

No. 99-B-1

BRAKE

AND

TRAIN AIR SIGNAL

INSTRUCTIONS

1928



THE PENNSYLVANIA RAILROAD

NO. 99-B-1

(Superseding No. 99-A-1, dated March 1, 1916)

BRAKE AND TRAIN AIR SIGNAL

INSTRUCTIONS

ISSUED ALTOONA, PA.

MAY 22, 1928

GENERAL NOTICE

Every employe whose duties are in any way connected with the operation or maintenance of the Brake and Train Air Signal Equipment is required to have a thorough knowledge of the instructions pertaining to the same.

This book gives the proper instructions relative to the operation and maintenance of the Automatic Air Brake, the Automatic Quick Action Brake, the High Speed Brake, the Universal (UC) Valve, the No. 6 ET Equipment, the Independent or Straight Air Brake, the Train Air Signal, and other air operated devices on Locomotives and Cars.

The equipment described in this book is Pennsylvania Railroad standard.

If it is necessary to modify these rules to meet any special condition on any Division, the subject must be taken up with the General Superintendent of Motive Power. Any modification must have the approval of the Chief of Motive Power.

E. W. Smith,

General Manager, Eastern Region.

C. I. Leiper,

General Manager, Central Region.

H. E. Newcomet,

General Manager, Western Region.

R. K. Rochester,

General Manager, Long Island Railroad.

F. W. HANKINS,

Chief of Motive Power.

OPERATION AND MAINTENANCE BRAKE AND TRAIN AIR SIGNAL

Essential Parts

1. THE BRAKE (SEE FIGS. 1 AND 3).

First. The Air Compressor, which produces the pressure.

Second. The Compressor Governor, which controls the Main Reservoir pressure.

Third. The Main Reservoirs, in which the pressure is stored.

Fourth. The Automatic Brake Valve, which controls the exhaust of air from and admission of air to the brake pipe to apply and release the brakes.

Fifth. The Feed Valve, which controls the pressure carried in the brake pipe, and maintains the air in the brake pipe at a predetermined pressure.

Sixth. The Straight Air or Independent Brake Valve, for applying and releasing the brakes on the locomotive and tender, independently of the rest of the train.

Seventh. The Brake Pipe, including Angle Cocks, Cut Out Cocks, Centrifugal Dirt Collectors, Strainers, Hose and Hose Couplings.

Eighth. The Triple Valve and Auxiliary Reservoir, the Distributing Valve and its Reservoir. (In the UC equipment the Auxiliary Reservoirs consist of the Auxiliary Reservoir proper, the Service Reservoir, and the Emergency Reservoir).

Ninth. The Brake Cylinder and its Piston connected to the brake lever.

Tenth. The Safety Valve, for reducing the pressure in the brake cylinder, when it exceeds a predetermined amount.

Eleventh. The Conductor's Valve, placed on all passenger equipment cars, for applying the brakes from the train when necessary.

Twelfth. The Pressure Retaining Valve, to be found on all freight equipment cars, some Pullman, foreign and business passenger equipment cars, and used to hold air in the brake cylinder when desired.

Thirteenth. The Double Heading Cock, placed in the pipe connecting the main reservoir with the automatic brake valve, used on Divisions where it is the practice to haul trains with two or more locomotives.

Fourteenth. Brake Pipe Air Gauge, Brake Valve, and Alarm Whistle on cabin cars.

1-A. THE TRAIN AIR SIGNAL (SEE FIG. 2).

Fifteenth. The Reducing Valve, which reduces main reservoir pressure to signal line pressure.

Sixteenth. The Signal Valve and the Signal Whistle.

Seventeenth. The Signal Pipe, including Car Discharge Valve, Combined Strainer and Check Valve, Stop Cocks, Cut Out Cocks, Hose and Hose Couplings.

GENERAL INSTRUCTIONS

Standard Air Pressures

2. Passenger Locomotives—

Main Reservoir—Single Top Governor	-	130 pounds
Brake Pipe	- - - - -	110 pounds
Safety Valve for straight-air brake or ET equipment	- - - - -	68 pounds
Reducing Valve for independent or straight- air brake and train air signal	- -	45 pounds

2-a. Freight Locomotives—

Main Reservoir—Single Top Governor	100 pounds
Double Top Governor, Low	100 pounds
High	130 pounds
Brake Pipe	- - - - - 70 pounds
By special instructions	- - 95-100 pounds

The brake pipe pressure must be 95 to 100 pounds before descending grades specified in the Time Table with freight trains of loaded cars; and the engineman must operate the air brake in such a manner as to maintain a brake pipe pressure of not less than 70 pounds at all times. On trains of empty cars on such grades, the brake pipe pressure must be the standard, 70 pounds. (See Instruction No. 6).

In all cases where freight locomotives are used to haul passenger trains, the brake pipe pressure on the locomotive must be increased to the standard for passenger trains, and the main reservoir pressure correspondingly increased, *before* the locomotive is coupled to the passenger train.

2-b. Air Gauges—When one air gauge is used, the black hand indicates equalizing reservoir pressure, and the red hand main reservoir pressure.

When two air gauges are used; one should be a 5" duplex air gauge, the red hand showing main reservoir pressure, and the black hand equalizing reservoir pressure; the other 3½" duplex air gauge, the red hand showing brake cylinder pressure, and the black hand brake pipe pressure.

2-c. Cars—

Governor Valve—water raising system	60 pounds
Reducing Valve—water raising system	20 pounds
Reducing Valve—high speed brake	58-62 pounds
Safety Valve—UC brake equipment	58-62 pounds

3. Signals—Engine Whistle

Apply brakes. Stop	- - - - -	0
Release brakes. Proceed	- - - - -	— —
Inspect train line for leak	- - - - -	0 —

3-a. Signals—Communicating

When standing—apply or release air brakes	o o o o
When running—brakes sticking—look back for hand signals	- - - - -

4. Trains—Percentage of Air Brakes—All trains must have the air brakes of all cars in the train coupled up and operative leaving terminal points. Under no circumstances must a train be operated with less than 85 per cent of the brakes, without specific instructions from the Division Superintendent, who may specify the manner in which the train brakes shall be operated.

NOTE—Whenever it is necessary to cut out the air brakes on any of the cars in the train enroute, care must be exercised to see that no two cars with the air brakes cut out shall be placed in consecutive order.

The word "car" means all cars or dead engines in a train. The tender of a steam locomotive or one unit of an electric locomotive will be counted as a car. If a car with two independent sets of air brake equipment has one set inoperative, the car must be counted as a non air car in determining whether the train has the required percentage of air brakes operative.

The following table may be used to determine how many cars will be allowed in trains without operative air brakes in order to maintain the required 85 per cent.:

Number of Cars in Train	Maximum Number of Cars Allowed Without Operative Air Brakes
6 cars or less	0
7 " to 13 cars inclusive	1
14 " " 19 " "	2
20 " " 26 " "	3
27 " " 33 " "	4
34 " " 39 " "	5
40 " " 46 " "	6
47 " " 53 " "	7
54 " " 59 " "	8
60 " " 66 " "	9
67 " " 73 " "	10
74 " " 79 " "	11
80 " " 86 " "	12
87 " " 93 " "	13
94 " " 99 " "	14
100 " " 106 " "	15
107 " " 113 " "	16
114 " " 119 " "	17
120 " " 126 " "	18
127 " " 133 " "	19
134 " " 139 " "	20
140 " " 146 " "	21

5. To Make Up a Train—(Passenger)—Connect the brake pipe and signal pipe by uniting the couplings A and M (Figs. 1 and 2) with the corresponding couplings on the next car. Turn the angle cock handle B

slowly in line with the hose, and stop cock handle L **slowly** to a position crosswise of the pipe, thus opening both the angle cock and stop cock. Always turn the angle cock handle B nearest the locomotive first, and the stop cock handle L nearest the locomotive last. Then see that cut out cock handle H is crosswise of pipe; that release valve K is closed; and that all hand brakes are released. If a car is equipped with a pressure retaining valve, it must be in release position (handle pointing downward).

5-a. (Freight Cars in a Passenger Train)—Must be equipped with a safety valve applied to the brake cylinder, or brake cylinder pipe. The safety valve must be removed when car returns to freight service.

5-b. (Freight)—Connect the brake pipe by uniting coupling A (Fig. 3) with the corresponding coupling on the next car. Turn the angle cock handle B **slowly** in line with the hose, thus opening the cock, being careful to turn the angle cock handle B on or nearest the locomotive first. Then see that cut out cock handle H is crosswise of pipe; that the handle of the pressure retaining valve is in release position (pointing downward) and that the hand brakes are released.

5-c. (Passenger Cars in a Freight Train)—A passenger car in a freight train should be coupled up as in the preceding paragraphs; but it *must* be equipped with a safety valve, which should be set at 35 pounds unless otherwise covered by special instructions. If this valve is not a part of the regular equipment of the car, a safety valve must be attached to the brake cylinder or its connections.

5-d. (Dead Locomotives in a Freight Train)—A dead locomotive in a freight train, equipped with A-1 brake equipment should be coupled the same as a freight car, (see above), the double heading cock must be closed, the handles of the brake valves securely clamped in running position by use of the clamp standard for that purpose and the safety valves, attached to the brake cylinders adjusted to 30 pounds.

Locomotives equipped with the ET brake equipment, the tension must be removed from the feed valve adjusting spring, the brake pipe exhaust blanked, rotary valve secured to its seat by use of standard air hose gasket applied to the top of the rotary key gaskets, and the safety valve on distributing valve adjusted to 30 pounds.

5-e. After the locomotive which is to haul the train has been coupled to the train, the train should be stretched to see that all cars are coupled. When this is known, and before the brake hose between the tender and the train has been coupled, condensation must be blown from the brake pipe, the engineman should make a 10-pound brake pipe reduction, and hold the brakes applied until the proper signal to charge the train has been received.

5-f. When air has been turned into the train, the engineman will place the automatic brake valve handle in release position, and allow it to remain there until the required pressure is obtained for a test of the brakes. The brake valve handle should then be placed in running position, and if the brake pipe pressure falls more than 5 pounds below the required pressure, the brake valve handle should be returned to release position until the desired pressure is obtained.

6. Testing Brakes—In no case must a train be started until one of the trainmen or inspectors has personally notified the engineman and conductor as to the condition of the brakes, the number of cars in the train, and the number of brakes operative.

6-a. In passenger service the signal for the application or re-application of the brakes may be made either as in freight service (see following paragraph) or by four blasts of the air signal whistle obtained by pulling the signal cord on **any** car in the train. The signal for the release of the brakes will be four blasts of the air signal whistle, which must be given by pulling the signal cord on the rear car.

6-b. In freight service, to first apply the brakes, or after a test has been made, should it be necessary to make additional applications of the brakes, on account of defects found while passing along the train, inspectors or trainmen shall signal the engineman as follows: A hand, flag, or lamp swung horizontally above the head, when train is standing. The signal for the release of brakes, when testing them, will be as follows: A hand, flag, or lamp held at arm's length above the head, when train is standing.

For Attaching and Detaching Locomotives or Cars in Passenger Train Service Without the Use of Brake Pipe Angle Cocks

*When Trains are Not Broken up and Change of Road
Locomotive is Only Required.*

7. Arriving Train—After stop is made, engineer will make a service brake application of 25 pounds, after which he will place the brake valve in Emergency position, and leave it there until a signal is received for a release. The air brake hose shall then be parted between locomotive tender and car. The air brake hose coupler on the locomotive tender will then be placed in the Dummy Coupling, after which a signal should be given to the engineer for a release of the brake. The engine will be cut off in the usual way.

7-a. Departing Train—After the road engine is coupled to the train, the engineer will make a service brake application of 25 pounds, after which he will place the brake valve in Emergency position, and leave it there until a signal is received for a release. The Inspector will then remove the hose from the Dummy Coupling on the locomotive tender, and unite it with the hose coupler on the first car in the train, and then signal the engineer to release the brake, except in cases where a change is to be made in the make-up of the train by a shifting locomotive from the rear. The engineer in charge of the road locomotive must not release the train brakes until the shifting has been completed. The usual air brake tests will then be made after the brake system has been charged to at least 70 pounds.

When Trains are Broken Up and No Change of Road Locomotives

8. Arriving Train—After stop is made, engine-man will make a service brake application of 25 pounds, after which he will place the brake valve in Emergency position, and leave it there until all shifting movements have been completed. The engine and tender brakes may be released, if necessary, by use of the independent brake valve.

8-a. Switching Road Train—Either Setting Off or Adding Cars—All switching of cars should be controlled by the air brake. The air brake hose on the rear of the rear car (furthest from the locomotive) in draft shall be coupled to either the Dummy Coupling on the car or the Back-Up Hose. After the shifting engine has coupled to the train and the hose coupler united, the trainman will open the angle or stop cock on the shifting locomotive to release the air brakes on the cars in the train.

When setting off or picking up cars in a train that is being shifted, it will be necessary for the engineman on the shifting locomotive to make a service brake application of 25 pounds after which he will place the brake valve in Emergency and leave it there until he receives a signal for a release of the brakes. The trainmen or inspectors will separate the air brake hose couplers where separation is to be made in the train, and couple them to the Dummy Couplings or standard Back-Up Hose before signaling for a release of the brakes.

When shifting trains without the use of angle cocks, it will be necessary to deplete the brake pipe pressure before any separation can be made, which should be done by making a service application of 25 pounds,

after which the brake valve should be placed in Emergency position until a signal is received to release the brakes. Dummy Couplings which are standard for all passenger locomotives and cars, or the standard Back-Up Hose and Alarm Whistle must be used for closing communication between the brake pipe and atmosphere when making train movements.

The speed of trains while shifting, should be controlled by the air brake, and in no case should shifting or road movements be made unless the brake system is charged to at least 70 pounds.

Terminal Train Brake Tests

9. Foremen of inspectors and inspectors are jointly responsible for the condition of the air brake and train air signal equipment on cars leaving their station.

9-a. The train signal system on passenger carrying trains shall be tested and known to be in suitable condition for service.

9-b. Each train must have the air brakes on all cars in effective operating condition, except in case of emergency, but at no time shall the number of operative air brakes be less than permitted by Federal requirements. Cars with inoperative brakes shall be placed back of those having operative brakes.

9-c. Condensation must be blown from the pipe from which air is taken before connecting yard line or engine to train.

9-d. The train must be charged to standard pressure, retaining valves and retaining valve pipes on freight cars inspected and known to be in suitable condition for service, and the position of angle cocks, cut-

out cocks and hose noted. A careful examination must be made for leaks and necessary repairs made to reduce leakage to a minimum.

9-e. After the brake system on trains is charged to standard pressure, a 15-pound service reduction must be made upon request or proper signal, then note the number of pounds of brake pipe leakage per minute 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.

9-f. When this examination has been completed, proper release signal must be given and each brake examined to see that it releases properly.

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

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

9-i. When the test is completed the inspector or trainman who made the test will personally inform the engineman and conductor, and advise them the number of cars in train and the number having inoperative brakes.

Defects discovered during a standing test that cannot be repaired promptly must be reported to the foreman inspector or conductor for appropriate action.

During standing tests brakes must not be applied or released until proper signal is given.

9-j. When a train is tested from a yard test plant, an engineer's brake valve, or a standard testing device

which provides for the increase and reduction of brake pipe pressure at the same or a slower rate as with the engineer's brake valve, should be used and be connected to the same point in the train to which the engine is to be attached.

The train should be charged and tested as prescribed in preceding rules and where practical should be kept charged until the road locomotive is coupled to train, when an application and release test should be made as prescribed in rule 10 for passenger trains and rule 10-a for freight trains.

If brake valve or testing device specified in rule 9-j is not used, or if after testing the brakes from a yard plant the train is not kept charged until road locomotive is coupled on, the brakes must be tested as prescribed in rule 10-b.

9-k. Before adjusting piston travel or working on brake rigging, cut-out cock in branch pipe must be closed, and reservoirs bled. Where cut-out cock is in cylinder pipe the latter only need be closed.

Road or Intermediate Terminal Train Brake Tests

10. On a passenger train, before an engine is changed or an angle cock closed, except for cutting off one or more cars from the rear of train, the brake must be applied. After recoupling and opening the angle cock and before proceeding, an application and release test must be made from the engine. Inspector or trainmen will note that the rear brakes of train apply and then signal for a release, noting that rear brakes release.

10-a. On a freight train, before an engine is detached or an angle cock closed on an engine or a car, the brake must be fully applied. After recoupling and

opening the angle cock and 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 are released. In the absence of a caboose gauge, a test must be made as prescribed in rule 10.

10-b. At point where motive power or engine crew or train crew is changed, tests of the train brake system must be made as follows:

After the brake system on a freight train is charged to not less than 5 lbs. below the standard pressure for that train, and on a passenger train to at least 70 lbs., a fifteen pound service reduction must be made upon proper request or signal, brake pipe leakage noted as indicated by the brake pipe gauge (which must not exceed 7 lbs. per minute), after which the reduction must be increased to 20 lbs. Then an examination of the train brakes must be made to determine if brakes are applied in service application on each car. When this examination has been completed, proper release signal must be given and each brake examined to see that it releases properly.

Note—Retaining valves should be tested at points specified by special instructions.

At intermediate terminals it will be satisfactory to make the terminal test on a passenger train when the brake system is charged up to 70 pounds, unless "Undesired Quick Action" has been experienced, when the full pressure should be used for testing.

In freight service, the engineman, upon receiving the proper signal, will give one blast of the locomotive whistle for brake test, (except at points where the blowing of the whistle is prohibited) and make a service application of the brakes for test, being careful to

note that the brake valve discharges the proper amount of air from the brake pipe.

10-c. When one or more cars are added to a train at any point subsequent to a terminal test the cars added, when in the position where they are to be hauled in the train, must be tested as prescribed in rule 10-b. 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 are released. In the absence of a caboose gauge, a test must be made as prescribed in rule 10.

10-d. Before a train is operated down a grade requiring the use of retaining valves, it must be known that they are in such condition that the speed of the train can be safely controlled by the engineman.

10-e. Whenever the locomotive is to be detached or a stop made on a heavy grade under circumstances in which the efficiency of the air brake system may be impaired by allowing the train to stand with the brakes applied, a sufficient number of hand brakes must be set to hold the train before the air brakes are released or the engine cut off. When ready to start, hand brakes must not be released until it is known that the air brake system has been fully recharged.

Air Brake Tests of Arriving Trains

11. Where inspectors are employed to make a general inspection of cars upon arrival at a terminal they must make a visual inspection of retaining valves, release valves and rods, retaining valve pipes, brake rigging, hand brakes, hose and position of angle cocks, and make necessary repairs or mark for repair tracks any cars to which yard repairs cannot be made promptly.

11-a. Freight trains arriving at terminals where facilities are available and at which special instructions provide for immediate brake inspection and repairs, shall be left with air brakes fully applied. Inspection of brakes and needed repairs must be made as soon thereafter as practicable.

Running Tests

12. On a passenger train, after engine or engine crew has been changed or an angle cock closed, except for cutting off cars from rear, and before descending grades as called for in special instructions, a running test of brakes must be made as soon as speed of train permits. Such test should be made by applying the train brakes with sufficient force to ascertain whether they are operating properly. Steam or power should not be shut off unless conditions require it. In case the brakes do not operate properly in this test, the signal for brakes must be given.

12-a. (On a Freight Train)—Enginemen must make a running test of the brakes at the first opportunity after leaving a terminal, and before descending grades as called for in special instructions.

13. Failure to Maintain Required Pressure—When, from any cause, the pressure required for the safe handling of the train cannot be maintained, the engineman must immediately notify the conductor, and both engineman and conductor will be held responsible for taking the necessary action to insure the safe movement of the train.

14. Inoperative Air Brake—(On Trains)—When the air brake becomes inoperative on a train it will proceed carefully with hand brakes to the first tele-

graph or telephone office, where the Conductor will report to the Superintendent for orders.

14-a. (On Locomotives)—All locomotives must leave terminal points with the driving wheel brake in serviceable condition. Therefore, when a driving wheel brake on any locomotive is found inoperative before, leaving the terminal point, such locomotive must not be permitted to leave, but must be replaced by a locomotive having the driving wheel brake in an operative condition.

15. Hand Brakes—All trains must be controlled by the air brake, supplemented on heavy descending grades by hand brakes when necessary to insure the safe movement of the train.

15-a. (Freight Trains)—The usual call for hand brakes—one short blast of the locomotive whistle—will signify that they must be applied supplementary to the air brakes. Continuous calling for brakes will signify “No Air,” in which event the angle cock at the rear of the train must be opened, and the hand brakes must be promptly applied on all cars until the train has been stopped, when it must be immediately protected as per Rule 99, Book of Rules. Engineman and conductor must then agree as to the method in which the brakes should be handled, to insure safe operation to the next telegraph or telephone office as per instruction No. 14, before the train should be allowed to proceed.

15-b. (Passenger Trains)—One short blast of the locomotive whistle will be a signal by the engineman that the brakes cannot be operated from the locomotive by reason of “No Air.” Trainmen should immediately open the conductor’s valve (see Instruction No. 33), and the hand brakes must at once be applied on all cars

until the train has been stopped, when it must be immediately protected as per Rule 99, Book of Rules. The train should not proceed until the conductor and engineman have agreed upon the method of handling the brakes, to insure safe operation to the next telegraph or telephone office. (See Instruction No. 14).

When a locomotive is detached from a passenger train, whether purposely or accidentally, or the air brakes become inoperative, on grades specified in the Time Table, trainmen must be governed as follows:

On ascending grades promptly apply the hand brakes on each car, beginning with the rear car in train, and if necessary, block the wheels. On descending grades, trains must be secured in the same manner, but beginning with the first car in the train. If blocking has been used it must not be removed, nor must the hand brakes be released until after the road train brake test has been made.

A car having the hand brakes inoperative must never be the rear car of a train.

A car having the air brake inoperative may, however, be the rear car in a train, except as otherwise covered by special instructions. (See also Rule 702, Book of Rules).

A car having an inoperative air brake must never be the first car in a passenger train when two or more locomotives are in charge, unless car is equipped with UC valve and brake cut out at brake cylinder cut out cock only, or the tender of the locomotive next to the train is equipped with brake pipe vent valve.

Trains standing on grades must be secured with hand brakes.

16. Pressure Retaining Valve—This valve, placed on the end of the car near the brake wheel, must be

used on grades where it is necessary to hold the brakes applied while recharging auxiliary reservoirs and to hold the slack of the train when operating conditions require. It is connected by a small pipe with the exhaust port of the triple valve, and through it the air is exhausted from the brake cylinders, when the brakes are released. When the handle 1 (Fig. 3) is vertical (pointing downward) the port is fully open, when horizontal (crosswise of pipe), a certain portion of the air is retained in the brake cylinder after the triple valve is in release position. Some cars are equipped with the three position retaining valves, in which the third position, midway between horizontal and vertical, and known as the 45 degree (middle) position, retains a higher pressure in the brake cylinder than the horizontal position.

On loaded cars equipped with the three-position retaining valve, the handle must be placed in the 45 degree position when descending grades as specified in the Time Table.

The conductor will be held responsible for knowing that the handles of the pressure retaining valves are in the proper position.

On trains of empty cars, descending specified grades, retaining valves will be used with the handles placed in horizontal position on 30 to 50 per cent. of the cars in the train, as required.

Trainmen will set these valves for use when necessary, and must change them back to vertical position as soon as their use is no longer required. Neglect of this will cause the brakes to drag, and may cause damage to wheels.

17. Train Dragging—If the train is found to be dragging on account of the brakes being slightly applied, the engineman must make an effort to release

the brakes, which may be done by either of the following methods:

A. By making a service application of the brakes and releasing in the usual manner.

B. By moving the brake valve handle to release position. If the excess pressure causes the brakes to release, the handle must be immediately moved to running position.

If the brakes cannot be released as outlined, the train must be stopped and the trainmen notified to examine the air brakes, hand brakes and retaining valves.

In passenger service, one long sound of the air signal whistle is a signal from the conductor to the engineman that the brakes are sticking. The engineman will answer with two short blasts of the locomotive whistle—after which the conductor will repeat the signal. The engineman should then proceed as above.

18. **Air Compressors**—Before starting an air compressor, care should be taken that all drain cocks are open. Always start and run an air compressor slowly until it becomes warm and about 30 pounds pressure is obtained in the main reservoir, which will provide for a cushion in the air cylinder, at which time the drain cocks should be closed. The maximum speed of an air compressor should not exceed 130 single strokes per minute. All drain cocks must be opened when air compressors are out of service.

The lubricator should be in operation as soon as possible after starting the compressor so as to thoroughly lubricate the steam cylinders, at which time the oil feed should be adjusted to feed 10 or 15 drops of oil as rapidly as possible; then regulate the feed to about one drop per minute per compressor. The lu-

bricator should be kept in operation while the compressor is running.

The air cylinders of the compressor are lubricated by the type "B" automatic air cylinder lubricators. These lubricators must be filled at the beginning of each trip at the time the hydrostatic lubricator is filled, and with the same grade of oil. Care must be exercised when filling to see that there are no leaks in the pipes and that the lubricator cap is properly tightened.

19. Helping Locomotives—When two or more locomotives are coupled to any part of a train, and when running light over the road coupled together, the air brake and air signal must be connected to, and the brakes operated from the leading locomotive. The handle of the double heading cock on all locomotives, except the one from which the air brake is operated, must be placed in position No. 2 (crosswise of pipe) (Fig. 4), thus closing the cock and blanking the brake pipe exhaust. On these locomotives (on which the double heading cock is closed) the handle of the automatic brake valve must be placed in running position, and when practicable the air compressor kept running to maintain the pressure in the main reservoirs, to apply the locomotive brakes and thus be prepared to assume control of the brakes in case of the failure of the air compressor, or some other part of the brake apparatus on the leading locomotive; but in no case must the handle of the double heading cock be placed in position No. 1 (in line with pipe) on any of the locomotives, not having control of the brakes, until the handle of the double heading cock on the locomotive, having control of the brakes is placed in position No. 2 (crosswise of pipe), or until the proper brake couplings are separated.

In case of emergency the brakes can be applied from a locomotive, having the handle of the double heading cock in position No. 2 (crosswise of pipe), by moving the handle of the automatic brake valve to emergency position.

When two locomotives are coupled on the head end of freight train on which the brake system has not been charged, the double-heading cock on the locomotive next to the train must not be placed in position No. 2 (cut out) until the brake pipe gauge pointer reaches sixty pounds when the standard brake pipe pressure is seventy pounds, or eighty pounds when the brake pipe pressure by special instructions is ninety-five pounds.

When two or more locomotives are coupled together and making yard movements to or from trains, the leading locomotive in charge of the train, when on the road, shall operate the brakes on both or all locomotives when making such movements.

Operation of the Automatic and Straight Air Brake (SWA & SWB)

20. To Charge the Train—Place the handle of the automatic brake valve (Fig. 5) in release position until the required pressure is obtained, as indicated by black pointer on gauge. Then move the handle of the automatic brake valve to running position.

20-a. To make a Service Application—Move the handle of the automatic brake valve to service position (Fig. 5) and hold it there until the pressure, as indicated by the black pointer on gauge, has been reduced the required amount; then move the handle of the automatic brake valve to lap position.

20-b. To Make an Emergency Application—Move the handle of the automatic brake valve quickly to emergency position, where it must remain until the train has stopped.

20-c. To Hold Brakes Applied—Place the handle of the automatic brake valve in lap position.

20-d. To Release Brakes—Move the handle of the automatic brake valve to release position.

20-e. To Apply the Straight Air Brakes on Locomotive and Tender—Move the handle of the straight air brake valve to application position (Fig. 6).

20-f. To Hold the Straight Air Brakes Applied on Locomotive and Tender—Leave the handle of the straight air brake valve in application position.

20-g. To Release the Straight Air Brakes on Locomotive and Tender—Move the handle of the straight air brake valve to release position, where it should remain when the brake is not in use, except that with the type S-3-A straight air brake valve the handle should be carried in running position.

Operation of the ET Brake Equipment

21. To Charge the Train—Place the handle of the automatic brake valve in release position (Fig. 7) until the required pressure is obtained in the brake pipe, as indicated by the black pointer on the gauge. Then move the handle of the automatic brake valve to running position, where it should remain when the brake is not being used. The handle of the independent brake valve should be in running position during this operation and at all times when the independent brake is not being used.

21-a. To Make a Service Application—Move the handle of the automatic brake valve to service position, and hold it there until the brake pipe pressure, as indicated by black hand on equalizing reservoir gauge, has been reduced as required; then move the handle of the automatic brake valve to lap position.

21-b. To Make an Emergency Application—Move the handle of the automatic brake valve quickly to emergency position, where it must remain until the train has stopped.

21-c. To Hold Brakes Applied—Place the handle of the automatic brake valve in lap position.

21-d. To Release the Brakes on Cars—Move the handle of the automatic brake valve to release position.

21-e. To Release the Brakes on Locomotive and Tender—Move the handle of the automatic brake valve to running position, if the brakes on the cars have been released as per Instruction No. 21-d, or if the brakes on the locomotive and tender have been held applied, as per Instruction No. 21-f. Move the handle of the independent brake valve to release position, and hold it there until the locomotive and tender brakes have been released, if the handle of the automatic brake valve is in any position other than running. Move the handle of the independent brake valve to running position if the application to be released had been made with the independent brake only.

The release position of the independent brake valve should release the brakes on the locomotive and tender under any and all conditions.

21-f. To Hold Brake Applied on the Locomotive and Tender Only—Move the handle of the automatic

brake valve to holding position, if the brakes on the cars have been released as per Instruction No. 21-d. Allow the handle of the independent brake valve to return to lap position, if the handle of the automatic brake valve is in running position and the application to be held applied had been made with the independent brake only.

With the holding feature eliminated, the brake can be released on the locomotive and tender when the automatic brake valve is in Release, Running, or Holding position with independent brake valve in Running position.

21-g. To Apply the Independent Brakes on Locomotive and Tender—Move the handle of the independent brake valve to either slow or quick application position as desired.

Enginehouse Foremen, Enginemen and Trainmen

22. Brake and signal equipment on locomotive and tender must be inspected and maintained in accordance with the Locomotive Maintenance Instructions.

It must be known before each trip that the brakes on locomotive and tender are in safe and suitable condition for service; that the air compressor or compressors are in condition to provide an ample supply of air for the service in which the locomotive is put; that the devices for regulating all pressures are properly performing their functions; that the brake valves work properly in all positions; and that the water has been drained from the air-brake system.

23. Locomotive Piston Travel—The piston travel on the locomotive and tender must not vary more than

1 inch in either direction from the following dimensions:

	Piston Travel
Equalizer Driver Brake	5"
Locomotive Truck Brake	5"
Locomotive Trailer Brake.....	5"
Tender Brakes	6"

24. Passenger Train Handling—Braking. To avoid rough slow downs and stops with passenger trains, the slack must never be changed suddenly. The slack action resulting from brake application or sudden closing of the throttle will be most severe at low speeds. Heavy brake pipe reductions should be avoided when the train speed is low, and care should be exercised to allow the slack to adjust after closing the throttle before applying the brakes. The following practice may be followed:

The locomotive steam throttle may be open when making the initial brake pipe reductions for slow downs or stops.

24-a. One Brake Application Method—With the steam throttle open (when desirable), the initial brake pipe reduction may be from 8 to 12 pounds. Heavier reductions may be made with short trains, with further reductions as required. The steam throttle should be gradually closed to drifting position as train speed is reduced and should not be closed at a speed of more than 15 miles per hour. The closing of the drifting throttle to be governed by local conditions.

With the steam throttle in drifting or closed position, the initial brake pipe reduction must not exceed

8 pounds. After the slack in train has adjusted, further reductions to be as required.

24-b. Two Brake Application Method—The initial brake pipe reduction should be made as called for in the preceding paragraphs, and the first application to be released at a speed which will allow the slack in the train to adjust itself before making the second application.

When stopping trains, it is desirable that the brake cylinder pressure should not exceed 20 pounds at the time stop is completed.

To insure the proper release of the train brakes, the total brake pipe reduction must be 12 pounds or more, and the brake valve handle should be placed in Release position a sufficient length of time to insure a prompt release of the brakes.

When the graduated release feature in the Universal (UC) Valve is cut into service, then the brake cylinder pressure may be graduated off as follows: Make the first graduated release by using Release position for a second or two, then back to Lap. Make the following graduated release by moving to Running position, and back to Lap. Use Release position for final release, return to Running position.

When necessary to stop a train immediately after starting, the brake valve should be placed in Service position and the throttle valve left open until the train stops.

When locomotives are controlling the brakes and pushing or backing trains, the stop should be made without changing the position of the steam throttle valve until the brakes are applied on all cars, and to improve the stop, the independent brake valve on locomotive should be held in Release position.

When making coal, water or station spot stops, handle the train as for ordinary station stop, except have the brakes fully released and the speed at about five (5) miles per hour, at a point which will permit the train being stopped at the proper place, with a light application of either the automatic or independent brake valve. Careful handling is required to avoid a sudden change of slack.

To release a stuck brake while running, make not less than a 12 pound brake application, and then place the brake valve in Release position a sufficient length of time to insure a release, followed by a "kick off" made by moving the handle of the automatic brake valve from Running to Release position for a second and then back to Running position.

24-c. Starting—Care must be exercised in starting passenger trains by the proper handling of the locomotive; taking sufficient time to take up all free slack slowly, and if two locomotives (double-header) the leading locomotive will control the slack in all cases; the second locomotive will also open the throttle valve very carefully, and at points where starting is difficult, use sand carefully when stopping to avoid locomotive slipping when starting.

When it is necessary to take slack to start, take the slack on only two or three cars, and should this fail to start the train, take the slack of the entire train, and when conditions require apply the automatic air brake on train, holding the locomotive brake off with the independent brake valve using steam until the train stops. The brake must be held applied until the steam has been exhausted from the locomotive cylinders and the reverse gear placed in forward motion. Make sure

the brakes are released and start carefully, stretching the slack slowly until the entire train is in motion.

24-d. Reporting Rough Handling by Trainmen—

In all cases where the train handling is not smooth, the trainmen should, at the first opportunity, inform the engineman as to just what happened in order that he may change his manner of handling.

25. Freight Train Handling —Braking. The initial brake pipe reduction on freight trains should not exceed 6 pounds, and the brakes must never be released at speeds of less than ten (10) miles per hour when trains are composed of 25 or more cars.

When starting trains, great care must be exercised, and the steam throttle valve must not be opened until sufficient time has been given to insure the full release of all brakes throughout the train.

The independent brake valve, if properly manipulated, may be used to advantage when making stops or to reduce speed under certain conditions, but must not be used to the extent of heating driving wheel tires.

When stopping or retarding speed of trains, in all cases, the brakes must be applied and released in such a manner as to prevent shocks and injury to cars and lading.

26. Frequent Application and Release of Brakes—

As the brakes are applied by air from the auxiliary reservoirs, frequent application and release reduces the pressure and consequently the power to apply the brakes; for, while applied, the supply of air to the auxiliary reservoir is cut off. Therefore, after each release, the handle of the brake valve must be left in release position until the moment the brakes are ap-

plied again, or until the required pressure is obtained in the brake pipe and auxiliary reservoirs.

27. Emergency Application, Accidental or from Train—Should the brake apply suddenly, the steam throttle valve must be immediately closed, and the brake valve handle moved to emergency position, and be left there until the train has stopped.

28. Reporting Defects—Engineman must report at the end of each trip, on the regular form furnished for the purpose, any defects to locomotive and tender brake and signal apparatus.

Conductors must report, on blank provided for the purpose, all defects existing in brake or signal apparatus on cars in their train. These blanks must be handed, on the arrival at the end of the trip, to Station Master, Yard Master, or Foreman of Car Inspectors.

Both engineman and conductor must report all cases of undesired quick action.

29. To Cut Off a Car or Locomotive from a Freight Train—

First—See that all the brakes on the car or locomotive to be cut off are released.

Second—Turn the angle cock handles crosswise of pipe on each side of the couplings to be separated, turning handle farthest from the locomotive first.

Third—Disconnect the brake hose couplings, which must be done before the cars are separated.

30. Cars Standing Detached from a Locomotive—The hand brakes and not the air brakes must be applied, except as noted below.

To prevent injury to passengers, it is desirable to have the air brakes applied on all cars in trains while

standing at stations where locomotive or car must be separated for shifting movements.

31. To Cut Out a Defective Brake—To cut out a defective brake on cars equipped with quick action triple valves, turn the handle of the cut out cock in the branch pipe (Figs. 1 and 3) in line with the pipe, and open the auxiliary reservoir release valve K, holding it open until all the air is exhausted from the reservoir.

On cars equipped with UC valves, when necessary to cut the air out on account of undesired quick action or a serious leak between the branch pipe cut out cock and the UC valve, turn the handles of the branch pipe and brake cylinder cut out cocks in line with the pipes. If the air is cut out for any other defect in the brake, merely turn the handle of the brake cylinder cut out cock in line with the pipe.

On cars in freight trains, attach a Defective Air Brake Card, M. P. 276, in accordance with detailed directions in Instructions Nos. 41 and 42.

When it is necessary to place a car on which the air brakes cannot be used on the rear of a train, the brake hose coupling must be united with that on the car in front, and the angle cocks (except that on the rear of the train) left open, so that the air can pass into the brake pipe of the rear car, when this pipe is in good condition. When the brake pipe is not in good condition, the angle cock on the forward end of rear car must be closed, and both engineman and conductor notified.

32. Releasing Brakes by Means of Release Valve—Open the auxiliary reservoir release valve K (Figs. 1 and 3) and hold it open until the air starts to escape from the triple valve exhaust port or retaining valve

exhaust port, when it must be immediately closed. When releasing a brake in a train, the release valve K should only be used after an investigation has shown that the brake cannot be released by the engineman.

33. To Apply Brakes from Train—This must only be done in case of emergency, and never from the rear car of the train except to avoid an accident. Trainmen must endeavor, wherever possible, to attract the engineman's attention by signaling, before applying the brakes from the train, and enginemen will look back along their train for signals, as often as it is consistent. When necessary to apply the brakes from the train either of the two ways may be used.

A—By opening the conductor's valve on passenger equipment cars or cabin cars and holding it open until the train is stopped.

B—By opening the angle cock on the rear of the last car in train (if car is equipped with angle cocks) by turning the angle cock handle B (Figs. 1 and 3) in line with pipe.

34. Burst Hose—In case of a burst air brake hose, turn the angle cock handle B (Figs. 1 and 3) immediately in front crosswise of pipe and signal engineman to release the brakes.

After the defective hose has been replaced, unite the couplings in the usual way and make the road test.

In case of a burst signal hose, turn the signal line stop cock handle L (Fig. 2) immediately in front in line with pipe.

35. Air Brake and Signal Hose, Removal of—Trainmen or inspectors in removing defective air hose from locomotives or cars will not remove the exten-

sion nipple where applied to the angle cock. These nipples are applied in order to give the air hose the proper length and their removal may result in the hose parting. Air brake or signal hose which become defective on trains enroute must be removed and properly tagged, showing the number of the train, initials and number of car or locomotive, which end of car, locomotive, or tender from which removed, date and place of renewal. If removed from locomotives or tenders they should be sent by the engineman to the Enginehouse Foreman, if from passenger equipment cars by the conductor to the authorized person, and if from freight cars they should be turned over by the conductor to the car inspectors, from whom he will receive a new hose for each defective hose turned in. (Note—The end of the car toward which the cylinder push rod travels is known as the B end).

The proper tagging of the hose is essential in order that the proper bill can be made against foreign roads for material applied to their cars.

In applying air hose gaskets, either on the road or in yards, the groove in the hose couplings, provided to receive the gaskets must first be cleaned out to admit the gasket. The trimming of the hose gaskets in order to have them enter the groove of the couplings is not permissible.

36. Broken Brake Pipe—In case of failure of brake pipe or branch pipe to the conductor's valve on passenger equipment cars or tenders, the signal line may be used on the car with the broken brake pipe to transmit brake pipe pressure to the rear cars in the train by forcing the signal line hose coupling with the air brake hose coupling on cars adjoining the one with the broken brake pipe. This change will destroy the oper-

ation of the air signal on the defective car and all cars following. In order to obtain a signal on cars ahead of the defective one, the signal line should be closed by placing the handle of the signal line stop cock on the rear of the car immediately in front of the defective car in line with the pipe.

At the point where couplings made in this manner are separated, the hose should be removed and forwarded to the shop so that they can be gauged with a gauge shown on standard tracing E-61709, to determine if any damage has been done by forcing the couplings together.

37. If Train Breaks in Two—Turn the angle cock handle crosswise of pipe on rear end of car immediately in front of break, and signal engineman to release brakes. After the train has been coupled, close the angle cock on rear portion of train immediately in back of break, and test the air brake hose before charging up the rear portion of the train and releasing brakes. After the brake system has been fully recharged, a road test of the brakes must be made.

38. Operation of the Train Air Signal—The pull on the valve cord should be directly downward, and only sufficiently hard to open the valve.

In order that the proper blast of the signal whistle be obtained, an exhaust of not less than one (1) second duration with not less than three (3) seconds intervening between pulls on the cord should be made. With a train of twelve cars or over, allow at least four (4) seconds between discharges.

A defective car discharge valve can be cut out of service by closing the cut out cock T in signal branch pipe (Fig. 2).

39. Piston Travel Adjustment—The adjustment of the brake rigging should be such that the piston travel under full service application shall be as follows:

On Cars—Piston travel less than seven (7) inches or more than nine (9) inches, must be adjusted to nominally eight (8) inches.

On Locomotives—See Instruction No. 23.

40. Repairs to Trucks—When necessary to make repairs of any character to the brake rigging, brake shoes, or any part of the truck, the cut out cock in the branch pipe must be closed and air pressure drained from auxiliary reservoir by means of release valve.

NOTE—If the car is equipped with the UC valve, merely turn the handle of the brake cylinder cut out cock in line with the pipe, and do not release the air from the auxiliary reservoir.

On locomotives equipped with the ET equipment, close the cut out cocks in the supply pipe to the distributing valve and brake cylinder. On locomotives having triple valves, follow the same procedure as for cars.

41. Use of Defective Air Brake Cards—The attention of trainmen is called to the importance of using Defective Air Brake Card, M. P. 276, when any defect occurs to the air brake equipment on cars in freight trains.

When necessary to attach this card to a car, the particular defect for which the brake is cut out must be marked off on the card for the information of inspectors and repairmen.

Cars having defective air brake cards attached must be repaired at the first terminal repair point.

When these repairs are made, cards should be removed, properly filled out and forwarded to the proper authority for billing in accordance with the A. R. A. Rules.

The defective air brake card should be attached to the branch pipe near the triple valve when the air brake apparatus is in a defective condition from one or more of the following causes. (See Fig. 11).

- B. Brake Will Not Apply.
- C. Brake Will Not Release.
- D. Triple Leaks at Exhaust.
- E. Undesired Quick Action in Service.
- F. Crossover Pipe (if between cut out cock and triple valve).
- G. Brake Cylinder.
- H. Brake Leaks Off.
- I. Brake Rigging.
- M. Retainer Valve Pipe.
- N. Release Valve.

41-a. Defects, Effects Of—Any of the parts noted in Instruction No. 41 being found in a defective condition, will render the air brake on a car inoperative, but does not in any way interfere with the main brake pipe for use in passing the air pressure through the other cars, so that a car equipped with air brakes having one or more of these parts defective, can have the air brake cut out of service by closing the cut out cock in the branch pipe, and by opening the release valve until all the air is exhausted from the reservoir. The car can then be operated between air braked cars in service to the first terminal repair point by having one of the cut out cards, M. P. 276, attached to the

branch pipe, as close to the triple valve as possible. Two cars so cut out should never be operated consecutively in the same train.

42. Use Of.—Defect cards should be attached to the brake pipe near the angle cock on both ends of a car when apparatus is defective for any of the following reasons:

A. Brake Pipe including cut out cock.

F. Crossover Pipe (if between brake pipe and cut out cock).

L. Angle Cock.

42-a. Defects, Effects Of.—Any of the parts noted in Instruction No. 42, being found in a defective condition, will render the air brake on a car inoperative, and will also prevent the use of the brake pipe to pass air through to other cars, so that a car having one or more of these defects cannot be operated between air braked cars in service.

In emergency cases where it is necessary to dispatch a car from a terminal repair point with inoperative air brakes, such car or cars must be placed between the cars with operative air brakes controlled by the engineman and the cabin car, and the air brake must be cut out on the cabin car.

43. Back Up Hose—When it is the practice to push trains in and out of stations, or through yards, or in the operation of work trains, the Back Up Hose must be used. This is a device, connected, by a standard hose coupling, to the air brake hose, by means of which the trainman on the leading car is enabled to apply the brakes either in service or emergency applications, when the handle of the automatic brake valve is in

running position. It is also used to give warning of the approach of the train by means of its whistle signal.

The cut out cock is closed when the handle (Fig. 9) is in line with the pipe.

To make a service application of the brakes, partially open the cut out cock by turning the handle toward a position crosswise of pipe, until the desired result has been obtained, when the cock should be closed. To make an emergency application, turn handle quickly crosswise of pipe and hold it there until the train stops.

To operate the whistle simply push the button.

When cars are pushed by an engine, the trainmen in charge of the movement must know that the air brake and train air signal are coupled through from the front of the leading car to the engine, and in an operative condition; that the Back Up Hose is coupled to the front end of the leading car, and is in good working order. The trainman riding the leading car will then take a conspicuous position on the front end, and signal the engineman by the use of both communicating air signals and hand signals.

The engineman will control the movement in accordance with signals from the trainman on the front end of the leading car.

When necessary to stop, the trainman on the front end of the leading car will signal to the engineman by means of the communicating air signal. If the engineman does not quickly respond to this signal, the trainmen will be held responsible for stopping the movement at once by opening cut out cock; also to stop the movement in emergencies.

The engineman shall not start the train until the signal to start, given by the communicating air signal, **has** been followed by a hand signal from the trainman. Cars may, however, be switched simply by the use of hand signals.

When the train air signal is inoperative, or when a freight train or work train not equipped with the train air signal is making a reverse movement, the trainman must notify the engineman, who will then be governed by hand signals only. When the stop signal is not acted on promptly by the engineman, the trainman on the front end of the leading car must stop the train (apply the brakes) by the use of valve (Fig. 9).

44. Air Operated Water Scoop—To lower the scoop, move the handle of the water scoop air valve to Down position (Fig. 2). To raise the scoop, move the handle of the air valve to Up position, which should be done before the end of the water trough is reached.

The water scoop air valve handle should be kept in Up position at all times except when using the water scoop.

INSPECTION AT TERMINALS

Cars

45. Duties of Inspectors and Repairmen—All car inspectors and repairmen, whose duty it is to inspect and make light repairs to trucks and draft arrangements must also be required to give the same attention to hand brake defects, adjustment of brake rigging, brake pipe hangers, angle cocks, hose and couplings, and pipe connections. The repairs must be made at

the same time that other defects to the cars receive attention.

46. Brake Cylinders, Triple Valves, UC Valves, Etc. Inspectors must see that these parts are cleaned, lubricated and tested not less frequently than once every twelve (12) months on passenger and freight equipment cars, and once every six (6) months on cabin cars, and the date on which this work is done must be stenciled on the auxiliary reservoir. (On a car equipped with the UC valve stencil the emergency reservoir). On cars not having the auxiliary reservoir in plain view, this stenciling should be placed on the side of car adjacent to the release valve rod, in accordance with standard tracings. Cabin cars are equipped with an air gauge connected to the brake pipe and this gauge must be tested when the brake equipment receives attention.

Note—For detailed instructions on this work see Passenger Car Maintenance Instruction P-2 and Freight Car Repair Instructions F-2.

47. Applying Triple and UC Valve Gaskets—The triple valve and UC valve gaskets should always be applied to the valves, and not to the auxiliary reservoir or pipe bracket, with the rib side of the gasket next to the valve. These gaskets must be in good condition.

48. Applying Triple and UC Valves—Precautions In applying the triple valve and parts of the UC valve, it should be known that the induction or supply pipe to the brake cylinder is clean and that all ports in the UC valve bracket are open and free from any foreign substance. The branch pipe should be thoroughly blown out and the cone shaped strainer in the branch

pipe leading to the triple valve or UC valve bracket thoroughly cleaned before the valves are connected. It should be known that the air escapes freely past the brake pipe strainer or centrifugal dirt collector, and if it does not, they should be cleaned or renewed; in case of renewal, the old parts must be sent to the shop for repairs. In all cases, the union connecting the centrifugal dirt collector to the UC valve bracket or triple valve, must be disconnected before blowing out the centrifugal dirt collector.

49. Testing Brakes After Applying a Triple Valve or UC Valve—When a new or repaired triple or UC valve is applied, a test must be made to ascertain that the brakes will apply in both service and emergency applications and release when operated in the proper manner. All necessary light repairs to the brake pipe, pipe hangers, angle cocks, and hose couplings must be made and the piston travel must be properly adjusted. (See Instruction No. 39).

50. Examination and Repairs to Brake Apparatus Examine carefully all parts of the air brake rigging, making repairs such as tightening of unions, applying cotters in brake lever pins, brake beams and connections, application of brake shoes, defective hose and couplings, including gaskets, burst or broken pipes, loose or missing pipe hangers, retaining valves and their pipes, also adjusting angle cocks so as to set at an angle of approximately 30 degrees, as shown on standard tracing (see Fig. 8). Nuts and bolts securing brake cylinder and auxiliary reservoir to car body must be tightened.

51. Adjustment of Brake Rigging—Brakes must be adjusted, being guided by clearance of brake shoes

on the wheels and not neglecting the adjustment of bottom connections so as to put levers in proper relation to one another.

52. The Automatic Slack Adjuster—To let out or take up slack for the application of new shoes, or to alter the piston travel, turn the adjusting screw with a wrench. In adjusting the brakes, the adjusting screw should not be drawn up to its limit, as in this position no more slack can be taken up. Should this occur, the stop screw on the end of the adjuster body should be loosened, which will loosen the ratchet wheel, and allow the screw to be turned. After proper adjustments have been made, the stop screw must be again tightened. The adjusting screw should be kept free from all lubricant, so as to avoid the collection of dirt. The adjustment of the foundation brake rigging should not be changed except to restore original conditions.

53. Inspection and Repairs of Hand Brake Connections—All parts and connections of the hand brake should be carefully examined and any necessary changes and repairs made.

54. Water Raising System on Passenger Cars—The general arrangement of this system is shown in Fig. 10. To fill the water tank W move handle H to a vertical position and close drain valve D by moving its handle to a horizontal position. Then fill the tank W by admitting water through inlet A, until the water flows from inlet A, when the tank will be full. (When handle H is in a vertical position the air is automatically cut off from the system by the five way cock V). As soon as the tank W is filled, handle H must be moved to a horizontal position and secured there, and

drain valve D must be opened by moving its handle to a vertical position.

To ascertain if the tank W is sufficiently full, proceed as follows:

Move handle H to a vertical position. If the ensuing exhaust of air is short, the tank is sufficiently full; but if long, the tank should be filled as above.

To drain the system, all the drain cocks in the car should be opened and left open, and handle H should be placed in a vertical position and left there, drain valve D opened and the hoppers flushed.

The air may be cut out of the system by closing cut out cock C.

The system may be cut out of the car by closing stop cock S, but this should only be done when absolutely necessary.

Trainmen and inspectors should make sure that the system is **drained** whenever conditions are such that the water is **liable to freeze**. Thus, if, at the lay over point—unless the lay over is unusually short—there is no equipment to keep the car heated, the system should be drained as above.

SPECIAL INSTRUCTIONS FOR CONTROLLING FREIGHT TRAINS WITH POWER BRAKES ON DESCENDING GRADES.

55. Locomotive Equipment—

No locomotive shall be used to handle a train of more than 1600 gross tons and the length of train must not exceed 40 cars, unless it is equipped with a cross-compound pump and double top type of governor set to maintain the reservoir pressure at 100 and 130 pounds.

The air brake equipment on the locomotive must be inspected, tested and repaired in accordance with Paragraphs 22 and 23. The Enginehouse Foreman must at all times know these instructions are properly followed.

The engineman must also inspect and test the air brake equipment on his locomotive prior to departure from the engine terminal and on his locomotive and train prior to departure from yard terminal, in accordance with Paragraphs 22, 23 and 6.

56. Car Equipment—

The air brake equipment on all cars of trains dispatched over the following grades must be inspected, tested and repaired in accordance with the following instructions:

SUNBURY DIVISION—New Boston Junction and Pottsville. Frackville and Morris Junction.

TYRONE DIVISION—Summit to Vail.

BUFFALO DIVISION—Keating Summit Grade.

RENOVO DIVISION—Kane to Wilcox.

PITTSBURGH DIVISION—Between Gallitzin and "BO". Gallitzin to "SN". South Fork Branch, Summit to Lovett. Beaver Branch. Llanfair Branch.

56-a. Piston Travel Adjustment—Piston travel less than 7-inches or more than 9-inches, must be adjusted to nominally 8-inches.

56-b. Brake Pipe Leakage—Charge the brake pipe to not less than 70 pounds, after which make a 15-pound brake pipe reduction and note the leakage, which must not exceed 5 pounds per minute.

56-c. Brake Cylinder and Retaining Valve Test—The brake cylinder and retaining valve leakage must

not exceed an amount which will permit the brake-cylinder pressure to leak off in 3 minutes with retaining valve handle in horizontal position (crosswise of the pipe) and triple valve in release position. In making retaining valve tests, Car Inspector will record each retaining valve which blows as the handle is turned down as an effective brake. The two-position retaining valve may be computed as an effective grade brake for 50 tons, and the three-position retaining valve for 95 tons. Example, multiply the total number of two-position retaining valves that hold 3 minutes by 50 tons, and the total number of three-position retaining valves by 95 tons, and the result of the two, will equal the retaining valve value of the train which must be equal to, or greater than the gross tonnage of the train.

To determine the tons per effective brake, divide the total number of effective grade brakes into the gross tonnage of the train.

The Foreman of Car Inspectors will be held responsible for the condition of the air brake equipment in trains dispatched from his respective terminals.

If the average tonnage exceeds the maximum tons per effective brake with the air brake equipment on all cars meeting the above requirements, the make up of the train must be changed and a sufficient number of cars of lower capacity added to reduce the maximum tons per effective brake to that specified, or less.

56-d. Air Brake Clearance Card—After tests and repairs have been completed, the Foreman of Car Inspectors, or his representative, will fill out Air Brake Clearance Card in duplicate, as outlined below, showing the condition of air brake equipment on cars in train and forward the original copy to party designated, retaining the carbon copy for his file.

THE PENNSYLVANIA RAILROAD
AIR BRAKE CLEARANCE CARD FOR FREIGHT TRAINS OPERATING ON HEAVY
DESCENDING GRADES

Place Date Locomotive No.....

No. of Cars in Train—Loaded..... Empty..... TOTAL.....

Was Piston Travel Adjusted as per Special Instructions.....

No. of 2-Position Retaining Valves..... No. Effective.....

50 No. of 3-Position Retaining Valves..... No. Effective.....

TOTAL.....

Gross Tonnage of Train..... TOTAL.....

Brake Pipe Leakage.....Lbs. per Minute.

Tons per Effective Brake.....

Conductor Engineman

Foreman of Car Inspectors.

NOTE: Gross Tonnage of Train Must NOT Exceed Retaining Valve Value. The Maximum of 75 and 105 Tons only applies between Gallitzin and "BO" or "SN".

57. Operation—

The engineman and conductor moving trains over the following Grades must know that the air brake equipment on locomotive and cars is in a serviceable condition to safely handle the train.

SUNBURY DIVISION—New Boston Junction and Pottsville. Frackville and Morris Junction.

TYRONE DIVISION—Summit to Vail.

BUFFALO DIVISION—Keating Summit Grade.

RENOVO DIVISION—Kane to Wilcox.

PITTSBURGH DIVISION—Between Gallitzin and "BO". Gallitzin to "SN". South Fork Branch, Summit to Lovett. Beaver Branch. Llanfair Branch.

57-a. After the brake pipe pressure is charged to the standard pressure, the engineman will then make a 15-pound brake pipe reduction and note the brake pipe leakage, which must not exceed 7 pounds per minute. The train crew will place the handle of the pressure retaining valve on the cars in a horizontal position (crosswise of the pipe) which is the minimum pressure retained by the retaining valve, after which the engineman will make a 25-pound brake pipe reduction and release the brakes. The trainmen will then make an inspection of the train brakes, and all brakes that leak off before a period of 3 minutes shall be considered ineffective air brakes when computing the number of tons per car with effective brakes. In making retaining valve tests, Trainmen will record each retaining valve which blows as the handle is turned down as an effective brake. It is permissible to compute one two-position type retaining valve passing the prescribed test as one effective grade brake for 50 tons, and one three-position type retaining valve passing the

prescribed test as one effective grade brake for 95 tons. Example, multiply the total number of two-position retaining valves that will hold 3 minutes by 50 tons, and the total number of three-position retaining valves that will hold 3 minutes by 95 tons, and the result of the two will equal the retaining valve value of the train, which must be equal to or greater than the gross tonnage of the train.

Trains of low tonnage, such as preference trains, or trains composed of empties and loads, the three-position retaining valve may be operated in the low pressure position and its value as an effective grade brake reduced from 95 to 50 tons when computing the retaining valve value for the train.

To determine the tons per effective brake, divide the total number of effective grade brakes into the gross tonnage of the train.

57-b. The Conductor moving the train will fill out his own Air Brake Clearance Card, after the air brake test has been made at the designated point, showing the condition of the train brakes, which must be signed by him and turned over to the Engineman, with any written comments he may have to make as to the condition of the train brakes, together with the number of tons per effective brake. When the air brake tests are made by Car Inspectors, the crew will only be required to make a road test of the train brakes. The Inspectors will furnish the Conductor with an Air Brake Clearance Card which must be signed by him and delivered to the Engineman, who will sign and deliver it with his Time Card.

57-c. Trains delayed at any point a sufficient length of time to endanger the safety of the train air brake, after the grade brake test has been made, a

Road test must be made. If anything should occur to prevent the proper operation of the train brakes, such as not being able to safely control the speed of the train, or apply and release the train brakes from the locomotive, a terminal test of the train brakes must be made.

57-d. The brake pipe pressure must be 95 to 100 pounds before descending grades with freight trains of loaded cars, to be obtained as follows: Locomotives equipped with the Type C-6 (old type) feed valve and Duplex air pump governor, the automatic brake valve must be carried in full release position. Locomotives equipped with the Type M-3-A (New type) feed valve and Duplex air pump governor with cut out cock in low pressure governor pipe to brake valve, the automatic brake valve must be carried in running position, the cut out cock in low pressure governor pipe closed and the feed valve adjusted to obtain 95 pounds pressure in the brake pipe. The Engineman must operate the air brake in such a manner to obtain a brake pipe pressure of not less than 70 pounds at all times.

On trains of empty cars on such grades, the brake pipe pressure must be the standard, 70 pounds. The pressure retaining valves must be operated in low pressure position on 30 to 50 percent of the cars in empty trains as required.

The following schedule running time between points on grades must be established and the speeds prescribed for various grades must not be exceeded:

57-e. SUNBURY DIVISION—New Boston Junction and Pottsville.

P. R. R. GRADE

TRAINS HAVING AN AVERAGE TONNAGE OF LESS THAN 51 TONS PER EFFECTIVE BRAKE

POINTS	Grade	Dis- tance Miles	Miles per Hour	Min- utes
New Boston Jct. to "RK"				
Tower	1.5 to 1.75	3.4	16	13
"RK" Tower to "Q" Tower..	1.2 to 2.9	2.5	12	12.5
"Q" Tower to St. Clair.....	2.9 to 3.1	2.2	12	11
St. Clair to "OT" Tower.....	.5 to 1.5	2.7	16	10
TOTAL.....		10.8		46.5

TRAINS HAVING AN AVERAGE TONNAGE OF 51 TO 80 TONS PER EFFECTIVE BRAKE

New Boston Jct. to "RK"				
Tower	1.5 to 1.75	3.4	16	13
"RK" Tower to "Q" Tower..	1.2 to 2.9	2.5	10	15
"Q" Tower to St. Clair.....	2.9 to 3.1	2.2	8	16.5
St. Clair to "OT" Tower.....	.5 to 1.5	2.7	16	10
TOTAL.....		10.8		54.5

P. & R. GRADE—FRACKVILLE AND MORRIS JUNCTION

"FA" Tower to "WH"				
Tower	3.3	1.9	8	14
"WH" Tower to "Q" Tower.	.7	.5	16	1.8
TOTAL.....		2.4		15.8

P. R. R. GRADE

TRAINS HAVING AN AVERAGE TONNAGE OF 80 TO 95 TONS PER EFFECTIVE BRAKE

New Boston Jct. to "RK"				
Tower	1.5 to 1.75	3.4	16	13
"RK" Tower to "Q" Tower..	1.2 to 2.9	2.5	8	19
"Q" Tower to St. Clair.....	2.9 to 3.1	2.2	6	22
St. Clair to "OT" Tower.....	.5 to 1.5	2.7	16	10
TOTAL.....		10.8		64

57-f. TYRONE DIVISION—Summit to Vail.

TRAINS HAVING AN AVERAGE TONNAGE OF LESS THAN 51 TONS PER EFFECTIVE BRAKE

UI Block Station to North End of Big Fill	1.98	2.5	16	10
North End of Big Fill to GN Block Station.....	.11 to 1.98	3.5	16	14
GN Block Station to Vail	2.2 to 2.86	3.8	12	19
TOTAL.....		9.8		43

TRAINS HAVING AN AVERAGE TONNAGE OF 51 TO 95 TONS PER EFFECTIVE BRAKE

UI Block Station to North End of Big Fill	1.98	2.5	10.7	14
North End of Big Fill to GN Block Station.....	.11 to 1.98	3.5	13.125	16
GN Block Station to Vail	2.2 to 2.86	3.8	9.1	25
TOTAL.....		9.8		55

57-g. BUFFALO DIVISION—Keating Summit Grade.

TRAINS HAVING AN AVERAGE TONNAGE OF 50 TONS OR LESS PER EFFECTIVE BRAKE

Milepost 108 to Milepost 109	2.0	1.0	15	4
Milepost 109 to Milepost 110	2.2	1.0	15	4
Milepost 110 to Milepost 111	2.0	1.0	15	4
Milepost 111 to Milepost 112	2.2	1.0	15	4
Milepost 112 to Milepost 113	2.0	1.0	15	4
Milepost 113 to Milepost 114	0.9	1.0	15	4
Milepost 114 to Milepost 115	0.8	1.0	15	4
TOTAL.....		7.0		28

**TRAINS HAVING AN AVERAGE TONNAGE OF
51 TO 95 TONS PER EFFECTIVE BRAKE**

Milepost 108 to Milepost 109	2.0	1.0	15	4
Milepost 109 to Milepost 110	2.2	1.0	10	6
Milepost 110 to Milepost 111	2.0	1.0	10	6
Milepost 111 to Milepost 112	2.2	1.0	10	6
Milepost 112 to Milepost 113	2.0	1.0	10	6
Milepost 113 to Milepost 114	0.9	1.0	15	4
Milepost 114 to Milepost 115	0.8	1.0	15	4
TOTAL.....		7.0		36

**RENOVO DIVISION—KANE GRADE—KANE TO
WILCOX**

THE FOLLOWING IS MAXIMUM SPEED FOR
EASTWARD FREIGHT TRAINS ON
THIS GRADE

	Grade	Distance	Speed
Kane to Sergeant.....	2.0	4.2 miles	15 miles per hr.
Sergeant to Wilcox.....	1.0	4.4 miles	24 miles per hr.

**57-h. PITTSBURGH DIVISION—Between Gallit-
zin and "BO".**

"AR" to "SF".....	1.23 to 1.97	1.1	12	5
"SF" to "AG".....	2.46 to 1.90	2.9	14.5	12
"AG" to Kittanning Point..	1.90 to 1.67	2.6	16	10
Kittanning Point to "GY"..	1.78 to 1.64	2.1	17	7
"GY" to "BO".....	1.87 to 1.38	2.4	16	9
TOTAL.....		11.1		43

PITTSBURGH DIVISION—Gallitzin to "SN"

"AR" to "SF".....	1.23 to 1.97	1.1	12	5
"SF" to "MS".....	1.79 to 1.03	7.6	16	29
"MS" to "SN".....	1.35 to 1.22	7.7	16	28
TOTAL.....		16.4		62

The maximum tonnage may be increased from 50 to 75 tons and 90 to 105 tons per effective brake between Gallitzin and "BO" or "SN".

PITTSBURGH DIVISION—South Fork Branch—
Summit to Lovett.

Summit to Lovett.....	2.57 to 2.39	4.2	10	25
-----------------------	--------------	-----	----	----

PITTSBURGH DIVISION—Beaver Branch

M. P. 5 to M. P. 3.....	3.72 to 2.18	2	6	20
M. P. 3 to Lovett.....	2.39 to 1.58	3	10	18
TOTAL.....		5		38

PITTSBURGH DIVISION—Llanfair Branch

M. P. 5 to Lovett.....	4.14 to 2.85	5	6	50
------------------------	--------------	---	---	----

*Speed from "AR" to "SF" is controlled by restrictions through tunnel and not the grade.

In the event of trains stopping between these points, the number of minutes delayed must be added to the minimum time.

58. In order to avoid exceeding allowable speed, the Engineman must make a brake application as soon as practicable after locomotive passes over the Summit, followed by additional applications of a sufficient number to keep the speed uniform. When making brake application, the brake valve handle should be moved from release or running position to service position promptly and held on lap as conditions may require, then moved to release position. To keep speed as required by the schedule, it will require frequent applications to maintain the desired pressures and allow maximum time for recharging of the auxiliary reservoirs on the cars.

59. Should it become evident to the Engineman when operating on the grade that the brake is not controlling the train effectively, or in attempting to do so, he is running the risk of depleting the air supply below 70 pounds brake pipe pressure, he must immediately stop the train, and if the brake pipe pres-

sure cannot be restored to the maximum, he will arrange with the Conductor for correcting the defect or for the necessary assistance in order that he may proceed to his destination. When a train is stopped for any cause on the grade, Trainmen must immediately apply a sufficient number of hand brakes to hold the train, the air brakes should then be released and not used to hold the train on the grade.

60. Retaining valves must not be released when approaching the foot of the grade until a signal is received from the engineman to release them.

61. All Conductors and Enginemen must be duly qualified and instructed as to their duties and knowledge in connection with making air brake tests and operation of trains controlled by air brakes on heavy descending grades. Copy below showing form to be prepared for permanent file:

**THE PENNSYLVANIA RAILROAD
CONDUCTORS OR ENGINEMEN — AIR BRAKE
QUALIFICATION CARD**

.....Division Date.....

..... Descending Grade

This is to certify

(Name)

..... has been duly

(Occupation)

instructed and qualified to operate and control trains
on descending grade by use of power brakes.

.....
Road Foreman of Engines

.....
Train Master

OPERATION AND MAINTENANCE BRAKE AND TRAIN AIR SIGNAL ESSENTIAL PARTS

	Instruction	Page
The Air Brake Equipment	1	5
The Train Air Signal.....	1-a	6
GENERAL INSTRUCTIONS		
Standard Air Pressures		
Passenger Locomotives	2	7
Freight Locomotives	2-a	7
Air Gauges	2-b	8
Cars	2-c	8
GENERAL INSTRUCTIONS (Continued)		
Signals—Engine Whistle	3	8
Signals—Communicating	3-a	8
Trains—Percentage of Air Brakes	4	8
To Make up a Train—Passenger	5	9
Freight Cars in Passenger Train	5-a	10
To make up a train—Freight	5-b	10
Passenger Cars in Freight Train	5-c	10
Dead Locomotives in Freight Train	5-d	11
Condensation in Brake Pipe	5-e	11
Charging the Brake System	5-f	11
Testing Brakes	6	12
Passenger Service	6-a	12
Freight Service	6-b	12
Attaching and Detaching Locomotives or Cars in Passenger Train Service without the use Of Brake Pipe Angle Cocks		
<i>When Trains are not Broken Up and Change of Road Locomotive is Only Required</i>		
Arriving Train	7	13
Departing Train	7-a	13
<i>When Trains are Broken Up and No Change of Road Locomotives</i>		
Arriving Train	8	14
Switching Road Train—Either Setting Off or Adding Cars	8-a	14
GENERAL INSTRUCTIONS (Continued)		
Terminal Train Brake Tests		
Responsibility	9	15
Train Air Signal	9-a	15
When to make Terminal Test	9-b	15
Condensation in Charging Line	9-c	15
Inspection after Charging	9-d	15
Inspection after Brake Application	9-e	16
Inspection after Release	9-f	16
Brake Pipe Leakage	9-g	16
Piston Travel	9-h	16
Reporting Condition of Brake	9-i	16
Testing Train from Yard Test Plant	9-j	16
Adjusting Piston Travel	9-k	17
Road or Intermediate Terminal Train Brake Tests		
Passenger Train	10	17
Freight Train	10-a	17

Where Motive Power or Engine Crew or Train Crew is changed	10-b	18
Adding Cars to Train	10-c	19
Retaining Valves	10-d	19
Setting Hand Brakes	10-e	19
Air Brake Tests of Arriving Trains		
General Inspection of Cars	11	19
Freight Trains	11-a	20
Running Tests		
Passenger Train	12	20
Freight Train	12-a	20
GENERAL INSTRUCTIONS (Continued)		
Failure to Maintain Required Pressure	13	20
Inoperative Air Brake on Trains	14	20
Inoperative Air Brake on Locomotives	14-a	21
Hand Brakes	15	21
Hand Brakes—Freight Trains	15-a	21
Hand Brakes—Passenger Trains	15-b	22
Pressure Retaining Valve	16	23
Train Dragging	17	24
Air Compressors	18	24
Helping Locomotives	19	25
Operation of the Automatic and Straight-Air Brake SWA & SWB		
Charging	20	26
Service Application	20-a	26
Emergency Application	20-b	26
Holding Brakes Applied	20-c	27
Release	20-d	27
Straight-Air Application	20-e	27
Holding Straight-Air Brake	20-f	27
Release of Straight-Air Brake	20-g	27
Operation of the ET Brake Equipment		
Charging	21	27
Service Application	21-a	28
Emergency Application	21-b	28
Holding Brakes Applied	21-c	28
Releasing the Brake on Cars	21-d	28
Releasing Locomotive Brakes	21-e	28
Holding Locomotive Brake Applied	21-f	28
Independent Brake Application	21-g	29
GENERAL INSTRUCTIONS (Continued)		
Enginehouse Foremen and Enginemen		
Inspection and Maintenance of Brake and Signal Equipment	22	29
Locomotive Piston Travel	23	29
Passenger Train Handling—Braking	24	30
One Brake Application Method	24-a	30
Two Brake Application Method	24-b	31
Starting	24-c	32
Reporting Rough Handling	24-d	33
Freight Train Handling—Braking	25	33
Frequent Application and Release	26	33
Emergency Application—Accidental or from Train	27	34
Reporting Defects	28	34
To Cut Off a Car or Locomotive from a Freight Train	29	34

Cars Standing Detached from a Locomotive	30	34
To Cut Out a Defective Brake	31	35
Releasing Brakes by means of Release Valve	32	35
To Apply Brakes from Train	33	36
Burst Hose	34	36
Air Brake and Signal Hose Removal	35	36
GENERAL INSTRUCTIONS (Continued)		
Broken Brake Pipe	36	37
If Train Breaks in Two	37	38
Operation of Train Air Signal	38	38
Piston Travel Adjustment	39	39
Repairs to Trucks	40	39
Use of Defective Air Brake Cards	41	39
Defects, Effects of—	41-a	40
Use of Defective Air Brake Cards for Brake Pipe, Crossover Pipe or Angle Cock	42	41
Defects, Effects of	42-a	41
Back Up Hose	43	41
Air Operated Water Scoop	44	43
CAR INSPECTION AT TERMINALS		
Duties of Inspectors and Repairmen	45	43
Brake Cylinders, Triple Valves, UC Valves, Etc.	46	44
Applying Triple and UC Valve Gaskets	47	44
Applying Triple Valve and UC Valves	48	44
Testing Brakes after applying Triple or UC Valves	49	45
Examination and Repairs to Brake Apparatus	50	45
Adjustment of Brake Rigging	51	45
The Automatic Slack Adjuster	52	46
CAR INSPECTION AT TERMINALS (Continued)		
Inspection and Repairs of Hand Brake	53	46
Water Raising System	54	46
SPECIAL INSTRUCTIONS for CONTROLLING FREIGHT TRAINS with POWER BRAKES on DESCENDING GRADES		
Locomotive Equipment	55	47
Car Equipment	56	48
Piston Travel Adjustment	56-a	48
Brake Pipe Leakage	56-b	48
Brake Cylinder and Retaining Valve Test	56-c	48
Air Brake Clearance Card	56-d	49
Operation of Trains over "Sunbury", "Tyronne", "Buffalo" and "Pittsburgh" Divisions	57	51
Preparation of Train	57-a	51
Air Brake Clearance Card	57-b	52
Delayed Trains	57-c	52
Brake Pipe Pressure	57-d	53
Schedule—Sunbury Division	57-e	53
Schedule—Tyronne Division	57-f	55
Schedule—Buffalo Division	57-g	55
Schedule—Pittsburgh Division	57-h	56
To Avoid Exceeding Allowable Speed	58	57
Brake Control Ineffective	59	57
Retaining Valve Release	60	58
Qualification and Instruction of Conductors and Enginemen	61	58

INDEX

CUTS

**Fig.
No.**

1. Complete Air Brake Equipment For A Passenger Train.
2. Complete Air Signal And Water Scoop System.
3. Complete Air Brake Equipment For A Freight Car.
4. Double Heading Cock.
5. G-6 Brake Valve.
6. Straight Air Brake Valve.
7. H-6 and S-6 Brake Valves.
8. Location Of The Angle Cock.
9. The Back Up Hose.
10. The Pneumatic Water Raising System.
11. Defective Air Brake Card.

RESERVOIRS FOR U. C. PASSENGER CAR BRAKE EQUIPMENT

AUXILIARY RESERVOIRS		Cylinders Standard with Auxillary, Service and Emergency Reservoirs. One Cylinder Fundamental with U. C. Equipment.	SERVICE RESERVOIRS		LARGE EMERGENCY RESERVOIRS	
Size, Inches	Cap. Cu. In.		Size, Inches	Cap. Cu. In.	Size, Inches	Cap. Cu. In.
10 x 33	2125	14" x 12"	12" x 33"	3088	22½" x 36"	12099
10 x 33	2125	16" x 12"	14" x 33"	4476	20½" x 54"	15930
10 x 33	2125	18" x 12"	16" x 33"	5724	22½" x 54"	18942

TABLE SHOWING STYLE OF TRIPLE VALVE AND SIZE OF AUXILIARY RESERVOIR RECOMMENDED FOR USE WITH SUNDRY BRAKE EQUIPMENT

Equipment	Class of Service		Cylinder Dimension	Triple Valve	Auxiliary Reservoir	Capacity Cu. inches
Cars	Passenger Cars	Without Supplementary Reservoir	8 in. x 12 in.	P 1 or L 1	10 in. x 24 in.	1588
			10 in. x 12 in.	P 1 or L 1	12 in. x 27 in.	2450
			12 in. x 12 in.	P 2 or L 2	12 in. x 33 in.	3088
			14 in. x 12 in.	P 2 or L 2	14 in. x 33 in.	4476
			16 in. x 12 in.	P 2 or L 3	16 in. x 33 in.	5724
			18 in. x 12 in.	L 3	16 in. x 42 in.	7436
		When equipped with Supplementary Reservoir L Type Triple Valve must be used.				
Cars	Freight Cars	Detached Equipment	8 in. x 12 in.	H 1 or K 1	{ Std. Cast. }	1620
		10 in. x 12 in.	10 in. x 12 in.	H 2 or K 2	{ Iron Res. }	2440
		Combined Equipment	8 in. x 12 in.	H 1 or K 1	{ Std. Cast. }	1620
		10 in. x 12 in.	10 in. x 12 in.	H 2 or K 2	{ Iron Res. }	2440

**TABLE SHOWING STYLE OF TRIPLE VALVES AND SIZE OF AUXILIARY RESERVOIRS
RECOMMENDED FOR USE WITH SUNDRY BRAKE EQUIPMENT**

Equipment	Class of Service	Cylinder Dimensions	Triple Valve	Auxiliary Reservoir	Capacity Cu. In.
Driver Brake	All locomotives with or without high-speed attachments.	8 in.	F 1	10 in. x 33 in.	2125
		10 in.	F 1	12 in. x 33 in.	3088
		12 in.	F 2	14 in. x 33 in.	4476
		14 in.	F 2	16 in. x 33 in.	5724
		16 in.	F 2	16 in. x 42 in.	7436
		18 in.	F 2	16 in. x 48 in.	8577
Truck Brake	All Locomotives.	6 in.	Drive Brake Triple	10 in. x 14½ in.	890
		8 in.		10 in. x 20 in.	1221
		10 in.		10 in. x 28 in.	1809
		12 in.		12 in. x 27 in.	2450
Tenders	Old Standard Equipment Passenger or Freight with Quick Action Triple Valve.	8 in. x 12 in.	H 1 P 1 P 2 P 2	10 in. x 24 in.	1588
		10 in. x 12 in.		12 in. x 27 in.	2450
		12 in. x 12 in.		12 in. x 33 in.	3088
		14 in. x 12 in.		14 in. x 33 in.	4476
		16 in. x 12 in.		16 in. x 33 in.	5724
	Old Standard Equipment Freight with Plain Triple Valve.	8 in. x 12 in.	P 2 F 1 F 1 F 2 F 2	10 in. x 24 in.	1588
		10 in. x 12 in.		12 in. x 27 in.	2450
		12 in. x 12 in.		12 in. x 33 in.	3088
		14 in. x 12 in.		14 in. x 33 in.	4476
		16 in. x 12 in.		16 in. x 33 in.	5724
	E. T. Equipment, All Classes.	8 in. x 12 in.	None	None	
		10 in. x 12 in.		Air Supply	
		12 in. x 12 in.		Taken from	
		14 in. x 12 in.		Main Res'voir	
		16 in. x 12 in.			

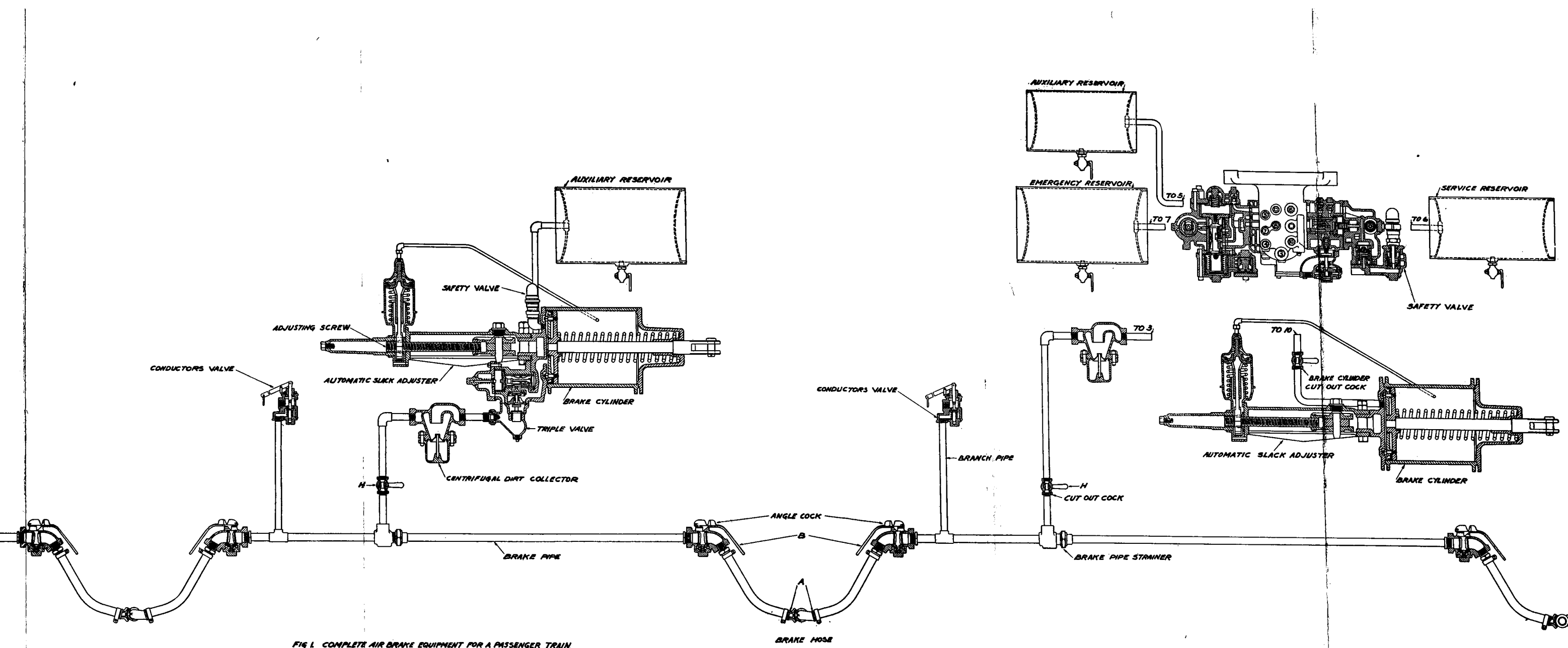
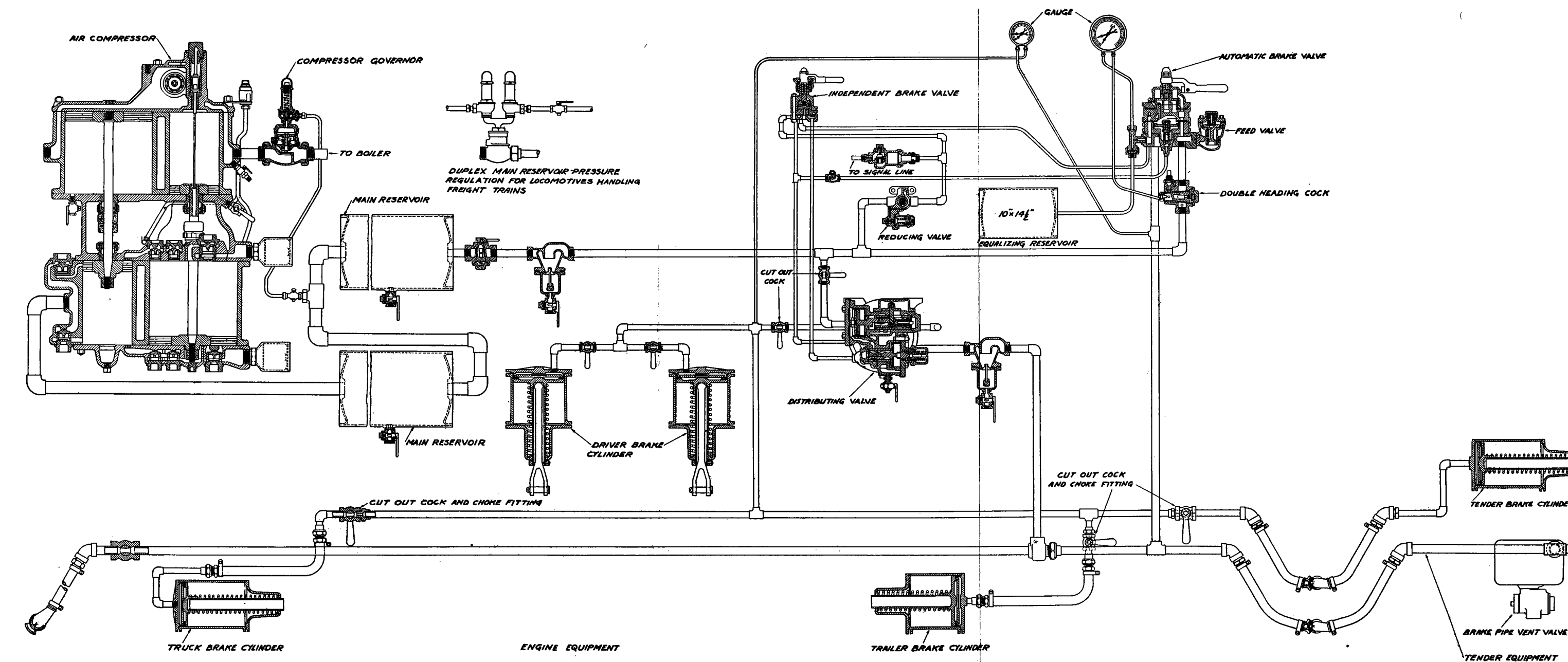


FIG. 1. COMPLETE AIR BRAKE EQUIPMENT FOR A PASSENGER TRAIN.

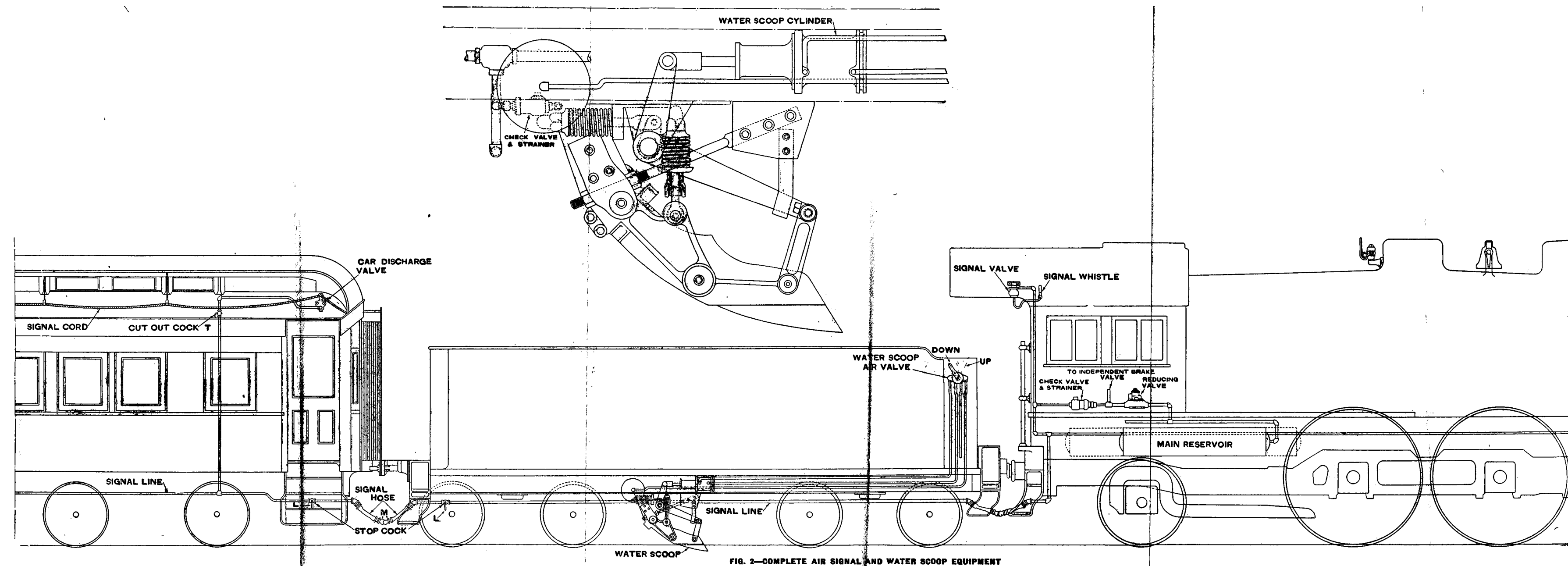


FIG. 2—COMPLETE AIR SIGNAL AND WATER SCOOP EQUIPMENT

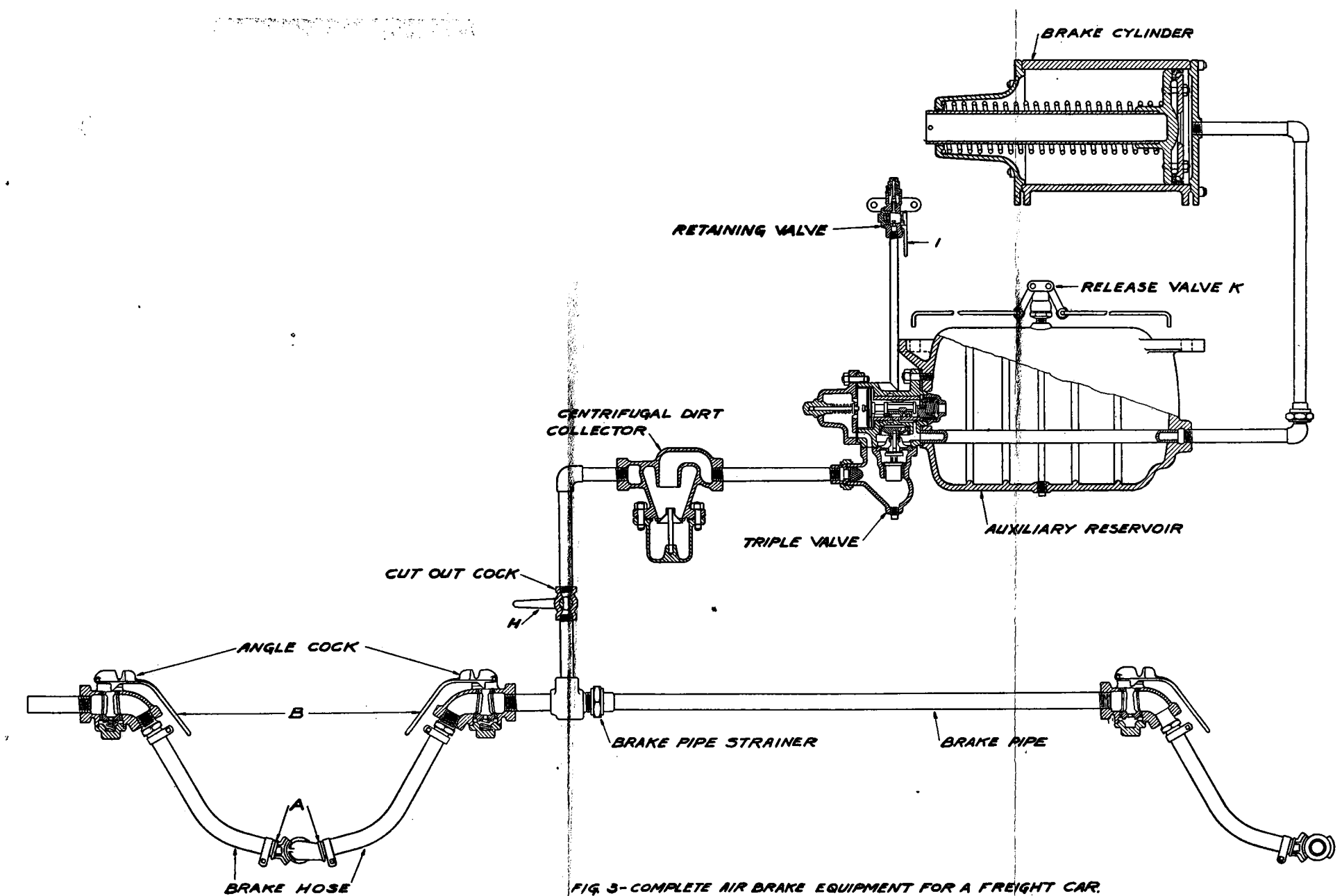
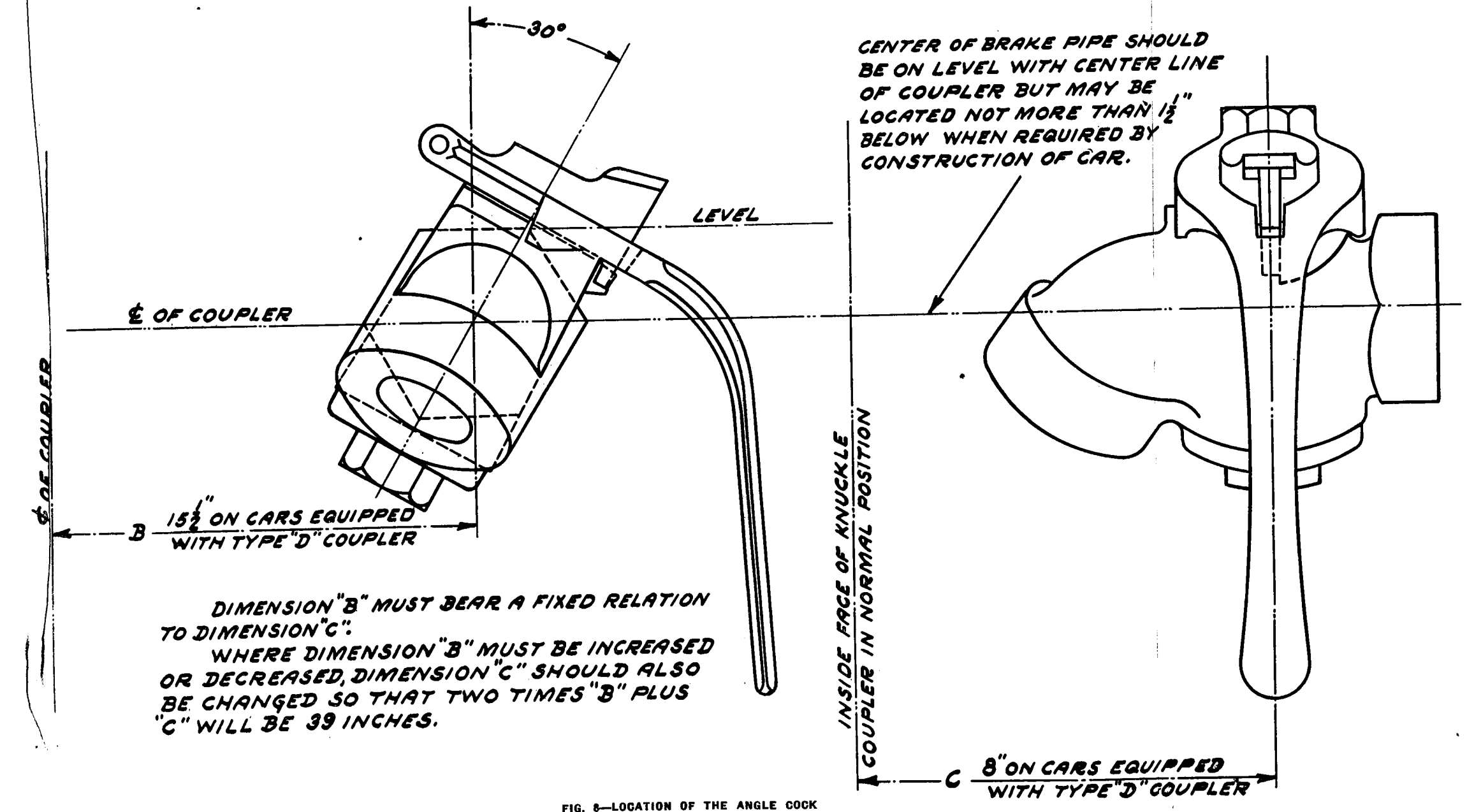
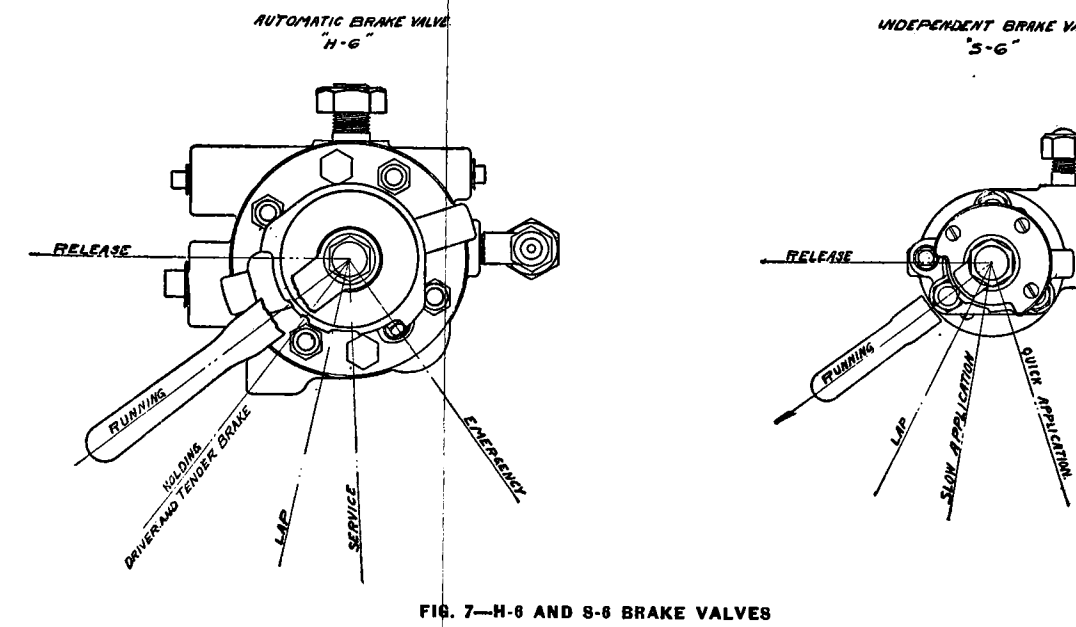
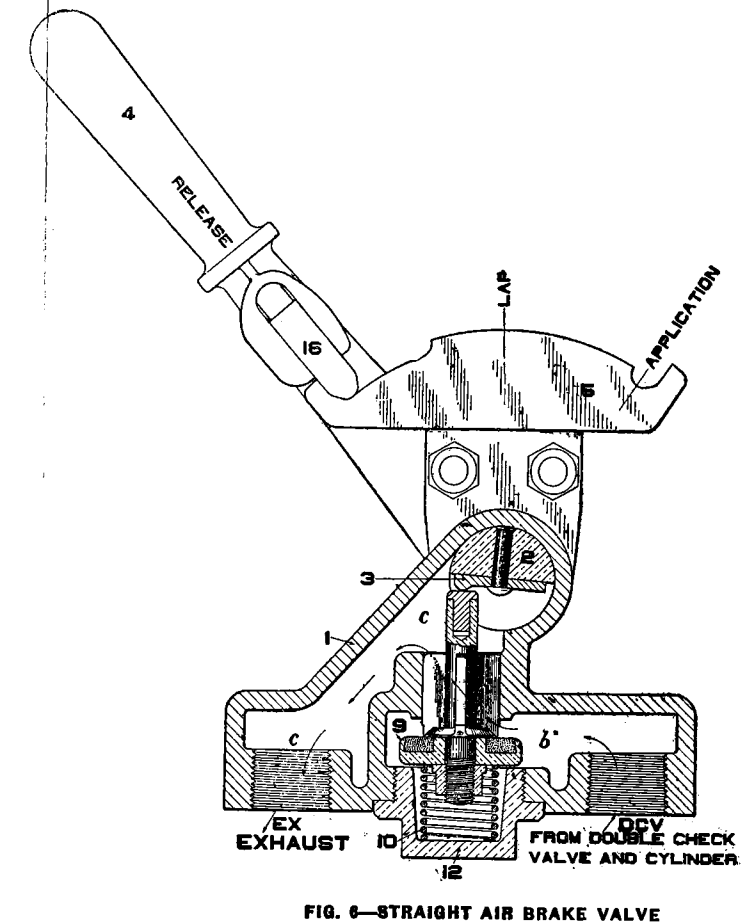
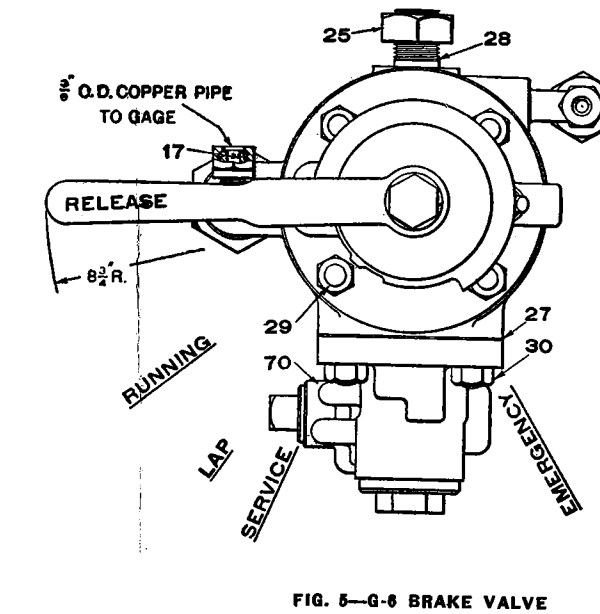
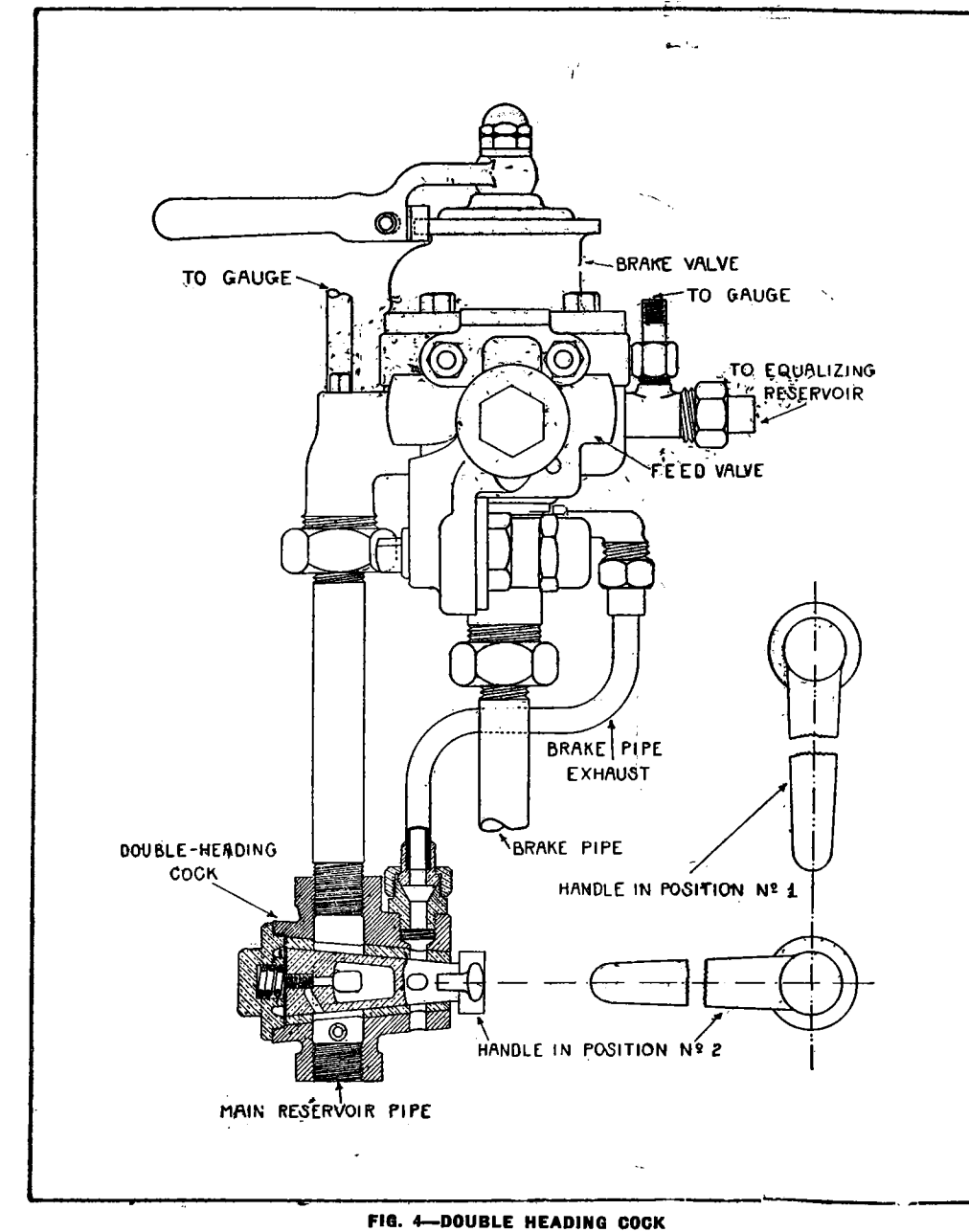
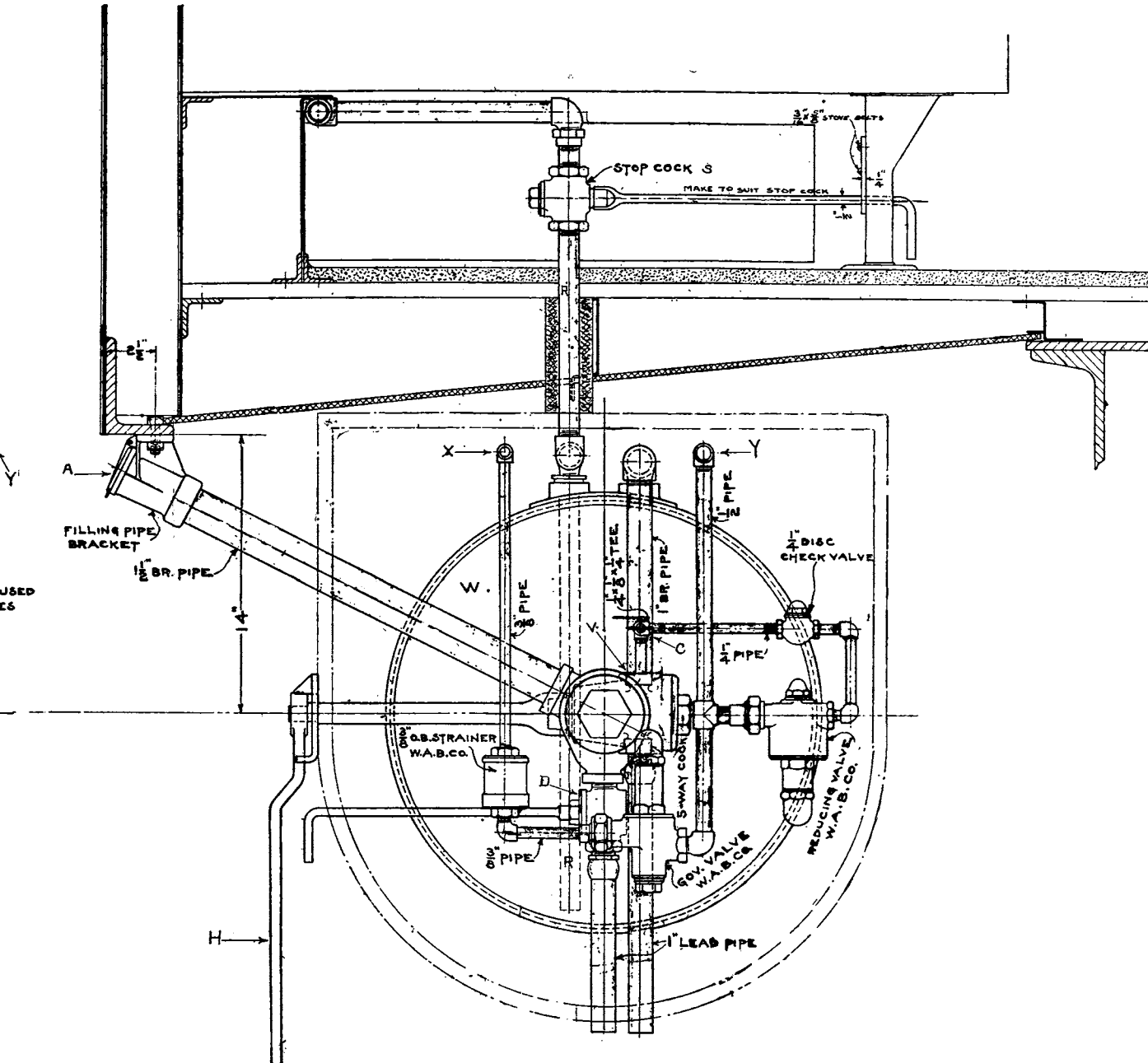
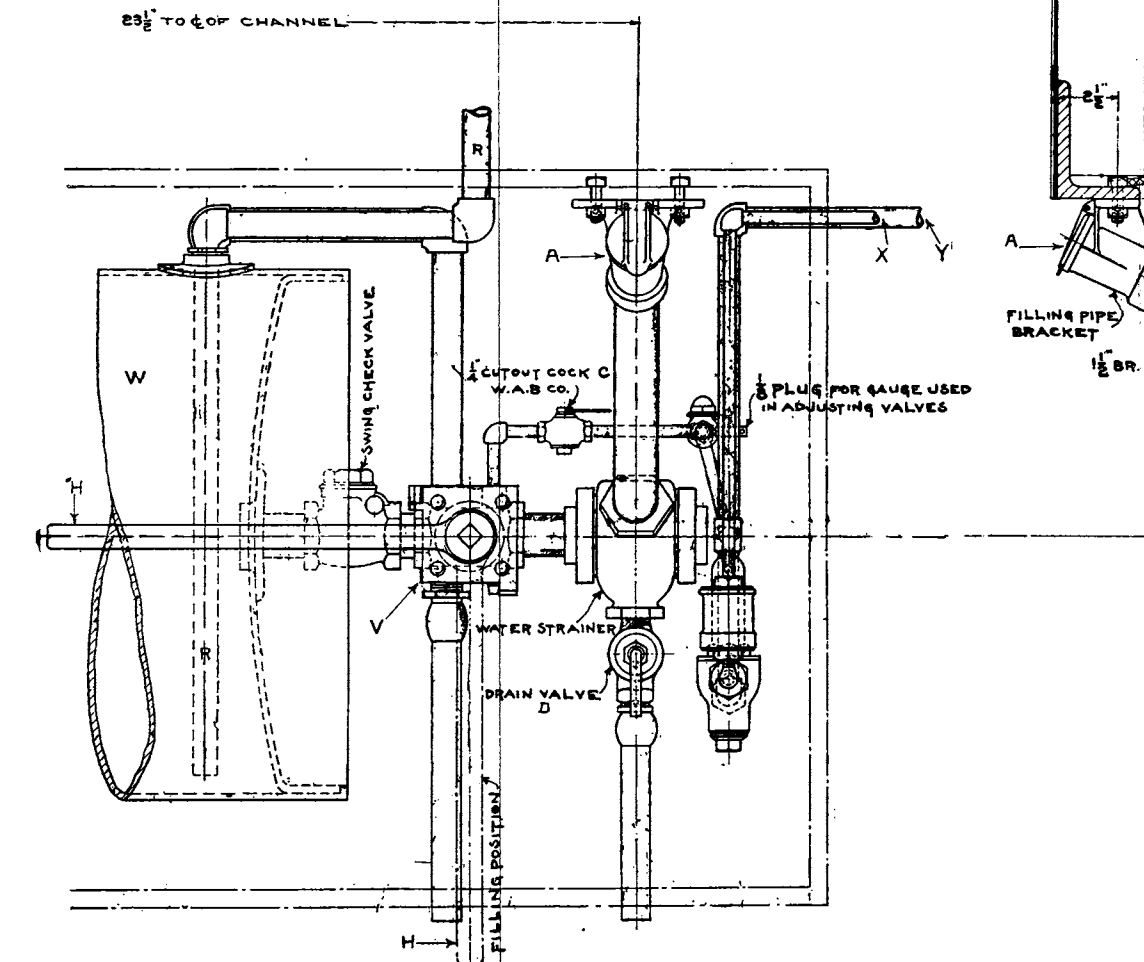
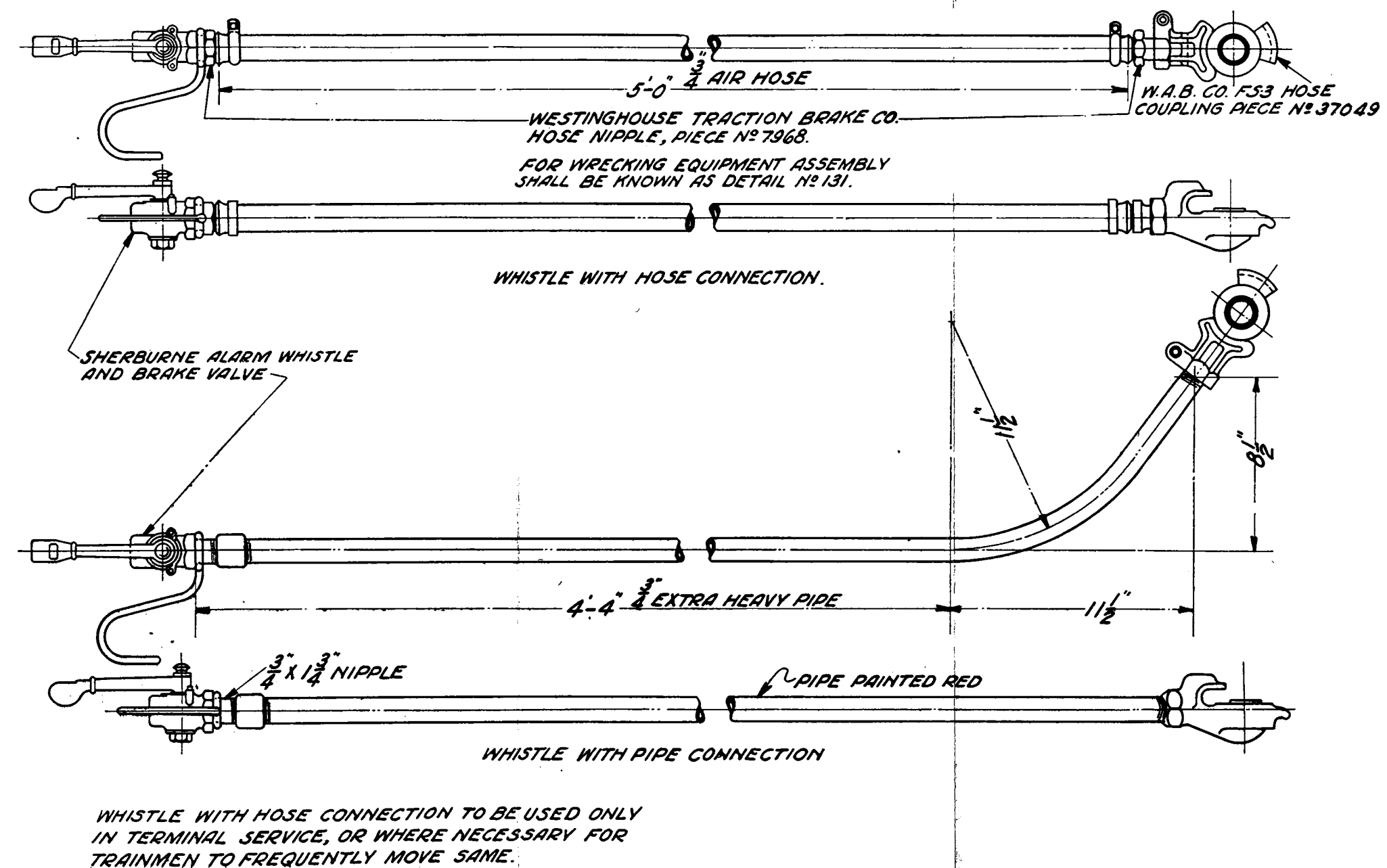


FIG. 3—COMPLETE AIR BRAKE EQUIPMENT FOR A FREIGHT CAR.





DEFECTS

- | | | |
|--|-----------------------------|-------------------------------|
| A —Brake pipe | F —Crossover pipe | L —Angle cock |
| B —Brake will not apply | G —Brake cylinder | M —Retainer valve pipe |
| C —Brake will not release | H —Brake leaks off | N —Release valve |
| D —Triple leaks at exhaust | J —Train pipe clamps | |
| E —Undesirable quick action
in service | K —Brake rigging | |

NOTE:—To designate the defect draw a line through description.

If car can be placed between air brake cars, tie this card near triple valve, where it can be readily seen.

If car must not be placed between air brake cars, tie a card to the brake pipe near the angle cock at each end of car.

