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DESCRIPTION AND INSTRUCTIONS FOR THE CARE AND OPERATION OF THE

155 MM. HOWITZER MATÉRIEL

MODEL OF 1915

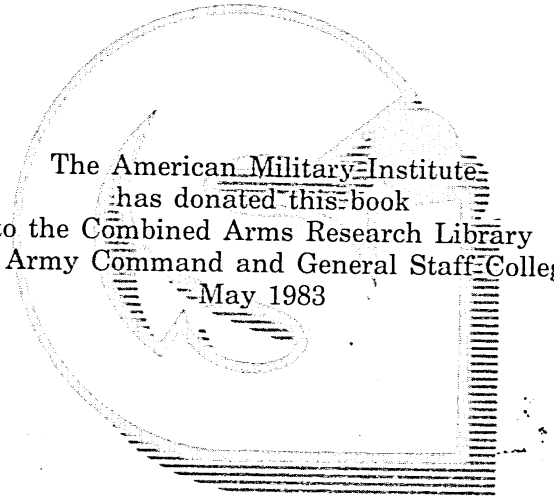
(SCHNEIDER)

TRANSLATED FROM THE FRENCH
OCTOBER 1, 1917

(*FOURTEEN PLATES*)

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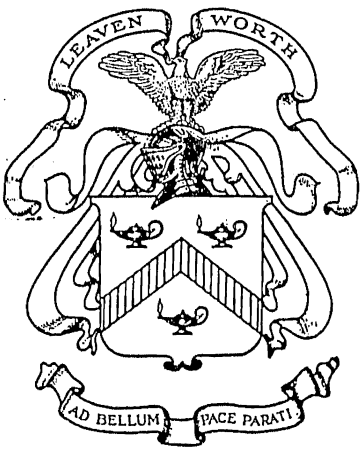

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PROPERTY OF U.S. ARMY

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, October 1, 1917.

This pamphlet is published for the information and government of the Regular Army, National Guard, and National Army of the United States.

By order of the Secretary of War:

WILLIAM CROZIER,
Major General, Chief of Ordnance.

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TABLE OF EQUIVALENTS.

1 meter (m.)	39.37 inches.
1 centimeter (cm.)	.3937 inch.
1 millimeter (mm.)	.03937 inch.
1 kilogram (kg.)	2.2046 pounds.
1 dekagram (dkg.)	.3527 ounce.
1 gram	15.432 grains.
1 liter	1.05671 quarts.
1 centigrade degree	1.8 Fahrenheit degrees.
1 inch	2.54 centimeters.
1 foot	.3048 meter.
1 yard	.9144 meter.
1 square inch	6.452 square centimeters.
1 cubic inch	16.39 cubic centimeters.
1 cubic foot	.02832 cubic meter.
1 cubic yard	.7645 cubic meter.
1 ounce	28.35 grams.
1 pound	.4536 kilogram.
1 quart	.9463 liter.
1 Fahrenheit degree	.555 centigrade degree.

DESCRIPTION AND INSTRUCTIONS FOR THE CARE AND OPERATION OF THE 155-MM. HOWITZER MATÉRIEL, MODEL OF 1915.

PART 1. CARE OF THE MATÉRIEL.

ARTICLE I.

GENERAL INFORMATION.

1. The 155-mm. howitzer matériel, model of 1915 (Schneider), is cared for and repaired by:

(*a*) The "gun squad," under the direction of the chief of section.

(*b*) The "battery repair section," composed of the chief mechanic and the other mechanics included in the battery personnel.

(*c*) The "mobile ordnance repair shop," composed of workmen organized and assigned to divisions. Each mobile repair shop is supplied with spare parts and the necessary tools for the upkeep of the matériel.

2. The spare parts and necessary tools are carried in the following places:

(*a*) *Trail box* (fig. 1).—Such smaller parts and tools as may be required for minor or hasty repairs are carried in the trail box of each howitzer.

(*b*) *The battery mechanic's chest.*—This chest contains such spare parts and tools, in addition to those carried in the trail box, as may be required for the general upkeep and repair of the matériel.

(*c*) *Motor trucks.*—The motor trucks of the mobile repair shop carry a large supply of spare parts, especially such parts as can not be conveniently carried in the two preceding places.

3. Battery commanders, with the assistance of the battery personnel, are authorized to replace only such parts as do not involve riveting, forcing, or metal filing.

The saddler will repair the leather parts (muzzle covers, etc.), and the canvas parts (wagon covers, instrument covers, etc.), as often as necessary to maintain them in proper condition.

4. The daily care of the matériel does not require the services of the mechanic. The gun squads should be able to keep the howitzers in good condition.

5. *Oils.*—The battery equipment normally includes glycerine, lubricating oil, clock oil, coal oil, and light slushing oil. Each of these oils is suited only for the particular purpose for which it is issued, as stated below, and care should be taken to see that it is not used for any other purpose. The use of any other oil is prohibited.

6. Glycerin is for use in the recoil cylinders *and for no other purpose.*

7. Lubricating oil will be used exclusively in all oil holes of the matériel and in lubricating such parts as wheels and axles, gun and cradle slides, elevating and traversing mechanisms, exterior of cylinders, brake bearings, hinges, breechblock surfaces, threads of breech recess, etc.

8. Clock oil should be used on the spindle and bearings of the battery commander's telescope, bearings of the panoramic sight, range quadrant, fuze setters, and on the observation telescope, sextant telemeter, etc. The oil should be applied only when the instruments are disassembled for cleaning and should be applied from the end of a dropper.

9. Coal oil is issued by the Ordnance Department for cleaning purposes only. In the field it may be used for lanterns. (Coal oil for general illuminating purposes is furnished by the Quartermaster Corps.)

10. Light slushing oil is prescribed for use in the protection and preservation of all bright or unpainted surfaces of steel or iron when the matériel is to remain unused for an appreciable time. Its use as a lubricant for mobile artillery is forbidden. Before applying the slushing oil to any surface the parts should be thoroughly cleaned, so as to be free from rust, water, coal oil, lubricating oil, etc., as their presence will cause rusting under the slushing oil. The slushing oil should then be applied in a thin, uniform coat. This is all that is necessary to give good protection. Except in very cold weather it can be applied with a

paint brush. In cold weather it should be applied by stippling—that is, lightly tapping the surface with the end of the sash tool held with bristles perpendicular to the surface to be covered. It can be applied to the bores of guns by the slush brush issued for the purpose. In cold weather it should be warmed before use for coating the bores of guns. It may be readily removed by the use of burlap or waste dipped in coal oil.

11. The use of pumice, emery powder, or any other abrasive is prohibited.

12. The matériel should be completely cleaned and greased at least once every two weeks under the supervision of a commissioned officer, the work being done by the battery mechanics.

The polishing of any part of the matériel is prohibited.

13. The sights (fig. 14) should be adjusted at least once a month under the supervision of a commissioned officer. The sights should be inspected as frequently as possible and particularly after any erratic shooting.

14. The care and inspection of the telephone equipment is under the supervision of a commissioned officer, the work being done by the sergeant in charge of the battalion telephone squad.

ARTICLE II.

GENERAL INSTRUCTIONS.

15. The gun squads are authorized to dismount only the following parts of the matériel:

(*a*) The breech mechanism (figs. 5, 6, 7), including the breechblock, ejector, firing pin, breechblock carrier, breech rack, breech latch, loading tray, and firing mechanism.

(*b*) The wheels and poles (fig. 3).

16. The gun squads are forbidden to dismount any parts other than those mentioned above or to use in dismounting and assembling any methods other than those prescribed by these regulations.

17. Any difficulty which can not be remedied by the prescribed methods shall be referred to the chief mechanic or to the mobile repair shop.

DISMOUNTING AND ASSEMBLING.

18. *To dismount the breech* (Figs. 5, 6, 7).—Dismounting the breech includes removing the breechblock and dismounting the parts as enumerated below.

(*a*) Open the breech halfway—that is, until the breech operating lever (Fig. 5) is parallel to the axis of the gun.

(*b*) Push on the flat leaf spring which is attached to the lower end of the vertical hinge pin of the breech operating lever by inserting a drift in the spring slot, and with the left hand lift the breech operating lever and hinge pin until the key comes out of its keyway in the body of the breechblock carrier. Grasp the loading-tray cam while raising the breech lever. Move the breech lever to the position of open breech.

(*c*) Remove the loading-tray cam.

19. *To remove the parts carried by the breechblock.*—

(*a*) Push in upon the spring latch, located in the face of the breech which holds the breech rack in position, and swing the breechblock carrier sufficiently to allow the rack to disengage and be withdrawn.

(*b*) Withdraw the breech rack to the right.

(*c*) Unscrew the breechblock by turning it clockwise while grasping it firmly to prevent it from falling when disengaged.

(*d*) Remove the firing-pin plunger.

(*e*) Remove the firing-pin spring and the firing pin.

(*f*) Remove the breech operating lever by lifting its hinge pin out of the bearings.

(*g*) Remove the breechblock carrier.

20. *To remove the loading tray.*—Swing the loading tray into the position of open breech, remove the split pin or other locking device, and withdraw the loading-tray hinge pin. Remove the loading tray.

21. *To remove the extractor* (Fig. 7).—Remove the extractor by drawing it out to the right, rear.

22. *To remove the projectile retaining latch.*—Raise the hinge pin, turn it so that the key guide comes opposite the opening, and then remove the bolt.

23. *To remove the salvo latch.*—Remove the bolts and then remove the salvo latch and salvo latch spring.

TO ASSEMBLE THE BREECH.

(Figs. 5, 6, 7.)

24. The parts of the breech mechanism are assembled in the following order:

(*a*) Salvo latch.

(*b*) Projectile retaining latch and its hinge pin.

(*c*) Extractor.

(*d*) Loading tray and its hinge pin.

(*e*) Connect the loading tray with the lever arm which is to actuate it.

(*f*) Breechblock carrier (to the position of open breech).

(*g*) *Breech operating lever.*—Allow the lever to remain partially in place, the hinge pin inserted in the upper hinge socket as far as the key.

(*h*) Firing-pin plunger.

(*i*) Firing pin.

(*j*) Firing-pin spring.

(*k*) Screw the breechblock onto the breechblock carrier by turning it counterclockwise. Insert the breech rack in the breechblock carrier. Turn the breechblock (to engage the rack teeth with the teeth on the circumference of the breechblock) until the reference marks on the block and the rack are opposite one another. The position of the breech rack spring latch is now underneath.

(*l*) Insert breech rack spring latch and its spring.

(*m*) *Breech rack.*—Press upon the spring latch and push the rack into place until the reference mark on it is opposite the reference mark on the breechblock carrier. Turn the breechblock clockwise to engage the rack. The position of the rack is determined by the breech rack spring latch.

(*n*) *Loading-tray actuating cam.*—Replace the cam in the position of open breech.

(*o*) Press the breech operating lever toward its closed position, engage the flat leaf spring catch with the lower base of the cylindrical cam and place the stud, on the lower side of the lever, in its proper receptacle in the breech rack shaft by swinging the breechblock carrier into the required position.

(*p*) See that the flat leaf spring catch on the lower end of the breech operating lever hinge pin is fully extended and that it properly grasps the cylindrical cam.

(*q*) Close the breech.

25. *To dismount the movable trail spade* (fig. 1).—

(*a*) Place the movable spade in its traveling position. (It may be necessary to use a piece of wood or other lever to push up on the face of the spade to compress the flat leaf spring which is placed between the spade and the body of the trail to prevent rattling of the spade.)

(*b*) Remove the split pin from the right side of the spade traveling lock hook and unscrew the hook.

(*c*) The traveling lock shaft fits tightly in its bearings in the trail body and a copper hammer or a block of wood to receive the blows of a sledge may be required to drive the shaft out.

(*d*) Remove the flat leaf spring by removing the split pin, unscrewing the nut and removing the bolt that fastens the spring to the trail body. The nut and split pin will be found on the underside of the trail. It is not necessary to remove the spade hinge pin in order to remove the spring.

26. *To replace the brake shoes.*—

(*a*) Release the brake.

(*b*) Remove the split pins at the ends of the brake beam, unscrew the nuts, and slide the worn brake shoes off the shaft.

(*c*) Slip the new brake shoes into place and replace the nuts and split pins. See that the brake alignment plates (which fit onto the hexagonal shoulders on the brake beam) are properly placed so as to force the brake shoes evenly against the wheels when the brake is applied.

27. *To dismount the gun-carriage wheels.*—

(*a*) Put the gun in battery so as to avoid any possibility of the gun becoming released from the traveling position and coming into battery during the work. Jack up and remove one wheel at a time.

(*b*) Remove the thong, locking key and washer and slide the wheel off the axle.

28. *To dismount the limber pole* (fig. 3).—Remove the fastening pin in front of the flexible pole joint and draw the pole out, working it loose if it sticks in the pole socket.

29. *To remove the haversack hamper.*—Unbuckle the straps, raise the latches with the fingers or use a drift, if necessary, and then remove the hamper. In replacing the hamper on the carriage see that the lugs fit properly in the brackets, that the supporting hooks are firmly clamped to the handles, and that the hamper is tightly held in position.

ARTICLE III.

CLEANING AND OILING.

30. The matériel in service with the battery must be constantly maintained in serviceable condition in the manner prescribed by the following regulations for daily inspection.

31. *General cleaning and oiling.*—Thoroughly clean and oil the elevating segment (fig. 11) brackets and levels; the trunnions (oil holes 17 and 18), carriage axles, wheel shoes (oil holes 21, 22, 23, 24 and 25), spade hinge pin, traveling locks, breech mechanism, salvo latch, loading tray, bore of the howitzer, and the slides. Test the recoil mechanism. (Fig. 13.)

32. *To clean the bore of the howitzer.*—Remove the breech-loading tray and salvo latch. Wash the bore with a solution made by dissolving one-half pound of sal soda (NaOH) in 1 gallon of boiling water. After washing the bore with this soda solution until the solution comes through clean, wipe perfectly dry and oil with a thin coat of light slushing oil furnished for this purpose. A slush brush for oiling the bore will be issued by the Ordnance Department upon requisition.

33. *To clean the breech mechanism* (figs. 5, 6, 7).—Dismount the breech mechanism and the loading tray. Carefully clean and oil the screw threads of the breechblock, breechblock carrier, and breech rack, loading tray cam and rocker shaft, firing pin, ejector, and firing mechanism. (Coal oil for cleaning purposes is furnished by the Ordnance Department.)

34. *To clean the salvo latch.*—Remove the latch and latch spring. Carefully clean the latch spring; oil both receptacles thoroughly before replacing.

35. *To clean the breechblock carrier.*—Open the breech. Oil the bearings and moving parts and work the oil into the mechanism by moving the parts while applying the oil. If the howitzer is in battery, first lay it in a horizontal position.

36. *To clean the slides.*—If the howitzer is in battery, clean the rear exposed surfaces of the slides with coal oil. Then place the howitzer in the traveling position and clean the front exposed surfaces of the slides. See that all the

oil holes are cleaned, filled, and ready for use (oil holes 18, 19, 20, 21, and 22).

37. *To clean the panoramic sight and bracket* (fig. 14).—Clean the sight supporting brackets. Turn the scales and adjustments, apply a drop of clock oil, and wipe clean after working the oil into the mechanism. Clean the glass of the sight and of the levels with a clean piece of cloth or chamois skin, removing any oil that may gave gotten on them.

38. *To clean the cradle traveling locks* (fig. 1).—Clean, move, and oil these parts with the howitzer in battery (oil holes 2, 3, 4, and 5).

39. *To clean the axles.*—Place the howitzer in battery, if not already in that position. Clean and oil the visible parts of the axle by successively traversing (fig. 10) the carriage to the full extent of its travel to the right and to the left. Oil the rollers in the roller boxes and see that the oilers are clean, full and ready for use. (Oil holes 9, 12, and 13.)

40. Clean and oil the hinge pin of the movable spade, spade traveling lock shaft and bearings. (Fig. 1.)

41. Clean and oil the elevating mechanism (oil hole 1). (Fig. 11.)

42. Grease the lunette (fig. 1) and the lunette-bearing plates with heavy grease.

43. *Use of cleaning and oiling equipment—The oil gun.*—Clean the nozzle of the gun with a piece of wire if the orifice has become congested by the coagulation of oil. Holding the gun in the left hand, insert the nozzle in the oil reservoir and with the right forefinger and thumb draw back the piston, keeping the nozzle well beneath the surface of the oil in the reservoir. With the piston rod (fig. 13) extending out as far as possible to the rear, insert the nozzle in the oil hole as far as it will go and gently push on the piston rod. Allow a few seconds to elapse after oil is seen at the hole and then repeat until certain that the part has sufficient oil. Wipe off the excess oil. In case the oil hole is clogged, clean it out with a piece of wire. In cleaning out the nozzle and oil holes, use nothing but a piece of wire. Splinters of wood may break off in the holes.

44. *The use of the greasing burlap.*—Cover the head of the rammer (fig. 1) with burlap, wrap it firmly around the head and bind it tightly with thongs wound in opposite directions and tied securely behind the head. A clean piece of burlap must be used to prevent scoring the bore with gravel, sand, or other abrasive.

ARTICLE IV.

PREPARATION FOR INSPECTION.

45. *Care and cleaning of recoil cylinders and other parts of carriage.*—The carriage must be properly cleaned and cared for to insure its working correctly. The officers responsible for the efficiency of the battery should familiarize themselves with the carriage mechanism and with the foregoing instructions as to the methods of mounting and dismounting the various parts, and should see that the carriage is properly handled, cleaned and cared for. The following general directions for its care and cleaning are given:

46. The recoil cylinders (fig. 13) should be emptied and refilled once every three months, and thoroughly cleaned once every six months, or oftener if conditions require it. The interior of the cylinders, the pistons and the stuffing boxes should then be thoroughly cleaned by the use of cotton waste and coal oil and wiped dry with cotton waste. The removal of the packing is not necessary in cleaning. The cylinder bores should be carefully inspected, and if any rust has formed, it should be removed with coal oil, using, if necessary, fine emery cloth. The latter must be used with great care, to prevent any increase in the clearance between the cylinders and pistons. If rubbing, burring, or scoring of the parts is noted, the rough spots should be carefully smoothed down by a skilled workman with a dead-smooth file or with emery cloth, and the cause of the roughness ascertained and removed. Where unusual rubbing or scoring has occurred, the facts will be reported to the officer of the Ordnance Department charged with the duty of keeping the battery in repair, for his information and action.

47. The parts should be reassembled immediately after cleaning and inspection, and the cylinders filled with the

glycerine solution, issued for that purpose. The pistons should be moved back and forth in the cylinder by hand to make sure that all parts are correctly assembled. The cylinders should then be mounted in the carriage and the gun pulled from battery by hand and permitted to counter recoil rapidly to insure that all parts are in proper position for firing. This should never be done, however, unless the cylinders are known to be filled with liquid. In reassembling the parts, the condition of the packings should be noted; they should be replaced whenever necessary to prevent leakage. In removing and inserting the piston rods, care should be taken to keep them central in the cylinders, so as not to bind, burr, or spring any parts. The dismounting and reassembling of the parts of the cylinders should in every case be supervised by a commissioned officer. Before firing, an inspection should be made to ascertain that the different parts, especially the piston rods, are correctly assembled.

48. The recoil-cylinder liquid should be stored in the closed cans provided for the purpose, and be carefully protected from dirt and sand. Liquid withdrawn from cylinders and containing any sediment must not be used again until it has been allowed to settle for not less than 24 hours. When the sediment has thus been permitted to settle, great care must be taken not to disturb it in removing the liquid. To insure the cleanliness of all cylinder liquid, it should be strained through a clean piece of linen or muslin before using.

49. The exterior of the cylinder should be kept well oiled and free from rust or dirt, and an inspection should be made at least once each month to ascertain its condition. Where rust has formed, it should be removed with coal oil, and, if necessary, with emery cloth. For shipment or storage, or where the carriage is to stand without firing for extended periods, the cylinder should be coated with the light slushing oil used for the bores of guns.

50. The recoil guide rails (Fig. 1) of the cradle should be kept well lubricated. Immediately before beginning to fire, they should be oiled through all the oil holes of the gun and dust guard. Lack of proper lubrication of these guide rails is the most frequent cause of failure of gun to return fully into battery.

51. The contact surfaces should be kept clean, thoroughly oiled, and free from rust. If indications of rusting, cutting, or scoring of these surfaces appear, the parts should be dismounted, the rust removed, and the rough spots smoothed away.

52. The elevating (Fig. 11) and traversing (Fig. 10) mechanisms should be dismounted at least once every six months for thorough cleaning and overhauling. They should be kept well oiled and should work easily. If at any time either mechanism works harder than usual, it should be immediately overhauled and the cause discovered and removed.

53. In traveling, the rear of the cradle should be lowered until it rests upon the two traveling studs, which are movably attached to the upper part of the trail (fig. 1).

54. The wheels and wheel fastenings should be dismounted periodically and the fastenings, hub boxes, axle arms, and axle bore cleaned and examined. All roughness due to scoring or cutting should be smoothed off.

55. The importance of strict compliance with these instructions can not be overestimated. The wooden parts of the wheels are made of thoroughly seasoned materials, and the hub bolts and bands, when the wheels are issued, are properly tightened; but all wood is susceptible to change with atmospheric conditions, so that the spokes speedily become loose, and if the wheel is used in this condition, it will rapidly be made unserviceable and may be damaged beyond repair.

ARTICLE V.

DAILY INSPECTION.

56. Before each march and each firing period, the chief of section, assisted by the gunner, should make a complete and careful inspection of the matériel under his command. After each firing period, the matériel should be given a careful cleaning and a complete inspection, as prescribed below, by the chief mechanic of the battery, who should make a verbal report of the results of his inspection to the battery commander. The battery commander should take the necessary action to place the matériel in good condition.

57. *The howitzer.*—Place the howitzer in the traveling position. Operate the breech mechanism and inspect the operation of the hammer and the firing pin. See that the firing-pin spring functions properly. See that the salvo latch works properly and that it moves freely in its seat. (Latch the hammer.)

58. Apply and release the road brake (fig. 9) and see that the shoes are held firmly at a suitable distance from the wheels, when the brake is released. If the brake shoes are badly worn or damaged, replace them as prescribed.

59. See that the chassis is firmly cloked to the cradle and that the cradle is firmly locked to the carriage.

60. Open the door (fig. 12) in the front of the cradle and see if the piston-rod locking shutter functions properly when its lever is moved. See that the door closes tightly without binding and replace the thong in the door latch.

61. Inspect the trail handspike (fig. 1). See that it is tightly held by its hinge pin and that it fastens securely to the trail at the handspike latch.

62. Inspect the firing lanyard (fig. 8) and see that the lanyard pulley is firmly held in place and that it turns easily.

63. Examine the axle traveling lock (fig. 4) and see that it is rigid and that it works properly. See that the catch pin enters the sockets freely at the two positions marked "ROUTE" and "TIR."

64. See that the copper gasket around the recoil cylinder filling plug is tight. It it is not tight, oil will be seen to ooze from around the filling plug.

65. See that the rammers and the sponge (fig. 1) are firmly fixed in position and that they can be lifted out readily.

66. Remove the panoramic sight cover (fig. 14) and see that the controlling thumbnuts and adjustments are in proper condition and that the levels are held firmly in their receptacles and are well protected.

67. See that the spade (fig. 1) is securely fastened in one of its two positions.

68. See that the wheel mats are in good condition and that they are carried on the proper carriage.

69. See that the breechblock carrier is tight and that it works freely.

70. See that the trail box cover (Fig. 1) opens and closes easily.

71. See that the trunnion caps are in place and that they are provided with thongs.

72. Operate the elevating and traversing mechanisms (Figs. 9, 10, 11) through the full extent of their travel and examine them for looseness and backlash.

THE CAISSON LIMBER.

73. Make sure that the pole key and attaching chain are securely fastened and that the draft springs work properly.

74. See that the wheel brakes work correctly, and place the locking pin so as to prevent the brakes from tightening by road shocks.

75. See that the loading hooks are in place, and, for the caissons with which it is furnished, that the fuze setter is in its case.

76. Examine the pole prop.

77. See that the chests are tightly fastened.

78. Verify the existence and location of the latch thongs on all the vehicles.

79. See that the pintle hook latch and its spring work properly.

80. See that the chest is tightly closed and that the powder compartments are held by the proper keys.

81. *Greasing the wheels.*—The axle bearings should be greased periodically at intervals of time varying with the circumstances. After each greasing, the leather washers, both inner and outer, should be examined.

PART 2.

ARTICLE I.

82. *The recoil brake and the recuperator.*—The packing of the joints of the recoil cylinder (Fig. 13) and of the recuperator (Fig. 13) are not entirely water-tight and the slight leaks which occur during firing and also when the howitzer is at rest are not serious. The volume of liquid in the recoil cylinder and in the recuperator should be measured from time to time, especially after prolonged use. A drop of liquid at the rear mouth of the recuperator is not always an indication of a loose packing, the exuded liquid may have come from the accumulation, behind the piston, of liquid scraped from the cylinder walls after each shot.

83. A complete inspection of the recoil cylinder and of the recuperator consists of the following operations:

(*a*) Measure the volume of liquid in the recoil cylinder.

(*b*) See that the recuperator is properly assembled and measure the pressure therein.

(*c*) Measure the volume of liquid in the recuperator.

84. The first two operations are simple, as will be shown later, and if care is used, the results are accurate. The third operation, that of measuring the amount of liquid in the recuperator is more complicated and will give erroneous results if it is not done with the greatest care, and particularly if the measuring instruments are out of order.

85. A measure of the quantity of liquid contained in the recuperator may be approximated by measuring the recoil.

86. If the recoil system is properly assembled and if the length of the recoil is normal—that is to say, less than the fixed values given in the table—the operation of the recuperator is satisfactory, it is properly assembled and it is not necessary to test the pressure or volume of liquid therein.

87. If the recoil is too long, after making sure that the recoil cylinder contains the proper volume of liquid, the pressure in the recuperator should be measured.

88. If the pressure is less than its normal value, reestablish it by the addition of more gas and measure the recoil again. In general, the recoil will be within the allowances fixed by the table.

89. If the length of recoil is still too great, or if the pressure gauge does not show any drop in pressure, measure the

amount of liquid in the recuperator. If the test shows that the amount of liquid is insufficient reestablish the normal level. If the recoil is now too long, call it to the attention of the inspector. At the same time examine the measuring instruments and call the inspector's attention to the recoil measurements. The adjusting of the recoil brake and of the recuperator should be done according to the following instructions:

90. If the howitzer is being fired—

(*a*) Measure the volume of liquid in the recoil cylinder before the howitzer is fired and frequently during intensive firing.

(*b*) Note the length of recoil each time the gun is fired.

(*c*) If the length of the recoil appears to indicate faulty operation of the recuperator, proceed as specified above.

91. If the howitzer is not being fired—

(*a*) Measure the volume of liquid in the recoil cylinder at least once a month and in any case immediately before the howitzer is fired.

(*b*) See that the recuperator is properly assembled before the howitzer is fired.

92. The recoil is measured by an index attached to a leaf spring with a screw adjustment placed on the right side of the cradle, which leaves a mark on the chassis during the stroke. Carefully turn the adjusting screw until the point of the indicator comes in contact with the chassis. Place some grease or other material on the slide in order to mark the travel of the indicator. When the howitzer has returned to battery, measure the distance which separates the indicator from the farther end of its trace, on the chassis. The recoil for different charges and at different angles should not exceed the following values:

Powder charges.

Angle of elevation.	00	0	1	2	3	4	5
°	*Meters.*	*Meters.*	*Meters.*	*Meters.*	*Meters.*	*Meter.*	*Meter.*
10	1.260	1.220	1.100	1.010	0.940	0.850	0.770
20	1.280	1.240	1.140	1.050	.970	.890	.810
40	1.300	1.250	1.170	1.100	1.020	.950	.870
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
10	49.6	48.0	43.3	39.8	37.0	33.5	30.3
20	50.4	48.8	44.9	41.3	38.2	35.0	31.9
40	51.2	49.2	46.1	43.3	40.1	37.4	31.2

NOTE.—The values given for the angles are only approximate and a slight variation of the angle will not alter the recoil to anygreat extent.

THE RECUPARATOR ASSEMBLY (FIG. 13).

93. The normal condition of the recuperator is determined by the initial pressure and by the amount of liquid contained therein. At 15° C. the initial pressure should be 31 kilograms per square centimeter, the quantity of liquid being 23.25 quarts (22 liters).

94. Since a temperature variation of 9° C. will cause a pressure variation of 1 kilogram per square centimeter, it will be seen that after a long firing period, the increase in temperature will cause an increase in the pressure that must be allowed for.

95. The following measurements are made with the howitzer in the firing position:

96. *Pressure measurement.*—Open the inspection port under the front end of the cradle and unscrew the two reservoir locking rings, remove the packing washers and the reservoir caps. Screw the manometer coupling into this front hole, covering the coupling with tallow, if necessary, to prevent leakage at the joint; open the valve with caution (it is important that the valve be opened slowly, because a sudden opening might result in damaging the gauge) and read the pressure, tapping the gauge with the finger to make certain that the indicating hand is not sticking. Close the valve. (Only the wrench that is provided for unscrewing the valve should be used. The other wrenches being heavier, might result in damaging the valve.)

97. *To measure the amount of liquid contained in the recuperator.*—

(*a*) Place the howitzer in a horizontal position.

(*b*) Put on the gauge and gauge coupling as described above and read the pressure, close the valve, making sure that the rear cylinder head of the recuperator is tight. Open the front port of the cradle (fig. 12), move the piston-rod lock, and remove the recuperator piston rod nut after driving out the pin.

(*c*) Place the recuperator compressor-screw support in the clips on the cradle. Make sure that the compressor screw is completely entered in the screw housing; that is to say, that the reference mark on the nut corresponds with the reference mark placed on the end of the screw housing opposite the screw lever.

(*d*) Screw the compressor screw into the threaded end of the recuperator piston rod until the end of the screw housing comes to rest on the shoulder.

(*e*) Then turn the compressor screw by means of the lever (insert the lever in the ring on the compressing screw and prevent the screw housing from rotating) until the reference mark on the screw corresponds with the reference mark on the lever end of the housing. Open the valve. Read the pressure on the gauge. Read the volume either on the compression curve or see if the volume is less than or exceeds the normal volume on the volume indicator.

(*f*) Remove the compressor screw and housing. Assemble the recuperator piston-rod nut and place the pin in place. Place the piston-rod lock in position. Close the front part, remove the gauge and coupling, and close inspection door.

98. *To fill the recoil cylinder* (fig. 13).—The howitzer being in battery, depress it as far as possible by means of the socket wrench E. B. 4, unscrew the recoil-cylinder filling plug, pour in the prescribed liquid through the special funnel until it commences to overflow. Return the howitzer to the horizontal position, allow about 6.1 cubic inches (100 cubic centimeters) to flow out, see that the gasket is in good condition, and then replace the plug.

99. *To fill the recuperator* (fig. 13).—After studying the volume indicator it will be evident whether liquid or gas is needed. If the volume of liquid is sufficient and if the initial pressure in the recuperator is less than 29 kilograms per square centimeter, gas is required. If, on the contrary, the volume of liquid appears to be insufficient, more should be added.

100. Usually the recuperators are filled with nitrogen to prevent oxidation of the metal. The howitzer is provided with reservoir tanks containing this nitrogen, The method of charging the recuperator by means of the reservoir tanks is prescribed in the Appendix of July 20, 1916. In the absence of nitrogen air may be used. The admission of a small amount of air into the recuperator is of no consequence and it may be substituted for the more inaccessible nitrogen. If a large amount of gas is required, however, nitrogen must be used.

101. *Introducing the air.*—Screw the air-pump tube onto the pump. Screw the other end of the hose onto the gauge. Pump until the pressure at the valve is equal to the pressure in the recuperator, open the valve, resume pumping until the desired pressure is obtained in the recuperator, and then close the valve.

102. *Introducing the liquid.*—Put the pump in place on the bracket on the left side of the cradle. Screw the hose to the gauge coupling and fasten the pump on the bracket by means of the clamping screw.

(*a*) Place the required amount of liquid in the pump. Open the valve on the chassis and pump the liquid into the recuperator. The gauge coupling is provided with a device which serves to protect the valve during this operation so that it is not affected by the fluctuation in pressure during the stroke.

(*b*) When this is completed close the valve on the chassis, remove the pump, place the plugs in position, and close the inspection port.

103. The inspection of the recoil brake and of the recuperator systems should be made as regularly as possible and always after the howitzer has been fired. The lack of sufficient liquid in the recoil cylinder has the effect of increasing the pressure in the recoil cylinder at the last part of recoil, accompanied by a stress in the metal which might become excessive.

104. If the volume of liquid falls below certain limits, the piston rods may be broken, putting the gun out of action. As far as the recuperator is concerned, an insufficient amount of air or of liquid reduces the pressure and does not completely return the howitzer into battery. The reference marks on the gun indicate the tolerances which may be allowed on the return into battery without causing difficulty. If the gun does not return to within the limits indicated by the reference marks the recuperator should be adjusted.

105. This test should be made in the presence of a commissioned officer, and all defects should be called to the attention of the commander of the mobile repair shop, who alone is authorized to dismount the recuperator and the recoil cylinder.

106. *Use of the volume indicator.*—

(*a*) First operation, rear face of the instrument (temperature side).

(*b*) Read from the gauge the pressure "p" before compression and measure or estimate accurately the atmospheric temperature "t" and move the index to coincide with the pressure "p" corresponding to the atmospheric temperature (fixed plate). The division of the plate which then comes opposite the index is the pressure in the recuperator reduced to a standard temperature of 59° Fahrenheit (15° centigrade).

(*c*) If this pressure lies between 29 and 31 kilograms per square centimeter there is no need of recharging the recuperator; otherwise, a compression is made. After compression, proceed with the following operations:

107. Second operation. Front face of the instrument (volume side).

(*a*) Place the central index to coincide with the pressure before compression as marked on the movable plate. Read on the gauge the pressure after compression of 19.68 inches (500 mm.). Turn the movable plate by means of the piece carrying the upper index until the central index coincides with the pressure after compression as marked on the fixed plate, and then read from the upper index the volume of liquid required or the amount in excess of the proper amount in the recuperator within an error of 0, 2.1 quarts (2 liters) more or less, or by interpolating between the two nearest divisions of the index read to within an error of 0, 1.05 quarts (1 liter) more or less.

108. Third operation. (Rear face of the instrument.) The liquid required having been supplied or the excess liquid having been drawn off, find the pressure "p" which at the atmospheric temperature "t" corresponds to the normal pressure of 30 kilograms per square centimeter at 59° Fahrenheit (15° Centigrade). To do this, place the upper index of the slide to correspond with the atmospheric temperature "t." Move the index (movable plate) to coincide with the pressure of 31 kilograms and read from the face of this index the desired pressure "p" on the fixed plate.

109. If the pressure in the recuperator is equal to "p," then the volume of liquid is correct and the recuperator

is properly charged; otherwise it is necessary to pump in air until the pressure "p" is reached.

NOTE.—The pressure inspection should not be made on material which has just undergone prolonged or rapid fire or which has been exposed to the heat of the sun for any length of time, because at such times the temperature of the mechanism is higher than that of the atmosphere and will cause error in calculating the air pressure.

110. *Preparation of the liquids for the recoil brake and for the recuperator of the 155 mm. howitzer matériel.*

RECOIL CYLINDER LIQUID.

Composition:	Per cent.
Neutral glycerine	50
Pure water	50

Boil this mixture, of specific gravity 21° Baumé at 59° Fahrenheit (15° Centigrade), (density 1.15), for 15 minutes.

111. *Recuperator liquid.*—

Composition:	Per cent.
Neutral glycerine	50
Pure water	50
Chemically pure commercial caustic soda (NaOH)	4

Do not boil.

NOTE.—The glycerine used in these two mixtures must be neutral. Test it with blue litmus paper which should not turn red on being immersed in the mixture. If it shows red, titrate with chemically pure commercial caustic soda (NaOH) and stir until the acid is neutralized and until blue litmus paper shows no red on being immersed.

112. The glycerine provided for making this equal part mixture is marked "25° Baumé."

113. If it is necessary to use a heavier glycerine, such as the commercial article marked Baumé 28 or 30, the amount of pure water should be increased. The usual mixture is marked 21° Baumé (density 1.15 to 1.16).

114. Use of the compression curves.

115. Read from the gage the pressure "p" before compression and measure or estimate accurately the atmospheric temperature "t."

116. Find on the chart the vertical line of pressure "p" (corresponding to the atmospheric temperature "t").

Locate the intersection of this line with the oblique line representing the temperature "t." From this point follow a horizontal line which gives the pressure reduced to standard conditions of 59° Fahrenheit (15° Centigrade).

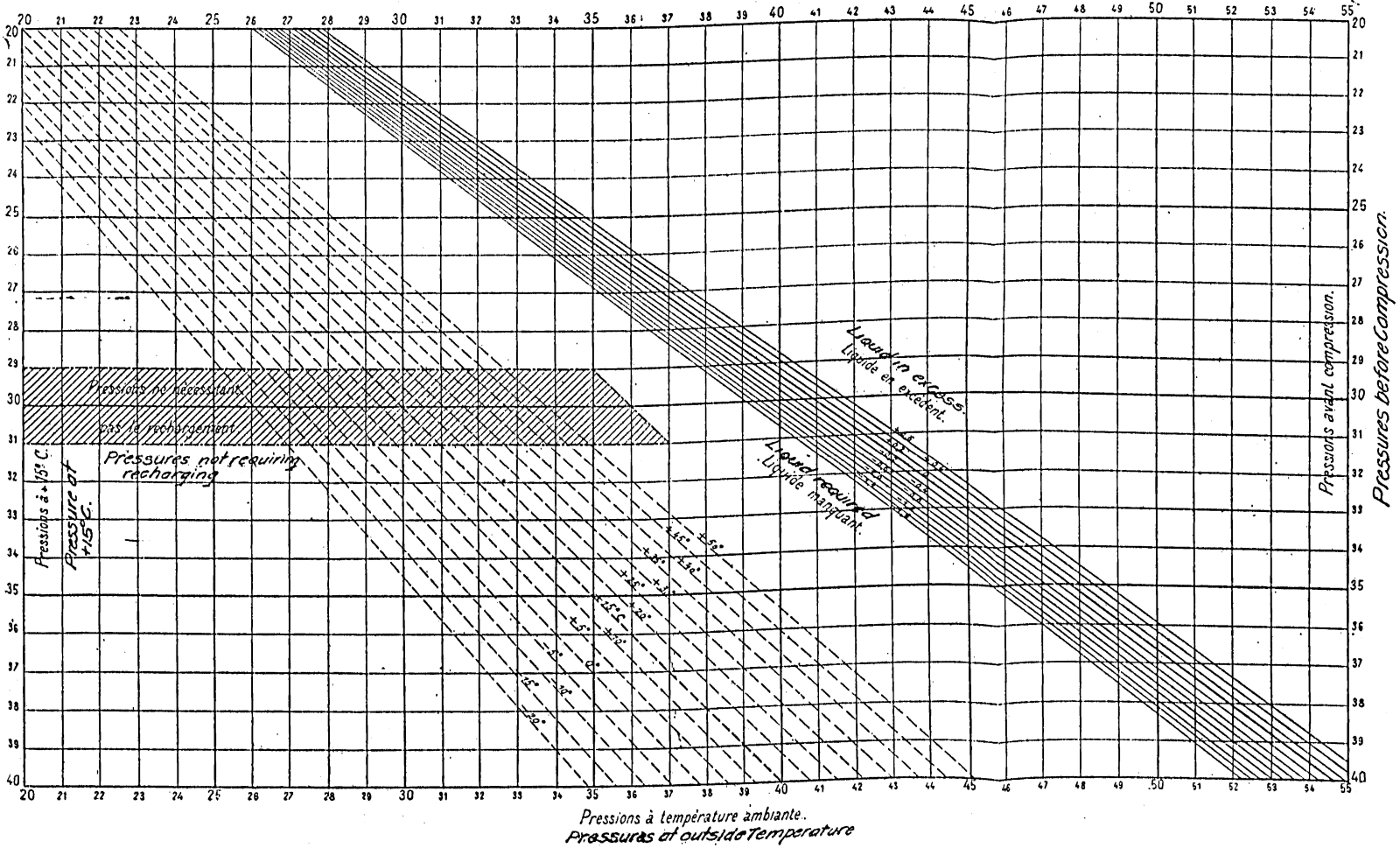
155MM (Schneider) - Howitzer Materiel - Model - 1915

Canon de 155 court M^le^ 1915.

Compression Curve

Graphique de compression.

NOTE:
PRESSURES IN THE DIAGRAM ARE GIVEN IN KILOGRAMS PER SQUARE CENTIMETER.



If the pressure lies between 29 and 31 kilograms per square centimeter there is no necessity for recharging the recuperator; otherwise, a compression is made. Read from the gage the pressure "P" after compression of 19.68 inches (500 mm.). Locate on the chart the oblique line of volumes of liquid nearest the intersection of the horizontal line of "p" and the vertical line of pressure "P." It is within an error of 0.2 liters, the volume of liquid required or in excess of the proper amount.

117. The liquid required having been supplied or the excess liquid having been drawn off, relocate on the chart the pressure "p" which at atmospheric temperature "t" corresponds to the normal pressure of 31 kilograms and a standard temperature of 59° Fahrenheit (15° Centigrade). To do this locate the intersection of the horizontal line corresponding to 31 kilograms and the oblique line corresponding to the atmospheric temperature "t," follow down the vertical line and read the pressure "p′" desired.

118. If the pressure in the recuperator is equal to "p′" when the volume of liquid has been corrected, the recuperator has been properly charged, unless it is necessary to pump in air until the pressure "p′" is reached.

NOTE.—The pressure inspection should not be made on material which has just undergone prolonged or rapid fire, nor which has been exposed to the heat of the sun for any length of time, because at such times the temperature of the mechanism is higher than that of the atmosphere and will cause error in calculating the air pressure.

ARTICLE II.

FURTHER DISMOUNTING OF PARTS.

119. *Dismounting the cradle traveling lock* (fig. 1).—The howitzer being in battery, remove the pin and unscrew the thread stop. Remove the bolt.

120. *To dismount the firing shaft* (fig. 8).—Remove the pin in the front end of the firing shaft. Unscrew the nut. Raise the pin, brake, and the shaft of the large pulley, and then remove the firing pin shaft and spring.

121. *To dismount the hammer* (fig. 8).—Unscrew the nut which holds the left end of the hammer shaft, remove the cam of the breech safety latch, then remove the shaft and the hammer.

122. *To dismount the pointing lever.*—Remove the hinge pin and washer and pull out the lever.

ARTICLE III.

CLEANING AND OILING THE MATÉRIEL.

123. The cleaning and oiling of the apparatus follows the same procedure as for the daily inspection heretofore prescribed and should be carried out thoroughly.

LOCATION OF THE OIL HOLES.

124. The oil holes of the carriage are numbered from 1 to 27.

No. 1. Pointing lever hinge pin.

Nos. 2 and 3. Cradle traveling lock bearings.

Nos. 4 and 5. Chassis traveling lock bearings.

Nos. 6 to 8. Bearings of the safety-firing-device shaft (right).

Nos. 9 to 12. Traversing mechanism case (right and left).

No. 13. Traversing worm. Center of the axle.

Nos. 14 and 15. Traversing roller boxes (right and left).

Nos. 16 and 17. Trunnion bearings (right and left).

Nos. 18 to 21. Chassis slides (right and left).

Nos. 21 to 25. Road brake (right and left).

Nos. 26 to 28. Elevating mechanism (right and left).

ARTICLE IV.

DETAILED INSPECTION OF THE MATÉRIEL.

HOWITZER.

125. First inspect the general operation of the breech (figs. 5, 6, 7), firing mechanism (fig. 8), and of the safety devices.

126. Dismount the breech, ejector, projectile retaining lock, and the loading tray. Examine each of the dismounted articles very carefully.

127. Also inspect the breechblock, the condition of the chamber, and of the bore of the howitzer (fig. 2); then assemble the parts. See that the bore is not "coppered." ("Coppering" will take place less rapidly if care is taken to carefully grease the projectiles around and slightly in front of the rotating band.)

128. Minor defects discovered by this inspection, if they do not interfere with the operation of the parts, do not necessitate the attention of the Ordnance Department.

129. Examine the slides by putting the howitzer in battery and in traveling position successively.

130. Examine the bearings.

131. Examine elevating mechanism.

132. See if the chain for locking the carriage to the limber is in good condition.

133. Inspect the road brake (fig. 9) and see if the shoes grip properly.

134. Inspect the shield (fig. 1). See that it is tightly fastened and the bolts are not loose and that the pins are in place.

135. See that the rammers and sponge are in good condition and tightly held in their supports. (Fig. 1.)

136. Operate the traversing (figs. 9, 10) and elevating mechanisms (fig. 11) through their full movement to see that there is no stiffness. See that the handwheels are not loose; that the handwheel grips turn freely on their spindles. See that the exposed portions of the axle are in good condition.

137. Examine the sight brackets. (Fig. 9.) See that they are well cleaned and that the rubbing surfaces are carefully oiled; that the drum works easily and that the drum brake works properly. (Fig. 14.)

138. See that the wheel latch thongs are in place and that no wheel bolts are loose.

139. See that the recoil cylinder and the recuperator (fig. 13) are properly assembled as prescribed above.

140. See that the wheels are in good condition and that the axle bearings are well greased. See that the inner and outer washers have at least one leather packing; that the linch pins are in good condition and bear properly on the hubs.

141. Inspect the operation of the optical instruments of the battery. Clean the faces of the lenses by breathing on them and drying them immediately with a perfectly clean cloth or piece of chamois.

142. Examine the exterior ironwork, neck yoke, draft springs, and pole prop. Separate the limber (fig. 3) from the carriage, remove the pole and substitute the spare pole. Inspect the oiling. Examine the pole joint and see that the bolts are tight. Remove the spare trace covers, withdraw the traces.

143. See that the trace covers, traces and trace-supporting straps are complete and in good condition.

144. Make an inspection of the wheels similar to that prescribed in article No. 85.

CAISSON.

145. See that the brake lever works properly and without stiffness; that the brake shoes bear properly on the wheels; that when the brake is completely loosened the brake shoes are approximately 2 inches (5 centimeters) distant from the tires, and that when the brake is set, they apply equally against the tires, there being a space of 0.78 inch (2 centimeters) or more between the shoulder of the operating screw and the brake shoe support.

146. Open and close the chest and examine the fastenings and levers.

147. Examine the door and the loading shelf hinges for looseness. Strike the shelf and see that the rear pins fall easily into their sockets. See that the stop chains of the doors have not become stretched. Examine the cartridge tray and the turnbuckles.

148. Raise the cover and examine the guides. See that the perforated collar plate fits freely in its two positions.

149. See that the unpainted portions are well oiled and that the bottoms of the oil cups and holes are clean.

150. Open the trail chest and examine the hinges and turnbuckles for looseness.

151. Inspect the ironwork. See that the loading hooks are in place and that they are not deformed.

152. Examine the pole prop.

153. Examine the security of the fastenings and the contents of the box for nails, spare bolts, etc., and of the fuze-setter compartment.

154. Examine the neck yoke.

155. Examine the rivets and shield plates.

156. Examine the wheels as prescribed in Art. 85.

157. See that the fuse setter is in good condition. Draw out the cutter head. Examine the rear spring stop and the cutter.

158. See that the punch accurately follows the cylinder carrying the range graduations.

159. Operate the corrector and work the lever as for fuse setting. See that the interior spring of this lever returns it properly.

160. When putting the fuse setter in place, see that a spare cutter is provided in the case and see that the cover locking spring is in good condition.

CAISSON LIMBER.

161. Make the same inspection as for the howitzer limber.

162. In particular open and close the cover and examine the condition of the limber-chest fastenings, bolts, turnbuckles; test the play in the hinges and in the cover slot. Make sure that the hinge pins are not loose.

163. Make sure that the cartridge-case tray is in good condition.

164. Make sure that the side-rail cases have not suffered injury and that their covers are in good condition.

165. See that the hampers are in good condition; that the pins rise and fall into place; that the spring works properly, and that the pins are held by the chains.

166. The detailed inspection given provides material for a complete return furnished to the commander of the unit in which are noted the operating defects discovered and the losses and damages revealed by the inspection. In cases of loss or damage the following measures are taken:

(*a*) In case of damage due to poor maintenance—proceed in the field to clean the damaged parts. If the authorized procedure is not sufficient to remedy the difficulty, proceed according to the third article given below.

(*b*) If the damaged or lost article can be replaced by the methods authorized—if there is a spare part in the equipment of the wagon, put it on. Make out a requisition on the mobile shop for the spare part required. By presentation of this requisition and the damaged article, or a survey report covering the damage, a spare part in good condition to be placed in the spare-part compartment of the carriage receiving it will be issued.

(*c*) If the spare part required is not included in the battery-wagon equipment, make out a requisition for the part required in exchange for the damaged part or a survey report.

167. If the remedy can not be effected by an authorized method, a report is immediately made out and signed by the commander of the unit and transmitted through military channels. If the mobile shop with the ordnance department equipment can not make the repairs necessary, the report is transmitted to the headquarters for this material, from which orders are issued to cover the measures necessary to replace the parts. It is important that in the case of slight damages that the part be submitted for examination by the mobile shop, without delay. By so doing it is often possible to eliminate serious damages and long and difficult repairs.

ARTICLE V.

ADJUSTMENT OF THE LINE OF SIGHT.

168. The correction of the line of sight is of the greatest importance, because the accuracy of the gun depends entirely upon the proper relation of the sights.

169. A defective assembly, accidental damage, or especially lack of proper care can disarrange the adjustment, with the result that the guns of the battery will not only not be uniform among themselves, but the individual gun itself will not be reliable nor able to fire in the direction for which it is laid.

170. This correction does not in itself present any great difficulty, but the operation must be executed with the utmost care and precision.

171. The gunners should be proficient in the operation of adjusting the sights, but this adjustment is always made in the presence of a commissioned officer.

172. By construction the axis of the gun established by the line joining the firing-pin hole when the breech is closed, and cross threads placed on the muzzle according to the manner indicated hereafter, should be parallel to the face of the pointing level.

173. Verification of the parallelism of the lines of sight and the axis of the bore.

(*a*) See that the optical axis of the telescope is parallel to the axis of the gun when the elevation is zero and the deflection is at 1,000, the bubble of the cross level being between its centering marks.

(*b*) See that the angle of site level gives exactly the angle of the gun with the horizontal when the range is zero.

(*c*) That the parallelism which exists between the axis of the gun and the optical axis of the telescope for a given angle applies equally well for all angles of site.

174. *Elevation.*—The piece having been placed in a horizontal position by the aid of a testing level, placed on the leveling plate, the elevation being zero and the angle of site being zero, the bubble of the angle of site level should be found between its centering marks.

175. If this is not the case, very carefully place the angle of site level bubble between its reference marks by means of the graduated angle of site drum. Then after seeing that the testing level is horizontal, unscrew (with wrench E. B. No. 8) the locking screw plug on the drum of the angle of site mechanism, loosen the drum, and make the reference mark coincide with the zero division of the graduation.

NOTE.—This operation, when it becomes necessary to unscrew the two pointing screws, can not be undertaken by the battery, except in rare cases, and should be left to the mobile shop. It is generally sufficient to measure this deviation and make allowance for it.

176. Tighten the drum.

177. *Direction.*—A target is placed about 54.68 yards (50 meters) from the muzzle of the howitzer, in a vertical position perpendicular to the line of sight, at such a height that the point "bore" is at the same height as the axis of the bore of the gun. The verticality of the target is assured by a plumb line.

178. The carriage is placed with the wheels and trail resting upon solid supports of wood or stone, the surfaces of which have been carefully leveled so as to bring the axle axis horizontal. Now direct the gun so that the prolongation of the axis of the bore, as determined by the bore sights, pierces the target at the proper point; the lines of sight of the open and panormaic sights are then adjusted in direction until they pierce the targets in the points marked, respectively, "open" and "panoramic."

179. The axis of the bore is determined and prolonged by means of bore sights. In the absence of such means,

a breech-bore sight may be made from an empty cartridge case from which the primer has been removed; a piece of paper should be pasted over the primer seat and a pinhole made in its exact center to serve as a peep sight. If the cartridge case does not completely fill the bore, it should be shimmed all around with tissue paper until it does so. For a muzzle-bore sight, use should be made of the traces of the horizontal and vertical planes containing the axis of the bore, which are marked on the muzzle of the gun. Fine threads or hairs stretched across the muzzle to coincide with these lines form a good bore sight, and the ends of such threads may be conveniently fastened to a cloth strap buckled around the muzzle of the gun.

180. In the field, where from lack of time or proper facilities the method just given can not be followed, the adjustment of the sights may be verified by bringing the lines of sight at zero elevation and deflection to bear upon some sharply defined point of a distant object. At such a range (for instance, 2,000 yards or more) the parallax may be neglected, and if the sights are correctly adjusted the lines of sight and the prolongation of the axis of the bore will sensibly pass through the selected aiming point.

181. After the sights and range quadrant are adjusted, they should be subjected to the following tests to insure their accuracy at extremes of elevation and azimuth:

(*a*) With the carriage level and gun and sights at zero elevation and deflection, the lines of sight and axis of bore prolonged pierce the target in the proper points.

(*b*) The gun is then moved to its maximum elevation; as the sight elevation is altered, the lines of sight should follow the vertical lines through the same points of the target.

(*c*) With conditions as in (*a*), the gun is moved upon the carriage to its extreme positions in azimuth; as the sight deflections are now altered, the lines of sight should follow the horizontal lines through the same points on the target.

(*d*) With conditions as in (*a*), the range-quadrant disk registers 0. As the gun is elevated and the sight elevation changed to bring the line of sight to bear upon the proper point of the target, the readings of the range disk, quadrant leveled, should agree at all ranges with those of the elevation scale of the sight.

182. By construction and assemblage the sights, if correctly adjusted, should fulfill the above conditions with substantial accuracy. If error be noted, a report of the facts of the case, with cause, if known, should be made to the ordnance officer charged with the repair of the matériel for his information and action.

ARTICLE VI.

SUGGESTIONS FOR CARE AND MAINTENANCE OF MATÉRIEL.

183. Various suggestions in reference to the care of this matériel and hints regarding things to be done or to be avoided are here condensed for convenient reference. Careful compliance with these suggestions will avoid delay and possible injury to personnel or matériel.

184. The breechblock should not be opened for at least one minute after a misfire.

185. All work upon recoil cylinders, sights, and other optical equipment should be done in the presence of a commissioned officer.

186. See that proper kind of oil is used for lubrication.

187. Strain the oil through a fine clean cloth and be sure that the receptacles used in handling the oil are clean.

188. Take every precaution to keep the interior of the cylinders clean and to prevent the entrance of foreign particles.

189. Lash parts with copper wire to prevent unscrewing.

190. Before firing, inspect to insure that cylinders are properly closed.

191. If time permits, oil slides before firing.

192. Note length of recoil for first few shots to insure that the recoil mechanism is working properly.

193. Lock the cradle to the trail at drill and in traveling to avoid unnecessary strain upon the pointing mechanism.

194. After unlimbering, release elevating and traversing lock before attempting to elevate or traverse gun.

195. Keep the hub bolts and hub bands properly tightened.

196. Replace and properly open all split pins after replacing nuts.

197. In moving the gun on or off the cradle, provide ample support for the breech end, so that the gun clips are

in prolongation of the cradle guides; if this is not done, the cradle guides may be ruined.

198. If the gun will not remain at the elevation at which set, the crank shafts are probably not correctly assembled.

199. If the elevating screws do not house in traveling, they are incorrectly assembled.

200. Do not strike any metal part directly with a hammer; interpose a buffer of wood or copper.

201. Frequently verify the adjustment of sights and quadrant.

202. Require special care in handling sights.

203. Do not permit cannoneers to use front sight as a handle in mounting.

204. Be sure that the methods of aiming are correct for the particular type of ammunition used by the battery.

205. Do not unnecessarily expose ammunition to the sun or load it into a warm gun before time for firing; if this is done erratic shooting may result.

206. Battery commanders should frequently make a detailed inspection of all of the vehicles in the battery, to see if any parts of them are broken, and any nuts, screws, split pins, etc., are missing. If any such defects are found he should immediately take steps to replace broken or missing parts. This is of the utmost importance, and compliance with these instructions will do much toward prolonging the life of the vehicles.

207. It has been found that the apron hinges occasionally become broken, and that the apron-hinge pins are frequently lost. Whenever this happens the hinges or hinge pins should be immediately replaced, for if this is not done the apron is apt to become cracked or broken.

208. Whenever the lunettes become loosened the lunette nuts should at once be tightened up.

209. All wheels and bearings should be frequently oiled.

210. All working and bearing surfaces of the carriage require oiling; those not directly accessible for this purpose are provided with oil holes.

211. See that no fuzes are punched before ready to be used.

212. In all requisitions and correspondence the correct name of the part referred to (if known) should be given. If the name of the part is not known submit a sketch

showing the location, shape, matériel, etc., sufficient to establish definitely the identity of the parts in question.

213. The use of the word "complete" in requisitions to signify a combination of parts sometimes leads to misunderstanding of the exact parts wanted. For example, if a piston rod is wanted, the order should state whether it is to be with or without the nut. If all details are itemized it will avoid mistakes and unnecessary expense.

ARTICLE VII.

SUGGESTIONS FOR LOADING BATTERY FOR TRANSPORTATION BY RAIL.

214. In loading a battery on cars during service operations it is very desirable to keep complete gun sections together as much as possible.

215. In loading the cars, if there is any permanent loading platform along the railroad tracks in the vicinity, the vehicles should be run on to these platforms and loaded from them. If there is no permanent platform in the vicinity, it will be necessary to build a temporary ramp. This should be built at the end of the cars. When loading vehicles from a permanent platform on the side of the cars, it may be necessary, if short cars are obtained, to remove the pole of the last limber placed on the car in order to get it on to the car. The pole should, however, be replaced in its socket as soon as the vehicle is placed in position.

216. When loading the cars, care must be exercised to load them so that there can be no movement of the vehicles on the cars longitudinally, transversely or vertically. All wheels, and trails of carriages, poles of limbers, lunettes of caissons and wagons must be secured to the bottom of the car. The vehicles are secured as follows:

217. 2 by 4 inch timbers nailed to the floor of the cars on both sides of all the wheels hold the wheels securely against transverse motion.

218. 2 by 4 inch chocks nailed to the 2 by 4 inch pieces which lie along the sides of the wheels hold the wheels against longitudinal motion on the cars.

219. 2 by 4 inch timbers, placed over the felloes, resting on the floor between the two lowest spokes and bolted

to the floor of the car with two ½-inch bolts, hold the wheels against vertical motion. The bolts should preferably be bolted through these braces on the outside of the wheels. If bolts for bolting these 2 by 4 inch cross pieces can not be obtained, the cross pieces should be nailed down with 7 or 8 inch spikes. The poles and lunettes should be secured to the floor by nailing one 2 by 4 inch block on both sides of each and one 2 by 4 inch piece across the top near the end of the poles or lunettes.

220. The trails should be secured to the floor by nailing 2 by 4 inch blocks as follows:

1 on each side of the trail.

1 at the end of the trail in prolongation of the axis, and 1 across the top near the end.

221. All of the lumber used on the cars is 2 by 4 inch stock.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, October 2, 1917.

FORM No. 1851.
Ed. Oct. 2-17—5,000.

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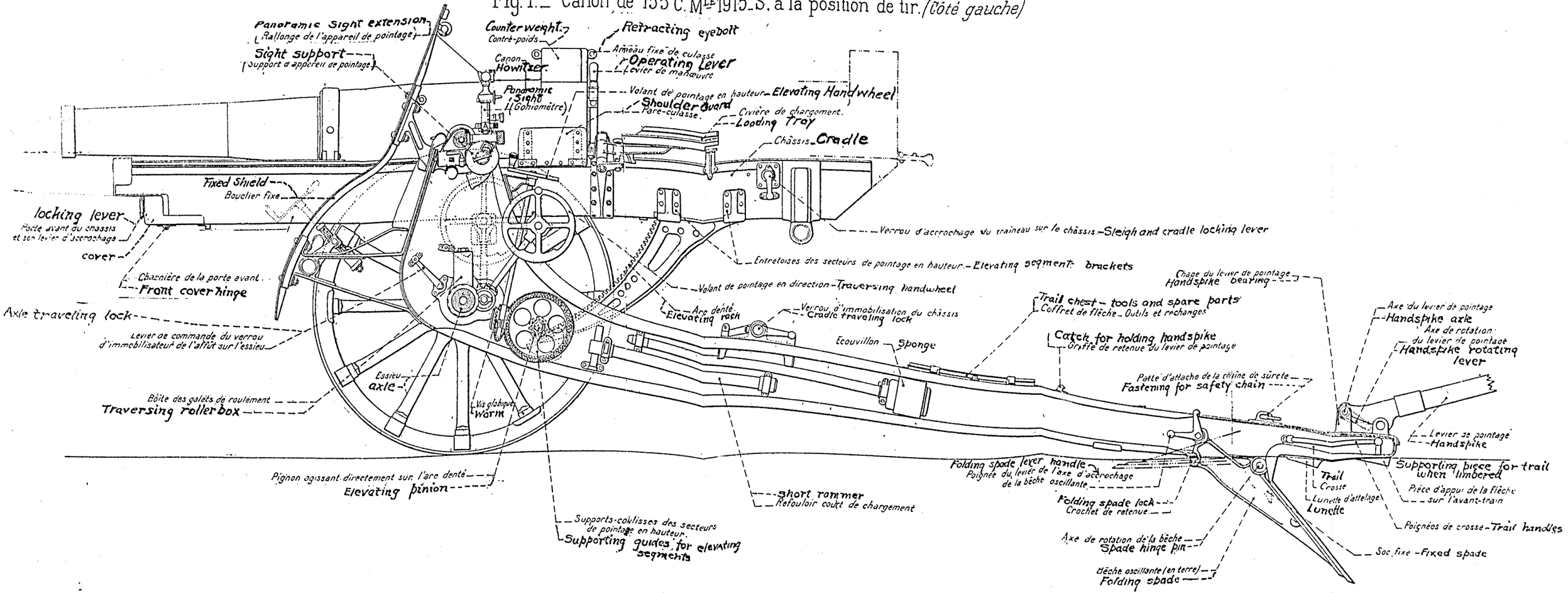
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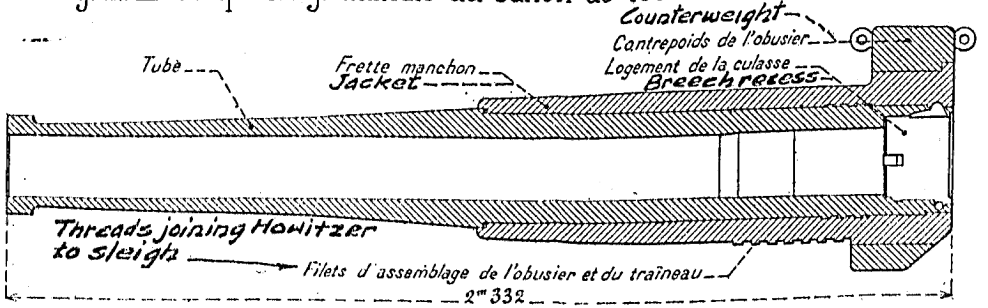
155 M.M. (Schneider) Howitzer Materiel. Model of 1915 — Firing position, left side.

Fig. 1.— Canon de 155 C. M^le 1915 S. à la position de tir. (Côté gauche)



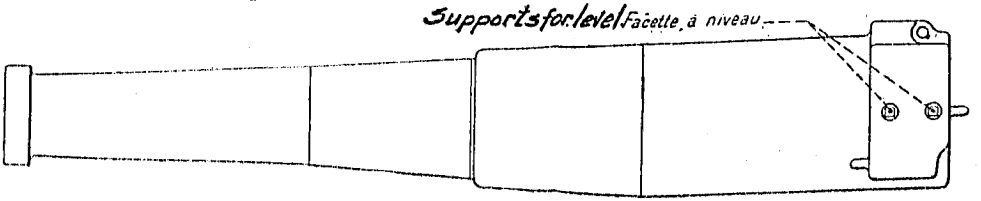
155 M.M. (Schneider) Howitzer Model of 1915 – Longitudinal Section

Fig. 2. – Coupe longitudinale du canon de 155 C. M^LE 1915 – S.



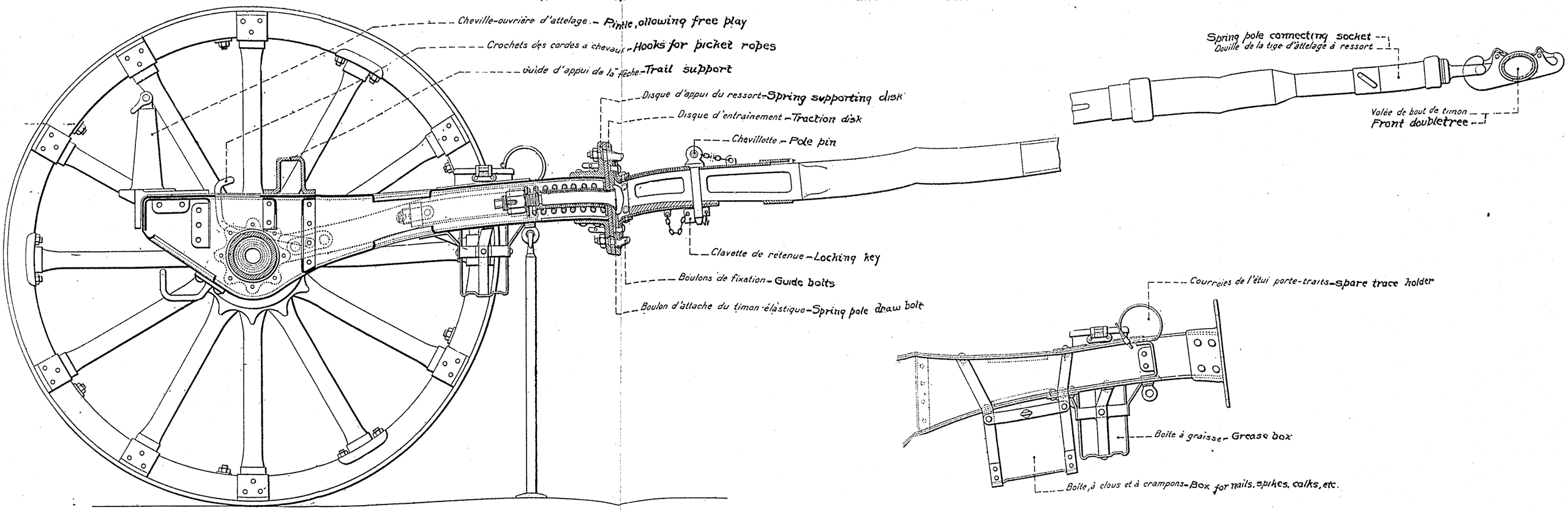
Plan View of 155 M.M. Howitzer. Mod. 1915.

Vue générale du canon de 155 C. M^LE 1915 – S



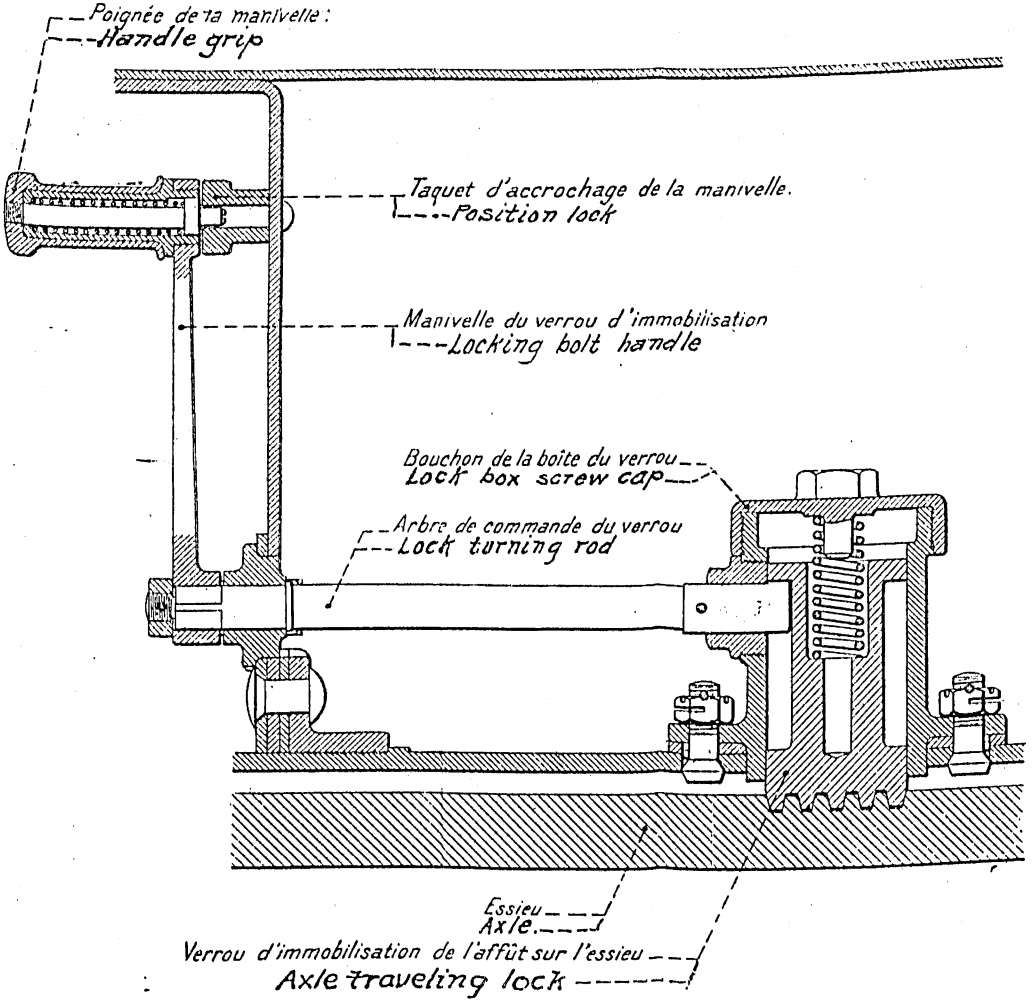
155 M.M. (Schneider) Howitzer Matériel Model of 1915 – Assembly of limber

Fig. 3. – Canon de 155 C. M^le 1915 S. – Ensemble de l'avant-train



'55 M.M.(Schneider) Howitzer Materiel, Model of 1915

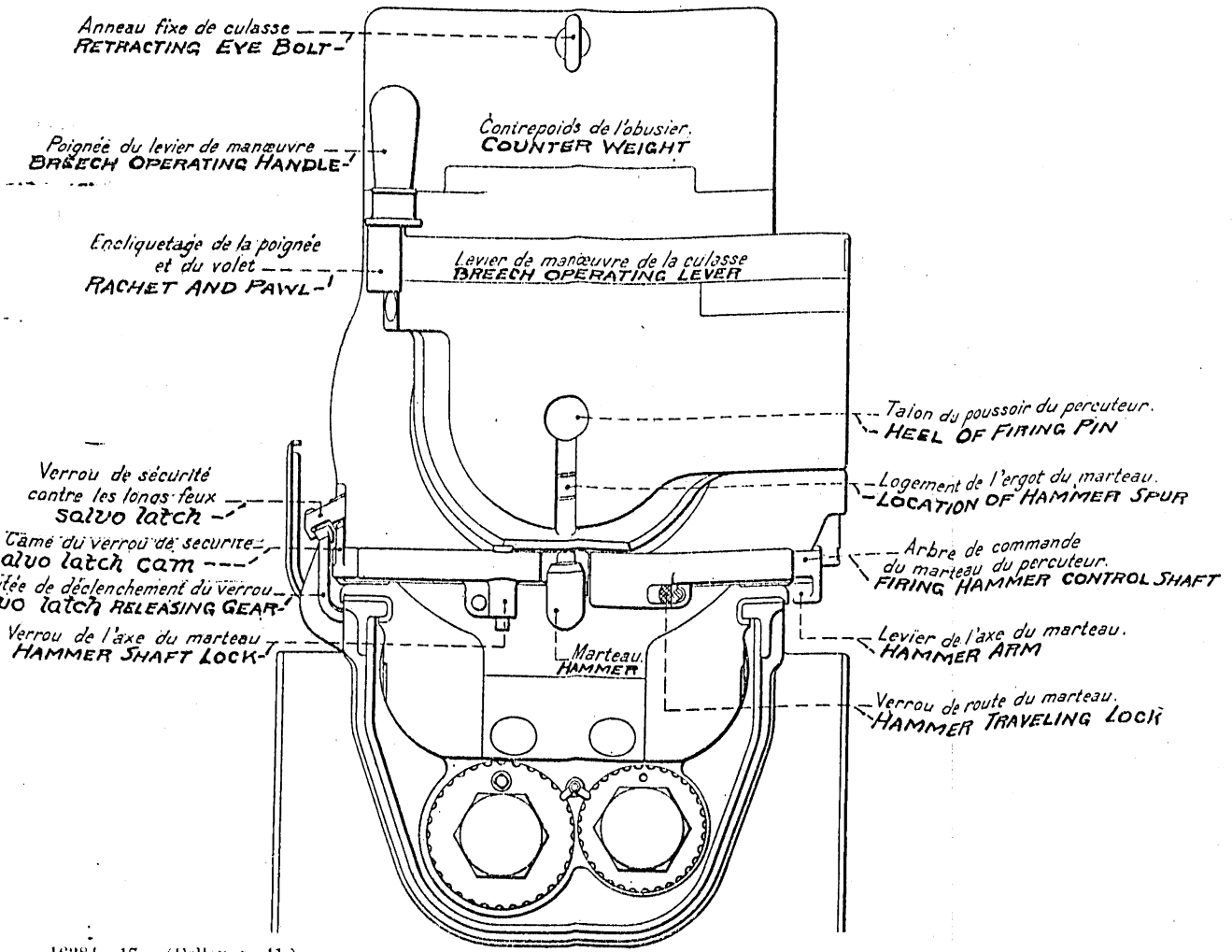
Fig. 4.— Coupe en plan du verrouillage de l'affût sur l'essieu à la route
Section of axle traveling lock



155 M.M. (Schneider) Howitzer Materiel, Model 1915

Fig. 5.— Elévation Ar de la culasse fermée

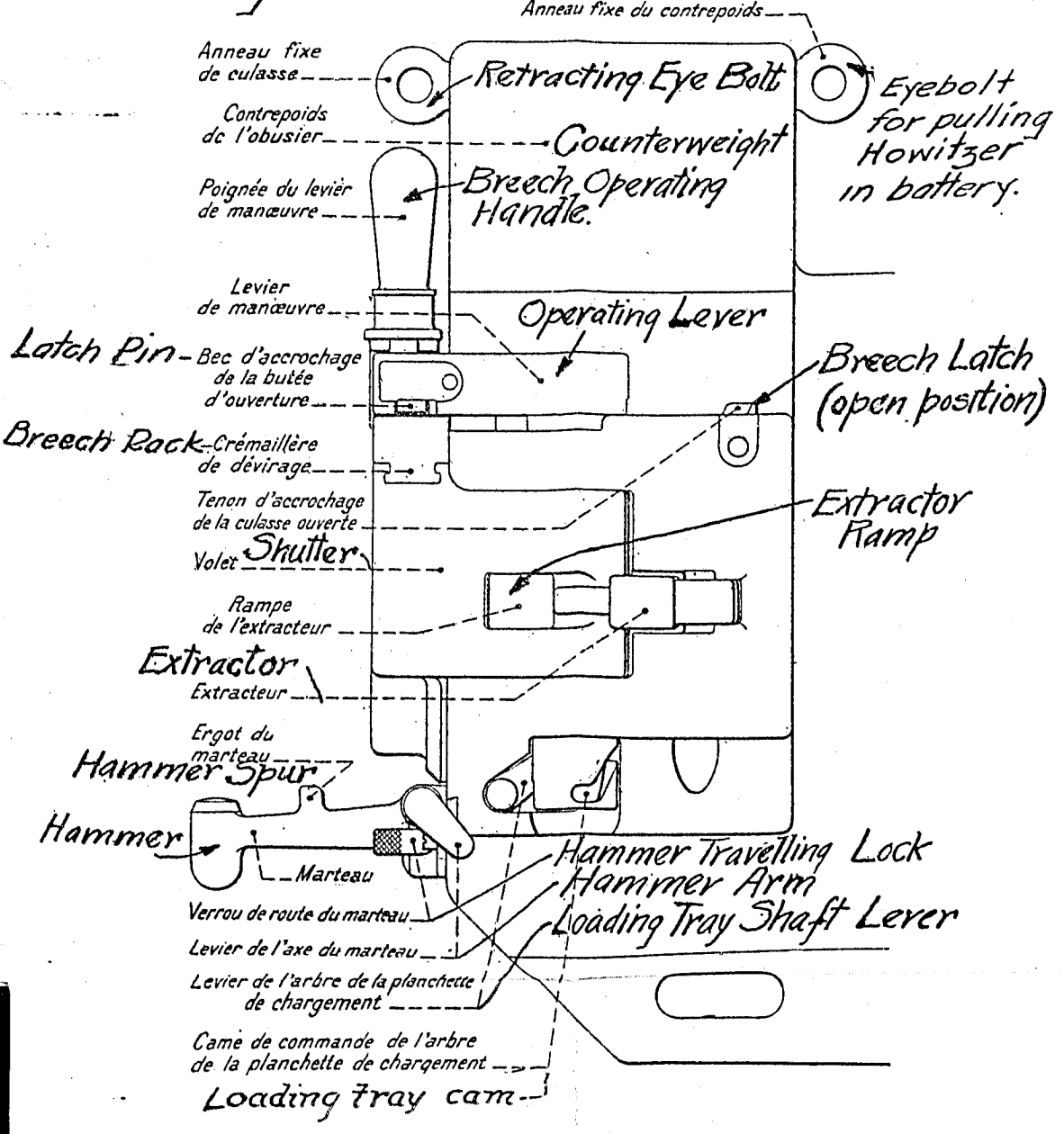
REAR ELEVATION - BREECH CLOSED



155 MM. (Schneider) Howitzer, Model of 1915

Fig. 6.—Elévation côté droit de la culasse fermée.

Right Side Elevation of Breech Closed.

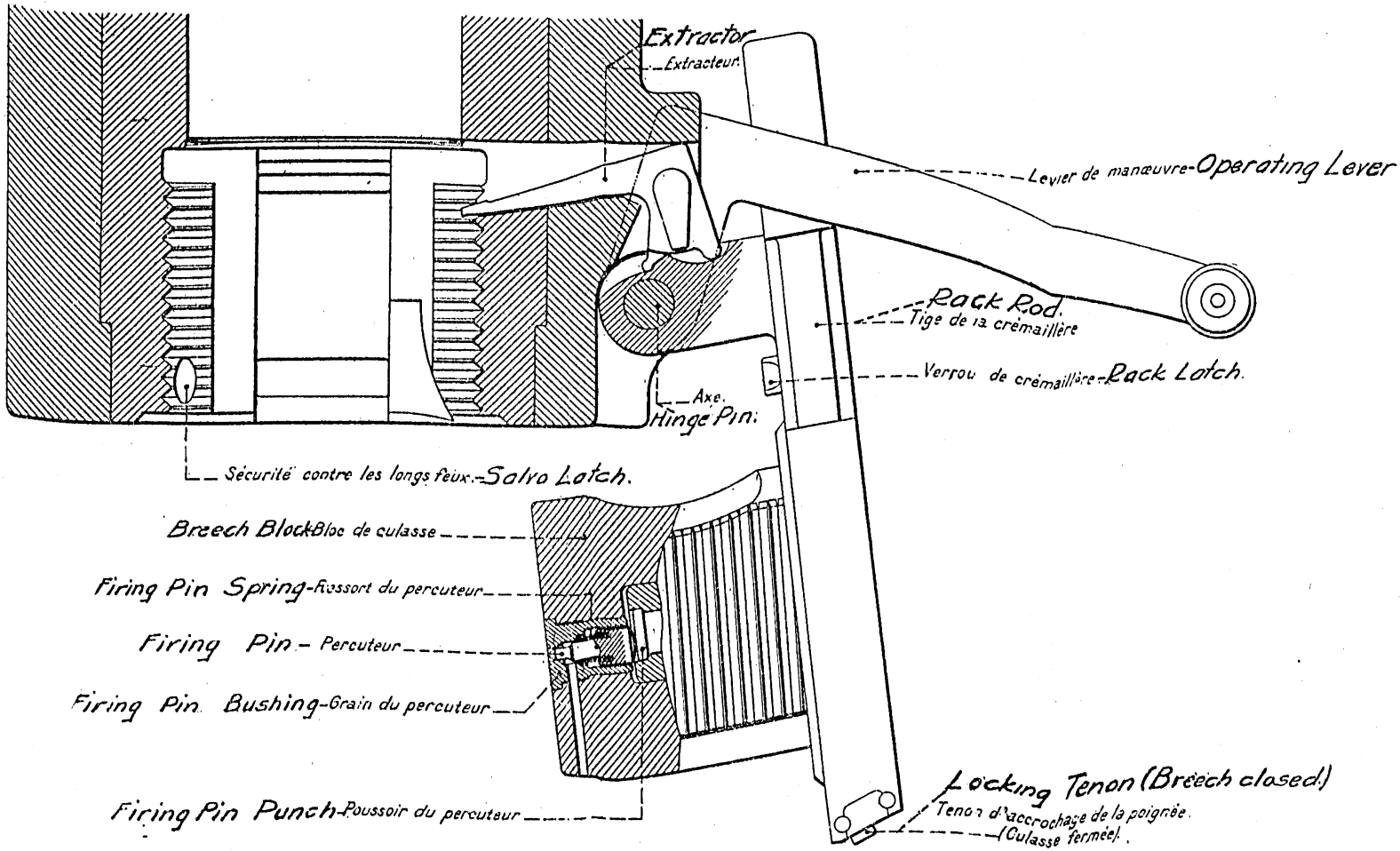


16284—17. (Follow p. 41.)

155 MM. (Schneider) Howitzer Model 1915.

Breech Open (Plan Section)

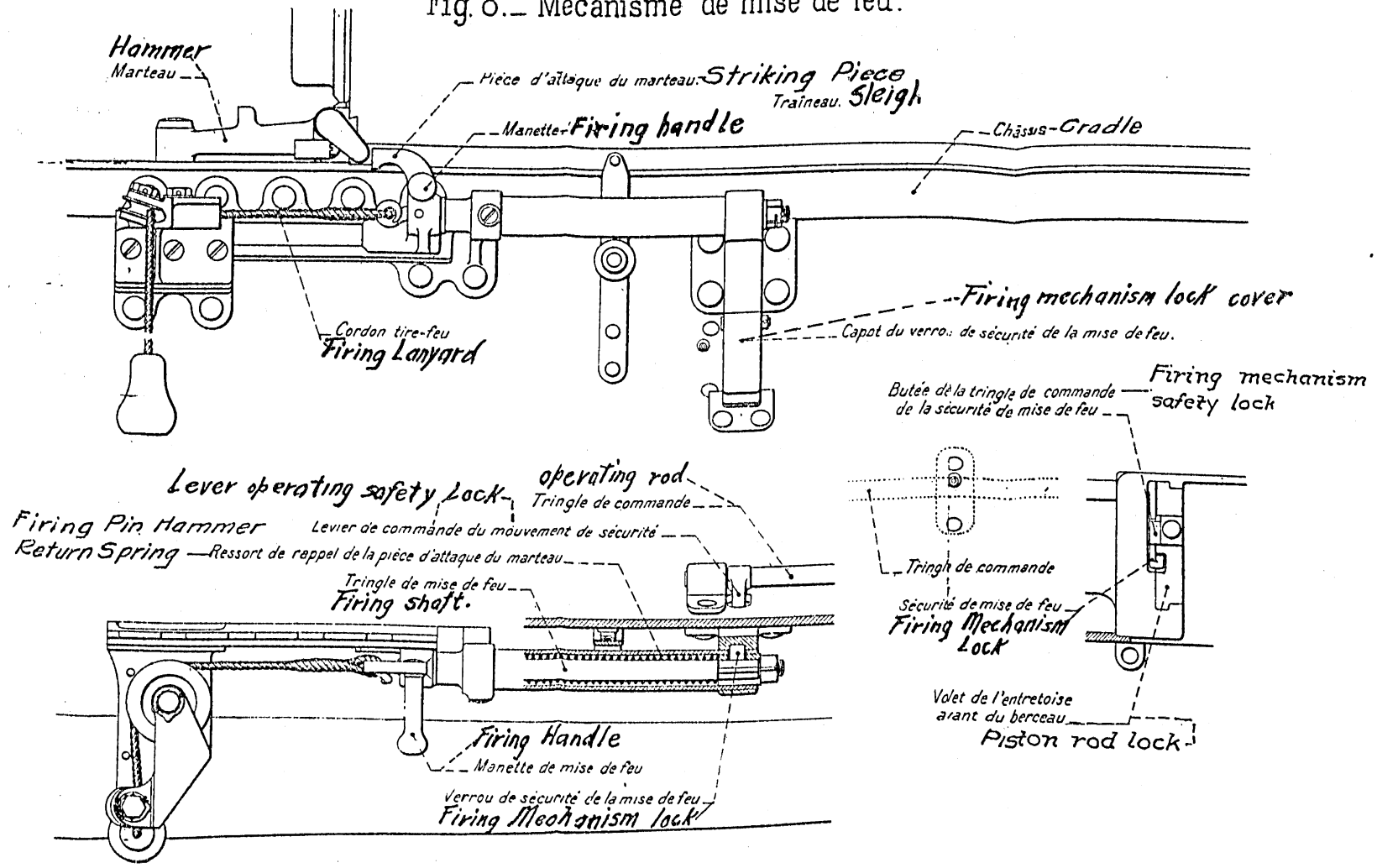
Fig. 7.— Culasse ouverte. (Coupe et plan).



155 MM. (Schneider) Howitzer Materiel Model 1915

Firing Mechanism

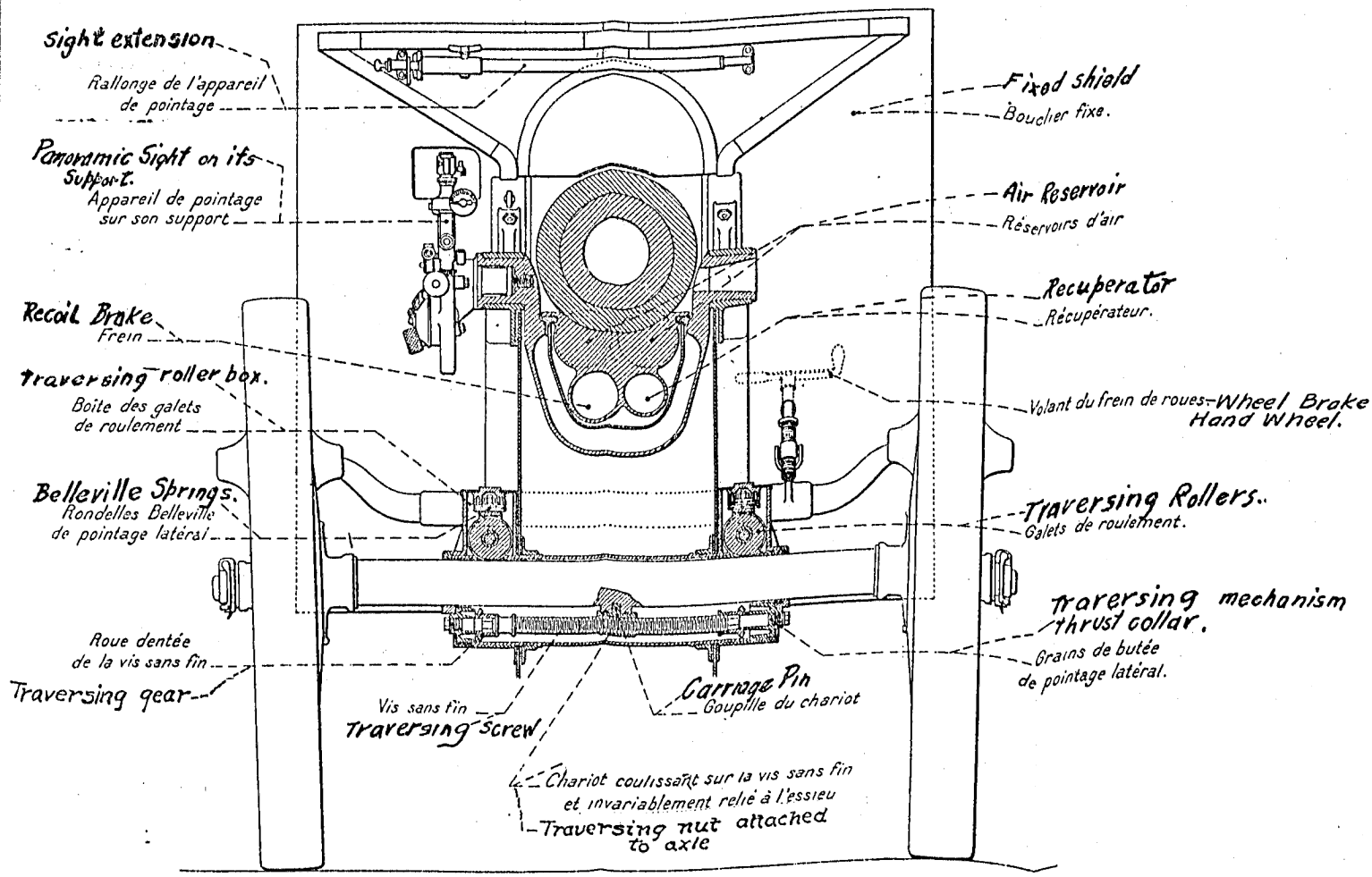
Fig. 8.— Mécanisme de mise de feu.



155 MM. (Schneider) Howitzer Materiel Model 1915

Fig. 9.— Coupe transversale de l'affût, montrant le mecanisme de pointage.

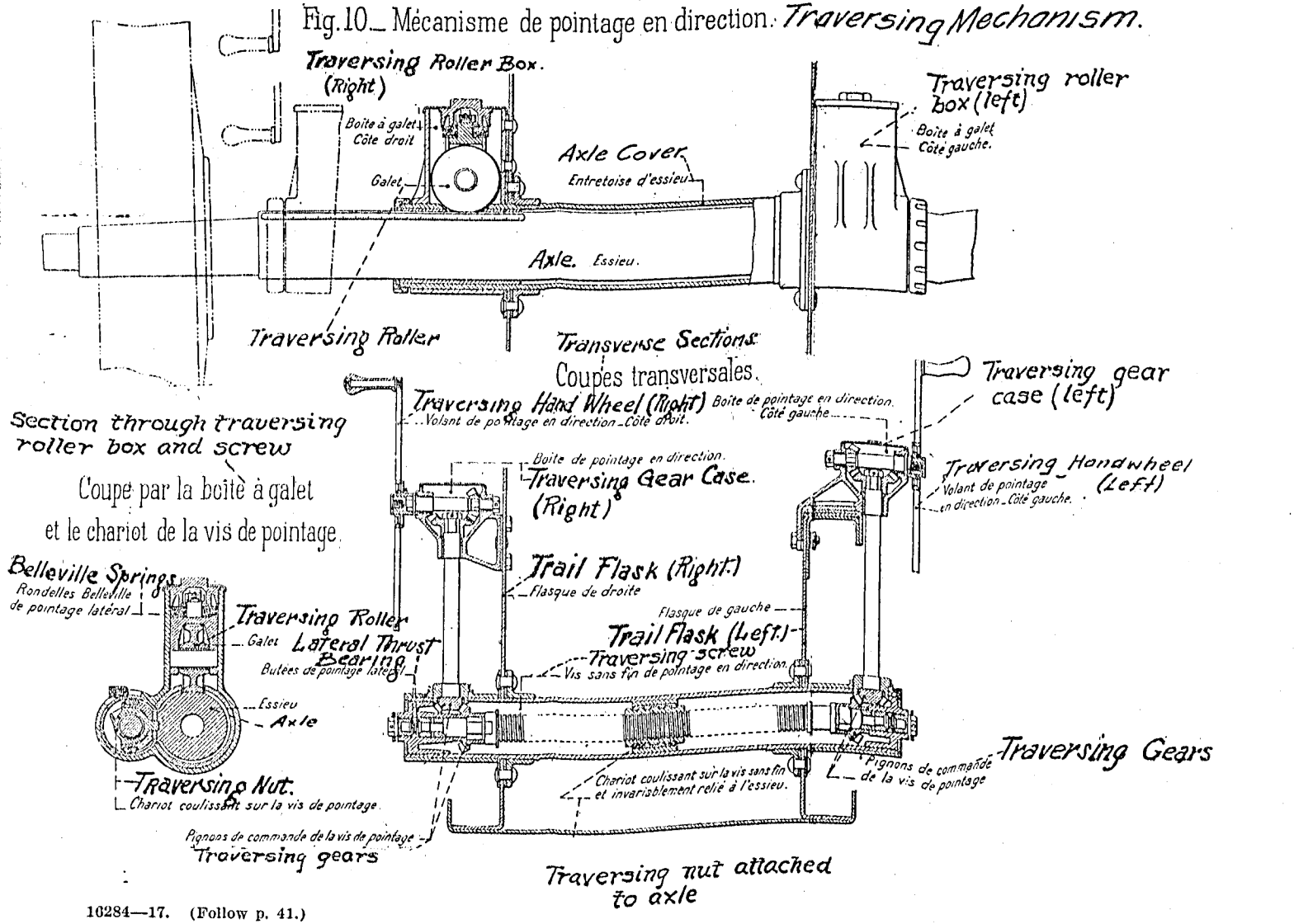
Transverse Section of Carriage showing Sighting Mechanism



16284—17. (Follow p. 41.)

155 MM (Schneider) Howitzer Materiel, Model 1915

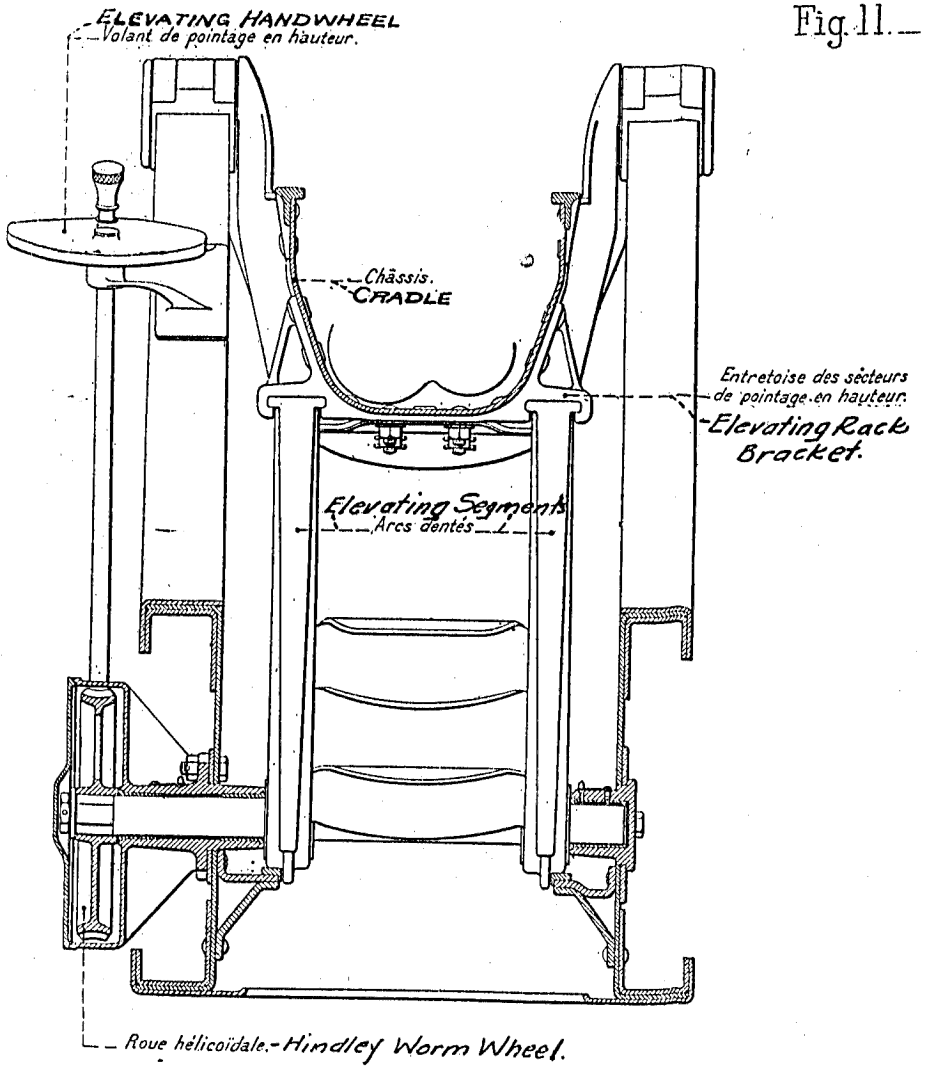
Fig. 10.—Mécanisme de pointage en direction. Traversing Mechanism.

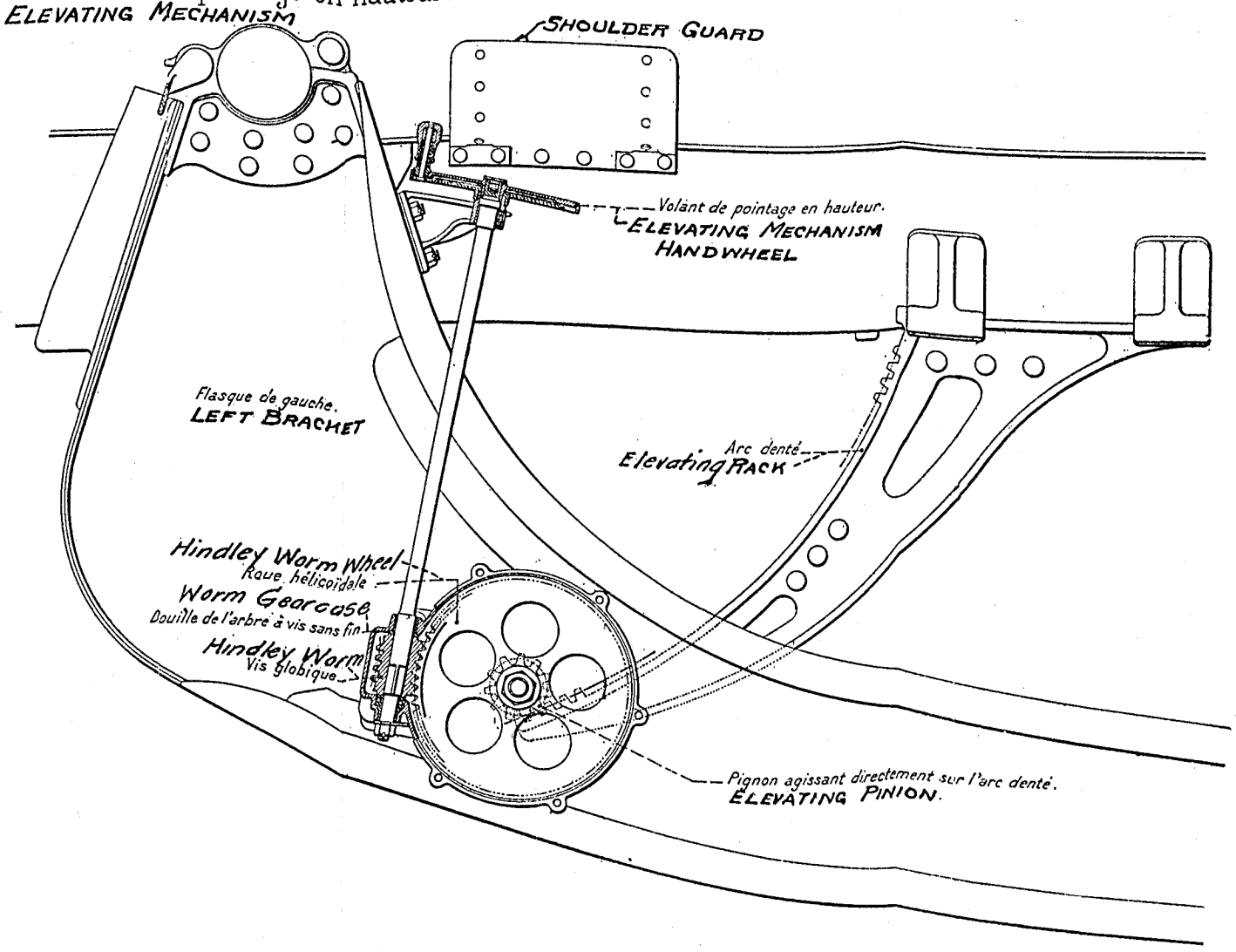


16284—17. (Follow p. 41.)

155MM(Schneider) Howitzer Materiel Model 1915

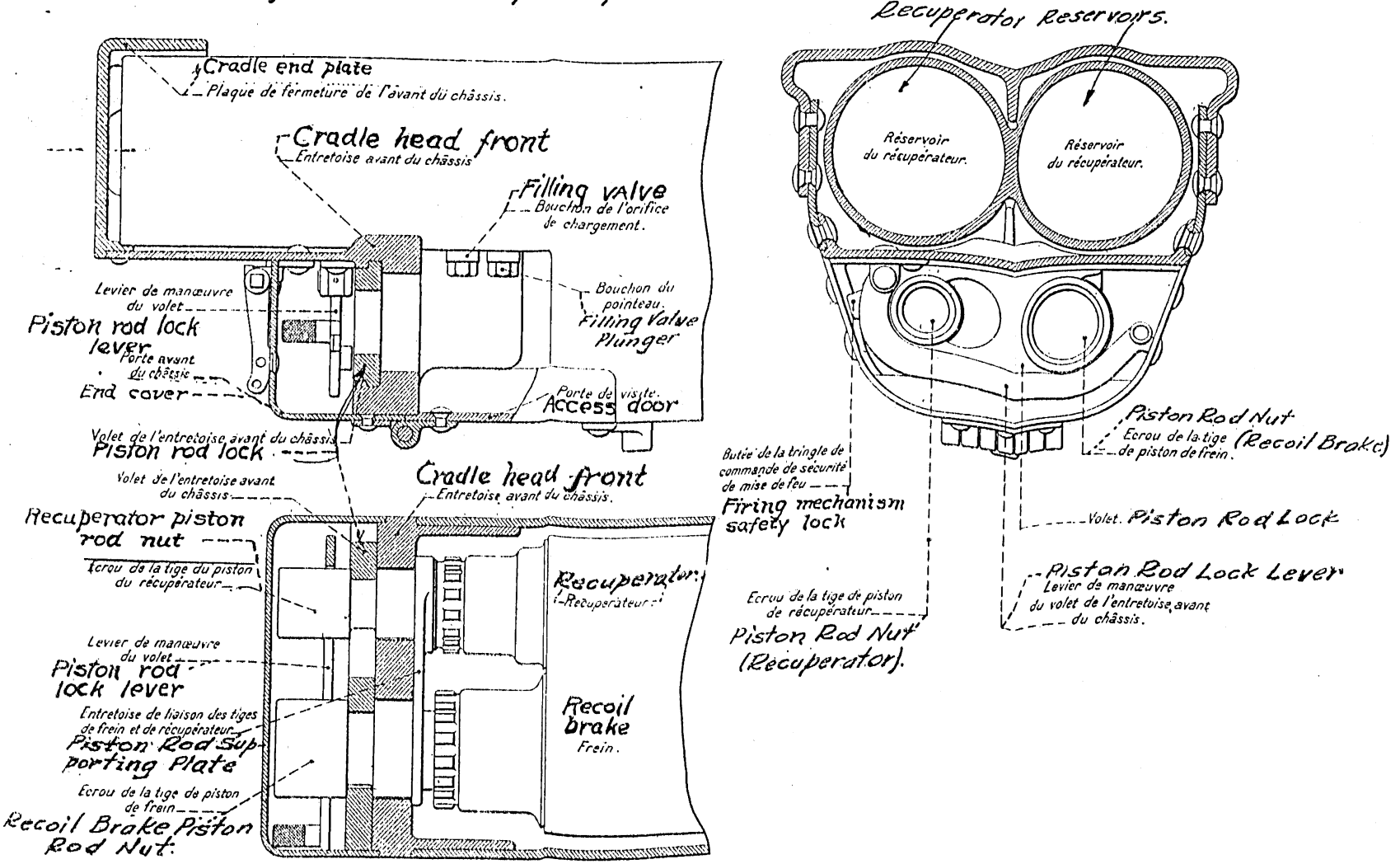
Fig. 11.— Mécanisme de pointage en hauteur.





155 MM. (Schneider) Howitzer Materiel - Model 1915

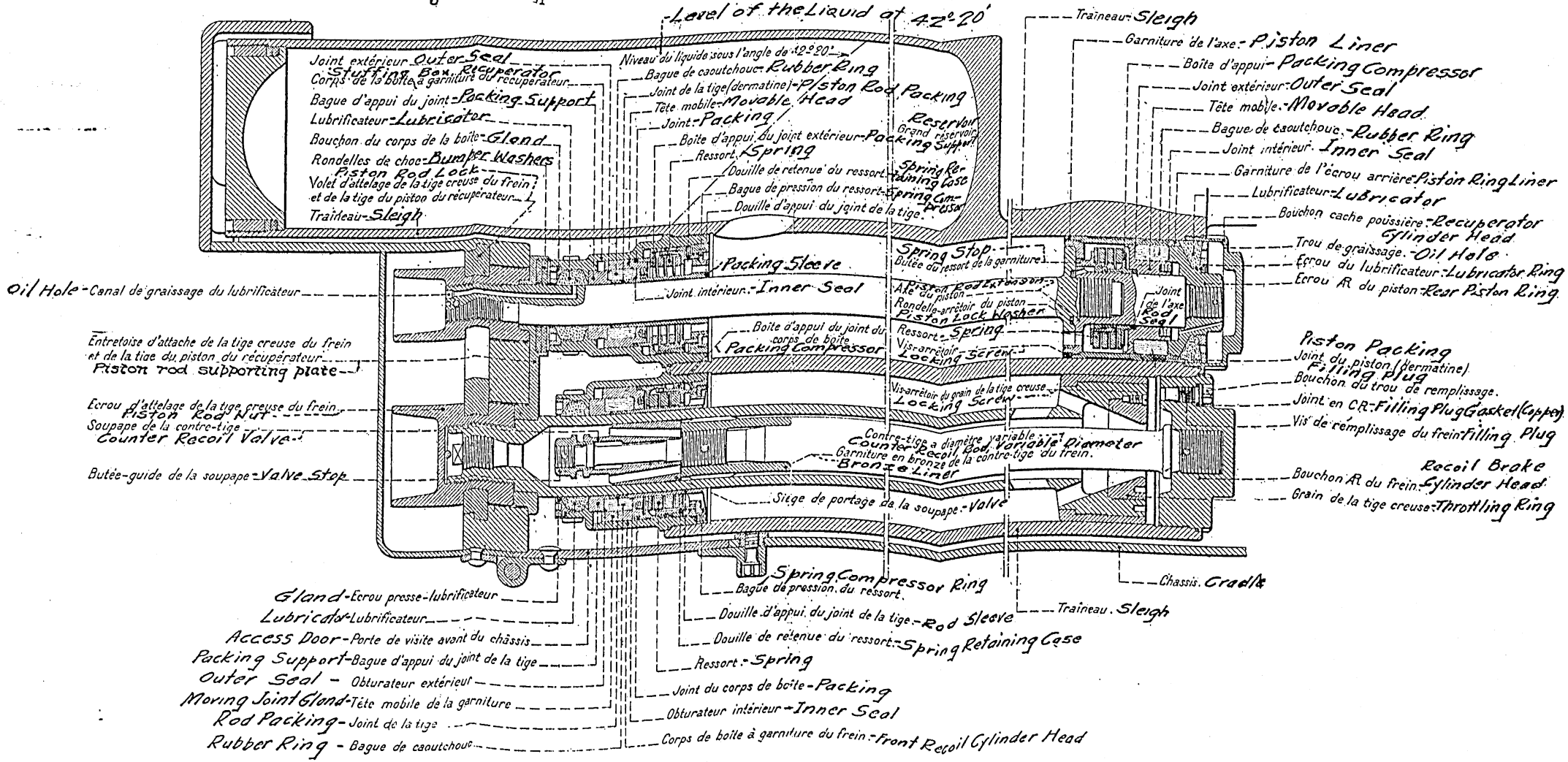
Fig 12. - Ensemble de la partie avant du châssis.
Assembly of the Front part of Cradle



16284—17. (Follow p. 41.)

155 MM (Schneider) Howitzer-Materiel - Model 1915
Longitudinal Section Through Recoil Brake and Recuperator.

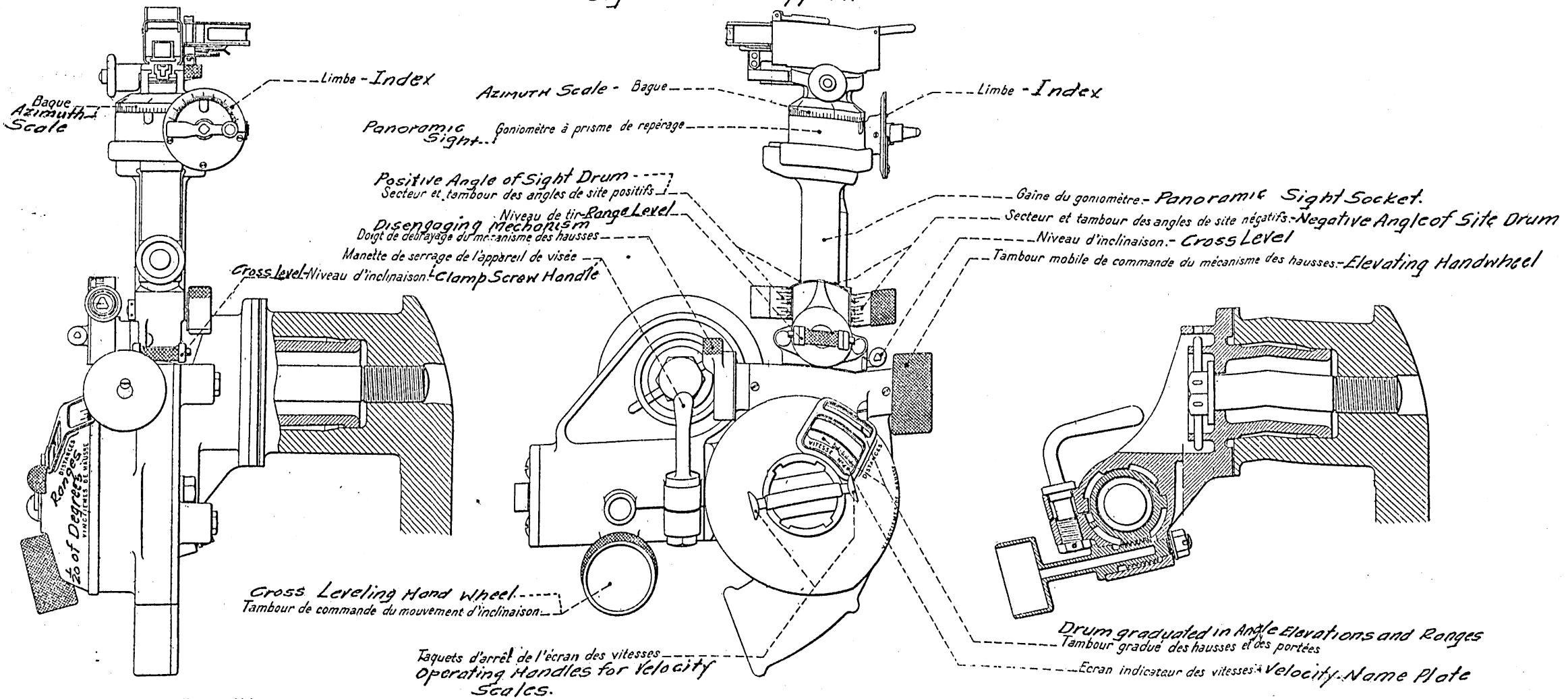
Fig. 13.— Coupe médiane et longitudinale du frein et du récupérateur



155 MM (Schneider)-Howitzer-Materiel-Model 1915

Fig. 14 _ Appareil de pointage et son support

Sight and its Support.



I.—ACCESSORIES AND SPARE PARTS CARRIED ON THE BATTERY VEHICLES.

II.—LIST OF SPARE PARTS.

Translated from the French of

"Annexe au Règlement Provisoire de Manœuvre de l'Artillerie de Campagne."

"Dispositions Spéciales aux Batteries Armées du Matériel de 155 Court Modèle 1915 S."

Approved by French War Department May 20, 1916.

I. *Accessories and spare parts*

Name of part.	Guns.	
	Carriage limbers.	Carriages.
1. Cast steel, 16 mm. square (630 mm. bar)	.....	.....
2. Matches (1 box)	.....	.....
3. Tinder (tinder wick)	.....	.....
4. Spare bulbs for electric pocket lamp	.....	.....
5. Shaft of cartridge case retainer	.....	1
6. Caisson prop, hook pin, with handle, washer, and pin	.....	.....
7. Spade latch shaft, complete	.....	.....
8. Spade shaft, complete	.....	.....
9. Caisson prop pin, with washer and pin	.....	.....
10. Lower pin of brake suspension rod (caisson)	.....	.....
11. Upper pin, with washer and split pin	.....	.....
12. Brake rod pin, with washer and split pin	.....	.....
13. Covers for pack carriers of 155 mm. howitzers, model of 1904, T. R	.....	.....
14. Oil can, with pump (large)	.....	.....
15. Coal-oil can, with pump (large)	.....	.....
16. Oil can (small)	.....	1
17. Coal-oil can (small)	.....	1
18. Coal-oil can for case of lantern, model of 1886	.....	.....
19. Can holding 5 liters of liquid for recoil system	.....	.....
20. Can holding 5 liters of liquid for recuperator	.....	.....
21. Beaked anvil, model of 1891, with block	.....	.....
22. Box for candles	.....	.....
23. Box for nails and calks	1	.....
24. Grease box (large), model of 1897	.....	.....
25. Grease box, model of 1897	1	.....
26. Grease box, model of 1827	.....	.....
27. Box for lanterns, model of 1891	.....	.....
28. Box for files	.....	.....
29. Box for light rations	.....	.....
30. Box for points (fuze setter)	.....	.....
31. Box for rosin	.....	.....
32. Box for rivets and nuts	.....	.....
33. Box for screws	.....	.....
34. Box for accessories	.....	.....
35. Box for gunner's quadrant, model of 1888	.....	1
36. Box for sal ammoniac	.....	.....
37. "Bonnettes de gaines de débochoir"	.....	.....
38. Leg guard for wheel driver	1	.....
39. Filling needle valve cap	.....	.....
40. Filling valve cap	.....	.....
41. Filling plug (recoil)	.....	1
42. Pump support cap	.....	.....
43. Candles, 24 to the kg	.....	.....
44. Bolts (assorted) (spares for caissons)	.....	.....
45. Bolts (assorted) (spares for wheels and poles)	.....	.....
46. Bolts for spade, latch shaft spring	.....	.....

* Indicates that these quantities have not yet been determined.

NOTE.—This table shows the source from which accessories and spare parts are drawn and where they are carried in the French battery organizations; it is not applicable to U. S. Army batteries.

carried on the battery vehicles.

Caissons.		Cannoneer's wagons.	"Chariot de pare."	Battery wagon.	Forge wagon.	Observation wagon.	Telephone wagon.	Forage wagon.	Quantity to be furnished by—	
Caisson limbers.	Caissons.								French War Department.	Schneider & Co.
....	....	.....	.....	.....	1.3k.	.....	.....	.....	1.3k.	.....
....	....	.....	.....	20	.....	.....	.....	.....	20	.....
....	....	.....	.....	20m.	.....	.....	.....	.....	20m.	.....
....	....	.....	.....	6	.....	.....	.....	.....	6	.....
....	....	.....	.....	.....	.....	.....	.....	.....	.....	1
....	....	.....	.....	1	.....	.....	.....	.....	1	.....
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	1	.....	.....	.....	.....	1	.....
....	....	.....	.....	1	.....	.....	.....	.....	1	.....
....	....	.....	.....	1	.....	.....	.....	.....	1	.....
....	....	.....	.....	1	.....	.....	.....	.....	1	.....
1	....	.....	.....	1	1	.....	.....	.....	10	.....
....	....	.....	.....	1	.....	.....	.....	.....	1	.....
....	....	.....	.....	1	.....	.....	.....	.....	1	.....
....	....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	....	.....	.....	.....	3	.....	.....	.....	3	.....
....	....	.....	.....	3	.....	.....	.....	.....	.....	3
....	....	.....	.....	3	.....	.....	.....	.....	.....	3
....	....	.....	.....	.....	1	.....	.....	.....	1	.....
....	....	.....	.....	4	1	.....	.....	.....	5	.....
....	½	.....	.....	.....	.....	.....	1	.....	9	.....
....	....	.....	.....	1	1	.....	.....	.....	2	.....
1	....	.....	.....	.....	.....	1	1	.....	14	.....
....	....	.....	1	.....	.....	.....	.....	.....	4	.....
....	....	.....	.....	.....	4	.....	.....	.....	4	.....
....	....	.....	.....	.....	1	.....	.....	.....	1	.....
....	1	.....	.....	.....	.....	.....	.....	.....	8	.....
....	....	.....	.....	.....	1	.....	.....	.....	1	.....
....	....	.....	.....	.....	1	.....	.....	.....	1	.....
....	....	.....	.....	.....	1	.....	.....	.....	1	.....
....	....	.....	.....	.....	1	.....	.....	.....	1	.....
....	(*)	(*)	.....	.....	.....	.....	.....	.....	(*)	.....
....	....	.....	.....	.....	1	.....	.....	.....	.....	4
....	½	.....	.....	.....	.....	.....	.....	.....	1	.....
....	....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	.....	.....	.....	.....	.....	.....	1
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	20k.	2k.	1k.	.....	23k.	.....	.....
....	....	.....	.....	35	.....	.....	.....	.....	35	.....
....	....	.....	.....	.....	22	.....	.....	.....	22	.....
....	....	.....	.....	1	.....	.....	.....	.....	.....	1

Name of part.	Guns.	
	Carriage limbers.	Carriages.
47. Bolts for the lower shield support		
48. Bolts for the upper shield support		
49. End for No. 7 pole, complete, with pole branches		
50. Pieces of wood for making wedges, etc		
51. Pole branches with collar (pair)		
52. Drag ropes, for cannoneers		2
53. Grease brushes		
54. Brushes		
55. Oiler, model of 1897		1
56. Oiler (old model of 90 mm. matériel)		
57. Stops for carriage brake shoes		
58. Padlocks, model of 1859		1
59. Chest for priming charge cans		
60 Coal box		
61. Box for cartridge cases for 155 mm. howitzer, model of 1907		
62. Box for lantern, model of 1866		
63. Box for carpenters' and mechanics' tools		
64. Box for blacksmiths' tools		
65. Tin box for 155 mm. howitzer matériel, 1904 T. R		
66. Box for battery pumps and their spare parts		
67. Box containing the spare breech block		
68. Box containing the battery repair tools: Marked "E. B."		
69. Box containing the spare parts furnished by the Schneider Works		
70. Box containing the spare parts furnished by the War Department		
71. Box containing harness-makers' tools		
72. Wheel chocks		1
73. Lunette chain, with ring and cross bar		
74. Sight-extension support chain		
75. Anthracite coal		
76. Pin drift, Schneider type		1
77. Fork strap key, with chain and eyebolt		
78. Dowel for joints of spokes		
79. Key and chain for loading-tray support		
80. Waste		.5 k.
81. Targets for testing the line of sight E. B. 10		
82. Bore sights for testing the line of sight, E. B. 9		
83. Scissors for cutting wick		
84. Key, with ring No. 1 for pole end		
85. Key, with spring for sight case		
86. Keys for end of carriage axle, with rings and pins		
87. Keys for end of pole No. 7		
88. Keys for pack carrier, with chain and eyebolt (right and left)		
89. Keys for the support of the sponge		
90. Keys for the pole key, with chain and ring		
91. Wrench for double action 30/55 fuzes		
92. Wrench for percussion fuzes with 30 and 40 seat		

on the battery vehicles—Continued.

Caissons.		Cannoneer's wagons.	"Chariot de parc."	Battery wagon.	Forge wagon.	Observation wagon.	Telephone wagon.	Forage wagon.	Quantity to be furnished by—	
Caisson limbers.	Caissons.								French War Department.	Schneider & Co.
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	1	.....	.....	.....	.....	1	.....
....	....	.....	.....	4	.....	.....	.....	.....	4	.....
....	....	.....	.....	2	.....	.....	.....	.....	2	.....
....	....	.....	.....	.....	.....	.....	.....	.....	.....	8
....	....	.....	.....	6	.....	.....	.....	.....	14	.....
....	....	.....	.....	12	.....	.....	.....	.....	12	.....
....	½	.....	.....	.....	.....	.....	.....	.....	8	.....
....	....	.....	.....	.....	1	.....	.....	.....	1	.....
....	....	.....	.....	2	.....	.....	.....	.....	.....	2
....	4	.....	2	7	4	2	.....	2	59	.....
....	....	.....	(*)	.....	.....	.....	.....	.....	(*)	.....
....	....	.....	.....	.....	1	.....	.....	.....	1	.....
....	....	.....	(*)	.....	.....	.....	.....	.....	(*)	.....
....	....	.....	.....	.....	3	.....	.....	.....	3	.....
....	....	.....	.....	.....	1	.....	.....	.....	1	.....
....	....	.....	.....	.....	1	.....	.....	.....	1	.....
....	....	.....	.....	1	1	.....	.....	.....	2	.....
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	.....	1	.....	.....	.....	1	.....
....	....	.....	.....	.....	.....	.....	.....	.....	1	.....
....	....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	....	.....	.....	2	.....	.....	.....	.....	.....	2
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	.....	68 k.	.....	.....	.....	68 k.	.....
....	....	.....	.....	2	.....	.....	.....	.....	2	4
....	....	.....	.....	.....	.....	.....	.....	1	1	.....
....	....	.....	.....	1	.....	.....	.....	.....	1	.....
....	1 k.	.....	.....	15 k.	2.5 k.	1 k.	.....	1.2 k.	27.7 k.	2 k.
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	.....	3	.....	.....	.....	3	.....
....	....	.....	.....	.....	.....	.....	.....	2	2	.....
....	....	.....	.....	2	.....	.....	.....	.....	.....	2
....	....	.....	.....	2	.....	.....	.....	.....	.....	2
....	½	.....	.....	2	2	.....	.....	.....	8	.....
....	....	.....	.....	2	.....	.....	.....	.....	2	.....
....	....	.....	.....	2	.....	.....	.....	.....	.....	2
....	....	.....	.....	1	.....	.....	.....	.....	.....	1
....	....	.....	.....	1	.....	.....	.....	.....	1	.....
....	....	.....	.....	.....	1	.....	.....	.....	1	.....

Name of part.	Guns.	
	Carriage limbers.	Carriages.
93. Wrench for 21/31 fuzes		
94. Wrench for 22/31 fuzes		
95. Wrench for manometer union, E. B. 5		
96. Wrench for the sight, E. B. 8		
97. Wrench for the recoil filling plug, E. B. 4		
98. Key of lock, model of 1859		3
99. Decapping wrench		
100. Wrench for filling needle valve, E. B. 6		
101. Double wrench for hammer-pin nut and threaded washer of loading-tray latch, E. B. 11		
102. Universal wrench, large		
103. Universal wrench, medium		
104. Universal wrench, small		1
105. Clinching nails (assorted)		
106. Blacksmith's apron		
107. Sponge cover		1
108. Rope (several sizes)		
109. Lashing cord for grain sacks		
110. Picket rope, 8 meters	1	
111. Picket rope, 16 meters		
112. Spare retracting rope		
113. Lanyard (steel wire)		1
114. Straps for picket rope and spare trace cases		
115. Straps for forage		
116. Straps for spare trace case	4	
117. Scraping knife		1
118. Muzzle cover		1
119. Cradle cover		1
120. Breech cover		1
121. Sight cover		1
122. Chalk (box weighing 1 kg.)		
123. Field jack, model of 1880		
124. Lanyard hook		
125. Spade traveling hooks		
126. Spade latch (right)		
127. Spade latch (left)		
128. Leather for knurled plugs		
129. Leathers for large piston of air pump		
130. Leathers for small piston of air pump		
131. Spare breech complete		
132. Brass cleaning tool		1
133. Fuze setter for 155 mm. howitzer		
134. Sponges		1
135. Nuts, miscellaneous (set of)		
136. Funnel, with filling pipe		
137. Sponges (0.1 kg.)		1
138. Linchpins with rings No. 2, complete, with thongs		
139. Linchpins with rings No. 8, bis, complete, with thongs		
140. Linchpins with rings No. 10 (for axles of caissons and forage wagons), complete, with thongs		

on the battery vehicles—Continued.

Caissons.		Cannoneer's wagons.	"Chariot de parc."	Battery wagon.	Forge wagon.	Observation wagon.	Telephone wagon.	Forage wagon.	Quantity to be furnished by—	
Caisson limbers.	Caissons.								French War Department.	Schneider & Co.
....	.....	.....	.....	1	.....	.....	.....	.....	1	.....
....	.....	.....	.....	1	.....	.....	.....	.....	1	.....
....	.....	.....	.....	2	.....	.....	.....	.....	.....	3
....	.....	.....	.....	1	.....	.....	.....	.....	.....	1
....	.....	.....	.....	2	.....	.....	.....	.....	.....	2
....	1	.....	1	7	3	1	.....	1	36	.....
....	½	.....	.....	.....	.....	.....	.....	.....	4	.....
....	.....	.....	.....	2	.....	.....	.....	.....	.....	2
....	.....	.....	.....	1	.....	.....	.....	.....	.....	1
....	.....	.....	.....	1	.....	.....	.....	.....	1	.....
....	.....	.....	.....	1	.....	.....	.....	.....	1	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	.....	.....	.....	.....	1	.....	.....	.....	1	.....
....	.....	.....	.....	.....	1	.....	.....	.....	.....	4
....	.....	.....	.....	.....	5k.	.....	.....	.....	5k.	.....
2	.....	.....	.....	6	6	.....	1	.....	13	.....
....	.....	.....	.....	2	2	.....	1	.....	25	.....
....	.....	.....	1	.....	.....	.....	.....	1	5	.....
....	.....	.....	.....	3	.....	.....	.....	.....	.....	3
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
4	1	.....	.....	.....	.....	.....	.....	.....	40	.....
....	2	.....	.....	.....	.....	.....	.....	.....	16	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16
....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	1	.....	.....	.....	.....	1	.....
....	.....	.....	.....	.....	1	.....	.....	.....	1	.....
....	.....	.....	.....	4	.....	.....	.....	.....	.....	4
....	.....	.....	.....	1	.....	.....	.....	.....	.....	1
....	.....	.....	.....	1	.....	.....	.....	.....	.....	1
....	.....	.....	.....	1	.....	.....	.....	.....	.....	1
....	.....	.....	.....	2	.....	.....	.....	.....	.....	2
....	.....	.....	.....	2	.....	.....	.....	.....	.....	2
....	.....	.....	.....	2	.....	.....	.....	.....	.....	2
....	.....	.....	.....	1	.....	.....	.....	.....	.....	1
....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	½	.....	.....	.....	.....	.....	.....	.....	4	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	.....	1	.....	.....	.....	1	.....
....	.....	.....	.....	2	.....	.....	.....	.....	.....	2
....	.....	.....	1	.....	.....	.....	.....	.....	4	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	.....	.....	.....	2	.....	.....	.....	.....	2	.....
....	½	.....	.....	.....	1	.....	.....	.....	5	.....

Name of part.	Guns.	
	Carriage limbers.	Carriages.
141. Linchpins with step No. 10 (for axles of caissons and forage wagons), complete, with thongs	.....	.....
142. Vise for field forge	.....	.....
143. Case for spare traces	1	.....
144. Case for battery commander's ruler	.....	1
145. Spare extractor	.....	1
146. Hand extractor	.....	1
147. Belt worn when using scythe, with small anvil, hammer, and whetstone	.....	.....
148. Sickles	.....	.....
149. Sheets of mica for lanterns, model of 1891	.....	.....
150. Plumb line	.....	1
151. Soft steel wire, 1 mm. (packages of 0.2 kg.)	.....	1
152. Portable battery forge	.....	.....
153. Lock for lanyard pulley axle	.....	.....
154. Cases for fuze setter boxes (canvas or leather)	.....	.....
155. Cases for crosscut saws	.....	.....
156. Pack carriers	.....	.....
157. Leather washers (outer) for axle ends of carriage limber	.....	.....
158. Leather washer (outer) for axle ends of carriage	.....	.....
159. Steel fittings for end of pole No. 7	.....	.....
160. Fittings for front compartment of cartridge case carrier	.....	.....
161. Leather washers (inner) for shoulders of carriage axles	.....	.....
162. Wheel fastening washers for axle No. 10 (caisson and caisson limber)	.....	.....
163. Wheel fastening washers for carriage axle	.....	.....
164. Packing for filling needle valve	.....	.....
165. Washers (leather) outer, No. 2 for axle arm	.....	.....
166. Washers (leather) inner, No. 2 for axle arm	.....	.....
167. Washers (leather), No. 10, for axle arm of caisson limber and caisson	.....	.....
168. Goniometer for 155 mm. howitzer carriage, model of 1915 (Schneider)	.....	2
169. 18 mm. pins (No. 3) for metal construction, ordinary	.....	.....
170. 10 mm. pins (No. 5) for metal construction, elongated	.....	.....
171. Set of split pins	.....	1
172. Pins for caisson brake shoe (to be riveted)	.....	.....
173. Pin for attaching the caisson brake operating sleeve	.....	.....
174. Heavy grease	2 kg.	.....
175. Special oiler	.....	1
176. Shell hooks	.....	.....
177. Combination ax and hammer	.....	.....
178. Hatchets	.....	.....
179. Light machine oil	.....	1 kg.
180. Volume indicator (E. B. 12)	.....	.....
181. Spare felloe No. 8 (in sections)	.....	.....
182. Leather strap with ring	.....	.....
183. Filling valve gaskets	.....	.....

on the battery vehicles—Continued.

Caissons.		Cannoneer's wagons.	"Chariot de parc."	Battery wagon.	Forge wagon.	Observation wagon.	Telephone wagon.	Forage wagon.	Quantity to be furnished by—	
Caisson limbers.	Caissons.								French War Department.	Schneider & Co.
....	½	.....	.....	2	1	.....	.....	.....	7	.....
....	....	.....	.....	.....	1	.....	.....	.....	1	.....
1	....	.....	1	1	1	1	1	1	21	.....
....	....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	....	.....	.....	.....	.....	.....	.....	1	1	.....
....	....	.....	.....	.....	.....	.....	.....	20	20	.....
....	....	.....	.....	130	13	.....	.....	.....	143	.....
....	....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	1	.....	.....	.....	1	.....	.....	.....	12	.....
....	....	.....	.....	2	.....	.....	.....	.....	1	.....
....	½	.....	.....	.....	.....	.....	.....	.....	.....	2
....	....	.....	.....	2	2	.....	.....	.....	4	.....
1	....	.....	.....	1	1	.....	.....	.....	4	.....
....	....	.....	.....	8	.....	.....	.....	.....	10	.....
....	....	.....	.....	8	.....	.....	.....	.....	.....	8
....	2	.....	.....	4	.....	.....	.....	.....	20	.....
1	....	.....	.....	.....	.....	.....	.....	.....	8	.....
....	....	.....	.....	8	.....	.....	.....	.....	.....	8
....	2	.....	.....	20	.....	.....	.....	.....	36	.....
....	....	.....	.....	8	.....	.....	.....	.....	.....	8
....	....	.....	.....	4	.....	.....	.....	.....	.....	4
....	....	.....	4	.....	.....	.....	.....	.....	16	.....
....	....	.....	4	.....	.....	.....	.....	.....	16	.....
....	2	.....	.....	½20	.....	.....	.....	.....	36	.....
....	....	.....	.....	.....	.....	.....	.....	.....	.....	8
....	....	.....	.....	.....	3	.....	.....	.....	3	.....
....	1	.....	.....	8	3	.....	.....	.....	3	.....
....	....	.....	.....	5	.....	.....	.....	.....	16	4
....	....	.....	.....	5	.....	.....	.....	.....	5	.....
3 kg.	....	.....	4 kg.	10 kg.	10 kg.	3 kg.	2.5 kg.	.....	5	.....
....	....	.....	.....	.....	.....	.....	.....	.....	77.5 kg.	.....
....	2	.....	.....	.....	.....	.....	.....	.....	4	.....
....	....	.....	.....	4	2	.....	.....	.....	16	.....
....	....	.....	.....	1	9	.....	.....	.....	6	.....
....	....	.....	.....	19 kg.	44 kg.	.....	.....	.....	10	.....
....	....	.....	.....	2	.....	.....	.....	.....	23.44 kg.	.....
....	....	.....	.....	.....	6	.....	.....	.....	.....	2
....	....	.....	.....	.....	8	.....	.....	.....	6	.....
....	....	.....	.....	2	.....	.....	.....	.....	8	.....
....	....	.....	.....	.....	.....	.....	.....	.....	.....	2

Name of part.	Guns.	
	Carriage limbers.	Carriages.
184. Points for fuze setter	.....	.....
185. Scythe blade with rings and wedge	.....	.....
186. Electric pocket lamps with dry batteries	.....	.....
187. Lashing straps for pack carrier	.....	.....
188. Thongs 300 mm. long (set of 10)	.....	1
189. Lanterns, model of 1891	.....	.....
190. Lanterns, model of 1891 (wooden wedges for)	.....	.....
191. Lanterns, model of 1877 (transformed for kerosene)	.....	.....
192. Hand spike (S. & P.)	.....	.....
193. Spoke hoops	.....	.....
194. Three cornered file, 11 mm	.....	1
195. File for breech thread	.....	1
196. Assorted files	.....	.....
197. Liquid for brake (recoil)	.....	.....
198. Liquid for recuperator	.....	.....
199. Scythe handle	.....	.....
200. File handle	.....	1
201. Greasing sleeve	.....	1
202. Manometer, with adapter	.....	.....
203. Hammer, small, model of 1897	.....	1
204. Sledge, model of 1880	.....	.....
205. Telephone matériel for a battery	.....	.....
206. Fire control equipment	.....	.....
207. Wicks for kerosene lanterns	.....	.....
208. Brass tape	.....	1
209. Gunner's quadrant, model of 1888	.....	1
210. Raw cotton (0.125 kg. package)	.....	1
211. Hand tool (set of) for battery carpenters and mechanics [1]	.....	.....
212. Swingletree	.....	.....
213. Wheel mats	.....	.....
214. Caisson brake shoes, plate, stop plate, rivets, and bolts	.....	.....
215. Brake shoes of howitzer carriage with supports riveted on	.....	.....
216. Square shovel	.....	.....
217. Round shovel	.....	.....
218. Firing pin	.....	1
219. Spring balance (or Roman scale), 50 kg. capacity, complete	.....	.....
220. Kerosene	.....	1 kg.
221. Spare cells for pocket electric lamps	.....	.....
222. Flat polished pliers, 16 mm	.....	1
223. Picks, model of 1862	.....	.....
224. Fastening picket, large	.....	.....
225. Fastening picket, small	.....	.....
226. Firing lanyard handle	.....	1
227. Air pump with delivery pipe	.....	.....
228. Liquid pump	.....	.....

[1] For details see table giving equipment of the battery (equipment of forge wagon).

on the battery vehicles—Continued.

Caissons.									Quantity to be furnished by—	
Caisson limbers.	Caissons.	Cannoneer's wagons.	"Chariot de parc."	Battery wagon.	Forge wagon.	Observation wagon.	Telephone wagon.	Forage wagon.	French War Department.	Schneider & Co.
....	6/2	.....	.....	.....	.....	.....	.....	.....	24	.....
....	.....	.....	.....	.....	.....	.....	.....	2	2	.....
....	.....	.....	.....	6	.....	.....	.....	.....	6	.....
....	.....	.....	.....	12	.....	.....	.....	.....	12	.....
....	1	.....	.....	2+2	2	.....	.....	2.5	16.5	2
....	.....	.....	.....	14	2	1	.....	.....	17	.....
....	.....	.....	.....	14	2	.....	.....	.....	16	.....
....	.....	.....	.....	.....	12	.....	.....	.....	12	.....
....	.....	.....	.....	10	.....	.....	.....	.....	10	.....
....	.....	.....	.....	.....	1	.....	.....	.....	1	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	.....	.....	.....	.....	24	.....	.....	.....	24	4
....	.....	.....	.....	15 kg.	.....	.....	.....	.....	.....	15 kg.
....	.....	.....	.....	15 kg.	.....	.....	.....	.....	.....	15 kg.
....	.....	.....	.....	.....	.....	.....	.....	2	2	.....
....	.....	.....	.....	.....	13	.....	.....	.....	17	.....
....	.....	.....	.....	4	.....	.....	.....	.....	8	.....
....	.....	.....	.....	2	.....	.....	.....	.....	.....	2
....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	.....	.....	1	4	.....	.....	1	1	10	.....
....	.....	.....	.....	.....	.....	.....	1	.....	1	.....
....	.....	.....	.....	.....	.....	1	.....	.....	1	.....
....	.....	.....	.....	.....	144	.....	.....	.....	144	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	.....	.....	.....	10	.....	.....	.....	.....	14	.....
....	.....	.....	.....	.....	11	.....	.....	.....	11	.....
....	.....	4	.....	.....	2	.....	.....	.....	.....	2
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8
....	.....	.....	.....	.....	2	.....	.....	.....	2	.....
....	.....	.....	.....	.....	2	.....	.....	.....	.....	2
1	.....	.....	.....	.....	.....	1	.....	.....	9	.....
....	.....	.....	1	5	2	.....	.....	1	12	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	1	.....	.....	.....	.....	1	.....
....	.....	.....	.....	18 kg.	11 kg.	.....	.....	.....	30 kg.	.....
....	.....	.....	.....	18	.....	.....	.....	.....	18	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	.....	6	1	5	2	2	.....	1	26	.....
....	.....	.....	2	9	9	.....	1	2	29	.....
....	.....	.....	2	9	9	.....	1	2	29	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	2	.....	.....	.....	.....	.....	2
....	.....	.....	.....	1	.....	.....	.....	.....	.....	1

I. *Accessories and spare parts carried*

Name of part.	Guns.	
	Carriage limbers.	Carriages.
229. Carrying case for spare mica		
230. Retracting rope and pulley		1
231. Follower for firing pin		1
232. Rope (prolonged)		
233. Spare spokes No. 8, ironwork assembled		
234. Theodolite, complete (without tripod)		
235. Rammer		1
236. Loading rammer (short)		1
237. Battery commander's rule		1
238. Small bronze rammer		1
239. Rosin		
240. 1 liter measure, graduated in half-deciliters		
241. Helical spring for safety latch		1
242. Latch shaft spring, for spade		
243. Pintle latch spring (for caisson limber)		
244. Sponge fastening key spring		
245. Firing pin spring		1
246. Union valve spring		
247. Filling valve spring		
248. Draft spring right with rivets		
249. Draft spring left with rivets		
250. Firing shaft spring		1
251. Percussion hammer shaft spring		1
252. Rack latch spring		1
253. Packing and valve springs for liquid pump (a bundle of)		
254. Rivets (soft steel), with countersunk heads (set of)		
255. Rivets (soft steel), with round heads (set of)		
256. Rivets (soft steel), for fastening spokes of wheel No. 8.		
257. Rivets (copper), for the leather case of the tripod of the theodolite		
258. Cup washers, notched, No. 8 bis		
259. Cup washers, notched, No. 10 (for caisson and caisson limber)		
260. Thrust collar (dermatine)		2
261. Linch pin washer (steel)		
262. Wheel for 155 mm. howitzer carriage limber, model of 1915 (Schneider)		
263. Wheel for 155 mm. howitzer carriage, model of 1915 (Schneider)		
264. Wheel No. 8 (for caisson and caisson limber)		
265. Wheel No. 2, for field use		
266. "Rouleau a meplats"		
267. Sandbags (sulphur treated)		
268. Grain bags for 65 kgs, with lashing ropes		
269. Bag for chalk		1
270. Bag for 100 gr. of raw cotton		1
271. Folding saw		1
272. Cross-cut saw		
273. Watering pail, model of 1897		

on the battery vehicles—Continued.

Caissons.		Cannoneer's wagons.	"Chariot de parc."	Battery wagon.	Forge wagon.	Observation wagon.	Telephone wagon.	Forage wagon.	Quantity to be furnished by—	
Caisson limbers.	Caissons.								French War Department.	Schneider & Co.
....	.....	.....	.....	10	1	1	.....	.....	12	.....
....	.....	.....	.....	1	.....	.....	.....	.....	.....	5
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
....	.....	.....	.....	.....	2	.....	.....	.....	2	.....
....	.....	.....	.....	.....	12	.....	.....	.....	12	.....
....	.....	.....	.....	.....	.....	2	.....	.....	2	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....
....	.....	.....	.....	.....	1	.....	.....	.....	5	.....
....	.....	.....	.....	.....	15 kg.	.....	.....	.....	15 kg.	.....
....	.....	.....	.....	1	.....	.....	.....	.....	.....	1
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	1	.....	.....	.....	.....	.....	1
....	.....	.....	.....	1	.....	.....	.....	.....	1	.....
....	.....	.....	.....	4	.....	.....	.....	.....	4	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	2	.....	.....	.....	.....	.....	2
....	.....	.....	.....	2	.....	.....	.....	.....	.....	2
....	.....	.....	.....	1	.....	.....	.....	.....	1	.....
....	.....	.....	.....	1	.....	.....	.....	.....	1	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	1	.....	.....	.....	.....	.....	1
....	.....	.....	.....	.....	1	.....	.....	.....	1	.....
....	.....	.....	.....	.....	1	.....	.....	.....	1	.....
....	.....	.....	.....	.....	5	.....	.....	.....	5	.....
....	.....	.....	.....	.....	10	.....	.....	.....	10	.....
....	.....	.....	.....	2	.....	.....	.....	.....	2	.....
....	.....	.....	.....	2	.....	.....	.....	.....	2	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8
....	.....	.....	.....	2	.....	.....	.....	.....	.....	2
....	.....	.....	.....	.....	.....	.....	.....	1	.....	1
....	.....	.....	.....	.....	1	.....	.....	.....	.....	1
....	.....	.....	.....	1	.....	.....	.....	.....	1	.....
....	1	.....	1	.....	.....	.....	.....	.....	2	.....
....	.....	.....	.....	30	.....	.....	.....	.....	8	.....
....	1	.....	.....	6	6	.....	1	.....	30	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	21	.....
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
....	.....	.....	.....	.....	4	.....	.....	.....	4	.....
....	.....	.....	.....	2	2	.....	.....	.....	8	.....
....	½	.....	1	1	1	1	.....	1	4	.....
									12	.....

I. *Accessories and spare parts carried*

Name of part.	Guns.	
	Carriage limbers.	Carriages.
274. Pail for field forge	.....	.....
275. Canvas water bucket	.....	.....
276. Sal ammoniac	.....	.....
277. Bolo knife	.....	.....
278. Soft solder	.....	.....
279. Valves for union on filling pipe	.....	.....
280. Filling valve	.....	.....
281. Counterrecoil valve	.....	.....
282. Paulin support with rope	.....	.....
283. Range table (complete) for 155 mm. howitzer, model of 1915 Schneider	.....	1
284. Table giving the equipment of a battery of 155 mm. howitzer, model of 1915 Schneider	.....	.....
285. Tray mounted on bracket (for accessories)	.....	.....
286. Pole (complete) for carriage limber of 155 mm. howitzer, model of 1915 Schneider (with supporting branches and chains)	.....	.....
287. Pole (spare) No. 7, rear part	.....	.....
288. Pole (spare) No. 7, middle part	.....	.....
289. Iron-bound pole for ammunition supply wagon	.....	.....
290. Iron-bound pole for forage wagon	.....	.....
291. Spare firing cord, without handle	.....	2
292. Screw driver, 4 mm. to 10 mm. ordinary, with handle	.....	1
293. Traces (spare) complete	2	.....
294. Delivery pipe, complete, with union	.....	.....
295. Rack lock	.....	1
296. Cartridge case retainer	.....	1
297. Traveling lock with spring and screw	.....	1
298. Safety lock with flat spring	.....	1
299. Wood screws, countersunk head, steel and brass, assorted diameters (assortment of)	.....	.....
300. Steel screws (spares for caissons)	.....	.....
301. Breech key screw	.....	.....
302. Access door screw	.....	.....
303. Needle valve for pump	.....	.....
304. Neck yoke	.....	.....

on the battery vehicles—Continued.

Caissons.		Cannoneer's wagons.	"Chariot de parc."	Battery wagon.	Forge wagon.	Observation wagon.	Telephone wagon.	Forage wagon.	Quantity to be furnished by—	
Caisson limbers.	Caissons.								French War Department.	Schneider & Co.
....	....	....	....	....	1	....	....	....	1	....
....	....	....	....	36	....	....	....	....	36	....
....	....	....	....	....	.44 kg.	....	....	....	.44 kg.	....
....	1	....	....	....	....	1	....	....	5	....
....	....	....	....	....	.40 kg.	....	....	....	.40 kg.	....
....	....	....	....	2	....	....	....	....	....	2
....	....	....	....	2	....	....	....	....	....	2
....	....	....	....	4	....	....	....	....	....	4
....	....	....	1	....	....	....	....	....	4	....
....	....	....	....	1	....	....	....	....	5	....
....	....	....	....	1	1	....	....	....	2	....
....	1	....	....	....	....	....	....	....	8	....
....	....	....	....	—	1	....	....	....	....	1
1	....	....	....	1	....	....	....	....	9	....
1	....	....	....	1	....	....	....	....	9	....
....	....	....	1	....	....	....	....	....	4	....
....	....	....	....	....	....	....	....	1	1	....
....	....	....	....	1	....	....	....	....	5	8
2	....	....	2	2	2	2	2	2	42	....
....	....	....	....	1	....	....	....	....	....	1
....	....	....	....	....	....	....	....	....	....	2
....	....	....	....	....	....	....	....	....	....	2
....	....	....	....	....	....	....	....	....	....	1
....	....	....	....	....	....	....	....	....	....	4
....	....	....	....	....	1	....	....	....	1	....
....	....	....	....	10	....	....	....	....	10	....
....	....	....	....	1	....	....	....	....	....	1
....	....	....	....	1	....	....	....	....	....	1
....	....	....	....	1	....	....	....	....	....	1
....	....	....	....	....	....	1	....	....	....	1

II. LIST OF SPARE PARTS.—TOOLS, EQUIPMENT, AND ACCESSORIES OF THE MOBILE REPAIR SHOP.

A. Spare parts for one mobile repair shop (1 set for 12 howitzers).

1 operating lever spring and 2 screws.
2 breech operating handle springs.
1 cartridge case retainer.
1 shaft of cartridge case retainer.
1 firing pin bushing.
1 firing pin bushing screw.
1 sight, complete, without the goniometer, with securing bolt and pin.
4 rod packing (recoil) (dermatine).
4 rubber rings (recoil).
1 rod packing spring (recoil).
2 filling plug gaskets (copper).
2 gaskets for front and rear recoil cylinder head (copper).
4 rod packing (recuperator) (dermatine).
4 rubber rings (recuperator).
4 movable head packings (recuperator) (dermatine).
1 rod packing spring (recuperator).
1 spring retaining case screw.
2 recuperator stuffing box gaskets (copper).
2 recuperator rods, lubricators.
1 piston spring (recuperator).
4 movable head packing (recuperator piston) (dermatine).
8 piston packing (recuperator piston) (dermatine).
4 rubber rings.
2 recuperator piston lubricators.
2 air tank head gaskets (dermatine).
2 filling needle valves.
2 filling needle valve gaskets.
2 carriage wheels.
2 carriage limber wheels.
4 Belleville springs.
2 traversing mechanism thrust collars.
1 locking tenon (breech closed) (2 screws).
1 hammer shaft lock.
1 extractor stop.
1 breech key screw.
1 retracting eyebolt (on howitzer) and locking screw.
1 retracting eyebolt (on shield).
1 front band key (washer, nut, and split pin).
2 trunnion cap chains with chain eyes and pins.
1 folding spade, with braces, shaft, latches, etc.
1 thrust bearing adjuster lock (traversing).
1 shaft bearing lock (traversing).
1 cylinder head, lock, and 3 screws (rear recoil).
2 angle of site levels, vials and their tubes.

2 cross level vials of the trunnions in their tubes.
1 pintle yoke with 1 unriveted pin.
2 spare poles, complete with pole branches and chains.
1 tool chest for mobile repair shop.
1 padlock, model of 1859.
1 key.

B. Special tools for one mobile repair shop.

2 spanners for air tank head follower, E. M. R. 1.
2 recoil rod stuffing box sleeves, E. M. R. 2.
2 recuperator rod stuffing box sleeves, E. M. R. 3.
4 piston disassembling tools, E. M. R. 4.
2 piston nut wrenches, E. M. R. 5.
2 stuffing box spanners, E. M. R. 6.
2 spanner extensions, E. M. R. 7.
2 adjustable teat wrenches, E. M. R. 8.
2 rear cylinder head wrenches (also for throttling ring), E. M. R. 9.
2 piston rod nut wrenches, E. M. R. 10.
2 breech key disassembling tools, E. M. R. 11.
2 filling plug wrenches, also for access door screw, E. M. R. 12.
2 pressure gauge wrenches, E. M. R. 13.
2 filling needle valve wrenches, also for pump, E. M. R. 14.
2 1-liter measures, graduated, E. M. R. 15.
2 funnels and filling pipes, E. M. R. 16.
2 sight bolt wrenches, E. M. R.
2 bore sights, E. M. R.
2 recoil piston rod wrenches, E. M. R. 17.
2 targets (adjusting sight).
2 padlocks, model of 1859.
2 keys for padlocks, model of 1859.
2 chests for special tools of mobile repair shops, E. M. R.

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