

W1.35:55-282

Document
Reserve

TM 55-282

WAR DEPARTMENT TECHNICAL MANUAL

NON-CIRCULATING

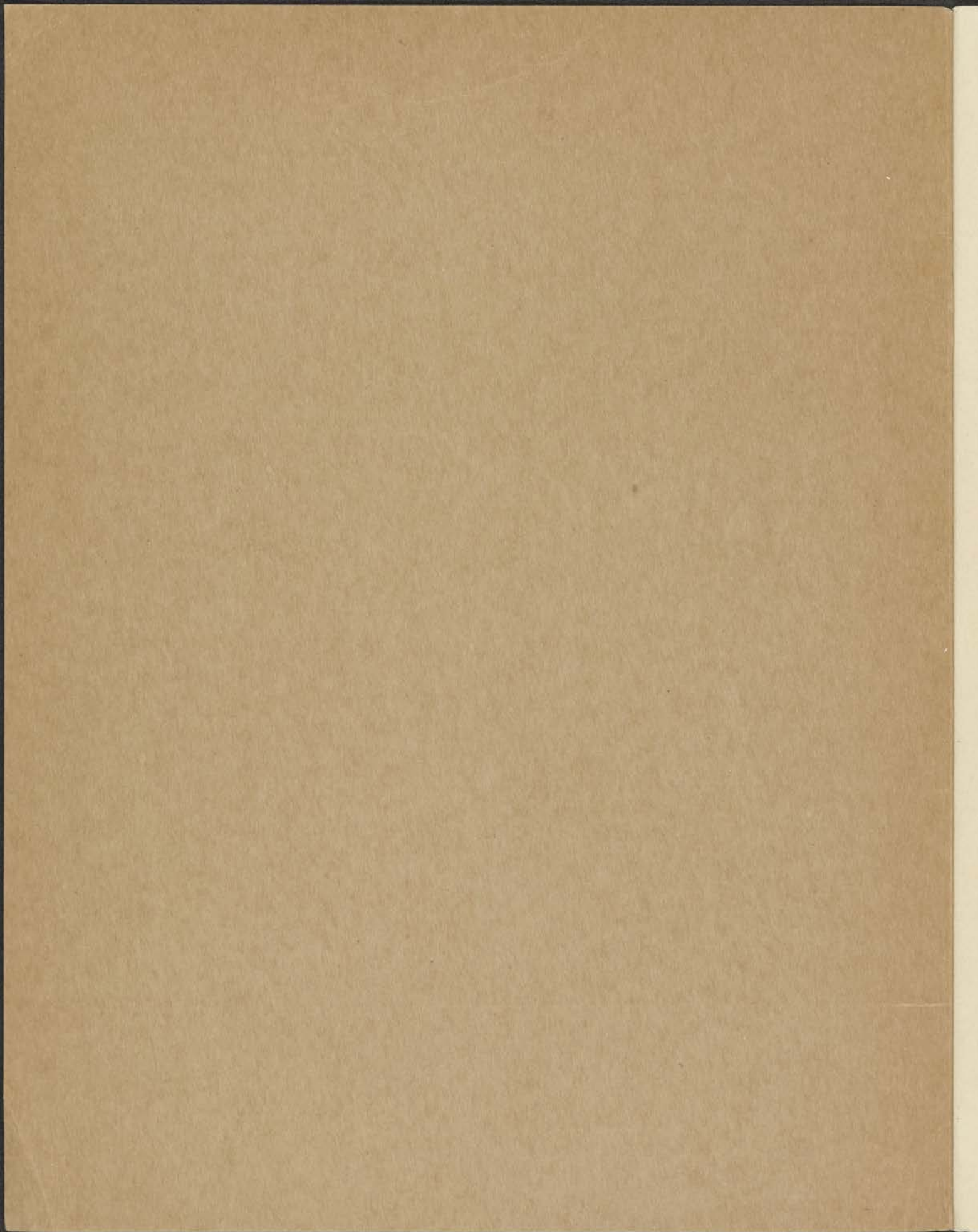
Operation of Railroads

MECHANICAL EXAMINATION
FOR STEAM
LOCOMOTIVE ENGINEERS

Questions and Answers

WAR DEPARTMENT • SEPTEMBER 1945

NTSU LIBRARY



WAR DEPARTMENT TECHNICAL MANUAL

TM 55-282

This manual supersedes WD AGO Form 55-233, 7 December 1944

Operation of Railroads
MECHANICAL EXAMINATION
FOR STEAM
LOCOMOTIVE ENGINEERS

Questions and Answers



WAR DEPARTMENT • SEPTEMBER 1945

WAR DEPARTMENT

Washington 25, D. C., 3 September 1945

TM 55-282, Operation of Railroads, Mechanical Examination for Steam Locomotive Engineers, Questions and Answers, is published for the information and guidance of all concerned.

[AG 300.7 (12 July 45)]

BY ORDER OF THE SECRETARY OF WAR:

OFFICIAL:

EDWARD F. WITSELL
Major General
Acting The Adjutant General

G. C. MARSHALL
Chief of Staff

DISTRIBUTION:

AAF (2); AGF (2); ASF (2); T of Opns (5); Dept (2); Base Comd (2); Arm & Sv Bd (1); S Div ASF (1); Tech Sv (2); SvC (2); FC (2); Class III Instls (2); PE (2); TZ (2); Gen & Sp Sv Sch (2); TCRRS (5); A (2); T/O & E 55-202 (3); 55-229 (50); 55-302 (5); 55-500, GA (2), GD (7).

Refer to FM 21-6 for explanation of distribution formula.

CONTENTS

	Page
Purpose and scope	1
General	1
Break-downs	3
Valve gear	5
Break-downs—Stephenson valve gear	6
General lubrication	7
Hydrostatic lubricators	8
Mechanical lubricators	8
Inspirators and injectors	8
Superheater	10
Reverse gears	10
Sanders	10
Safety valves	10
Throttles	11
Air compressors	11
Main reservoirs	13
Gauges	13
Brake valve	13
Distributing valves	14
Triple valves	16
Broken pipes	17
Brake cylinder and retaining valves	18
Air brakes, general	18

PURPOSE AND SCOPE

This manual provides questions and their answers for personnel concerned with the operation of steam locomotives. It contains information the locomotive engineer should know for the proper mechanical care of his locomotive and the correct handling of the train. The candidate for steam locomotive engineer will study TM 55-270, Operation of Railroads, General Instruction for the Inspection and Maintenance of Locomotives and Locomotive Cranes; TM 55-285, Operation of Railroads, General Instructions for the Inspection and Maintenance of Rolling Stock (when published), and the answers to the questions contained in this manual. He will then be required to pass a written examination on WD AGO Form 55-232 (Mechanical examination for steam locomotive engineer—questions and answers) in order to qualify mechanically for steam locomotive engineer.

GENERAL

1. Q. What is your duty when called?
 - A. To report to the engine terminal at the specified time with the necessary personal equipment to perform the duty for which called.
2. Q. What are your duties on arrival at the enginehouse?
 - A. To check my watch per instructions on WD AGO Form 55-206 (Combined register of trains and comparisons of watches), examine bulletin board for new orders, and sign register book if one is required to be signed.
3. Q. What are your duties when taking charge of a locomotive?
 - A. To check the tools and supplies that are supposed to be on the locomotive as shown on WD AGO Form 55-202 (Locomotive equipment, supply and tool list) which is displayed in the cab of every locomotive. Give the locomotive an inspection, noting particularly that brakes apply and release with the independent brake valve; note the water level in the boiler; and look in the fire box to see there are no crown stays, tubes, or sidesheet leaking; blow out the water column; try the gauge cocks; see that there is an ample supply of coal and water; properly oil all oscillating parts; and see that hydrostatic or mechanical lubricators are filled.
4. Q. What do the rules require you to have in your possession before leaving?
 - A. Copy of TM 55-280, Operation of Railroads, Transportation Rules (when published), and special instructions relating thereto, copy of the current timetable, necessary train orders or other special instructions.
5. Q. What is the most important thing to do when working around a locomotive?
 - A. See that the locomotive brake is applied, throttle securely closed, reverse lever in the center, and cylinder cocks open.
6. Q. What tools are necessary to have on an engine?
 - A. Such tools and supplies as are required by WD AGO Form 55-202 posted in the locomotive cab.
7. Q. What are the requirements of the engineman signing the register book before leaving and booking work on WD AGO Form 55-226 (Locomotive Inspection report) on arrival at terminals?
 - A. Where the engineman is required to register at the enginehouse, the register should be signed as provided by the special rules applicable thereto. He should book the work on the locomotive, noting all defects that have come to his notice while he was in charge of the locomotive. The special spaces for injectors, safety valves, and other appurtenances of the locomotive should be filled out on WD AGO Form 55-226.
8. Q. What precautions should an engineman take if any repairs have been made on his engine?
 - A. To note that the repairs have been properly made and if new rod bush-

ings or other parts of the machinery have been applied, to see that they are properly lubricated before leaving the terminal.

9. Q. What special attention should be given to the boiler, especially gauge cocks and water glasses?

A. The water glass should be thoroughly blown out and checked against the gauge cocks for proper reading. All gauge cocks should be free from obstructions and in proper operating condition.

10. Q. Is it good policy to depend entirely upon the water glass when the locomotive is working?

A. No, gauge cocks should be used at intervals, to check against the water glass.

11. Q. Why is it necessary to keep the front end doors and all joints from admitting air to the front ends?

A. When air leaks occur in the front end, there is a tendency for the air to enter the front end and supply the necessary oxygen to cause the cinders to set fire. If repairs are not made, the fire caused by hot cinders will oftentimes heat the front end and warp it. Air leaks in the front end also break the vacuum and cause engine to steam poorly.

12. Q. How does the exhaust nozzle affect the steaming of the locomotive?

A. The large nozzle will often reduce the velocity of the steam to such an extent that the draft will not be sufficient for proper steaming purposes. If nozzle is made too small the locomotive will steam properly perhaps, but will build up high back pressure, causing the engine to be operated with high back pressure which will affect its hauling power.

13. Q. How would you manage if the grates were burned out on the road?

A. Fire in the ash pan should be removed and the holes in the grates be covered with angle bars or any other material that can be obtained to plug the holes. The grates should not be

moved if it is possible to get in without doing so. Such action on the part of the engineman will probably result in the loss of fire.

14. Q. What would you do in case of a burst flue?

A. Generally a burst flue will cripple the engine and not much of anything can be done; however, if the locomotive is to be moved from one terminal to another, the best method is to use a tie rod about $\frac{5}{8}$ inch in diameter, having on each end a plug that will fit the flue, with sufficient threaded portion so that plug can be pulled into the flue tightly.

15. Q. What would you do in case of a burst steam pipe?

A. To move the locomotive in for repairs, the bursted steam pipe can be disconnected and a blind gasket inserted in the joint to provide steam enough for one cylinder.

16. Q. If an engine pounds when the steam is shut off, what does it indicate?

A. Piston strikes cylinder head, an obstruction in the cylinder, or piston loose on piston rod.

17. Q. Why are domes placed on the locomotive boiler?

A. To increase the volume of steam in the locomotive boiler and to raise the throttle valve as high as possible from the water, thus insuring dry steam.

18. Q. Why are turrets used on locomotive boilers and where do they get their steam?

A. To provide one common connection on the boiler for all the appurtenances, such as blower valve, injectors, steam heat connections and others, an internal steam pipe is provided inside the boiler so that steam may be taken direct from the dome.

19. Q. In case of a hot tender or trailer journal on an engine equipped with water cooling hose, how should this journal be treated?

A. Repack journal box, turn on water, and proceed.

20. Q. Would you reverse an engine while it is traveling in the opposite direction?
- A. No. Such action will cause the driving wheels to skid and if allowed to travel too far, serious flat spots will be put on the wheels.
21. Q. How would you locate a pound in a locomotive?
- A. Place the engine on the top quarter on the side to be tested. Have a small amount of steam applied to the cylinder, and move the reverse lever from front to back gear while noting the condition of all rods, driving boxes, guides, and crossheads. Pound in cylinder will be indicated if piston head is loose on piston rod.
22. Q. In what position would you set the crank pin when keying up a tip end brass? Why?
- A. On the center. This is generally the largest diameter of the pin.
23. Q. How would you set up a wedge? How would you set up a wedge on an engine equipped with Franklin compensators?
- A. Place engine on right top forward eighth, place reverse gear in forward motion. In this position, steam will be admitted to back end of both pistons (if engine is right lead) forcing boxes against shoe faces. Pull wedges up with a 12-inch wrench as far as they will go; then pull back down main wedges $\frac{1}{16}$ inch, others $\frac{1}{8}$ inch, and tighten lock nuts. Franklin wedges are not to be treated in this examination.
24. Q. Why do we use water treatment in our locomotive boilers?
- A. To prevent the adhesion of scale to the locomotive boiler and to keep it in suspension so that it may be easily removed from the boiler by use of the blowoff cocks. Also to counteract the chemical effect of certain waters which cause pitting of sheet courses and flues.
25. Q. What is the purpose of the blowoff cock as applied to our locomotives?
- A. To remove certain portion of the water which generally contains considerable impurities in suspension. Also for the purpose of draining boilers when necessary, and to refill boiler after washout.
26. Q. Is it your duty as an engineman to supervise and direct the fireman in his work upon the engine?
- A. It is my duty.
27. Q. Do you understand that it is your duty to so familiarize yourself with the locomotive and its appliances as to do the necessary work on the road and report repairs intelligently on the work book?
- A. I do.

BREAK-DOWNS

28. Q. How would you detect a loose piston head?
- A. A loose piston head would be discovered by a severe pound while the locomotive is drifting.
29. Q. What would indicate an obstruction in the cylinder?
- A. Obstruction in the cylinder would be indicated by a sharp knock when the locomotive is drifting without steam being applied to the cylinders.
30. Q. How would you handle an engine with an obstruction in the cylinders?
- A. First determine which cylinder the piston obstruction is in. If it is possible to work the obstruction out by removing the cylinder cock, that method would be satisfactory; however, it may be necessary to remove the front cylinder head if obstruction is ahead of the piston; if back of the piston head, it becomes necessary to remove the piston from the cylinder.
31. Q. What is the principal cause of broken cylinder heads, packing rings, loose pistons, and damaged valve and piston rod packing?
- A. The principal cause is the admission of water in the cylinders which sets up a very severe strain on the cyl-

- inder head, pistons, valve and piston rod packing.
32. Q. What would you do in case of a broken piston rod?
 - A. Remove the broken parts, center valve on broken side, disconnect the radius rod, and tie it to the running board, and remove eccentric rod.
 33. Q. What would you do in case of a broken piston head? Cylinder head?
 - A. The same procedure used in No. 32 should be followed for a broken piston head or a broken cylinder head.
 34. Q. How would you test the valves and pistons for leakage?
 - A. To test main valve, set the engine on a quarter on the side to be tested, center the valve by placing the reverse lever in the center of the quadrant, open throttle and cylinder cocks and observe the amount of steam that passes through cylinder cocks. At the same time, notice if there is a blow at the stack to test pistons for leakage, set the engine on top quarter, place reverse lever in forward gear, and block open the front cylinder cock. If steam escapes from the front cylinder cock, a cylinder packing blow or loose piston is indicated; if blow continues with engine reversed, the eye package is blowing; if the blow stops, the piston is loose on the rod.
 35. Q. What is the advantage of working steam expansively?
 - A. Reduces the coal consumption by taking advantage of the expansive characteristics of steam whereby a small amount of steam at high pressure admitted to the cylinder will do the same amount of work as a larger amount of steam admitted to the cylinder under a lower pressure.
 36. Q. If you broke a main crank pin close to the wheel center, how would you disconnect?
 - A. Remove all rods and tow engine dead in train.
 37. Q. If you broke a main rod, how would you disconnect on that side?
 - A. Remove the broken parts and, if no further damage is done, put a collar on the main pin and move the locomotive with all side rods up, using the good side to propel the locomotive, and blocking the valve so that no steam could get to cylinder.
 38. Q. What side rods should be taken off in case one was broken?
 - A. The broken rod and the corresponding rod on the opposite side must be removed.
 39. Q. If you broke a guide, how would you disconnect on that side?
 - A. Remove main rod, apply wood blocks to main crank pin to hold side rod in line, remove eccentric rod, disconnect front end of radius rod, block valve on center, block crosshead in extreme forward position, and proceed.
 40. Q. How would you block a crosshead with the main rod removed?
 - A. Place crosshead in extreme forward position, place wood block on guide extending from guide yoke to crosshead, secure block in place with bell rope or fence wire.
 41. Q. How would you proceed with a broken frame?
 - A. A broken frame between the main driving box and cylinder should be moved into the terminal light, using as little steam as possible to avoid placing an extra strain on the boiler. With a broken main frame behind the main axle, it is advisable to disconnect the side rods behind the main pins so as to remove the strain on the boiler, as there will be no longitudinal support behind the broken frame.
 42. Q. In case of a broken spring hanger or equalizer, what should be done?
 - A. If broken parts are not striking moving parts of engine and pilot clears rail, proceed. If broken parts are striking moving parts or pilot is not clearing the rail, use jack or wedge to raise engine up and block

between frame and top of driving box at whatever location necessary on the engine.

43. Q. What is a good method of raising a driving wheel?

A. The use of wedges, either steel or hardwood, will compress the driving springs and cause the driving box to move upward in the pedestal.

44. Q. How would you proceed to relieve the weight on a hot driving box or a loose crown brass?

A. Raise the wheel up on the wedge, block between the spring saddle and the frame or between the ends of the equalizers, thus removing considerable weight on that box.

45. Q. How would you proceed in case of a broken driving wheel tire?

A. Run the driving wheel with the broken tire up on a wedge or jack it up, block between the spring saddle and frame to relieve the weight on the driving box, remove the grease cellar, and place a block between the binder and the journal to provide a clearance between the broken tire and the rail. If the tire will remain on the wheel center, no action is necessary to remove it. Proceed cautiously, especially if the tire is on one of the leading or rear wheels. Driver brake must be cut out, also.

46. Q. How would you proceed in case of a broken axle? Inside the frame? Outside the frame?

A. If a driving axle breaks between the frames, it may be possible to handle the locomotive carefully for a sufficient distance to clear the main line without the necessity for blocking up in any manner. If the driving wheels stand approximately in their normal position this may be attempted, being careful not to slip the driving wheels and proceeding slowly. If they stand in such a position that the side rods are badly cramped, remove the side rods, moving the locomotive sufficiently to loosen the side rods if possible; run the wheels at the broken axle upon

a wedge, and if necessary, jack up the end of the axle between the frames so that the driving box cellars may be removed; place a block solidly between the driving axle and the pedestal brace; chain the bottom of the wheels together tightly, or place a timber or rail through the driving wheel spokes and over the top of the frames to help carry the weight of the wheels. When the wheels are removed from the wedges, they could clear the rails. If the main axle breaks outside the driving box, remove all the side rods and the driving wheel, jack up the broken end to normal position, remove the driving box cellar, and block solidly between the axle and the pedestal brace; also block solidly between the spring saddle and the frame at the point where the axle is broken. When locomotives are being prepared for towing on account of being disabled, the engineer must consider the necessity for cutting out the driver, tender, or trailer brakes. If there are no defects which would make it unsafe to operate the brakes, they must be left cut in and working.

47. Q. How would you proceed with a broken tender wheel? Tender axle?

A. A broken tender wheel or axle can generally be skidded into the clear. In such case it is well to let the broken section be moved to a point where a tie can be chained across the wheel and securely wedged in the broken section, letting the tie come against the tender frame so that it will slide on the rail. Before starting, a small amount of oil should be placed on the rail so as to aid the process of skidding at the start.

VALVE GEAR

48. Q. How is the piston valve balanced?

A. The construction of the piston valve, having two pistons, one on each end of equal diameter, causes an even pressure to be exerted on each end of the valve, thus balancing it.

49. Q. How is the slide valve balanced?

A. The slide valve has on the flat portion, known as the top of the valve, certain grooves into which are inserted springs and oblong, rectangular strips. These strips are forced by the spring up against the pressure plate on the steam chest cover. The surface of the pressure or balancing plate is maintained smooth to provide the minimum frictioning. Within the enclosed section of the slide valve is a relief port for the purpose of relieving any pressure which might tend to build up as a result of leakage by the balancing strips.

50. Q. What is meant by the following terms: Lead?

A. The amount by which a valve uncovers or opens a steam port at the beginning of a stroke of the piston. This results in admitting live steam to the cylinder before the piston reaches the end of the preceding stroke.

51. Q. Steam lap?

A. The amount by which the edges of the valves, when in the center of the valve seat or chamber, overlap the edges of either steam port.

52. Q. Exhaust lap?

A. Exhaust lap is the amount by which the inside edge of the valve overlaps or goes beyond the inner edge of either steam port when the valve is in the exact center of its travel on the valve face. The effect of exhaust lap is to delay the release of the steam from the cylinder to the exhaust pipe.

53. Q. Exhaust clearance?

A. Exhaust clearance is the distance between the exhaust edge of main valve and the exhaust edge of steam port when the valve is in central position.

54. Q. Cut-off?

A. That point of the stroke of the piston where the steam flowing from the boiler to the cylinder is cut off.

55. Q. Release?

A. At that point of the stroke where the main valve connects the steam port with the exhaust port.

56. Q. Closure?

A. At that point where the flow of steam from the boiler to the cylinder is cut off as explained in No. 54.

57. Q. What is meant by piston clearance?

A. Distance between the cylinder head and the piston when the engine stands on dead center.

58. Q. What is a direct motion valve gear? An indirect motion valve gear?

A. Direct motion valve gear is one that transmits the motion direct from the eccentric to the main valve. An indirect motion valve gear is one that moves the valve opposite the motion of the eccentric. For example: a direct motion rocker arm as compared with an indirect motion rocker arm.

59. Q. What is the difference in the valve movement in relation to the piston for outside and inside admission valves?

A. At the beginning of the stroke an outside admission valve moves in the same direction as the piston. Whereas, with an inside admission valve, at the beginning of the stroke, the valve moves opposite to the movement of the piston.

BREAK-DOWNS — STEPHENSON VALVE GEAR

60. Q. How would you disconnect in case of a broken eccentric blade? Broken eccentric strap?

A. In case of a broken go-ahead eccentric, eccentric strap or blade, take down the broken part, disconnect the link hanger, allowing the link to drop down on the link block. Disconnect the valve stem and place the valve on center, block the rocker arm so that it will not interfere with the valve rod, and proceed on one side with the back-up eccentric and blade connected. For a broken back-up eccentric, eccentric strap or blade, take

down the broken part, disconnect the link hanger, allowing the link to rest on the block or on a bunch of waste inserted between the link and block, tie the bottom of the link so that it will not turn over, and proceed on both sides. Do not attempt to reverse the locomotive under these conditions as the disabled part will be working in full gear ahead.

61. Q. What should be done in case of a broken reverse lever? Quadrant? Reach rod? Reversing arm or tumbling shaft?

A. In all these break-downs, disconnect the broken parts, place a block between the top of the link block and the top of the link. Size of the block should be such that the engine can be started at various points and regulate the speed of the train by means of throttle opening.

62. Q. In case slide valve yoke or stem becomes broken inside of steam chest, how can the break be located?

A. In the event of the valve yoke or valve stem being broken, either of the ordinary slide valve or of the piston valve, if the crank pin is placed on either quarter and the reverse lever is moved from full forward to backward gear, with the throttle opened slightly and the cylinder cocks open, steam will show only at one cylinder cock; while if the valve yoke or stem is intact, steam will show ordinarily at each end of the cylinder as the lever is moved back and forth. If the valve stem is broken inside the steam chest or the yoke is broken, remove the plug from the relief valve opening, push the valve back until it is on center, then fit a piece of wood which will drive into the relief valve pipe and which will just reach to the valve on center, and screw the plug and pipe back in place. Then push the valve stem at opposite end solid against the valve and clamp it. This will hold the valve on center.

63. Q. How would you handle an engine dis-

abled on one side, to avoid stopping on center?

A. Engineman should be very observant of position of crank pin and use brakes forcibly to avoid stopping on center.

GENERAL LUBRICATION

64. Q. What is important to determine, in taking charge of an engine, with regard to valve gear lubrication?

A. See that all oil holes are clear of sand, gravel, or other foreign matter; that the oil cups or other containers have the necessary packing in them.

65. Q. How would you treat hot guide bars?

A. If the heat cannot be corrected by lubrication, slack off on the guide bolts and insert or remove a thin shim, whichever is required to give the cross-head more clearance.

66. Q. Do you understand that water must never be used to cool off hot guide bars? Why?

A. Yes, because water may cause the hot guide to warp.

67. Q. How would you treat a hot engine, trailing, or tender journal?

A. If the hot engine truck will not run cool with additional oil, remove engine truck cellar and repack. If engine trucks are equipped with water cooling system, turn on the water. If a hot trailing or tender journal, equipped with water cooling system, will not run cool with additional oil, repack box, turn on water, and proceed.

68. Q. How would you treat a hot driving journal?

A. Repack the driving journal box, giving it a liberal supply of oil, and proceed. If it is not possible to cool the journal down by this process, relieve some of the weight on that driving box, using a block between spring, saddle, and frame.

69. Q. How would you treat a hot rod bearing: (a) With key brass? (b) With

floating bushing brass?

- A. (a) Slack off on the key and supply additional pin grease under compression. (b) Use a good liberal supply of pin grease making frequent stops to renew it. If possible to give the engine a little more lateral on that pin, do so.

70. Q. Why should the expansion pads be oiled?

- A. If the expansion pad is not oiled, it sets up a great deal of friction and causes the bearing to be cut. It also places considerable strain on the belly of the boiler.

HYDROSTATIC LUBRICATORS

71. Q. Describe how the hydrostatic lubricator works?

- A. By equalizing pressure to a head of water (together with the specific gravities of oil and water) to force this oil from the reservoir to the outlet chambers, which chambers are at all times subject to full boiler pressure. Steam and oil are permitted to escape through a choke or passage so that pressure at the outlet is maintained at practically that of boiler pressure. This feature insures proper displacement of lubricator whether engine is working steam or standing.

72. Q. If the lubricator feeds regularly when the engine is working and too rapidly after shutting off, what is the cause?

- A. Indication would be that chokers or reducing plug in delivery chamber were worn excessively.

73. Q. If the feed or choke jet should become blocked, how would you proceed to open it?

- A. There is a drain over top of regulating valve to flush feed sights. This may open feed jet; if not successful remove regulating valve and blow out with steam, or use small wire to remove obstruction in jet.

MECHANICAL LUBRICATORS

74. Q. If a valve or cylinder is not lubricating with a mechanical lubricator, where would you look for the trouble?

- A. (a) Disconnect pipe to valve or cylinder, whichever the case may be. This is easily accomplished as there is a coupling there for this purpose. (b) Crank lubricator by hand to see if oil is pumped to this point. (c) If flow of oil is not sufficient for lubrication, open feed to lubricator. (d) If you fail to get oil at the recoupled pipe, it is conclusive the trouble is in lubricator pump.

75. Q. In case of a broken oil pipe, what would you do?

- A. Close feed adjusting screw in lubricator and open the one to valve or cylinder, as the case may be. This should sufficiently lubricate both valve and cylinder; if not, at intervals drift engine long enough to pour some valve oil in release valves. If pipe to air pump or other auxiliary is broken and cannot be repaired, hand oil at intervals until reaching repair shop facilities.

INSPIRATORS AND INJECTORS

76. Q. Describe the most common causes for inspirators failing?

- A. (a) Tank valve is restricted or partially closed; (b) tank hose strainers are stopped up with foreign substances; (c) boiler check valve is stuck or leaking—pipe getting air at injector joint which breaks vacuum; (d) delivery nozzle in injector is worn or obstructed; (e) water is too hot in tank; or (f) tank covers are too tight.

77. Q. How would you prevent the feed pipes on a lifting inspirator from freezing when not in use?

- A. If engine is hot, put on warmers. Due to the various types of injectors used, this is to be accomplished by the special instructions applicable to each type of injector.

78. Q. How would you thaw out a feed or supply pipe to the best advantage?
 A. Put warmer on injector. Put oily waste over pipe and ignite with torch.

79. Q. Name a few causes why the inspirator will not supply the boiler?

A. Foreign substances in tank hose strainer, or tank strainer. Lining of hose softened, obstructing water flow. Tank valve partly closed. Delivery nozzle of injector cut, worn, or obstructed.

80. Q. If an inspirator primes and fails to deliver the water to the boiler, where is the trouble almost always found?

A. Either the boiler check is stuck or the injector delivery nozzles obstructed.

81. Q. Explain how a boiler check works?

A. It is necessary that when the injector is not in use some means of preventing a return flow of water from the boiler be provided. The check valve or boiler check is employed to prevent the return flow when the injector is shut off; the boiler pressure acting upon the check automatically closes it. When the injector is started, the velocity of the water lifts the check valve against boiler pressure.

82. Q. Explain how a nonlifting inspirator works?

A. The water flows to the injector by gravity. Steam is admitted to injector steam nozzle valve. The purpose of steam nozzle is to change the steam from a high pressure and low velocity to a low pressure and very high velocity; this immediately goes into a combining tube which combines the steam and water and guides or directs the flow into a delivery tube; the delivery tube brings about a gradual equalization of velocities between the fast moving water in combining tube and the slower moving water in the delivery pipes; this velocity in feed pipe exercised against boiler check, raises it, admitting water in boiler.

83. Q. Explain how the lifting inspirator works?

A. The same principle as described in No. 82, except steam passing through tubes and out overflow causes a vacuum in feed pipe; this combines with atmospheric pressure in tank lifting water to injector.

84. Q. Why should the alarm valves be kept open on all outside inspirators?

A. So that engineman will be immediately notified if for any reason injectors fail to work.

85. Q. Why is the water admitted to the boiler so far away from the fire box?

A. Due to the temperature of water delivered by injector or feed water pump being much lower than boiler temperature, the boiler check is placed as far as possible from fire box to equalize the temperature before the water is against fire box area.

86. Q. If the injector fails to prime, where is the trouble?

A. Tank valve shut off. Water restricted in tank hose. Injector getting air at pipe joints. Water too hot in feed pipe.

87. Q. If the injector fails to lift the water upon opening the starting valve, what indication would you have?

A. Boiler check stuck, or delivery tube worn or obstructed, or branch pipe obstructed.

88. Q. If the injector primes and then fails to maintain the water in the boiler, where is the trouble?

A. Delivery tube worn. Boiler check not completely open. Water partly obstructed.

89. Q. What would you do if a boiler check valve should stick up?

A. Tap boiler check body lightly; see if check will fall; if not, close stop, cock valve, remove check valve and clean formation or obstructions.

90. Q. What damage is done when the inspirator is suddenly shut off?

A. Causes a water pound in branch pipe

at injector, sometimes fracturing pipe and cap on injector body.

SUPERHEATER

91. Q. Name the principal parts of a superheater?
- A. (a) Superheater unit. (b) Superheater header for steam distribution to units.
92. Q. Trace the flow of steam through a superheater.
- A. When the throttle valve is open, saturated steam passes through the dry pipe and into that portion of superheater header designed to receive this saturated steam; from this section of the header, which is in communication with one end of superheater unit, the steam passes downward through one pipe of the unit backward toward the fire box; the steam then moves upward and forward returning to the header, but enters another compartment from which it passes into the steam pipe and down to the cylinder.
93. Q. What is the advantage of using superheated steam?
- A. The principal advantages obtained through the use of superheated steam are occasioned by the increased volume of steam derived from water consumed, also efficiency is increased, and coal economy is effected.

REVERSE GEARS

94. Q. How often should the reverse gear be oiled?
- A. The control levers, guides, and crosshead should be lubricated before starting each trip and as frequently thereafter as required to maintain good lubrication. The reverse cylinder does not require any oil as the leather packing cups are applied with grease.
95. Q. If steam has been used on the reverse gear at any time, what should be done on arrival at the terminal?
- A. The fact that steam has been used

in the reverse gear cylinder should be reported to the maintenance forces on arrival at the terminal, due to the fact that steam softens the leather packing cups which permits the reverse gear to creep. New packing leathers should be applied to reverse cylinder.

96. Q. Should any part of the reverse gear fail, to render it inoperative, what would you do?
- A. Place link blocks in forward motion and proceed with train. However, if train was light enough for the engine to start when hooked up, the link blocks could be blocked in a position consistent with what the engine could start.
97. Q. What are a few causes that make the reverse gear creep?
- A. Packing leathers weak in cylinder, lost motion in operating valve or lost motion in operating levers, reach rod to operating lever not properly braced, valve seats cut, or broken strip or ring.

SANDERS

98. Q. What generally causes sanders to become inoperative?
- A. Foreign substance in sand or damp sand stopping nozzles.
99. Q. What is the danger of working sand on one rail only?
- A. This may result in stripping engine or throwing rods off. It is detrimental, due to the fact that an undue strain is placed on the side of the engine that gets the sand.
100. Q. What is meant by sand pipes in line with rail?
- A. This is a very important feature: the sand pipes should be clamped so they will always put sand on the rail whether on a curve or straight track.

SAFETY VALVES

101. Q. Why is there more than one safety valve on our locomotives?
- A. TM 55-270, Operation of Railroads:

General Instructions for the Inspection and Maintenance of Locomotives and Locomotive Cranes, Rule No. 27 reads as follows: "Every boiler will be equipped with at least two safety valves, the capacity of which will be sufficient to prevent, under any conditions of service, an accumulation of pressure more than 5 percent above the allowed steam pressure." It protects the boiler in case one safety valve fails.

102. Q. What would you do if a safety valve opened and failed to close?
 A. Engineer could ignore it and continue with train. If time permitted, it would be consistent to screw down on adjusting screw; occasionally this will cause the foreign material, holding valve open, to blow out.
103. Q. What would you do if a safety valve failed to open?
 A. Be sure that steam pressure on boiler is not allowed to exceed maximum working pressure; and at first shop facilities, have the valve reset.
104. Q. If a safety valve blows back too far from the required pressure, what is the cause?
 A. Improper adjustment of blow back ring.
105. Q. What causes a safety valve to hum?
 A. Blow back ring is too closely adjusted.
106. Q. Where is the balancing ring located?
 A. Just below the feather valve or just above main valve of pop.

THROTTLLES

107. Q. How can you distinguish between a throttle and dry pipe leak?
 A. A throttle leak emits dry steam, whereas a dry pipe leak shows steam and water.
108. Q. What would you do if the throttle valve became stuck open? Closed?
 A. If throttle valve is stuck open, good judgment should be used in handling the power reverse to keep engine near center. Train should be brought

to terminal without difficulty. If throttle valve is stuck closed, there is nothing to do but kill engine and enter boiler to find and correct trouble.

AIR COMPRESSORS

109. Q. Explain how the pump should be started, what lubricant used, and how the air end is lubricated?
 A. To start pump, drain valve should be opened on pump and steam turned on slowly until sufficient air pressure is built up to cushion piston in pump. The air pump lubricant is valve oil. The latest method of lubricating the air compressor is with an individual mechanical lubricator that is activated by the exhaust of pump. However, nonautomatic or automatic oil cups can be used, but good judgment must be exercised as to the amount of oil used, because too much oil causes carbon in the ports restricting operation of pump.
110. Q. Give the causes of the air pump pounding?
 A. Air piston loose, compressor not well secured to boiler, reversing valve plate loose, reversing rod or plate may be so worn that the motion of compressor is not reversed at proper time, stuck or broken valves, or reversing plate stud loose.
111. Q. Give the causes of the air pump heating?
 A. Air passages restricted with carbon, leakage past air piston rings, discharge valve having insufficient lift. A compressor in perfect condition will become excessively hot and possibly damaged if run very fast and continuously for a long period of time. Other causes of heating may be lack of lubrication or excessive leakage.
112. Q. What should be done in case the air pump becomes excessively heated?
 A. Determine cause of excessive heat; if it is due to lack of lubrication, the engineman can rectify the trouble; otherwise, conserve all air possible

- and report this condition on arrival at next terminal.
113. Q. How can you tell if the steam is reaching the pump properly?
A. Open drain valve in body of pump just under steam pipe connection, and note amount and pressure of escaping steam.
114. Q. What are the common causes of the air pump stopping?
A. Insufficient oil, worn main piston rings, or main piston rings too tight which causes main valve to stick.
115. Q. What would be the effect of the intake valve stuck or broken?
A. If the receiving valve was stuck open or broken, the low pressure piston would have a quick stroke toward the defective valve and the high pressure piston would have a slow stroke away from the defective valve; and air would be forced out to the atmosphere through the air inlet on the quick stroke of the low pressure piston. If the receiving valve was stuck closed, the low pressure piston would have a quick stroke toward the defective valve and a slower stroke away from the defective valve, and the high pressure piston would have a quick stroke toward the defective valve. No air would be taken in and none forced out past the defective valve.
116. Q. What would be the effect of a discharge valve stuck or broken?
A. If a discharge valve was stuck open or broken, the low pressure piston would have a slow stroke towards the defective valve and the high pressure piston would have a quick stroke away from the defective valve. No air could be taken in and none forced out on the end where the defective valve is located; and when main reservoir pressure reached 40 to 65 pounds, the pump will stop.
117. Q. If the compressor stops, how can you tell if the trouble is in the governor or compressor?
A. Open drain cock in steam passage to compressor, and if steam blows out with pressure there is no obstruction in the steam pipe and the governor is functioning; consequently, trouble would be in compressor.
118. Q. What would be the effect of the pump strainer becoming stopped up?
A. Pressure would not be developed.
119. Q. About how many drops of oil per minute should be fed the steam end of the pump to insure proper lubrication?
A. Ten to fifteen drops as rapidly as possible when pump is started, then regulate lubrication to feed about one drop per minute.
120. Q. Explain the operation of the governor?
A. The air portion of pump governor actuates the valve in the steam portion. The air portion consists of casing adjusting nut, spring diaphragm, and ring pin valve and spring. Steam end of governor consists of piston and spring, steam valve, and stem. A supply pipe direct from main reservoir is connected to air portion of governor; when main reservoir pressure under the diaphragm is less than the tension of the regulating spring, the diaphragm is forced down, thus seating the pin valve and closing the port that admits main reservoir pressure on top of the governor piston. The air on top of the governor piston is free to escape to the atmosphere through the vent port, the steam pressure being constant under steam valve; with the assistance of governor, piston spring raises and unseats steam valve thus permitting steam to pass to the compressor.
121. Q. How are the pump governors adjusted?
A. By adjusting screw in top portion of air portion which directs tension on spring against diaphragm.
122. Q. What can cause the governor to fail to stop the pump when proper pressure has been accumulated, and what

would you do if this occurred?

- A. If drip port is stopped up or if piston in steam end is stuck with valve in open position, the governor will remain in open position and main reservoir pressure will build up against governor adjustment. The action to take is to use the steam throttle in cab, holding the main reservoir pressure constantly at approximately the required pressure. As soon as convenient, see if port is stopped up; if this is the case, the trouble can be corrected by removing the obstruction. If the piston is stuck, rather than delay the train, control the pressure with the throttle in the cab and report this condition at engine terminal.

123. Q. If the governor stopped the pump below the pressure and would not start, and you could not make repairs, what would you do?
- A. Block steam valve open and control pressure with throttle in cab, reporting this condition at first shop facilities.

MAIN RESERVOIRS

124. Q. What is the purpose of the main reservoir?
- A. Storage for adequate supply of compressed air to charge brake pipe system, to apply the brake on locomotive and tender, to operate air accessories on locomotive, and to maintain a differential pressure between brake pipe and reservoir air.
125. Q. Where does the water come from that accumulates in the main reservoirs?
- A. From the atmosphere.

GAUGES

126. Q. What is the purpose of the air gauges?
- A. To register air pressure in pounds. On large gauge, the red hand indicates main reservoir pressure and the black hand equalizing reservoir pressure. On small gauge the red hand indicates brake cylinder pres-

sure and the black hand, brake pipe pressure. A quadruplex gauge may be used but the indications would be the same.

127. Q. What does the red hand on the duplex gauge indicate?
- A. Main reservoir pressure.
128. Q. What does the black hand on the duplex gauge indicate?
- A. Equalizing reservoir pressure.
129. Q. With E. T. equipment what does the red hand on the small duplex gauge indicate?
- A. Brake cylinder pressure.
130. Q. With E. T. equipment what does the black hand on small duplex gauge indicate?
- A. Brake pipe pressure.
131. Q. How can you test the principal air gauge to prove its probable correctness?
- A. Place the brake valve in full release, having cut-out cock closed, and note if the 2-gauge hands will register together, which they should if the gauge is in good condition. While this test will not prove the absolute accuracy of the gauge, it will prove the correctness of one hand as regards the other; if during the test the hands do not register within 3 pounds of each other, or they do not respond properly to variations in pressure, the gauge should be reported for test and adjustment.

BRAKE VALVE

132. Q. What are the symptoms of a leaky rotary valve, and how would you test for this leak?
- A. When automatic brake valve is in running position and brake pipe pressure runs up to main reservoir pressure, it indicates a leaky rotary valve in automatic brake valve, or defective brake valve body gasket or feed valve gasket, or feed valve out of adjustment or defective. To test for this leak, move brake valve handle to service position; reduce brake

pipe pressure below the adjustment of feed valve; and if, with the brake valve handle in lap position, pressure does not increase, the trouble is in feed valve. If pressure does increase, the defect is in the body gasket or rotary valve.

133. Q. To what part of the brake valve is the equalizing reservoir connected and for what purpose?

A. Connected to chamber above the equalizing discharge piston. It adds volume to this chamber for the purpose of controlling the movement of the equalizing discharge piston when making service reductions.

134. Q. What would be the effect of a leak from chamber "D", and where could such a leak occur?

A. Equalizing discharge piston would move upward, allowing brake pipe pressure to escape which would consequently apply brakes. Such a leak would usually be the result of a broken equalizing reservoir pipe.

135. Q. With a bad leak from chamber "D" or with a broken equalizing reservoir pipe, how would you handle a train to best advantage?

A. Plug equalizing reservoir pipe at the union at brake valve connection. To apply brake, move the handle of automatic brake valve gradually toward emergency position, making the desired brake pipe service reduction, and gradually direct the return of the handle to lap position.

136. Q. What would cause the equalizing piston in the brake valve to fail to seat properly after a reduction has been made, particularly when handling a long train?

A. Feed valve not functioning, foreign substance under equalizer discharge valve seat, leak in equalizing reservoir, or leak in pipe. In the case of a long train, the equalizing pressure would have some trouble in overcoming the volume of brake pipe release.

137. Q. What does it indicate if, when making a brake application, the service

exhaust port snaps shut and the brakes go on hard?

A. Indicates an undesired emergency which could be caused by a sensitive triple valve in train, burst air hose, or train parting.

138. Q. How would you handle the brake valve to promptly release the brakes and get under way in event of a burst hose or a train parting or after making a coupling?

A. The train should be charged to required pressure, after which a 15 pound reduction should be made; note the number of pounds of brake pipe leakage per minute as indicated by the gauge. Increase reduction to 20 pounds; and after train crew observes results, release brakes and proceed.

139. Q. How would you handle the brake valve if the feed valve was inoperative?

A. If the feed valve becomes inoperative it can be replaced by the reducing valve. If the M-3 type feed valve is used, the B or C reducing valve can be turned upside down and substituted; otherwise brake valve should be carefully handled, as no graduation could be accomplished and brake would go into emergency application when the handle is moved to service position.

140. Q. When the brake valve is in running position and the brake pipe pressure runs up to main reservoir pressure, where is the trouble?

A. A leaky rotary valve in automatic brake valve, defective brake valve body gasket, feed valve out of adjustment or defective.

141. Q. Give some of the causes of the brake valve working hard?

A. Dirty, gummed up, or dry rotary valve; dry latch on rotary stem; or key gasket badly worn.

DISTRIBUTING VALVES

142. Q. Describe the independent action of the brake with E. T. equipment?

- A. It applies and releases the locomotive and tender brakes independent of the automatic brake on locomotive and train, holds locomotive when standing, and protects tires from becoming overheated when excessive braking is required. In train movement, it can be used with or independent of train brakes, and this without regard to location of locomotive in train, and can be applied with any desired pressure between the minimum and maximum.
143. Q. Describe the automatic application of the brakes with E. T. equipment?
- A. It is used to enable the engineman to control properly the exhaust of air from, and admission of air to the brake pipe to release and apply the brakes. By placing automatic brake valve handle in service position — thereby making a slow gradual reduction in brake pipe pressure — a service application of brakes is accomplished.
144. Q. Where does the pressure come from that enters the brake cylinders?
- A. From the main reservoir through the feed valve which is used to maintain a predetermined brake pipe pressure.
145. Q. Will excessive piston travel or ordinary brake cylinder leakage affect the brake cylinder pressure on the locomotive?
- A. As the air admitted to the brake cylinder comes directly from main reservoir, any pressure in the application cylinder of distributing valve will force the application piston to close the exhaust valve, open the application valve, and admit air from the main reservoir to the locomotive brake cylinders until the pressures are equal or pressure slightly exceeds that in the application cylinder whereupon the application piston and valve will be returned to lap position, closing the application valve. Any variation of application cylinder pressure will be exactly duplicated in the locomotive brake cylinder and the resulting pressure maintained regardless of any brake cylinder leakage.
146. Q. What is the purpose of the safety valve on the distributing valve?
- A. To prevent abnormal brake cylinder pressure on locomotive and tender when application is actuated by automatic brake valve.
147. Q. For what pressure should the safety valve be set on the distributing valve?
- A. The maximum pressure limit, 68 pounds, as per Interstate Commerce Commission rules.
148. Q. What will cause the brake cylinder pressure to decrease after the brake valve is lapped?
- A. Leak in application chamber or cylinder, or leak in application pipe.
149. Q. What will cause the brake cylinder pressure to increase after the brake valve is lapped, and the equalizing portion of the distributing valve is lapped after making a partial service application?
- A. Any air pressure leaking into the application cylinder or chamber, or a brake pipe leakage.
150. Q. What will cause a continuous blow at the brake valve exhaust when the handles of both brake valves are in running position?
- A. Leaking of automatic or independent rotary valve equalizing slide valve or distributing valve body gasket.
151. Q. How can you determine if the leak is from the main reservoir, rotary valve of the independent brake valve, or the pressure chamber?
- A. With brake pipe pressure at 70 pounds, make a partial application of the brake and note the increase of brake cylinder pressure; if brake cylinder pressure increased to only 46 pounds, it indicates a leak through the independent brake valve; if brake cylinder pressure increases to safety valve adjustment (68 pounds),

it indicates a leak from main reservoir.

152. Q. Can the brakes be applied with the automatic brake valve, with the independent brake valve in release position?

A. No.

153. Q. How can you determine if the application valve is leaking?

A. There will be a constant blow at distributing valve exhaust when in release position.

154. Q. How can you determine if the exhaust valve is leaking?

A. There will be a constant blow at distributing valve exhaust when in application position.

155. Q. Do you understand the necessity of keeping the distributing valve thoroughly drained?

A. Yes, particularly in subfreezing weather.

TRIPLE VALVES

156. Q. Give some of the causes of the undesired quick action?

A. Dirty or greasy condition in slide valve or main piston valve ring, or a weak or broken slide valve spring, weak or worn ring in main piston valve, or leaks at the triple valve.

157. Q. How does one triple going into quick action affect the rest of the triple valves in the train?

A. One triple assuming the quick action position, brake pipe air is vented to brake cylinder locally, which affects the rest of the triples in the train in the same manner.

158. Q. Name the defects in the quick action triple valve that will cause a blow at the exhaust of the triple?

A. A triple valve body gasket, slide valve, emergency check valve case gasket, emergency valve induction tube leaking.

159. Q. What is the effect of an auxiliary reservoir leak to the atmosphere?

A. Causes brake to release after being

applied, and will cause a brake pipe leak when triple is in release position.

160. Q. About how long does it take to charge an auxiliary reservoir? Why?

A. With the locomotive brake system fully charged and air cut in to one car, the auxiliary reservoir would charge in approximately 80 seconds. (Why) It is charged through a small feed groove and the port is made small in order to obtain a more uniform recharge and to limit the back flow of auxiliary air into the brake pipe while making a service application.

161. Q. Should the brakes be applied and released without the escape of air from triple valve exhaust? What is the defect?

A. A defective packing cup in brake cylinder, or a leak of air out of brake cylinder or related piping.

162. Q. Name some of the causes of brakes failing to release?

A. A dirty or greasy triple valve causing feed port to be stopped to auxiliary reservoir; consequently triple would not return to top position.

163. Q. Which brake will release the quickest, a full application or a light application, especially on the rear of a long train?

A. A full or heavy application.

164. Q. How should the feed valve be cleaned and lubricated?

A. It is most desirable to carry it to a special department, disassemble and clean it in a solvent. The only part of a feed or reducing valve requiring lubricant is the slide valve, which should be lubricated with dry graphite.

165. Q. Explain the difference between the feed valve and a reducing valve?

A. The only difference between a B6 feed valve and a C6 main reservoir reducing valve is the adjustment. The reducing valve is designed to reduce main reservoir pressure to a

single fixed pressure. Reducing valve, when used with the independent brake and signal equipment, simply distinguishes it from the feed valve supplying the automatic brake valve.

166. Q. What should be the adjustment of the reducing valve?

A. Forty-five pounds.

167. Q. Can reducing valves be used as feed valves?

A. Yes.

168. Q. In what way could the feed valve on the first engine cause the brakes to creep on the second engine, when doubleheading?

A. By the feed valve being defective with brake pipe leakage.

BROKEN PIPES

169. Q. What could be done if the main reservoir supply pipe was broken off? What could be done if the brake cylinder pipe was broken off?

A. On the main reservoir supply pipe, close cut-out cocks or blank the pipe. This renders locomotive and tender brakes inoperative. A broken brake cylinder pipe permits escape of main reservoir air when the brake is applied and may cause the release of one or more of locomotive brake cylinders, depending upon where the break occurs; if the break cannot be repaired, close cut-out cock in the pipe leading to the broken pipe; if the break occurs next to distributing valve reservoir, close the cut-out cock in main reservoir supply pipe next to distributing valve.

170. Q. What could be done if brake pipe branch pipe is broken off at the distributing valve?

A. Plug the end leading from the brake pipe. You can then operate the train brake in usual manner, but you cannot operate the locomotive brakes by the automatic brake valve.

171. Q. What could be done if the application cylinder pipe was broken off? What feature is lost?

A. Plug the pipe on the distributing valve side of brake. You cannot apply the locomotive brake with the independent brake valve; the emergency maintaining feature is lost.

172. Q. What could be done if the distributing valve release pipe was broken? What feature is lost?

A. If the release pipe breaks between the automatic and independent brake valve, there is no cause for any delay as it merely cuts out the holding feature of the automatic brake valve and does not interfere with the operation of the independent brake valve. If the break occurs between the independent brake and the distributing valve, the holding feature is lost; and it is also impossible to keep the locomotive brakes fully applied unless the opening from the distributing valve side of the brake is closed. The holding feature is lost, as explained.

173. Q. What could be done if the reducing valve pipe were broken?

A. Remove the tension from the reducing valve or blank the pipe; independent brake valve and air signal system would then be cut out.

174. Q. What could be done if the feed valve pipe were broken?

A. If the break occurs between the reducing valve and the branch pipe leading to the feed valve, plug both sides of pipe. This cuts out the independent brake valve and signal system; it does not interfere with handling of the locomotive and train brake with the automatic brake valve, except that the independent brake valve handle should be placed in slow application when brakes are applied, and left there until brakes are released.

175. Q. If a cross-over pipe is broken between main brake pipe and cut-out cock on passenger equipment, how could it be repaired?

A. If it cannot be plugged or repaired, use signal lines to carry brake pipe air to rear of car. This, of course,

destroys signal connection.

176. Q. What could be done if the cross-over pipe on a freight car were broken?
 A. Plug pipe next to brake pipe. If necessary remove cut-out cock and nipple, and screw in to brake pipe fitting.

BRAKE CYLINDER AND RETAINING VALVES

177. Q. Name the working parts of a brake cylinder?
 A. Piston, piston rod, packing leather, and release spring.
178. Q. How is the packing leather held against the wall of the cylinder?
 A. By means of a spring expander.
179. Q. What is a retaining valve?
 A. The purpose of the retaining valve is to permit the free discharge of air from the brake cylinder to the atmosphere during a release of the brake when the handle is turned down. With the handle turned up, the valve restricts the discharge of air from the brake cylinder to the atmosphere and finally retains a predetermined amount therein, with the triple valve in release position. Retaining valves are used on grades to keep the brakes applied while the auxiliaries are being recharged.
180. Q. Where are the pressure retaining valves generally located?
 A. At "B" end of cars; parallel to brake staff; or if on passenger equipment, in vestibule.
181. Q. To what are they connected?
 A. To triple valve.
182. Q. What is the position of the retaining valve handle when it is in retaining position?
 A. There are 2-way and 3-way retaining valves. The retaining valve handle is in a horizontal position when retaining in a 2-way retaining valve. The 3-way retaining valve has two retaining positions — high pressure and low pressure. When handle is in high pressure position, it is at a 45°

angle. When handle is in low pressure position, it is horizontal.

183. Q. How much pressure will it retain?
 A. This will depend on the type used, as there are 2-way and 3-way type retaining valves. The 2-way retaining valves will retain 10 pounds pressure. The 3-way retaining valves will retain 10 pounds pressure in the low pressure position, and 20 pounds pressure in the high pressure position. The manner of testing retaining valves at terminals is given in chapter 6, TM 55-285.
184. Q. What defects will cause a retaining valve to be inoperative?
 A. The retaining valve is a spring weight and pressure type, consequently a weak or broken spring, or a leak in related piping generally is the cause of defective valve.

AIR BRAKES, GENERAL

185. Q. What is the maximum reduction necessary to make a full service application from 70 pounds brake pipe pressure?
 A. Twenty pounds.
186. Q. If, with the locomotive and train brakes applied, there is danger of engine wheels sliding, how can you guard against it?
 A. Release brake on engine with independent brake valve, and use little sand.
187. Q. Will variations of piston travel with E. T. equipment affect the brake cylinder pressure?
 A. No.
188. Q. Should you observe the pressure on the gauge when making reductions in a service application?
 A. By all means; and, otherwise, at frequent intervals.
189. Q. What terminal test of the brakes is required before leaving the terminal?
 A. Both passenger and freight trains should be tested in accordance with

the instructions in chapter 6, TM 55-285.

Synopsis. The car inspectors and foremen of car inspection are jointly responsible for this test. Each train must have the air brakes on all cars in effective operating condition except in case of emergency, and at no time shall the number of operative air brakes be less than permitted by Federal requirements. After the brake system is charged on a freight train to not less than 5 pounds below the standard pressure for the train and on passenger trains to at least 70 pounds, a service reduction must be made upon proper request or proper signals. Then note the number of pounds of brake pipe leakage as indicated by the brake pipe gauge; after which the reduction must be increased to a total of 20 pounds. Then an examination of the train brakes must be made to determine if brakes are applied in service application on each car, that the piston travel is correct, and that brake rigging does not bind or foul.

Brake pipe leakage must be reduced to the minimum but must not exceed 7 pounds per minute.

Piston travel less than 7 inches or more than 9 inches must be adjusted to nominally 8 inches.

When the test is complete, inspector or trainman who made test will personally inform engineman and conductor of the number of cars in train and the number having inoperative brakes.

190. Q. What should the brake pipe leakage be confined to at this test?
- A. To the minimum, but not to exceed 7 pounds per minute.

191. Q. What other test is required at any time additional cars are picked up in the train?
- A. When one or more cars are added to a train at any point subsequent to a terminal test, the cars added, when in position where they are to be hauled in the train, must be tested as prescribed in answer to question

189. Before proceeding it must be known that the brake pipe pressure is being restored as indicated by the caboose gauge, and that the rear brakes in train are released.

192. Q. Is it permissible to use emergency application at water plugs and coal chutes with passenger trains?
- A. It is permissible to use emergency only for emergency, and with good judgment this can be avoided.

193. Q. In steadying the train on curves, should the brakes be applied on approaching the curve or on the curve?
- A. Applied while train is on straight line or before reaching curve; released after speed is reduced required amount and still on curve.

194. Q. What is the standard piston travel on engine and tender brakes?
- A. Rule 51, TM 55-270, Operation of Railroads: General Instructions for the Inspection and Maintenance of Locomotives and Locomotive Cranes: "The minimum piston travel will be sufficient to provide proper brake shoe clearance when brakes are released. The maximum piston travel when locomotive is standing will be as follows:

	Inches
Cam type of driving wheel brake	3½
Other forms of driving wheel brake	6
Engine truck brake	8
Tender truck brake	9"

195. Q. If, on making a 10-pound reduction and the brake valve is in lap position, the brake pipe exhaust continues to blow, where would you look for the trouble?
- A. Particularly if in a long train, a piece of scale or rust may have been carried from brake pipe and lodged on the seat of the equalizing piston, or the packing ring of equalizing piston leaking. Close doubleheading cock and make an emergency application.

196. Q. How should sand be used in connection with an application of the

- brakes?
- A. The judicious use of sand will cause the wheel to grip the rails better and thereby reduce the liability of drivers slipping or wheel sliding. It will cause the brakes to hold better, also, by increasing the friction between the shoes and wheels, and must be used to prevent sliding of wheels during the controlling and stopping of locomotives and to prevent slipping of drivers in starting. Where there is liability of wheels sliding, the rail should be sanded under the entire train before the speed is low or the brake cylinder pressure high, and the use of sand continued until the train is at rest. Failure to accomplish this is liable to result in wheel sliding. Once wheels are sliding, sand will not start them revolving, but will cause large flat spots. If using sand to prevent wheel sliding, at or near the completion of a passenger train stop, the sand should not be started running until after the brakes are applied, the object being to have sand between the wheels and the rails. Prevent as far as possible any sand from getting between the shoes and the wheels. Sand once started should not be shut off until the train stops or the brakes finally released.
197. Q. In handling freight trains, what reduction in brake pipe pressure should be made on the first application?
- A. The initial reduction should not exceed 6 pounds.
198. Q. What should be the total reduction of the brake pipe pressure, with long trains, before an attempt is made to release brakes?
- A. At least 12 pounds, preferably 15 pounds.
199. Q. Does it take longer for the air to go through the brake exhaust with a long train than with a short train?
- A. Yes.
200. Q. After stopping a train on a grade, should the air or the hand brakes be used to hold the train for an indefinite period?
- A. Hand brakes.
201. Q. In handling trains with two or more engines, which engineer must handle the brakes?
- A. The engineman on leading engine.
202. Q. When making a stop with a freight train, should the locomotive brakes be allowed to remain applied or should they be released? Why?
- A. They should be released, and the throttle graduated open to hold slack out of train. This will prevent run-in of slack and avoid possibility of sliding engine and flattening tires. At final stop, if it is desired to have slack bunched, engine brakes can be used advantageously.
203. Q. Should trains be stopped with the slack bunched or stretched when using locomotives with E. T. equipment? Passenger trains? Freight trains?
- A. Long passenger trains should be stopped with the slack bunched. Short passenger trains should be stopped with the slack stretched. Freight trains should be stopped with the slack bunched.
204. Q. Does it take longer to make a 5-pound reduction through preliminary exhaust with a long train than with a short one?
- A. No, as the volume affected is the same.
205. Q. What is the dead engine feature as applied to the locomotive?
- A. The dead engine feature is for the operation of the locomotive brake when the compressor fails or when it is desired to handle a dead engine in train. The dead engine feature is piped from brake pipe to main reservoir and has a cut-out valve that is kept closed, as the feature is not required until desired as above mentioned. The dead engine feature consists of a dirt-collector and check valve loaded with a spring and choke. The choke prevents a sudden drop in brake pipe pressure and the

application of the train brakes, which would otherwise occur with an uncharged main reservoir cut in to a charged brake pipe. (Close cut-out cock under brake valve and carry brake handle in running position.)

206. Q. What takes the place of the dead engine feature, and how would you operate the feed valve and automatic brake valve in case there is no dead engine feature?

A. If engine is not equipped with dead engine feature, the tension must be removed from the feed valve spring, the brake pipe exhaust blanked, and brake valve handle carried in running position. (Air must be admitted to reservoir very slowly to prevent unseating rotary in brake valve.) The safety valve of the distributing valve must be adjusted to 30 pounds.

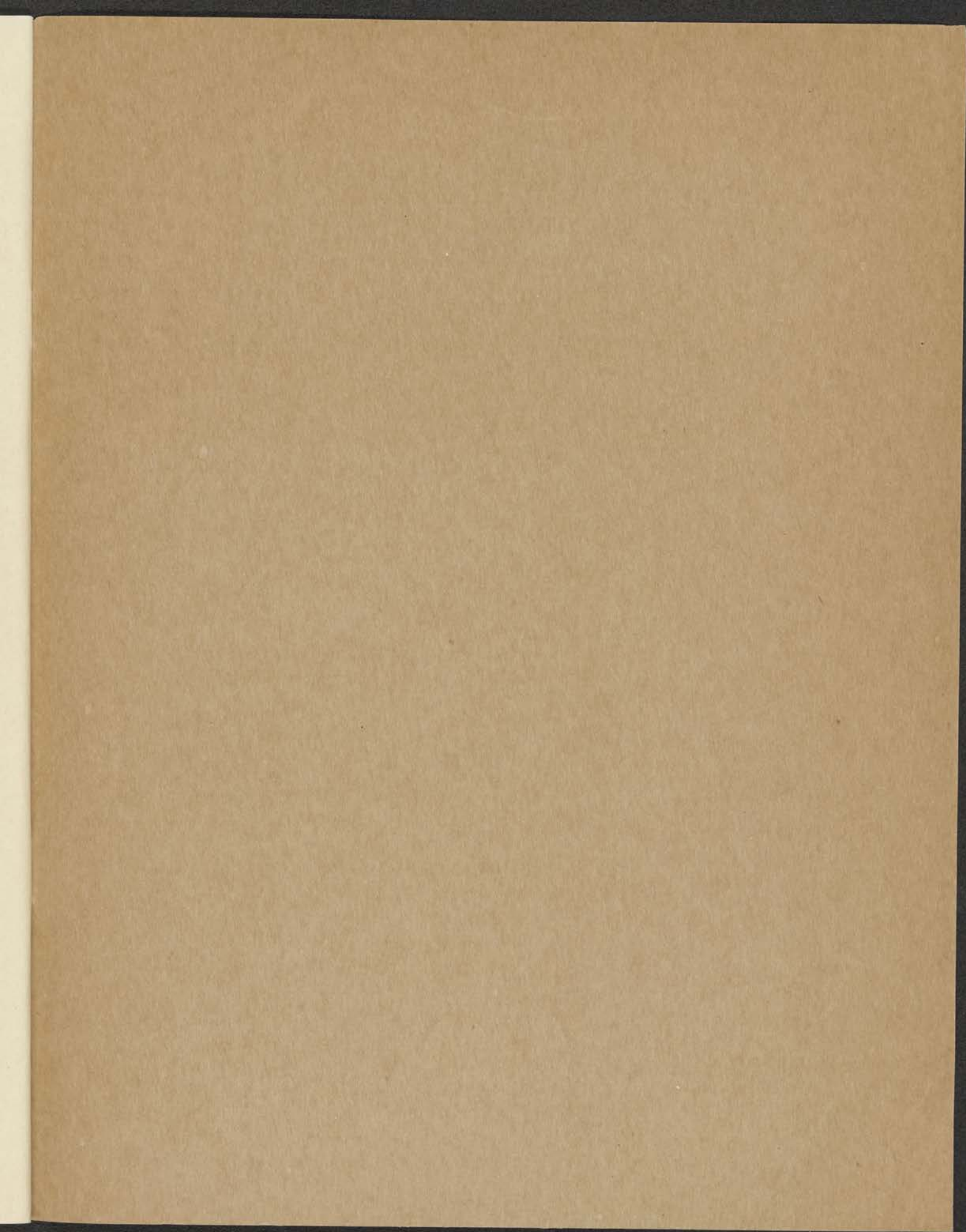
207. Q. How should the brake valves be operated on both engines, when doubleheading, while making slowdowns or stops?

A. The engineman on second engine closes doubleheading cock underneath the brake valve, and carries

brake valve handling in running position with the No. 6 equipment. For No. 5 equipment, close doubleheading cock and carry brake valve handle in lap position. (Unless the particular brake has been modified to carry in running.) The engineman on the second engine, however, should watch his brake cylinder gauge, and kick his engine brake off with independent brake valve if, in his judgment, it is excessive and heating his tires.

208. Q. What is meant by kickoff of brakes?

A. This is used in freight service with a train of K type triple valve, in order to insure a uniform release of the brakes throughout train. Place the brake valve in release position momentarily or for a sufficient length of time to insure that the K type triple valve in the front portion of train has assumed the retard-release position, after which the brake valve handle should be moved to holding position followed by a kickoff made by moving the brake valve handle to release position and then to running.



Oct. 1, 1945

WITHDRAWN

NTSU LIBRARY

CL 1945 mod p 1284
See

