the ordinary steam pressure system—one or more cars equipped with this system does not affect the heating of other cars in the train.

111. No blow-off valves are used with the vapor system; the pipes are open to the atmosphere at the outlet, and all water and condensation will pass out as soon as it reaches lowest point. The heating pipes do not contain steam under pressure.

112. Steam may be turned on or off any heating coil by opening or closing cut-out valve located near center of the car on floor; in baggage and mail cars valve is located near end of coil. The cut-out valve should be opened as far as it will go in direction desired. When steam is not on the car no attention need be given to the apparatus on the inside to prevent freezing. Cut-out valve may be left either open or closed when car is not under steam.

113. Train pipe valve outside under end of the car should be left open when steam is not in use. The thermostat or expansion device at outlet of the apparatus is used to control the inlet of steam to the pipes instead of being used to control the outlet valve of steam trap. When the admission valves are open the heating pipes contain steam at atmospheric pressure only, or steam at 212 degrees temperature.

BAKER HEATERS.

129. Trainmen and carmen must know that all Baker heaters not using fire have been supplied with coal, kindling, etc., for emergencies.

In recharging heater, open combination cock on end of drum and pour water in until it runs freely from same. Water should always stand

at height of combination cock; this may be ascertained by opening cock when fire is low and no pressure on.

130. Steam inlet valve in Baker heater room should be open to admit air. This to be sure to get all water out of pipes. Should valve be left closed there is a liability of creating a vacuum which will hold water in pipes. Keep heater half full of coal. Never open inside safety lid, except to build fire or put in coal. Do not force fire by opening lid. To increase heat, open lower damper and close upper damper; to reduce heat, close lower damper and open upper damper. By properly working dampers, temperature (which should be as near seventy degrees as possible) can be regulated as desired, without having to open and close ventilators.

When necessary to use ventilators, it is better to open them in rear of car. Sash in rear door may be used as a ventilator, but do not use sash in front door, except in extreme cases. Particular attention should be paid to ventilation to secure plenty of fresh air without causing drafts. Owing to large amount of piping, the circulation is slow, and a forced fire is liable to cause serious trouble. Failure of heater generally arises from running too long without coal, then filling heater full and operating drafts. This stops circulation and creates gases, which are liable to explode.

131. When practicable, cars must be turned so heater will be in forward end.

132. If Baker heater pipes are frozen, fire must not be started in the heater, steam should be used to warm the cars; when steam is not available or when pipes are too badly frozen to be thawed out, car should be promptly sent to repair yard.

PINTSCH LIGHT.

152. To light lamps, first see that lamp cocks are closed, then open main cock wide; open globe of lamp, then partly open lamp cock, hold light to tips, close globe and open lamp cock, until jets burn full without smoking. After all lamps are lighted the lights may be turned down by partly closing the main cock.

To extinguish the light turn off the cock at each lamp first, then close the main cock.

Turn gas down about 10:00 p. m. by partly closing main cock, and extinguishing unnecessary lights.

In lighting the lamps equipped with mantle, the following instructions must be observed: Before turning on the gas at the lamp cocks, light a torch or taper, then turn on the gas, and immediately hold flame under the lamp bowl. Never put taper inside of bowl, as it may touch the mantle and break it. If taper is blown out through any cause, shut off the gas at the lamp cock until taper is relighted, for if gas is permitted to accumulate in the bowls, a slight explosion will occur on lighting, which will damage the mantles. The latter are delicate and must not be touched.

In lighting or turning out the gas, always operate each lamp cock separately. If you desire to reduce the light, do not turn the gas low, but turn out completely a number of the lights, leaving the others burning full.

153. Conductors will be supplied with keys for main and receiving cocks.

154. When light goes out leak is apparent, the cocks on end of receiver should be turned off; under no circumstances before doing this should receivers or pipes in the vicinity of leak be approached with any lights whatsoever.

155. Trainmen must report all leaks or defects in the apparatus.

156. In case of accident, close main cock and receiver cocks under car, using every precaution to guard against fire.

In case of serious derailment, trainmen must immediately open cocks and permit the gas to escape, this to prevent damage, should it be necessary for men to work around the cars with lights.

ELECTRIC LIGHTING—TRAINS.

176. Train electrician will be in charge of the lighting on trains electrically lighted and shall be responsible for same. Train electricians are subject to the authority of and governed by instructions from the electrician in charge of train lighting in all matters pertaining to the management and care of electrical apparatus used in the lighting of trains, and will report all defects or failures in such apparatus to him without delay.

177. On taking charge of dynamo car, electrician will proceed at once to check up waybill of electrical equipment in the presence of connecting electrician, and also shall make same check upon delivering car to connecting line.

178. Steam connection will be maintained between locomotive and dynamo car at all times while locomotive is attached to train. In case of failure of trainmen to maintain such connection, report should be made to electrician in charge of train lighting.

179. Current must be maintained on the train at all times. When engine and generator are stopped, battery should be cut in. If

the loss exceeds the capacity of the battery, notify trainmen to cut out all lights except hall and vestibule.

180. In starting dynamo engine, either for testing or regular run, all oil cups and lubricator should be filled and started first to see if they are in proper working condition.

181. Steam pressure should be maintained at all times at 90 to 100 pounds, while engine dynamo is in operation, whether lights are in use or not.

During lighting hours steam must not be turned off dynamo when locomotives are detached from the train until stop has been made.

182. No attempt should be made to repair switch board instruments, which are sealed to prevent tampering. Such repairs will be made by instrument makers. Special report of broken seals on switch board instruments should be made to electrician in charge of train lighting.

183. Special care should be exercised to maintain proper voltage on train line at all times. Excessive voltage will result in damage to fan motors and lamps, and, insufficient voltage produces inferior service. Train electrician should make it his special interest to see that the very best possible service is maintained.

184. Upon turning over dynamo car to connecting line electrician, report should be made of condition of lighting apparatus, especially of any trouble or defects, in order to enable the relieving electrician to repair same, or to guard against a continuance of same trouble. The apparatus in car should be turned over in good shape to connecting electrician, car and

engine should be cleaned, and oil cups and lubricator filled and ready for immediate use.

185. Report should be made to the electrician in charge of train lighting each time a car is received from connecting line with electrical apparatus out of order, giving train and car number, date and full particulars. Special report should be made to electrician in charge of train lighting covering each case of rough handling of dynamo car.

186. Train electrician, if not relieved at junction points, will continue in charge of car until relief is furnished.

187. When new lamps, sockets or fuse plugs are taken from regular supply in car locker, the damaged lamps, sockets or plugs, should be replaced in locker.

188. Special instructions on the operations of engine, generator and batteries are printed, framed and placed in each dynamo car and should be followed carefully.

189. Cars with axle generators are equipped with a signal device known as a "pilot light" to indicate to the crew whether dynamo is generating while car is in motion.

190. Circuit breakers are provided with two adjustments operated as follows:

First—By raising or lowering the screw, diminishing the distance between the magnets.

Second—By varying the tension springs by means of adjusting screw.

191. Circuit breakers are properly adjusted before cars leave the end of their run and should not be tampered with unnecessarily.

192. The fuse box of the Newbold System is supplied with either plain or cartridge fuses. The right hand terminals take negative or battery fuse. The middle take positive field fuse and the left hand terminals take positive main dynamo fuse. The main knife switch is provided to prevent the dynamo from generating when fuses are being inserted while car is in motion.

193. Fuse boxes are provided for other systems and differ only as equipments differ, all fuse boxes carry main generator fuse, also field fuse.

194. Except as above, fuses should not be applied while train is running. Failure of pilot lamp to burn would indicate that main fuse had burned out, and the train crew should reapply same at first stop.

195. If two main fuses blow out consecutively it should be understood that there is either circuit breaker generator or battery trouble and an inspection should be made by a competent person before applying additional fuses.

196. There are a number of causes of trouble in axle lighting which are confined principally to five sources—dynamo, battery, regulator, wiring and drive.

197. A diagram is appended to be used in locating derangements from which they may be located, and if they cannot be remedied by the crew, this will enable an intelligent report to be made of the possibilities of the trouble which are as follows: (See diagram, page 69.)

a When car is running, if pilot lights fail to burn, see C 10 or C 11.

b When car is running, if pilot lights burn steadily a dull red, but regulator arm does not come down, although train speed exceeds 25 miles per hour, see E 6.

c When car is running fast, if pilot lights do not burn and regulator arm does not come down, although lights in car are good, see C 12 A 12, or C 12 B-12, or C 12 C-12, or C-2.

d When car is running, if pilot lights burn brilliantly, but regulator arm does not move downward with increasing speed, see C-1.

e When car is running, if pilot lights burn brilliantly, automatic circuit breaker chatters violently, and regulator arm does not move downward with increasing speed, see C 1 D-1.

f When car is running, if lights are exceedingly brilliant, burning out at different locations, brilliancy increasing and decreasing with acceleration and retardation of train, see C 2 B-2; then see B D or B E.

g When car is running, if lights good, apparatus apparently working correctly but dim lights when car stops, see B. If terminal inspection is known to be good, trouble most likely due to B H.

h When car is running, if apparatus only works periodically, see C 2, C 12 B-12, D 1 B-1, A 5 A-5.

i When car is gradually accelerating to normal speed, if pilot lights burn brilliantly, then suddenly diminish to dull red and regulator arm starts downward violently, see C 1 C-1.

j When car is gradually reducing speed, if coming to rest (for example a station stop), lights momentarily appear dim just before car comes to rest, see C 1 C-1, or C 9, or C 3.

k When entering car and closing lighting

circuit switches, if car fails to light up, see D 4 C-4, or D 4 D-4; if found correct, see B II, or D 4 A-4, or D 2 B-2.

l When car generates correctly in one direction, and fails to generate at all in opposite direction, see A 1.

m When car is running, if lights too bright, see D 3 C-3.

198. Train men must be governed by the following instructions:

a Lights should at all times be used as sparingly as possible, and only necessary circuits used after ten o'clock at night. All lights must be turned off as soon as not required in the morning.

b In cases of long stops or delays, all circuits not absolutely necessary must be turned off, and not turned on again until train gets under motion.

c In case of defective generator or loss of belt, or from any other cause where lights are used from battery exclusively, extreme care must be exercised in use of lights, as the use of current from battery can be prolonged by reducing number of lights burning in car.

d Each circuit is provided with separate fuse plugs, and if any individual circuit fails to burn, train men should examine circuit fuses and reapply new fuse in place of defective one. This may be done at any time while lamps are burning.

ELECTRIC HEADLIGHTS.

208. Headlight electricians shall be subject to the authority of, and governed by instructions from the electrician in charge of train lighting in all matters pertaining to the management and care of electrical apparatus used in connection with electric headlights. The duties of headlight electricians shall consist of the installation, care and maintenance of electric headlight apparatus, consisting of engines, dynamos, lamps, wiring and headlight proper, and any other electrical apparatus used in connection therewith. When such duties do not require the entire time of headlight electrician, he shall perform such other work as shall be assigned to him by the locomotive foreman.

209. Electric headlights on locomotives so equipped shall be inspected, cleaned and oiled, and lamp trimmed after each trip. Headlight must be tested under steam prior to leaving roundhouse on each trip.

210. Speed of engine generator should be taken at intervals of one week and maintained within the limits set by the manufacturers of the kind of apparatus in use. A speed of 1,800 (or as near as can be operated without fusing copper electrode) revolutions per minute, with full load, and a maximum speed of 2,200 revolutions per minute without load, are the proper speeds.

211. Care must be exercised in the oiling of engine and generator. Before filling bearings, plugs must be removed so that excess oil may overflow. An excess of oil will certainly result in damage to dynamo armature. Plug should be removed from hole at top of engine and a small quantity of oil (black or engine) poured in to prevent rusting. This should be done twice a month outside. Bearing on engine must be lubricated with valve oil, as ordinary lubricating oil will cut this bearing and cause armature to drag on the pole pieces, resulting

in light failure. Lubricating oil can be used in inside bearing.

212. Commutator and brushes must receive attention at end of each trip. If commutator is rough or badly out of round, it should be turned in lathe upon the centers of its own shaft; if only slightly rough, it should be sandpapered. Sandpapering is done by holding a strip of No. 0 sandpaper the width of commutator across it while dynamo is running. Sandpaper should not be pressed against the commutator with the fingers. This will only magnify any irregularities in the face of commutator. Brushes should be carefully fitted to commutator. This can be best done by drawing a strip of sandpaper back and forth between the brush and commutator, keeping the sanded side of paper next to the brush, and the brush under pressure of brush holder spring, which will result in end of brush assuming the same curvature as the face of the commutator.

The commutator must be maintained in good condition if satisfactory results are to be secured. The brushes should bear upon the commutator only hard enough to prevent sparking, and they must not bear on more or less than two and one-half segments at the same time. The mica between copper segments should be kept slightly below surface of commutator.

213. If sparking continues under heavy brush pressure, it will be found to be due to other trouble in generator which must be located by testing for grounding, short or open circuits, or for lamps drawing excessive current due to sticking of carbons or grounded solenoid.

214. Governor valve on engine should be examined once each month and if found to be cut, should be ground or faced off as required. Bronze liners between governor stands must be kept faced off and under no circumstances must the turbine be operated without these liners being in place. To do so would result in steam cutting seat on main casting. If plungers are allowed to cut badly, engine may race, causing damage.

215. Headlight should be focused to throw the beam of light parallel with the track and in the center of the track. It may sometimes be found necessary to adjust focus so that the beam of light will incline slightly downward, but the inclination should be slight.

216. The following instructions should be followed very carefully in adjusting lamps:

Place the center of the end of the copper electrode in the center of the reflector and

$2\frac{3}{8}$″ from back of 16″x8″ reflector.
$2\frac{1}{4}$″ from back of 18″x9″ reflector.
1 1-3″ from back of 18″x12″ reflector.
$2\frac{1}{8}$″ from back of 23″x14″ reflector.

After setting copper electrode, as herein directed, drop copper electrode $\frac{1}{8}$″ below center of reflector and focus will be perfectly established. The front edge of the reflector must be parallel with the front edge of the case, and the carbon must be in the exact center of chimney hole in reflector. If the light is focused as herein directed, but does not properly strike the center of the track, do not change focus, but shift entire case on baseboard.

The copper or negative electrode will maintain its pointed shape when the lamp is working properly. If the copper does not maintain

its shape, but burns off rapidly, it is proof that equipment is running too fast and speed should be reduced.

217. Other minor instructions for adjusting and handling electric headlights are issued by the manufacturers which should in all cases be followed, and headlight electricians should provide themselves with a copy of such instructions.

218. Reflectors should be cleaned and polished with mixture of signal oil and lamp black. No other kind of polishing powder or paste should be used. To secure good results, the surface of the reflector must be kept highly polished.

ACETYLENE HEADLIGHTS.

238. Detach hose from pipe and withdraw cotter pin from pipe; lift off cover and take out gasometer, water tank and carbide can. Remove spent carbide and thoroughly clean out can, replace grate in carbide can and fill with five to six pounds calcium carbide. Place gasometer in position and fill generator wall with clean water in summer, and salt water in winter, until it flows from side hole. Remove gasometer and drain out bottom of generator with bibcock. Fill tank with clean water, replace carbide can, tank, gasometer, cover, and insert cotter pin and attach hose.

239. To start: Turn off cock in headlight, remove cotter pin, allowing gasometer to settle down, which opens tank valve, permitting water to drop on the carbide, thereby generating gas immediately.

240. At end of run, or at daylight, take water can from generator and place it in receptacle provided on running board.

241. It is important to always use clean water in water tank. Keep torches away from generator at all times. Particular attention is called to necessity for turning off cock in headlight before starting generator to prevent an accumulation of gas inside of headlight; if this is not done a severe explosion will follow an attempt to light the jet.

Inspectors must pay particular attention to valves of the water can, to see that they are not leaking.

242. The cock in generator bottom should be opened by engineer once every day during cold weather and once a week in warm weather.

243. The pipe line from generator is provided with a pet cock to drain off the condensation.

GENERAL INFORMATION

FOR

TRAIN AND ENGINE MEN, AND TRAIN INSPECTORS

IN THE

CARE OF AIR BRAKES, AIR SIGNALS, HEATING AND TRAIN HANDLING.

The safe control of trains is dependent on the efficiency of maintenance and manipulation of the air brakes. Those who make use of the apparatus must have a knowledge thereof to the extent herein given, which is also a guide to further investigation.

Q. What power is used to operate brakes on engines and trains?

A. Compressed air.

Q. Does this include both the automatic and straight air brakes?

A. Yes.

Q. What was the first system of brake in which air was used as power?

A. Straight air.

Q. What is the present system in general use?

A. Automatic.

Q. What equipment is necessary on engines and gasoline motors for operating straight air?

A. A pump, main reservoir, train pipe, three-way cock, and air gauge.

Q. What equipment under cars or tender?

A. Train pipe, branch or cross-over pipe, and brake cylinder.

Q. With the straight air brake, where is the air stored?

A. In a main reservoir on the engine.

Q. How is this brake operated?

A. Applying brakes by turning the handle of the engineer's three-way cock in position to allow air to flow back direct to brake cylinder through train pipe connections.

Q. Can this brake be operated by train crew?

A. No, only from engine.

Q. If hose should burst or train pipe become broken, what would occur with this system of brakes?

A. If brakes were applied they would release, and if hose or pipe should be broken when brakes were released they would not be applied automatically, nor could they be applied by the engineer.

Q. In handling trains with straight air, what essential is necessary?

A. Air must be set gradually to avoid slack of train running in.

Q. Is straight air brake in use at present?

A. Yes, on switch engines, also on some road engines and the gasoline motor cars.

Q. When used on road engines, what is its purpose?

A. To keep the slack together after releasing automatic brakes, in controlling slack of train at any time and in handling light engines.

Q. Should a long freight train be stopped with straight air brake alone?

A. The use of straight air brake alone with freight trains, is bad practice. It is hard on draft gear, and should never be used unless slack has first been

bunched, if moving ahead, or slack is out if backing up, at which time it should be applied very lightly at first.

Q. What two systems of air brakes are used on this road?
A. New York and Westinghouse.

Q. What additional equipment is needed to operate the automatic brake?
A. Locomotives require an engineer's brake valve, duplex air gauge, supplementary or equalizing reservoir, auxiliary reservoir, and triple valve.

Q. Why is an auxiliary reservoir needed?
A. To carry an independent storage of air on each car for braking purposes.

Q. Must each car, tender or engine equipped for automatic air, have an auxiliary reservoir?
A. Yes.

Q. What valve operates the brake?
A. Triple valve, actuated by any variation in train pipe pressure.

Q. What two forms of triple valves are used?
A. Plain and quick action.

Q. Which was the first form in use?
A. The plain triple valve.

Q. Which was the second form?
A. Quick action triple valve.

Q. Will both forms work together in harmony in service?
A. Yes.

Q. When is quick action obtained?
A. In emergency application, or when any sudden reduction of train pipe pressure is made.

Q. Why is it called a triple valve?
A. Because it does three things, charges the auxiliary reservoir, applies and releases the brakes.

Q. Name working parts of plain triple?
A. Triple piston, slide and graduating valves.

Q. Are the same parts contained in quick action triple valve?
A. Yes, and in addition an emergency valve, piston and check valve.

Q. Are all valves fastened to triple piston?
A. No, only slide and graduating valves.

Q. What is the duty of triple piston?
A. To move both valves.

Q. What moves the triple piston?
A. The difference of air pressure on either side of triple piston.

Q. What two pressures are carried on sides of triple piston?
A. Train pipe pressure carried on one side, and auxiliary reservoir pressure on the other.

Q. Then the entire system with automatic brake is charged with air?
A. Yes.

Q. To have triples respond promptly on application, how must these pressures stand?
A. Equal.

Q. To apply automatic brake, what pressure is reduced?
A. Train pipe.

Q. If air was blowing out of exhaust port of retaining valve when brake was re-

leased, car being equipped with the Westinghouse triple valve, what would be the trouble?

A. The emergency valve is off its seat or dirt under it, permitting train pipe air to flow through into the brake cylinder also escaping at the exhaust port of the triple valve.

Q. How would you remedy this defect?

A. Tap the check case of the triple valve lightly, and if valve does not seat and cut off flow of air from the exhaust port, close the cut out cock in branch pipe and bleed off the auxiliary reservoir pressure through the release valve.

Q. If air should escape at the port under the side plate over the quick action piston of the New York triple valve, what is the trouble?

A. Vent valve in triple cap is off its seat, permitting train pipe pressure to escape to the atmosphere. This is a direct leak from the train pipe, and will vent the entire pressure to the atmosphere. To remedy the defect, tap the triple cap lightly and if flow of air does not cease, close the cut-out cock in the branch pipe, bleed off the auxiliary reservoir pressure through the release valve.

Q. If check case gasket should blow out of the Westinghouse triple valve, how would you remedy the defect?

A. This defect cannot be remedied on the road, so cut out the brake by closing cut out cock in branch pipe, and bleed off auxiliary reservoir pressure.

Q. If triple valve gasket should blow out, what should be done?

A. Cut out brake by closing the cut out cock in branch pipe, and bleed off the auxiliary reservoir pressure.

Q. What is the function of the retainer or retaining valve?

A. To hold a certain pressure in brake cylinder, varied according to type of retainer, thus keeping the brakes applied sufficiently to allow a longer period for recharging auxiliary reservoirs.

Q. To what part of triple valve is retainer pipe attached.

A. To exhaust port, making exhaust passage from triple valve to retaining valve.

Q. Where are they used?

A. On descending grades.

Q. Why used on such grades?

A. To control speed of train and give the engineer time to recharge auxiliary reservoirs.

Q. Do retainers hold air in the brake cylinders before, or after brake is set?

A. After brake is set and released.

Q. What position should handle be in for full release?

A. Handle down, or parallel to retainer pipe.

Q. In what position to hold air in brake cylinder?

A. Handle up and at right angles to retainer pipe.

Q. If this pipe is broken or retaining valve is gone, should brake be cut out?
A. No, you only lose retaining feature.

Q. If plugged up to stop a blow, what would be the result?
A. Brakes would not release, causing overheating and the liability of cracked or flattened wheels.

Q. If brake was applied, also air was released from brake cylinder, and brake remained applied, where would you look for the trouble?
A. See if the retainer handle was up, and if not, see if hand brake was applied. The lever or rods under the car may be caught, if this trouble does not exist, the trouble is in the brake cylinder.

Q. Suppose the air did not leave brake cylinder when brakes were released, where would you look for the trouble?
A. In the exhaust port of the retainer, or retainer pipe.

Q. How would you release brakes in that case?
A. Part the retainer pipe at the union or clean out the exhaust port.

Q. How should the air pump be started?
A. Very slowly with drain cock open until all condensation has passed out.

Q. What oil should be used in the air cylinder?
A. Valve oil, sparingly.

Q. What is the New York pump called?
A. Duplex.

Q. How many steam cylinders and valves, air valves and cylinders has this pump?
A. Two steam cylinders, two steam valves, six air valves and two air cylinders.

Q. Name the air valves?
A. Upper and lower receiving, upper and lower intermediate, and upper and lower discharge valves.

Q. Has the No. 5 pump also six air valves?
A. No, it has eight.

Q. Where is the steam cylinder located, at the top or bottom?
A. At the bottom.

Q. Are the steam valves located there?
A. Yes.

Q. What moves the steam valves?
A. The valve stems which work in the piston, which is hollow.

Q. Which is the steam end of the Westinghouse pump?
A. Top.

Q. If the air pump stops, how may the trouble be located?
A. Open the drain cock in steam passage and see if steam is flowing to the pump. Throttle valve may be disconnected or governor may have shut off the pump.

Q. If steam is reaching pump, what should then be done?
A. Shut off steam, tap lightly around the pump heads, then open throttle and see if pump starts.

Q. If a New York air pump does not start what further can be done to locate the trouble?
A. Shut off the steam, take out the oil cups, and push both pistons to the lower end of their stroke, put caps back and turn on the steam slowly.

Q. If right piston travels up and stops, and left piston remains down, where would defect be located?

A. Broken valve stem on right or low pressure side.

Q. If both pistons go up and stay?

A. Broken valve stem on left or high pressure side.

Q. Which steam valve operates the right or low pressure piston?

A. The left one.

Q. Which steam valve operates the left or high pressure piston?

A. The right one.

Q. If the right piston travels up very slowly but returns fast, what is the trouble?

A. Upper intermediate passage choked, or valve is stuck to its seat.

Q. If the left or high pressure piston travels up very slowly, but returns fast, what is the trouble?

A. Upper discharge valve is broken or passage choked up.

Q. If right or low piston goes up normally, but returns quickly, what is the trouble?

A. Upper intermediate valve broken or cracked, or copper gasket blown out between the two cylinders.

Q. What are pump governors for?

A. To control pumps.

Q. Where are they located?

A. Between the steam throttle and pump.

Q. If governor is connected to pump with Westinghouse (G6) engineer's brake

valve, what pressure would control the pump.

A. Main reservoir pressure.

Q. Why?

A. Because this style of brake valve has train pipe governor attached to it.

Q. If duplex governor is connected to the New York pump, what are its duties?

A. One head to control pump at main reservoir pressure, the other head to control pump at train pipe pressure.

Q. What are the duties of the triplex governor?

A. A pressure head to stop pump when main reservoir pressure is obtained, also two other heads, one for normal, the other for heavy train pipe pressure.

Q. If either governor has failed to stop the pump when desired pressure is obtained, where would trouble be located?

A. In the air passage leading to the pressure head or top of air piston.

Q. If the governor stops the pump but does not allow it to start properly, where is the probable trouble?

A. The vent port may be stopped up.

Q. If you desire to set the main reservoir governor and engine was equipped with New York engineer's brake valve, where would you place the brake valve handle?

A. Lap position.

Q. If you desire to set the train pipe governor, and engine was equipped with New York engineer's brake valve, where would you place the brake handle?

A. Full release position.

Q. What is the general distinguishing feature of the New York and Westinghouse engineer's brake valves?

A. The New York uses a slide and the Westinghouse uses a rotary valve.

Q. How many chambers has a New York engineer's brake valve.

A. Four.

Q. What pressure is carried in the top chamber?

A. Main reservoir pressure.

Q. What is carried in the lower chamber?

A. Train pipe pressure.

Q. In the middle, or back of main piston?

A. Supplementary reservoir pressure.

Q. In the fourth chamber?

A. Air for pump governor.

Q. How many positions can the handle be placed in?

A. Five.

Q. Name them.

A. 1st full release, 2nd running, 3rd lap, 4th service, and 5th emergency.

Q. What are the duties of the main slide or rotary valves?

A. To control opening from main reservoir to train pipe, from train pipe to atmosphere, or to blank all ports.

Q. When brake valve handle is placed in full release position, do we get the maximum opening from main reservoir to train pipe?

A. Yes.

Q. When brake valve handle is placed in emergency position, do we get the maximum opening from train pipe to atmosphere?

A. Yes.

Q. When the brake valve handle is placed in lap position, what ports does it blank?

A. All ports, except port to the supplementary reservoir, with old style of New York brake valve.

Q. With brake valve handle in lap position, what two pressures are separated?

A. Main reservoir and train pipe.

Q. When brake valve handle is placed in running position, how does air get to the train pipe?

A. Through what is known as the feed or supplementary passage.

Q. What valve and spring are placed in this passage?

A. Excess pressure valve and spring.

Q. What is this valve and spring for?

A. To maintain an excess pressure.

Q. Where?

A. In the main reservoir.

Q. What care is required to insure proper operation of this valve?

A. It must be kept clean, and the spring working freely.

Q. If handle of brake valve is placed in running position, pump started and red hand on gauge shows full pressure, but black hand on the gauge is still at zero mark, where would trouble be looked for?

A. The excess pressure valve is stuck to its seat or passage stopped up.

Q. If coupled to train and this trouble occurred, in order to avoid delay, how could train pipe be charged and brake handled?

A. Move handle of brake valve to full release position.

Q. Suppose train was fully charged, excess pressure valve in above condition, then brake valve handle was brought over to running position, what effect would this have on the brakes?

A. They would apply through leakage in train pipe, caused by reduction in train pipe pressure.

Q. Then it is important that this valve be kept clean?

A. Yes.

Q. How should the brake valve handle be carried except on descending grades?

A. In running position.

Q. On descending grades should handle be carried in full release position?

A. Yes, to quickly recharge auxiliary reservoir.

Q. What is the small valve under the main slide valve called?

A. Graduating or cut-off valve.

Q. What are its duties?

A. To control the flow of air from the train pipe to the atmosphere.

Q. To what piston is this valve connected?

A. To graduating piston.

Q. In what chamber is this piston located?

A. Train pipe chamber.

Q. What are its duties?

A. To control the graduating valve.

Q. What pressure operates the graduating piston?

A. Supplementary reservoir pressure.

Q. Where is air obtained in charging supplementary reservoir?

A. From the train pipe.

Q. How does pressure in the supplementary reservoir and train pipe start?

A. Equally.

Q. How is the graduating piston operated?

A. Main slide valve is drawn back to allow air to escape from the train pipe, this causes supplementary reservoir pressure to move piston forward until train pipe and supplementary reservoir pressure have equalized.

Q. In making application of brakes, how is air released back of the graduating piston?

A. Placing the handle of brake valve in full release position in the old style New York valve, in the new style New York valve to a position between lap and running.

Q. What then?

A. Before making another service application, brake valve handle must be placed in running or lap position to charge the supplementary reservoir.

Q. Is this necessary in the new style brake valve?

A. No, the supplementary reservoir is charged through a ball check valve located in the graduating piston.

Q. With the New York or Westinghouse engineer's brake valve, if the brakes after being set, and the valve being placed on lap should release through the triple valve, what would this indicate?

A. A leak past the slide or rotary valve in brake valve to the train pipe or from the auxiliary reservoir.

Q. In making a service application with Westinghouse brake valve, if train pipe pressure continues to flow to the atmosphere, after the required reduction has been made, and brake valve placed on lap, what would this indicate?

A. A leak in the equalizing reservoir, its connections, the discharge valve sticking or the discharge valve has been cut.

Q. With the New York engineer's brake valve, in the preceding question, what would this indicate?

A. A leak in the supplementary reservoir, or a leak back of the equalizing piston.

Q. Some engines are equipped with straight air brake valve, does this operate the automatic brake?

A. No, this operates engine and tender brake only.

Q. Where is air taken from to operate this brake?

A. From the main reservoir.

Q. What is the object of this device?

A. To operate engine and tender brakes, independent of automatic brake.

Q. How many positions has the handle of the straight air brake valve?

A. Three.

Q. What is the extreme forward position?

A. Release.

Q. What is the extreme backward position?

A. Full service.

Q. What is the middle position?

A. Lap.

Q. Are there any other positions on quadrant for handle in the latest type of straight air brake valve?

A. Yes, a fourth, indicated by notch between full service and lap.

Q. What is this for?

A. Slow service application.

Q. Where should handle of the automatic brake valve be carried when engine is equipped with straight air brake?

A. In running position with New York apparatus.

Q. If automatic brake is applied, can straight air brake be used?

A. Yes.

Q. If straight air brake is applied and it is necessary to recharge with automatic, what should be done with straight air?

A. It should be held applied and then released gradually before applying the automatic.

Q. How should this brake valve be handled in applying brakes?

A. Always graduating the application.

Q. If the handle of the automatic brake valve is carried in full release position, how does pressure in main reservoir and train pipe stand?

A. Equalized.

Q. What would be liable to occur, if the straight air brake was applied?
A. It would apply the automatic brake, and not having any excess pressure, it could not be released until the required excess was obtained.

Q. What is the main reservoir for?
A. For storing air pressure on engine.

Q. What is this pressure used for?
A. For charging train pipe and auxiliary reservoir, and to release brakes.

Q. If located on the engine, how many hose connections are needed between the engine and tender?
A. One, train pipe.

Q. If on passenger engines, how many?
A. Two, train pipe and signal pipe.

Q. If straight air is used?
A. Three, train pipe, straight air, and whistle.

Q. If located on tender?
A. Three, one from pump to main reservoir, one from main reservoir to brake valve, and one from brake valve to train pipe.

Q. Supposing pump discharge was coupled directly to train pipe, can brakes be operated by the engineer?
A. No, only by train crew.

Q. Trace course of air through system?
A. 1st from the pump to main reservoir; 2nd, from main reservoir to brake valve; 3rd, from brake valve to train pipe; 4th from train pipe to branch pipe; 5th, from branch pipe to triple

valve; 6th, from the triple valve to the auxiliary reservoir; 7th, from auxiliary reservoir to the brake cylinder; 8th, from brake cylinder through triple valve to the atmosphere.

Q. With New York engineer's brake valve, if pipe leading from supplementary reservoir is broken off, can brakes be applied in service?
A. Yes, make the necessary train pipe reduction and close exhaust slowly by moving brake valve handle forward.

Q. What pressure is now made the stronger?
A. Auxiliary reservoir pressure.

Q. What effect does it now have?
A. It moves triple piston and admits air from auxiliary reservoir to the brake cylinder.

Q. To release brakes what pressure must be restored or made stronger?
A. Train pipe.

Q. Is there any other way to release brakes?
A. By bleeding auxiliary reservoir.

Q. How would you release brakes on a car if it is applied and engine is not on?
A. By opening bleed cock on auxiliary reservoir.

Q. How long would you hold this open?
A. Until the triple valve commences to release.

Q. What effect follows if cock is left open?
A. It is liable to set other brakes.

Q. Why?
A. It is an indirect train pipe leak.

Q. Can crew operate this brake?
A. Yes, by opening conductor's valve or an angle cock.

Q. When brakes are released, how does air from brake cylinder escape?
A. Through exhaust port in triple valve.

Q. When this pipe is broken off air escapes, and if leakage is not stopped, what effect would it have upon the brakes?
A. This being a train pipe leak, the brakes would apply.

Q. With Westinghouse brake valve, if pipe between brake valve and equalizing reservoir is broken off, what should be done?
A. Follow above instructions, with exception that train pipe exhaust port must be plugged.

Q. How could brakes be applied?
A. By operating brake valve in emergency position, using care to apply and close the exhaust gradually.

Q. Should a New York brake valve fail to cut off when applying brakes, after black hand of air gauge registers the proper reduction, what should be done?
A. Push brake valve handle forward slowly until exhaust closes.

Q. Where would this trouble be located?
A. In the joint which the back head of piston makes with pipe connection to the supplementary reservoir, or in the packing leather of the graduating piston.

Q. If engineer makes a reduction to set brake, and desires to make a still further reduction, and fails to obtain the exhaust

until brake valve handle is placed in emergency position, what is wrong?
A. Leak above equalizing piston or connection to supplementary reservoir, or train pipe at its connection with the air gauge.

Q. How many valves on an engine for operating signal whistle?
A. Two, reducing valve and signal valve.

Q. Where is the reducing valve located?
A. Between main reservoir and signal valve.

Q. What are its duties?
A. To cut down main reservoir pressure to a suitable point for operating the whistle.

Q. What pressure is required for operating same?
A. 40 pounds.

Q. If signal blows every time the brake is released, what is wrong?
A. Dirt under the feed valve in the reducing valve.

Q. How does this affect the whistle?
A. Allows pressure in main reservoir to equalize with signal pipe pressure and when brakes are released, main reservoir pressure being lowered, the pressure in signal pipe flows back to the main reservoir, which reduction causes whistle to blow.

Q. If whistle fails to blow and you know signal pipe is charged, where is the trouble?
A. In signal valve.

Q. Before reporting same, what inspection should be made?

A. Inspect all connections for leaks, and see if signal whistle needs adjusting.

Q. What are the cocks called which are placed in the train pipe at each end of the car?

A. Angle cocks.

Q. How many kinds of these cocks are there?

A. Two, the angle cock, which is the standard in use, has a curved handle standing parallel to train pipe when open; and a cut out cock used on older equipment, which has a straight handle standing crosswise or at right angles with train pipe when open.

Q. How must angle cocks be left to operate brakes throughout train?

A. All open except the one on rear end of train.

Q. Where are cut out cocks placed?

A. In branch or cross-over pipe between train pipe and triple valve.

Q. What are they placed there for?

A. To enable a car to be cut out on account of defective brake apparatus.

Q. What would indicate to engineer that there was a triple valve in the train that took emergency in service application?

A. The discharge from the train pipe would cut off short and black hand of air gauge would continue to fall.

Q. What is meant by overcharged train pipe?

A. A pressure in train pipe higher than in auxiliary reservoir.

Q. If eighty pounds in train pipe and seventy pounds in auxiliary reservoir, would this be called overcharging train?

A. Yes.

Q. If with eighty pounds in train pipe and seventy pounds in auxiliary reservoir, could brakes be applied?

A. Yes, by reducing train pipe pressure more than ten pounds.

Q. With eighty pounds in auxiliary reservoir and seventy pounds in train pipe, how would brakes act?

A. They would apply.

Q. How could brakes be released under this condition?

A. By raising train pipe pressure a little higher than the auxiliary reservoir pressure.

Q. How should throttle be handled when steam heat is needed on train?

A. Open throttle slowly until it is wide open.

Q. What regulates pressure in the train?

A. The steam heat regulator.

Q. If coupled on to train and regulator will not allow steam to pass through, how can same be temporarily fixed so as to let steam through and avoid delay?

A. If a Mason regulator, take off bottom cap, put in small block and screw it back on. This will keep valves up so that steam will pass through.

Q. If Leslie small regulator is used, and it fails to let steam through, how can this be fixed?

A. Remove lower cap and take out the valve.

Q. How must steam be regulated?

A. By the throttle. It must be watched and not allowed to raise pressure too high or blow off hose.

Q. Is it permissible to shut off steam to favor an engine that is steaming poorly?

A. No.

TRAIN HANDLING.

Q. What standard of train pipe pressure is carried on passenger and freight trains on this road?

A. Eighty pounds, except on high speed brake trains.

Q. What is the standard pressure for high speed brake trains?

A. One hundred and ten pounds.

Q. With eighty pounds in train pipe, what pressure should be carried in main reservoir?

A. On passenger trains, one hundred and forty pounds; and on freight trains one hundred and thirty pounds.

Q. On high speed brake trains, how much pressure should be carried?

A. One hundred and forty pounds.

Q. Should brakes be held applied on passenger trains until brought to a full stop?

A. No, release before coming to a full stop with less than ten cars, grades permitting.

Q. How soon should brakes be released before coming to a full stop?

A. In time to allow brakes to release, so as to prevent discomfort to passengers.

Q. On long passenger trains, ten cars or over, would you follow same practice?

A. Brakes should not be released before coming to a stop, it should be held applied.

Q. Why?

A. For the reason that the brakes on the rear end of train would not release before the slack ran out, which with added weight of engine, would probably cause a break-in-two.

Q. What is the best practice to follow when stopping passenger trains?

A. The two application method, as train can be stopped with a second application with a lower brake cylinder pressure.

Q. What is meant by application of brakes?

A. From time brakes are applied until released.

Q. In using the air brakes, several reductions can be made, are they considered applications?

A. No, there may be several reductions to one application.

Q. Give an illustration of what is known as the two application method of handling brakes?

A. Would apply brakes strong enough with first application to bring the speed of train down to eight or ten miles per hour, then release, immediately bringing the brake valve handle to lap position, next application would necessarily be light, and should not tilt the trucks.

Q. Is this considered good practice, especially with long passenger trains?

A. It is the proper method to use.

Q. What application of brakes must not be practiced by engineers when stopping at water crane, coal chute, and making other ordinary stops.

A. Must not use the emergency, for as the name implies, it is to be used only in such events.

Q. If you desire to sand the rail while making a stop with the air brake, how should it be done?

A. Start the sand running until the entire train has passed over it, then apply brakes.

Q. What is meant by overcharging train pipe?

A. When train pipe pressure is above that of the auxiliary reservoir pressure.

Q. How is this overcharging usually brought about?

A. By having a high excess pressure in the main reservoir when brakes are applied and released by leaving handle of brake valve in full release position too long on short trains.

Q. To overcome this, how should brake valve be used?

A. Leave handle of brake valve in full release position long enough to start all triple valves to release position, then return to running position.

Q. Is this the best practice when stopping passenger trains in making station stops?

A. Yes.

Q. If desired to steady a passenger train around a curve with the air brake, how should it be done?

A. Make application just before reaching curve, and release the brakes as the engine enters the curve.

Q. If all cars on high speed brake trains, also tenders and engines, are not equipped with Westinghouse high speed or New York Company compensating or temporary safety valves, set at sixty pounds, what pressure must be carried?

A. Eighty pounds train pipe pressure.

Q. How should a long freight train be stopped with automatic brake?

A. Make a reduction of not less than ten pounds in the train pipe pressure, and wait until the brakes have equalized. If a still further reduction is needed, follow it with a reduction of sufficient amount so that the stop may be made at the point desired. However, just before the train comes to a stop, make a train pipe reduction to insure a slow but continuous train pipe exhaust from the engineer's brake valve at the time stop is made, thus applying the brakes harder on the head end of the train, permitting the rear end to run in gradually. In following this method, always endeavor to have available a sufficient amount of air in the auxiliary reservoir above the point of equalization to make the last reduction while the train is stopping.

Q. With one engine, how should a long freight train be started?

A. If brakes are set, release them, allowing at least one-half second for each car in the train, and keep brake valve handle in full release position. Start the engine slowly, picking up one car at a time until the entire train is fully started. Engine should not be allowed to stop after start has been made.

Q. In handling freight trains should brakes be released before or after the stop?

A. After the stop.

Q. Why?

A. With long or ordinary freight trains, brakes releasing on front end of train first, the weight of the moving engine would run out the slack with rear brakes set, causing a strain on draft gear, probably causing a break-in-two.

Q. If it is found that brakes can be released before coming to a stop, what should be done to prevent slack from running out?

A. Before releasing brakes, straight air brake should be applied gradually with moderate pressure in brake cylinder, to prevent slack from running out.

Q. In leaving brake valve handle in full release position too long, then bringing it back to running position, how do some of the brakes apply?

A. The excess pressure valve spring closes the excess pressure valve, no air can pass into the train pipe until the excess pressure is pumped out, train pipe leakage will cause train pipe reduction, thus applying the brakes.

Q. Is it then poor practice to leave handle of brake valve in full release position too long?

A. Yes.

Q. If it is found that all brakes cannot be released with the proper amount of excess pressure, how can they be released from the engine?

A. Make a heavy reduction then move handle of brake valve to full release position. If this fails to release the brakes it is evident there is a defect or obstruction in the drain cup branch pipe strainer, triple valve, auxiliary reservoir tube, or perhaps hand brake applied, which should be located and repaired; or if repairs cannot be made, brake must be released by hand and cut out.

Q. In case a train on heavy descending grade for any reason, should accelerate its speed beyond the safe limit, what should engineman do?

A. Start sand running, apply the brake in emergency and signal for hand brakes, leaving brake valve in emergency position until train is stopped, then recharge train to maximum pressure before hand brakes are released.

Q. Is it of importance that enginemen should handle brake valve properly when applying or releasing brakes on all trains?

A. Yes.

Q. If brakes should go into emergency in making service application, would you release them?

A. No, unless the speed of train was sufficient to allow brakes to equalize

throughout train. Brakes, however, should not be released at slow speed.

Q. With the New York engineer's brake valve, if a reduction of train pipe air is made, and the flow of air is shut off by the engineer too soon, or before pressure has equalized, what is likely to occur?

A. Brakes on head end would be released, causing slack to run out, which produces understrains on the draft gear, and the possibility of break-in-twos.

Q. How should brake valve be handled?

A. Brake valve should be left in quadrant until pressure equalizes.

Q. When proper reduction is made, how is it indicated?

A. By observing the black hand of duplex air gauge.

Q. If air is still venting, what must be done?

A. Move the brake valve handle slowly forward until blow stops.

Q. Why is it undesirable to apply brakes too lightly and release same repeatedly?

A. If too light reductions are made, brake cylinder piston would not move out past leakage groove, and air would be wasted.

Q. Why is it undesirable to hold brakes applied too long, especially on grades?

A. Some of the triple valve piston rings may be defective, allowing auxiliary reservoir air to pass under rings into the train pipe, and train pipe leakage would waste the air; then, if necessary to stop suddenly, there would not be sufficient pressure in the auxiliary reservoir.

Q. It is then very important and necessary that train pipe leaks should be closed?

A. Yes.

Q. In releasing brakes on grade, what position should handle of brake valve be placed in?

A. In full release position until auxiliary reservoirs are recharged.

Q. Why is it that the train pipe charges quicker in full release position?

A. Larger ports are open between main reservoir and train pipe in this position.

Q. Why is it bad practice to move brake valve handle to full release position from running position immediately before making a reduction?

A. Having excess pressure in the main reservoir, this is vented into the train pipe, and the latter becomes overcharged.

Q. What would be the result if the engineer immediately made a reduction of train pipe pressure under the above conditions?

A. Not having given the air in train pipe and auxiliary reservoir time to equalize, brakes would not apply.

Q. What is a better plan when applying brakes?

A. Notice air gauge, and if there is sufficient pressure, bring brake valve handle to lap position for a second before making reduction.

Q. Should enginemen observe the air gauge frequently to see if they are carrying the required air pressure?

A. Yes.

Q. How should brake valve be placed, in case of a burst air hose?

A. In lap position.

Q. Why?

A. To prevent loss of main reservoir pressure.

Q. How should terminal air tests be made?

A. Train should be charged up to eighty pounds, and train examined and all leaks stopped, full reduction of twenty pounds should then be made to insure full application of brakes.

Q. If brakes fail to apply, or brake cylinders with long piston travel are found, what should be done?

A. Notify the engineer of the condition of the brakes, and make such adjustments of the brake rigging as will enable the train to be handled with absolute safety.

Q. When hose on passenger trains is uncoupled for any purpose, or engine changed, what test should be made?

A. When hose is coupled and train charged to pressure carried, engineman should be signaled to apply the brakes, which must be done by making a reduction of twenty to twenty-five pounds pressure. Inspectors or trainmen must then examine train to see if all brakes are applied.

Q. Should air equipment on engines be fully tested before leaving roundhouse?

A. Yes.

Q. With double-header, what engine should do the braking?

A. The head engine.

Q. What should the second engineer do?

A. Close the cut out cock under brake valve, keep the pump working to maintain maximum pressure in main reservoir, so as to be prepared to take control of train if signaled to do so.

Q. If pump on leading engine fails, or the engineer wishes second engineer to take control of train, what signal should be given?

A. Two short and one long blasts of steam whistle.

Q. What should the second engineer do?

A. Open cut out cock under brake valve, and assume control of train, then answer by repeating signal.

Q. What should head engineer do on receiving this signal?

A. Close cut-out cock under brake valve so as not to interfere with work of second engine.

Q. If the head engineer wishes the second engineer to assist in recharging train, what signal should be given?

A. Two short blasts of steam whistle repeated after an interval.

Q. What should the second engineer do?

A. Open cut out cock under brake valve, and place brake valve handle in full release position until train is recharged. He must then close cut out cock to avoid releasing the brakes after being applied by head engineer.

Q. If this occurred and the head engineer was unable to make the second engineer understand that he should close cut out cock under brake valve, how then could brake be applied and held applied.

A. By placing handle of brake valve in emergency position.

Q. Is it necessary for engineer to know that the engine and tender brakes are in good working condition before coupling onto a train?

A. Yes, he should make an inspection of them on taking charge of the engine.

Q. Some engines have attached to their brake cylinders, safety valves provided with handles, what is their use?

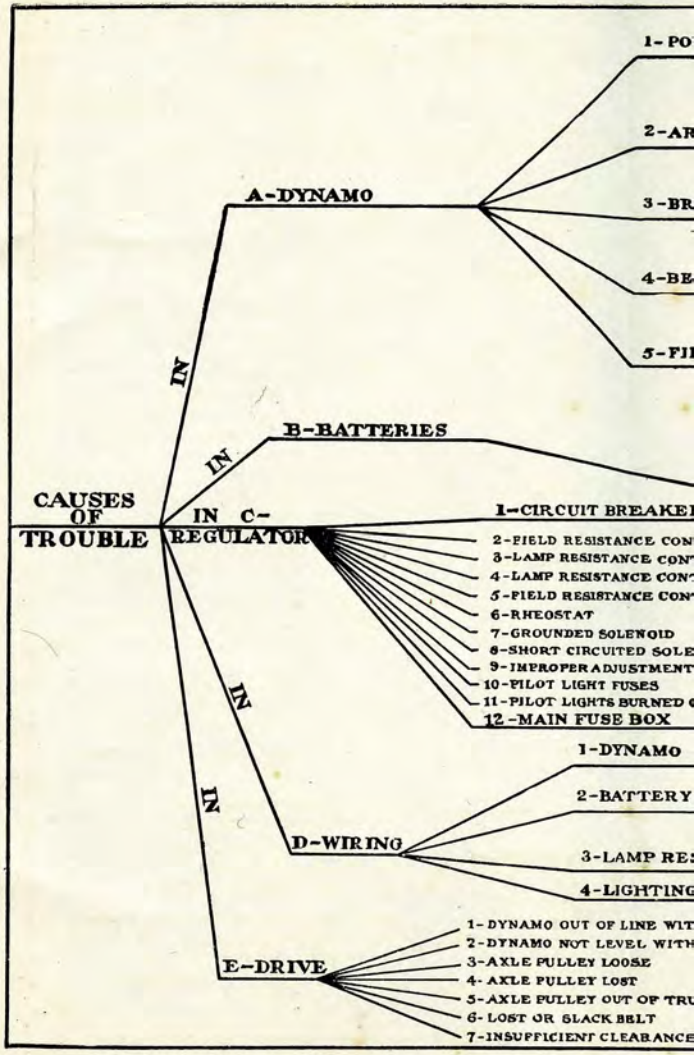
A. To prevent too high pressure in the brake cylinders; the handles are provided to permit engineman to relieve the pressure from brake cylinders, if the tires should become heated or driving wheels slide.

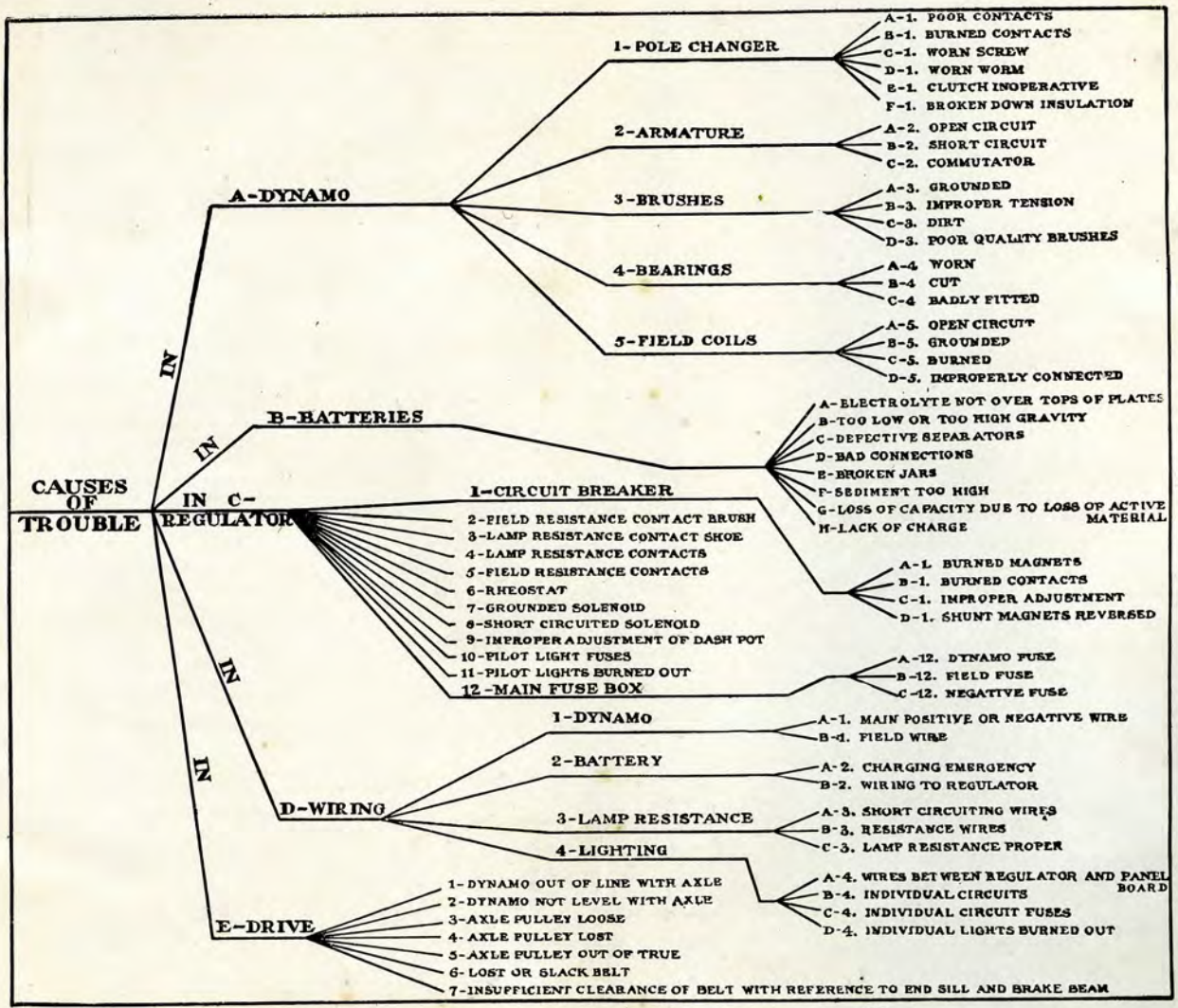
Q. At what pressure should this safety valve be set on engine?

A. Not over forty-five pounds.

Q. If it is found that the straight air reducing valve allows pressure to feed up above its point of setting, what should be done?

A. Close stop cock between brake cylinder and main reservoir, and clean reducing valve.




CAUSES OF TROUBLE
IN A-DYNAMO
1-POLE CHANGER
A-1. POOR CONTACTS
B-1. BURNED CONTACTS
C-1. WORN SCREW
D-1. WORN WORM
E-1. CLUTCH INOPERATIVE
F-1. BROKEN DOWN INSULATION
2-ARMATURE
A-2. OPEN CIRCUIT
B-2. SHORT CIRCUIT
C-2. COMMUTATOR
3-BRUSHES
A-3. GROUNDED
B-3. IMPROPER TENSION
C-3. DIRT
D-3. POOR QUALITY BRUSHES
4-BEARINGS
A-4 WORN
B-4 CUT
C-4 BADLY FITTED
5-FIELD COILS
A-5. OPEN CIRCUIT
B-5. GROUNDED
C-5. BURNED
D-5. IMPROPERLY CONNECTED
IN B-BATTERIES
A-ELECTROLYTE NOT OVER TOPS OF PLATES
B-TOO LOW OR TOO HIGH GRAVITY
C-DEFECTIVE SEPARATORS
D-BAD CONNECTIONS
E-BROKEN JARS
F-SEDIMENT TOO HIGH
G-LOSS OF CAPACITY DUE TO LOSS OF ACTIVE MATERIAL
M-LACK OF CHARGE
IN C-REGULATOR
1-CIRCUIT BREAKER
A-1 BURNED MAGNETS
B-1. BURNED CONTACTS
C-1. IMPROPER ADJUSTMENT
D-1. SHUNT MAGNETS REVERSED
2-FIELD RESISTANCE CONTACT BRUSH
3-LAMP RESISTANCE CONTACT SHOE
4-LAMP RESISTANCE CONTACTS
5-FIELD RESISTANCE CONTACTS
6-RHEOSTAT
7-GROUNDED SOLENOID
8-SHORT CIRCUITED SOLENOID
9-IMPROPER ADJUSTMENT OF DASH POT
10-PILOT LIGHT FUSES
11-PILOT LIGHTS BURNED OUT
12-MAIN FUSE BOX
A-12. DYNAMO FUSE
B-12. FIELD FUSE
C-12. NEGATIVE FUSE
IN D-WIRING
1-DYNAMO
A-1. MAIN POSITIVE OR NEGATIVE WIRE
B-1. FIELD WIRE
2-BATTERY
A-2. CHARGING EMERGENCY
B-2. WIRING TO REGULATOR
3-LAMP RESISTANCE
A-3. SHORT CIRCUITING WIRES
B-3. RESISTANCE WIRES
C-3. LAMP RESISTANCE PROPER
4-LIGHTING
A-4. WIRES BETWEEN REGULATOR AND PANEL BOARD
B-4. INDIVIDUAL CIRCUITS
C-4. INDIVIDUAL CIRCUIT FUSES
D-4. INDIVIDUAL LIGHTS BURNED OUT
IN E-DRIVE
1-DYNAMO OUT OF LINE WITH AXLE
2-DYNAMO NOT LEVEL WITH AXLE
3-AXLE PULLEY LOOSE
4-AXLE PULLEY LOST
5-AXLE PULLEY OUT OF TRUE
6-LOST OR SLACK BELT
7-INSUFFICIENT CLEARANCE OF BELT WITH REFERENCE TO END SILL AND BRAKE BEAM