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REPORT ON AMERICAN GUNS AND CARRIAGES

By: Thor Borresen, December 1939

Colonial NHP (Original)

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REPORT ON AMERICAN GUNS AND CARRIAGES

In commencing the report on American guns and carriages it seems best to set forth the comments of one authority on this subject, namely, Lieutenant William E. Birkhimer. Birkhimer began his researches in 1872-73. He was for a while stationed in the vicinity of New York City, and later in Washington, D. C., where he had all the sources of the War Department at his disposal. With all this material at hand, he admits that many details are missing from the volume which he published, Historical Sketch of the Organization, Administration, Matériel and Tactics of the Artillery, United States Army. The author himself states in the preface:

> "When the writer of this work joined the army as a commissioned officer, in 1870, he cast about with a view to learning something of the career in this country of the arm to which he had been assigned---the artillery. The result was unsatisfactory. Of record there was almost nothing, and that little was sometimes glaringly erroneous. Experienced officers who were consulted could give little information regarding matters of a date anterior to their entry into service, and when they wished to speak positively concerning those things of which they were per-

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> sonally cognizant their memories were frequently so defective as to surprise even themselves.
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> "All this was a subject for wonder to the writer. It seemed strange that with our admiration for and knowledge of foreign services our own had not received more attention;..."[1]

Yet his book contains a wealth of general information; all his reasoning is good and for the most part substantiated by other authors. He gives a very good description of the various calibers of guns, howitzers, and mortars in use. Of their specific dimensions or architectural design he has nothing to say except that they used mostly English armament, although much was purchased in France and Germany, and some cast in our own colonies. He describes carriages and their method of construction, giving purely English design; he does not describe or mention the privileges taken by American engineeers and artificers when adapting a carriage of one type to fit a gun of another. In other words, he makes no attempt to interpret, or to divert from basic principles of construction to those of combinations suitable to take care of emergencies.

It is common knowledge that officially the Continental artillery

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1 Historical Sketch of the Organization, Administration, Matériel and Tactics of the Artillery, United States Army, (Washington, D. C., 1884), p. v, Preface.

followed the ordnance regulations laid down for the English Royal artillery in dimensions of guns, dimensions of carriages, and in all accoutrements. As late as 1796 we still find the Americans copying the English types of guns. In an article of agreement between Oliver Wolcott, Jr., Secretary of the Treasury, and Samuel Hughes of Harford County, State of Maryland, Agent for the Cecil Company, dated October 25, 1796, the Cecil Company agreed to furnish 6-, 9-, and 12-pounder naval cannon to conform in weight, bore, caliber, and length exactly to the English ship guns of the same description then in use.[2] This practise, of course, could not be precisely adhered to; the colonies lacked equipment and facilities for their own manufacture, and had very small funds to provide the necessary essentials. These circumstances made it necessary to adopt conglomerate measures to supply their needs. Regardless of the type of gun, were it brass or cast-iron, if it were needed in the field and would not fit a

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2 American State Papers (Vol. XIV) of Naval Affairs (Vol. I), p. 55, Item No. 12.
[American State Papers. Documents, Legislative and Executive, of the Congress of the United States, from the First Session of the First to the Second Session of the Eighteenth Congress, inclusive: Commencing March 3, 1789, and Ending March 5, 1825. Selected and Edited, under authority of Congress, by Walter Lowrie, Secretary of the Senate, and Walter S. Franklin, Clerk of the House of Representatives, (Washington, Published by Gales and Seaton, 1834).]

standard type of carriage, a suitable carriage was constructed. The architectural design was copied from the English regulations, with the exception of necessary changes to fit the particular gun being mounted. Those changes consisted mostly of widening the space between the trunnions or lengthening the cheek plates to suit the length of the gun. If a gun were much heavier than the usual one of the same caliber, heavier material was needed for its carriage.

It is in this regard this report has been written and the several drawings prepared. What other authors mention, but only casually, the writer has collected and included in this report. From such material the drawings have been made, using original guns of the period for necessary measurements. The architectural designs of the carriages have been copied from John Muller.[3]

But before going into details on carriages, we must describe the guns, their calibers and types, and the metal of which they were made. Prior to the Revolutionary War, the British government sent into the colonies a large quantity of cannon of both iron and brass manufacture for use in Indian warfare and in the war against the French (1755-1760). These cannon were scattered throughout the

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3 A Treatise of Artillery, (London, 1756).

colonies. They covered, approximately, the period of three ordnance regulations - the 1736 (Armstrong regulations); the 1753; and the experimental guns, later adopted into the 1764 regulations; and many others which were brought over for experimental purposes but never officially adopted. The writer has never found a table of lengths and weights of the guns covering the 1736 regulations, although Muller[4] records their proportions in relation to their diameter of shot. From these proportions a drawing of one 12-pounder brass gun and one 12-pounder cast-iron gun was prepared (see photograph No. 1). Their lengths are:

Brass Gun
8 feet 11 3/4 inches
Overall length, including the cascable, 9 feet 7 1/2 inches

Iron Gun
7 feet 11 1/2 inches
Overall length, 8 feet 7 3/4 inches.

[Most of the tables giving the lengths of guns give the length from the end of the base ring to the face of the muzzle.[5] Unless specified, this rule is generally followed by authors on ordnance. T.B.]

Before going into the lengths and weights of guns it will be best to clarify the early English weight measures used for ordnance. This was based on pounds, quarters, and hundred weights. One hundred weight was 112 pounds; one quarter was 28 pounds; and the

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4 Ibid., pp. 70-74.

5 Ibid., p. 68.

pound 16 ounces. When the weight of a gun is given thus: 4: 3: 14, we have the following:

4 x 112 = 448
3 x 28 = 84
= 14

Add the figures 448, 84, and 14, and the actual weight, 546 pounds, is obtained. A brass gun of the Armstrong period 9 feet long would weigh approximately 29: 0: 0 (3,248 pounds). This considerable weight made taking it into the field difficult.

The primitive conditions of travel in the British Colonial possessions brought about experiments with light weight guns.[6] This statement

> "...and it may so happen that the heavy Pieces cannot be carried thro' bad roads, as in America,..."[7]

substantiates the belief that the American colonies were partly responsible for the great variety of ordnance. The assumption is strengthened when one considers the prevalent lack of good roads, the complete absence of roads in long distances of wilderness which had to be traversed, and the frequent travel by water. In America water offered by far the most favored mode of transportation. Few boats used on any of the campaigns would carry more

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6 Muller, John, A Treatise of Artillery, (London, 1756), pp. 10-11, Introduction.

7 Ibid., p. 12, Introduction.

than a 6-pounder. The usual armament consisted of swivels from 1/2- to 1 1/2-pounders; next in preference were the 2-, 3-, and 4-pounders. Most all these cannon were cast-iron, due to economic reasons. Loss of guns transported by water was great. The bateaux might sink in the river or capsize in the rapids, which, of course, would result in the loss of the cannon.

During the British conquest of Canada, after the capture of Fort Lewis on the St. Lawrence, the English left for Montreal, passing the rapids at Coteau lu Luc. During this journey they lost forty-six bateaux, seventeen whaleboats, one row galley, and eighty-four men while crossing the rapids, and they lost eighty bateaux and their carcassiers at Coteau lu Luc.[8] Carcassiers received special mention by Pouchot: "...barges called carcassieres, each carrying thirty men and a twelve pounder."[9] How many of the bateaux carried guns is not mentioned, but that most of them carried cannon of one type or another is certain. We do know that prames, a kind of floating battery---being a flat-

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8 Pouchot, M.-----, Memoir upon the Late War in North America, Between the French and English, 1755-60, [Translated and edited by Franklin B. Hough], (Roxbury, Mass., 1866), II, 40, footnote, and II, 41.

9 Ibid., II, 22.

bottomed vessel which drew little water, mounted several guns, and was very useful in covering the disembarkation of troops--- were in general use for transporting troops over the lakes in America.[10]

The use of cast-iron guns for bateaux armament was not practised by the English troops only. The French from their earliest occupation of Canada and the Ohio and Mississippi Valleys made their travels mostly in canoes and bateaux. Most boats capable of carrying a small cannon did so, especially during the French and English War of 1755-60. Many of the French frontier forts had cannon mounted. As those forts and frontier posts were taken over by the English the ordnance was retained for their own protection.

In the American State Papers and in private publications there are many letters dealing with the casting of cannon by the colonies. A letter written by Joseph Hoff, Manager of the Hibernia Furnace, Morris County, New Jersey, to Colonel Moylan, Quartermaster General of the Continental Army, dated August 31, 1776 testifies to the manufacture in this country of guns for boat use. This letter says in part, "A certain Mr. Thomas Ives apply'd to me to make a number say 36 or 38 three pounders Cannon for the Gondoliers.

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10 Smith, Captain George, An Universal Military Dictionary, (London, 1779), pp. Poz-Pro.

We have two ready for tryal some days past...."[11] Often the boats would have to be abandoned and the troops travel overland, in which case what cannon could not be taken along were either dumped in the river, buried, or left in small frontier fortifications, where the 2-, 4-, or 6-pounders were the most favored, along with swivels from 1/2- to 1 1/2 pounds. At the beginning of the Revolutionary War nearly all of the frontier forts were taken over by the Continentals and local militia; hence, the American soldiers fell heir to a miscellaneous collection of ordnance. Add to this their own home-made cannon and ordnance stores and it becomes an increasingly difficult problem to definitely establish the American ordnance used during the Revolutionary War.

Few of the larger siege guns like the 18- or 24-pounders were taken on long expeditions in America. However, we have record of a few cannon of this type having been carried along with the armies of the various nations which at one time or another have occupied the colonies, and it may do well to record the calibers and places where they were known to have been used in order to fully understand the ordnance which constituted the original background of the American Colonial Artillery. On his march to Canada in 1760,

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11 Boyer, Charles S., Early Forges & Furnaces in New Jersey, (Philadelphia, 1931), p. 95.

Captain Pouchot, in describing the English batteries firing on Fort Lewis, located in the St. Lawrence river, mentions in one two 24-pounders, in another two 24-pounders and six 12-pounders, and in still another two 12-inch mortars besides howitzers and royals.[12] All told, in this action, seventy-five pieces of various types of cannon were used, all of which had been brought from Albany, taken by Mohawk River to Oswego, and from there by bateaux up the St. Lawrence to Fort Lewis. What percentage of these were brass and what iron is not mentioned. The ordnance mounted by Pouchot at Fort Lewis consisted of twelve 12-pounders, two 6-pounders, thirteen 4-pounders, four 1-pounders, and four brass 6-pounders.[13] Here, the greater share of the ordnance was of iron. Out of a total of thirty-five, there were only four brass guns, and the largest a 12-pounder. At the defeat of Braddock, on July 13, 1755, the French captured four brass 12-pounders, four brass 6-pounders, four 8-inch brass howitzers, and three 4 1/2-inch grenade mortars (Coehorns).[14] Braddock's march was a typical field campaign with roads and transportation a trying experience; hence, all the

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12 Pouchot, op. cit., II, 28.

13 Ibid., II, 38, footnote.

14 Ibid., I, 43, footnote.

equipment was made of brass and as light as possible. All those guns were brought from the field of battle to Fort Niagara, where they arrived the following March and were used by Captain Pouchot when he defended that post against the English in 1759. The largest cannon mounted at Fort Niagara at the time of its capture by the English under Sir William Johnson in 1759 were 12-pounders; several of those were the brass guns captured from Braddock in 1755. Another record where a 24-pounder had reached as far as the Great Lakes was when the French captured Oswego on August 14, 1756. The English then surrendered seven brass cannon from 9- to 24-pounders, eight iron guns from 3- to 9-pounders, one 10-inch brass mortar, and thirteen royals and Coehorns.[15] Only in the movement of large armies during a general campaign were the large and heavy types of cannon taken along. As those occasions were rare in the colonies, very few of the large siege pieces were brought into the field; this, of course, does not include the few 16-, 18-, and 24-pounders already placed in forts to protect the rivers and harbors, bordering the Great Lakes, which would all have been made of cast-iron, but of which we have very little record.

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15 Pouchot, op. cit., I, 68, footnote.

manual gun

2/3 - length of standard field piece

12/4 105

2/3 ~~108~~ 89

78

John Muller[16] explains the enormous number of horses needed to transport the heavy artillery in the field. The record cited was taken from a report made in 1748. A heavy 3-pounder needed four horses; a 6-pounder, seven; a 12-pounder, ten; and a 24-pounder, seventeen to eighteen horses. At times this number had to be augmented, due to bad roads. In 1753 a few lighter guns were adopted, but it was not until 1764 that suitable light artillery for the field, which would permit the moving of a 3-pounder with only one horse, a 6-pounder with two horses, a 12-pounder with three horses, and a light 24-pounder with six horses had been perfected.

Next, we must consider the naval guns, their various types and calibers. These constituted a large item in the colony's supply of cast-iron guns. Among these we must consider the cannon taken from merchant and transport ships captured by American privateers. These merchant and transport ships are in large measure responsible for the confusion in types of guns which makes classifying so difficult. Each ship's captain armed his vessel as he thought would best protect it against pirates and privateers. He was not subject to government control as to his ordnance; he purchased his cannon from private contractors or

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16 A Treatise of Artillery, (London, 1756), pp. 260-61.

foundries that were also outside of government control. Usually their calibers were the same as for guns cast by the government but the architectural features differed from the government's and the designs of the privately manufactured guns varied, though in some respects they did favor the appearance of the government issues. Guns from captured merchant ships or men-of-war, were often brought ashore and mounted in works to protect the harbor or frontier posts, and if suitable carriages could be constructed, they were taken into the field, regardless of the metal of which they were made.

Photograph No. 2 shows a table of guns adopted in 1753, including both brass and iron. Photograph No. 3 shows a table of brass guns; and photograph No. 4 shows one of cast-iron, both adopted in 1764. In adding up all the guns which were passed and approved by the English ordnance board we have thirty-one different types of cast-iron guns, and twenty-six different types of brass guns, a total of fifty-seven guns different in dimensions and weight.

> [On the photograph (No. 2) showing the 1753 ordnance are several check marks. The types of guns so marked were not continued in the 1764 regulations; but were discontinued sometime between 1753 and 1764. However, they are included in the total figure of fifty-seven types of guns. Those not check marked were a part of the 1764 regulations, and are counted from photographs Nos. 3 and 4. T.B.]

The guns rejected in the 1753 regulations proved unsatisfactory

during the period. They probably had minor changes made, and were then approved for the 1764 regulations. Hence, many of the guns in the 1764 regulations are only slightly different from those not carried forward from 1753. To the layman this may not make any difference in appearance, but for those constructing the carriage it matters; one or two inches more in circumference would mean widening the carriage at the trunnions, lengthening the transoms, etc., and if much weight were added, additional thickness of material would be needed.

For field use, the English ordnance called for brass guns exclusively. Their calibers were 12-, 9-, 6-, 3-, and 2-pounders; the 1 1/2- and 1-pounders were also used, mounted on galloper carriages. See photograph No. 5, which is of an English 3-pounder mounted on a carriage constructed at Colonial National Historical Park, and accompanying drawing NHP-Col. #4,004. For siege purposes the brass 24-, 18-, and 12-, and the heavy 6- and 3-pounders were used.

Garrison guns, mounted in forts and water batteries, consisted of the 24-, 18-, 12-, 9-, and 6-pounder heavy cast-iron guns; the 32- and 42-pounders were used for seacoast defense almost exclusively.

Ships' guns were of cast-iron, in the following calibers; 32-24-, 18-, 12-, 9-, 6-, and 3-pounders, together with all types of

swivels. On rare occasions a 42- or 36-pounder might have been mounted, yet the majority of authors on American ordnance definitely state that a 24-pounder was the heaviest gun used aboard American vessels up to 1798; also, that there were no guns heavier than a 24-pounder cast by the Colonial foundries, and that those which may have found their way into the American ordnance were either taken over from the British, captured from them, or furnished by the French.

Although the 1753 ordnance regulations list brass guns for ships (see photograph No. 2), few probably were cast, for John Muller in 1756 suggested the adoption of brass guns for ship armament. The few that had been cast were used mostly in the commander's cabin; whereas the main armament consisted of iron guns.

In the American Army, however, the question of need was more important than set principles. Hence, if a cast-iron gun of the lesser weight could be properly mounted, it was brought along. Congress, when instructing the Cannon Committee to purchase guns, did not specify definitely the type of material. On August 21, 1776, that Committee was ordered to purchase six 6-pounders, six 12-pounders, four 8-inch howitzers, six 6-inch howitzers, and six Coehorn mortars, preferably of brass, but if that were impractical,

then of iron.[17]

Let us now consider other guns of the period which do not correspond in weight or dimensions to tables given in the English ordnance regulations, but of which we have plentiful examples. In Morristown National Historical Park there are several cast-iron guns dating back to the period of the Revolutionary War, yet none of them compares to the weight and dimensions of the English tables. One is a 6-pounder, 5 feet 6 1/2 inches long overall, weighing 11: 3: 2 (1,318 pounds), cast in 1778. The gun has a crown embossed on the chase in the rear of the first reinforce ring. Its supposed legend is that it was captured in Springfield, New Jersey, from the British and used as an alarm gun at Short Hills to the end of the Revolutionary War. Given by General Benoni Hataway to Colonel William Britten on the last training at Morristown, it was presented to the Washington Association in 1890 by William Britten, with the consent of public authorities. The crown on this gun shows it was under royal subsidy, probably from the East India Company, many of whose vessels were taken into the government service during an emergency. (See photographs Nos. 6 and 7.)

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17 Birkheimer, William E., op. cit., p. 257.

Another old gun at Morristown is a 6-pounder, dating back to shortly before 1750. The gun is only 4 feet 6 1/2 inches long and is a typical boat, or bateau, gun. (See photograph No. 8.)

A third is a cast-iron gun, a 3-pounder only 3 feet 11 3/8ths inches overall, and weighing 4: 0: 18 (466 pounds). (See photograph No. 9.) In checking this figure with those in the tables, (photographs Nos. 2 and 4), you will notice it is a lot smaller than standard ordnance. According to legend the gun was given by George Washington to Captain Nathaniel Camp for the protection of Newark, New Jersey.

Located at Guilford Courthouse National Military Park is a cast-iron gun only 42 3/8ths inches long and weighing 413 pounds. On the left trunnion it has the following inscription and numbers, "533 CARRON 1776", which represents cannon casting #533, cast by the Carron Foundry Company, Carron, Scotland, in the year 1776. This is another small boat, or bateau, gun.

In Yorktown we have several English cast-iron guns. These guns were recovered through diving operations in the York River during the fall of 1934 and summer of 1935 from the English ships sunk in 1781. Three of these guns are 5 feet 7 1/2 inches long overall, and weigh from 1,317 to 1,414 pounds. They do not conform to any of the guns in the tables given, yet they have the broad arrow

stamped on top of the breech field slightly to the rear of the first reinforce ring. Only government guns could be thus marked. (see photograph No. 10).

Fort McHenry also has several guns of similar types.

In Morristown there is a pair of bronze 4-pounders, beautifully cast, only 3 feet 10 inches long. They weigh in the neighborhood of 360 pounds each. The legend of the guns is that they were captured at Saratoga at the surrender of Burgoyne in 1777 and were presented to the Washington Association by the State of New Jersey. (See photographs Nos. 11 and 12.) These guns are not regular government issue. They do not have the customary coats of arms or monograms of the King or Master General of Ordnance; neither do they bear the master founder's name nor date when cast. The guns were cast sometime previous to 1753, as can be seen by the large reinforce ring, O.G's, and fillets. Of these mouldings and fillets was said, "That the greatest part of the mouldings should have the same dimensions, from a 3-pounder to one of 32, appears contrary to reason,..."[18] These large reinforce rings and fillets do not appear on guns after 1753. We have several guns of the later date in Yorktown, and others have been examined from which comparison has been made. There is another portion of

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18 Muller, op. cit., p. 75.

these two guns which confirms the suggestion that they are not of government issue. The two lugs on the under side of the neck and button to which the elevating screw is fastened are crudely made. Compare these with those on guns cast by the government from 1728 to 1777; you will see a considerable difference in workmanship. (See photographs Nos. 13 and 14.) Those of regular government issue are all perfectly made; this, however, does not discredit the legend of the guns. The entire march from the St. Lawrence River to Albany by way of Lake Champlain and Lake George was well known to the English from their campaigns against the French twenty years earlier. Burgoyne naturally cast about for the lightest guns that would be useful yet not burden him with unnecessary weight. Many of his guns and much of his equipment were collected in Quebec, Canada, and only those suitable for quick and light travel were chosen.

Let us summarize the notes previously made and see what the authors of the early days have to say. It has already been stated that the English ordnance regulations had thirty-one different types of cast-iron guns and twenty-six of brass. We also have the several experimental guns; at the proof butts only the casting was tried. For their efficiency, etc., they were taken into the field, where they were condemned or approved. Many were left in the colonies, where no record of them is extant except the guns themselves. Of the guns at Colonial National Historical Park

which are original ones surrendered by Cornwallis in Yorktown in 1781, several date from 1759, yet they do not appear on the government regulations until 1764, and some do not appear at all. Those from private foundries, which we have ample proof were numerous throughout the country, must also be added. Of the guns cast in the colonies, we have very little record; we know of foundries and their locations but not so much about their products. Birkhimer explains the similarity of the American artillery to that of the English -- "First they were familiar with it, both through inheritance and the fact that Muller's Treatise, with its plans and tables for artillery constructions, was in every workshop and foundry which turned out this species of matériel;..."[19] There are many letters and references to guns having been cast by these foundries, but of the articles they actually manufactured the records are few. There is no doubt that many of the guns still exist, but until more complete descriptions are obtained or the makers' drawings and sketches have been examined, they must be placed among unclassified ordnance.

Thus, many of the guns we cannot properly classify we can safely state originated in our own foundries. Most of them do have

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19 Historical Sketch of the Organization, Administration, Matériel and Tactics of the Artillery, United States Army, (Washington, D. C., 1884), p. 224.

English architectural design, but have no markings, dates, or numbers of any kind for identification. Further research may reveal this answer. A few of the Colonial foundries had been casting guns and cannon for the English Army as early as the French and Indian War of 1755-1760. Among these, several are outstanding. The Ancram Iron Works at Manor Livingstone, Columbia County, New York, cast cannon and shot for General Amherst when he was preparing his army for the capture of Fort Niagara and Crown Point.[20] The foundry was erected in 1740 by Philip Livingstone. Livingstone had previously erected a furnace at Salisbury, Connecticut, in 1734.[21] The Salisbury Foundry became one of the largest producers of cannon and shot during the Revolutionary War. Another foundry which had gained considerable experience in casting cannon was located at Raynham, Massachusetts, (formerly part of Taunton); it cast cannon for the colonies and the English Army early in the eighteenth century.[22] One good history of the Salisbury works and its produce mentions guns being cast of calibers from 1/2-pound swivel to 18-pounders.[23] Bishop claims the Salisbury works cast

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20 Bishop, J. Leander, A History of American Manufactures from 1608 to 1860, (Philadelphia, 1868), I, 511,530.

21 Ibid., I, 511.

22 Ibid., I, 482.

23 Middlebrook, Louis F., Salisbury Connecticut Cannon - Revolutionary War, (Salem, Massachusetts, 1935), p. 35.

guns from 4- to 32-pounders.[24] From the citation, "standard full-size cast-iron ordnance...for military or field use",[25] it seems that the American artillery had developed a cast-iron field gun of standard dimensions, but proportions are not mentioned. For naval use the guns were 2/3rds the length of the standard size field guns, and some for ships with cramped quarters only half the length.[26] If this statement is correct we can then account for some of the very short guns which do not conform to any standard ordnance regulations. The custom must have been to cast many of the guns to suit individual ships. How common this custom was the writer has been unable to determine, but he doubts that it was a general practise and believes that the occasions when the guns were so cast were few. Many of those smaller cannon undoubtedly were used in the field, and in the various forts and batteries. One description of these guns is not very complimentary to the Colonial foundries --- "The guns were necessarily of crude construction, the casting far from perfect, due to the hurried manner in which they were produced,..."[27] "Voluminous contracts, records, agreements, account books and other papers pertaining to the oper-

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24 A History of American Manufactures from 1608 to 1860, (Philadelphia, 1868), I, 511.

25 Middlebrook, op. cit., p. 35.

26 Ibid., p. 35.

27 Ibid., p. 29.

ation of the Salisbury Cannon Foundry are on file among the State Archives of Hartford."[28] A review of some of these documents reveals lists of various men who received and receipted the completed guns, and for what service they were designated---navy, coast defense, frontier defense, or the field. Those papers undoubtedly contain much valuable data on American ordnance. Probably they, like so many old records, have been searched for their literary value only, and not for the technical descriptions of which we are so sadly in need.

Middlebrook gives a list of ordnance and accoutrements captured in Fort Ticonderoga taken from Ethan Allan's report, dated May 10, 1775:

"120 pieces of cannon
2 10" mortars
1 howitzer
1 cohorn
50 swivels
10 tons of musket ball
3 cart loads of flints
30 new gun carriages
A quantity of shells
100 stands of arms
2 brass cannon
10 casks of powder
48 prisoners of war."[29]

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28 Middlebrook, op. cit. p. 42.

29 Ibid., p. 4. Middlebrook took this list from Lossing, Benson J., The Pictorial Field-Book of The Revolution, (New York, 1851), I, 125.

From this we see even the English were careful of their brass artillery - only two brass pieces out of a total of 122 guns.

Another collection of document which would be of immense value to the National Park Service are the papers of Henry Knox, now deposited with the Massachusetts Historical Society. A part of these documents, in photostat form, have been received and examined, but no important details have come to light. In F. S. Drake's Life of Henry Knox, there are no descriptions of any technical value to a technician doing research on ordnance or fortifications, yet there must be the specific references we seek on this subject in original papers.

Out of thirty-eight foundries mentioned by Bishop, and eleven mentioned by Boyer, as having cast cannon and shot for the Continental Army during the Revolutionary War, only four are specifically mentioned as casting brass ordnance. "Colonel Paul Revere was the proprietor of a foundry on Lynn street. Boston,...Very neat brass cannon was cast at this foundry."[30]

Benjamin Loxley made proposals as early as 1776 for casting 8-inch mortars, howitzers, cannon and shells. Several brass cannon cast by Loxley were tested by Daniel Joy of the Reading

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30 Bishop, op. cit., I, 497.

(Pennsylvania) furnace.[31] A third man, James Byers, also cast brass cannon; of this person Bishop gives no data except that his foundry was in Pennsylvania.[32] A fourth person was Daniel King, who commenced a brass foundry as early as 1759 at the upper end of Second Street, Philadelphia.[33] Later reference is made in this report to Daniel King.

From this we can fully understand the difficulty there must have been in trying to supply the Continental Army with brass ordnance, and that to fully equip the artillery, cast-iron guns must have been used to a large extent. No doubt iron cannon must have been experimented with in order to find a type suitable for the field, but dimensions remain in obscurity. That they were closer to the English type than those of any other nation is certain. The experimenting done would have been mostly in weight and length; their design certainly would have closely resembled the British.

That the English have contributed much to the confusion of

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31 Bishop, op. cit., I, 573.

32 Ibid., I, 574.

33 Ibid., I, 574.

identifying this miscellaneous collection of guns is evident.

Even Muller complained in 1756:

> "The reader may easily perceive the perplexity of these constructions, arising from the different scales that are used without the least necessity."[34]

and

> "Tho' these light Pieces were then highly esteemed for their easy carriage and facility of working them, yet much longer and heavier have been made ever since without any manner of reason: and we should have continued so, had it not been for Col. Weideman, a German, who brought light Pieces in use again, as a new invention; by the express command of his Royal Highness the Duke of Cumberland: ..."[35]

and

> "...for on 12th June 1751, some experiments were made on Putney-Common by Messrs. Moore and Baron Stark, with a Piece made of new metal of their invention; which Piece was a 6 pounder of three feet and a half long, and weighed 3: 2: 0 [392 pounds]; as they said, and it was fired three hundred rounds in three hours and forty-five minutes,..."[36]

and

> "This Piece was four feet and a half long, and weighed 4: 3: 0 [532 pounds]; and after being fired three hundred rounds in three hours

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34 Muller, op. cit., p. 75.

35 Ibid., p. 9, Introduction.

36 Ibid., p. 10, Introduction.

and twenty-seven minutes, loaded with the same charge as above, was found not to have received the least damage."[37]

and

"There are several old Guns in the Warren, whose thickness of metal is no more than I would make them; there are even some not so strong, and yet they have been serviceable to this day: amongst these may be reckoned many 6 pounders that belonged to the East-India company, which were tried over again, to know if the rust had not rendered them unserviceable; and tho' they were not above half the thickness at the muzzle astragal as the present ones, yet they all stood the whole charge of powder without bursting. Some new ones were proved at the same time, according to the late Mr. Robins's construction; and since, a few others of the same caliber,..."[38]

Another caliber of gun seldom mentioned in the English ordnance regulations was the 2-pounder. Only three references to it have come to light:

1) See photograph No. 2, upper left corner, under "Field-pieces"; [39]

2) "John Fuller, Master Founder for the Heath field foundries in Sussex cast several 2-pounders and sold them to the English government in 1735:
60 2-pounders - 5 feet long
60 2-pounders - 5 feet 6 inches long";[40]

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37 Muller, op. cit., p. 11, Introduction.

38 Ibid., pp. 14, 15, Introduction.

39 Smith, Captain George, op. cit., photocopy from.

40 Foulkes, Charles, Gun-Founders of England, (Cambridge, 1937), p. 77.

3) An account of the Battle of Moores Creek, North Carolina, mentioned a 2-pounder.[41]

That they were used by the Americans in the War for Independence we have ample proof in letters and receipts from captains of vessels who drew ammunition and balls for some from the powder magazine in Williamsburg:

"Public Stores, Williamsburg, 1778-1779
Mss. Account Books, Virginia State Library Archives
Journal of the Council of the State of Virginia
Vol. 2, 1777-1781, Page 128

Virginia Williamsburg, 22d June 1778

-Schooner Boat Defiance Capt. Joseph Wrenn Dr.

To the Public Magazine		Sundries Vizt
12 Muskets	36 flints	100. 2 lb Ball
50 Swivels Ball	6 lb Sheet lead	
2 Dutch Ovens	50 lb Powder	
To 2..2 pounders	2 Swivels	2 Howits" [42]

[Italics by T.B.]

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41 Stedman, Charles, The History of the American War, (London, Printed for the author, and sold by J. Murray, 1794).

42 THE POWDER MAGAZINE, typescript compilation of material on the Williamsburg, Virginia, powder magazine by Colonial Williamsburg, Inc., Williamsburg, Virginia, dated August 7, 1934, p. 100.

"Journal of the Council of the State of Virginia
Vol. 2, 1777-1781, Page 200
Public Stores, Williamsburg, 1778-1779
Mss. Account Books, Virginia State Library Archives
Virginia Williamsburg December 2d 1778
-Sloop Dolley Henry Dr. to Sundry Accounts Vizt
Public Magazine 28 lbs. lead 15 muskets
12 cutlasses 15 cartouch boxes 100 flints
8 Powder Horns 50 lbs. musket ball 2 armrests
2 Iron post 200 lbs Powder 200 lb 2. Ball
200 Swivel Ball."[43]

[Italics by T. B.]

Birkhimer gives a list of ordnance, copied from a report by Knox, dated January, 1778:

> "Brigade artillery, seventeen brigades, with four guns each, sixty-eight pieces, to be 3, 4, or 6-pounders; with the park, two 24-pounders, four 12-pounders, four 8-inch howitzers, eight 5 1/2-inch howitzers, ten 3 or 4-pounders, ten 6-pounders; for the reserve, to be kept at a proper distance from camp, thirty 3, 4, and 6-pounders, two 12-pounders, one 24-pounder; all the foregoing brigade, park, and reserve guns and howitzers to be of brass. In addition, twelve 18-pounders, twelve 12-pounders, battering pieces, on traveling carriages, together with two 5 1/2-inch and twelve 8, 9, and 10-inch mortars; the battering pieces and mortars to be of cast-iron."[44]

From this we see that iron ordnance was used almost exclusively

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43 Ibid., p. 102.

44 Historical Sketch of the Organization, Administration, Matériel and Tactics of the Artillery, United States Army, (Washington, D. C., 1884), p. 275.

for the heavy traveling or siege equipment. From an inventory taken at the close of the war, Birkhimer sets forth the various calibers which had existed in the Continental Army:

> "In this there were enumerated as being on hand, mounted and ready for service: Of guns, 1, 3, 4, 6, 9, 12, and 24-pounders; of mortars, 4 1/2, 5 1/2, 8, 10, 13 and 16-inch; of howitzers, 5 1/2 and 8-inch, all of brass; and of iron, 1, 2, 3, 4, 6, 9, 12, 18, 24, and 32-pounder guns, 18-pounder carronades, and 3 1/2-inch howitzers."[45]

It would have been interesting to have seen this collection assembled in one place!

A letter signed by H. Knox, Secretary of War, to the Senate, dated December 16, 1793, lists the military and ordnance stores of each arsenal and depot in the colonies, and states:

> "I have the honor to submit a return of the ordnance, arms, and military stores in possession of the United States...."[46]

[See Table #1, attached.]

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45 Ibid., p. 275.

46 American State Papers (Vol. XII) of Military Affairs (Vol. 1), p. 44, Item No. 10.
[American State Papers. Documents, Legislative and Executive of the Congress of the United States, from the First Session of the First to the Second Session of the Fifteenth Congress, inclusive: Commencing March 3, 1789, and Ending March 3, 1819. Selected and edited, under authority of Congress, by Walter Lowrie, Secretary of the Senate, and Matthew St. Clair Clarke, Clerk of the House of Representatives, (Washington, Published by Gales and Seaton, 1832).]

In checking all the heavy ordnance in the various lists, it totals only 506 pieces; of this number 244 were of brass and 262 of iron. Table #1, attached to the back of this report, has been compiled and itemized from the reports of the various depots. According to a statement[47] the itemized report of ordnance and stores of 1789 differs only by 27 guns, 16 of brass and 11 of iron, which had been removed during the years 1789 to 1793.

It hardly seems possible that the number of guns here given (533) would be the total of heavy ordnance in the States, when we consider that 267 were captured from Cornwallis alone when he surrendered in Yorktown. There must have been quite a number of cannon aboard ships, in several of the fortifications; also, cannon belonging to the State Militias. Thus we can consider that only those in depots are included in this total and not the number of guns throughout the country. The most interesting part of the list of ordnance is the information of the various calibers and types in use.

The writer is not familiar with the 3 1/2-inch iron howitzer mentioned in Table #1. In the Military Museum at West Point Military Academy, New York, there are three brass howitzers having a

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47 Ibid., p. 60, Item No. 10.

diameter of 2.65 inches, which bear the following label: "Made by Daniel King, Germantown, Penn. This is one of the very few authentic pieces of ordnance made in this country during the Revolutionary period and still in existence. Supposed to have been cast and made by the order of Gen. Anthony Wayne" (see photograph No. 15). On the reinforce field there is stamped "Daniel King, Germantown, Pa.", and on the chase "USZOGNO"; on the cascable "236", and on the left trunnion, "U.S.". There is no date on this gun.

Up to this time we have given an account of various types, lengths and weights of guns as given by various authors; also of guns which we actually have. This has left us with many types of guns to be clarified and recognized. The variety of designs are many, the actual caliber of guns in use very few. This prepared table[48] will give an idea of the caliber of guns most commonly used.

Pounder of gun	Diameter of Shot	Caliber of Bore
1	1.923	2.019
2	2.423	2.544
3	2.775	2.913
4	3.053	3.204
6	3.498	3.768
9	4.000	4.200
12	4.403	4.623
18	5.040	5.292
24	5.547	5.824

48 Smith, Captain George, op. cit., compiled from.

From this table we see there are only nine calibers for the fifty-seven different types of guns of adopted regulations, plus those of which we have no other record than the guns themselves.

There were eleven different types of 6-pounders approved, plus the five guns previously described, making a total of sixteen 6-pounders, counting both brass and iron guns. Excluding the 6-pounders above two thousand pounds as being too heavy, and using only those below this weight, still leaves us ten different guns of this same caliber. It would be necessary in order to mount these guns for field service to construct ten differently dimensioned carriages; their architectural features would be the same but one suitable for a 6-pounder of 4: 3: 14 (546 pounds) would not be strong enough for a cannon weighing 18: 0: 0 (2,016 pounds). In describing the construction of the carriages, we will use a later edition of Muller.[49] Birkhimer says:

> "So far as is known, Professor Muller's work on gunnery was the only text-book for artillery constructions extant in this country prior to 1797. That it was extensively used by those having charge of artillery technical affairs is well known. With this book in the hands of a superintendent, there was no reason why skilled artisans should not produce English guns and carriages of the most approved patterns. The carriages that Stevens describes as having been used during the Revolution and down to the time at which we write were Muller's. The American edition of Muller's

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49 Muller, John, A Treatise of Artillery, (Philadelphia, 1779), et passim.

> treatise, published in Philadelphia in 1779, was dedicated (doubtless without the author's consent) 'to Generals Washington and Knox, to Colonel Proctor [sic], and the officers of the continental army....'[50]

The dedication mentioned by Birkhimer is copied here as it appears in the book:

> TO HIS EXCELLENCY
> GEORGE WASHINGTON, ESQ;
> COMMANDER IN CHIEF
> OF THE ARMIES OF THE UNITED STATES
> OF AMERICA:
> GENERAL HENRY KNOX:
> COLONEL THOMAS PROCTER:
> AND
> THE OFFICERS
> OF THE
> CONTINENTAL ARTILLERY,
> THIS TREATISE,
> ON GUNNERY, &C.
> IS MOST RESPECTFULLY INSCRIBED,
> BY THEIR
> MOST HUMBLE SERVANT,
> JOHN NORMAN [51]

The next volume which Birkhimer mentions as being a guide to the American Colonial Artillery is that by Stevens.[52] This book deals mostly with tactics and manoeuvres which are purely English.

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50 Historical Sketch of the Organization, Administration, Matériel and Tactics of the Artillery, United States Army, (Washington, D.C., 1884), pp. 225-226.

51 Muller, (1779), op. cit., Title page.

52 Stevens, William A., A System for the Discipline of the Artillery of the United States of America, or, The Young Artillerist's Pocket Companion, (New York, 1797), et passim.

The references to carriages and equipment pertain solely to the English types and all the illustrations in this volume are exact copies from John Muller. William Stevens was a first lieutenant in Colonel Henry Knox's regiment as organized pursuant to resolve of Congress, December 2, 1775.[53] In 1778 he was commissioned Captain in John Lamb's regiment of artillery. We still find him a captain in John Lamb's regiment at the end of the Revolutionary War.[54] The organization of the first artillery regiment arrayed against the forces of the Crown at Boston, in June, 1775 was raised by the Colony of Massachusetts, adopted by the Continental Congress, and commanded by Colonel Richard Gridley, a half-pay British officer. His services terminated at the expiration of his enlistment period on January 1, 1776. He was replaced by Henry Knox who had been made a colonel by action of Congress, December 12, 1775.[55]

Although there were bills passed by Congress for administering the various army units, there are no bills which definitely state the types of ordnance and accoutrements.

Again quoting Birkhimer,

"It has been naturally but erroneously

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53 Birkhimer, op. cit., pp. 332-333.

54 Ibid., p. 344.

55 Ibid., pp. 1, 2, and 3.

> supposed that the Gribeauval carriage [1764 French regulations] was introduced into the American service during the Revolution; instead, the English was then used, and it remained during the eighteenth century the only style known practically to the American artillery service. Many cannon and other military stores were procured in France and the conclusion was drawn that the carriages accompanied them, and that in effect the whole Gribeauval system was transplanted to American soil. There is no proof, however, that this was the case."[56]

From the above we know that the American ordnance during the Revolutionary War comprised English approved guns and carriages, and that from France only cannon were purchased.

Contrary to this statement and deduction, there is, in the photostated portion of the Knox Papers now at Colonial National Historical Park, a letter dated at Boston, April 24, 1777 which specifically mentions carriages being received from France:

> "...It is probable you will hear before this reaches you of the Arrival of a large Ship at Portsth from France with 58 Ps Brass cannon carriages shott & Cloathing Blanketts Powder Seals reports of the quantities Various....Ship arrived Sunday..."[56a]

This is interesting information, but the following quotation may be interpreted so as to lessen its importance:

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56 Birkhimer, op. cit., p. 223.

56a Letter from J. Jackson [?] (presumably to a man named Harrison). Paper No. 161 in Papers of Henry Knox.

"A French Ship arrived last Sunday at Portsmouth from France after a Passage of 3 Months She has brought 52 brass Cannon, 7000 Musquets, 10,000 Cannon Shot 9000 Grenade Shells, 5 Tuns of Powder a large number of Tents, a large quantity of Lead Balls & some Linnen. The account we had yesterday of her Cargo made it a much more valuable one & which I sent just as I received it to our Friend Harrison. You will correct that Account -..."[56b]

To these sources we must add those made by private foreign concerns, and those made in America. Such equipment naturally caused considerable confusion in fitting out a train of artillery, and it is no wonder that our system has been called a "mongrel system".[57] Though this may have been an appropriate term, it proved its worth in the end.

"The consequences are obvious, and will be felt more sensibly in the United States, where, we have had occasion to remark, a contractor, a carpenter, at a distance from the public arsenals, had the liberty of employing timber of any kind and size; and was satisfied if the carriage he had contracted for was like that of a neighboring fort, and thought it unnecessary to pay any attention to the caliber and length of the guns. This want of uniformity,...impeded for a long time the pro-

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56b Letter signed "J J" to General Knox, dated April 24, 1777 at Boston. Paper No. 88 in Papers of Henry Knox.

57 Lemly, Henry R., "Changes Wrought in Artillery in the Nineteenth Century, and their Effect Upon the Attack and Defense of Fortified Places", (Essay published by U. S. Artillery School, Fort Monroe, Virginia, 1886), p. 1.

gress of the French artillery, as it will that of America, unless a similar system is adopted."[58]

This was written in 1809 but a uniform system was not officially adopted by the United States Army until 1819.

Before going into detail in describing the carriages and the principles by which the drawings were made, it will be necessary to describe the several methods used in scaling and proportioning the construction of the carriages. In preparing drawings for the guns of the earlier type (1736) the scale used was by dividing the diameter of the shot into several parts. The brass (bronze) gun had its diameter divided into sixteen parts, and the iron gun into fourteen, so that the entire gun was constructed in proportion to its diameter of shot. The breech consisted of so many diameters and so many parts, as did also the reinforce, chase, and each moulding.

In John Muller's writings, both in the original edition of 1756 and the reprint of 1779, he used a scale by dividing the diameter of both brass (bronze) and iron guns into twenty-four parts: "...the whole diameter being divided into 24, as in the construction of guns."[59] As each carriage for a standard type cannon had to be

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58 Tousard, Louis de, American Artillerist's Companion, (Philadelphia, 1809), II, XIV, Introduction.

59 Muller, (1779), op. cit., p. 113.

constructed in proportion to the cannon itself, this same scale was used. For example, the thickness of the cheek plates is always one diameter. Thus, the carriage for a 6-pounder with a diameter of shot 3.67 inches had cheek plates 3.67 inches in thickness. For a 12-pounder, whose diameter of shot was 4.62 inches, the cheek plates of the carriage measured the same in thickness. The length of each cheek plate consisted of so many diameters. On the 6-, 12-, and the short field 24-pounder this was 13 diameters and 4 parts, but for siege carriages for the 18- and 24-pounders, which were of considerable length and weight, a much heavier carriage was needed. The thickness of cheek plates remained the same. For the 18-pounder this would be 5.040 (5 inches), and for a 24-pounder, 5.547 (5 1/2 inches).[60] The length of cheek plates, however, was based on so many diameters of shot and feet. For both the 18- and 24-pounder this was 12 diameters plus 7 feet, 6 inches. Thus the only difference in length of these two carriages was the difference the 12 diameters of shot made. The cheek plates for the 18-pounder would be 12 feet 6 3/4 inches long, and for the 24-pounder 13 feet 1/2 inch.[61]

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60 Muller (1756), op. cit. p. 56.

61 Ibid., p. 169.

From this we see how each carriage is constructed in relation to each gun of standard ordnance. That this was not always satisfactory due to the variety in weights and lengths of guns, Muller himself admits:

> "This is common construction of field carriages; but as it relates only to the four calibers, whose dimensions have been given, the reader will still be at a loss how to construct any other; and as the length of the cheeks depends not only on the caliber of the gun, but likewise on the height of the wheels, as well as on the length of the pieces, which varies very often: therefore, in the following construction, we suppose the wheels of the common size, and the guns to be 20 or 21 diameters long, which is the common length at present of the 24 pounders."[62]

[Traveling or siege carriage wheels are 58 inches in diameter; those of a field carriage are 50 inches.[63]]

On page 32 of this report is given a list of the nine calibers in use. They were cast into fifty-seven different types - different in weight and length of metal. There were eleven different types of 6-pounders of a standard or approved pattern. Plus those five which exist, but of which we have no record, gives a total of sixteen 6-pounders. If the English regulations were adhered to strictly, only three types of carriages were constructed for these

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62 Muller (1779), op. cit., p. 103.

63 Ibid., pp. 108 and 113.

6-pounders ---field, garrison and naval carriages. Of these the field carriage would be of standard dimension. As the medium weight gun might occasionally have been used in the field, a fourth carriage might have been constructed. Both guns are of brass. Of the cast-iron cannon, the garrison guns would be next, as only certain types are suitable for this purpose. The largest share of the different weights and dimensions of carriages would be for the naval guns. In the Continental Artillery only the weight of guns would differ, regardless of purpose or usage, although brass was the most sought after for field use. The demand for cannon of this metal could not be supplied; hence, cast-iron cannon were substituted, and the only restrictions were that guns of this metal whose weight would interfer with the army while moving in the field should be placed in batteries and mounted on siege or garrison carriages and those suitable for field operations should be mounted on field carriages. If we are to exclude the six 6-pounders whose weight is above 2,000 pounds, as mentioned on page 33, it still leaves us ten 6-pounders which could be mounted on suitable carriages for field use. Each of these carriages would have to be different in thickness of material, length, and width, and would be considerably different in weight. While some of the carriages could be constructed entirely on the field gun pattern, by placing a wrought iron collar around the neck of the button (this will be more detailed later) others had to be con-

structed by a combination method, that is, combining both the field and traveling, or siege, carriage.

We readily see where the English had to construct only two types of field carriages for ten light and medium guns. In using their standard ordnance, the Americans would have to construct ten different carriages for mounting the same number. We fully realize that the scale as advocated by Muller is only suitable for guns of standard ordnance, and for naval and garrison guns whose weight and length varied greatly a different method had to be used. For comparison we will use the standard English field gun of 1753 and 1764 and the gun marked #1 on Drawing NHP Col-10,016, Sheet 1.

Muller gives the length of a 6-pounder field gun of the 1753 regulations as 4 feet 6 inches; and one of the 1764 period as 4 feet 1 inch. The guns weigh, respectively, 4: 3: 10 (542 pounds) and 4: 2: 5 (509 pounds).

In building a carriage for a 6-pounder 5 feet 6 inches long and weighing 11: 3: 2 (1,318 pounds) [see Drawing NHP Col-10,016, Sheet 1] the same proportions for all three guns could not be used; the weight and length of at least two of the guns would be all out of proportion to the carriage. It would have been necessary for the American artisans to use three proportions if they were to keep

anywhere near a proper balance between gun and carriage. First, the length of the gun from "A" to "B" had to be measured. Gun #1 shows this to be 2 feet 2 1/4 inches. This length would be needed on the carriage from center of trunnion socket to center of transom "F" of the elevating platform; the remaining part of the platform was for resting the elevating coin, Fig. J; if an elevating screw was used only the center transom was needed, as shown on gun #4, Fig. G; the proportions in lengths of cheek plates are all in relation to each other; if the distance from "C" to "D" was one-third, or thereabouts, of the distance "D" to "E" on one carriage, it would be the same on the other. For the thickness and depth of the plates it is necessary to use an entirely different method. The weight of the gun enters into the subject and has to be used. The dimensions of cheek plates used for a light 6-pounder weighing only 4: 2: 5 (509 pounds), of 84 1/2 pounds for each pound of the shot weight, would not do for a gun weighing four times as much. The gun of 5 feet 6 inches long, weighing 11: 3: 2 (1,318 pounds) had 203 pounds for every pound of the shot weight.

The plank of white oak or elm needed for the light 6-pounder ---3 inches by 12 1/8th inches by 7 feet 10 inches in dimension--- could not be used for the heavier gun, but by using the same proportion as existed in relation to pounds of metal per pounds of shot in the lighter type to the one of the heavier, we find the

size of plank or timber necessary for the heavier gun to be 3 1/2 inches by 13 1/2 inches by 8 feet 1/2 inch.

For the three transoms, the breast, center and trail, the writer has substituted the thickness of material, that is, where Muller gives the dimension as one and two diameters, he has used the single, or double the thickness of the cheek plates (see "F" and "G", Sheet 1, Drawing NHP Col-10,016).

The width between the cheek plates at the trunnions and at the trail depends on the gun; the carriage has the same taper as the gun from the base ring to the side of the second reinforce ring (see "B.B." and "H.H.", Sheet 1).

There are two different methods of elevating the gun; one was by a coin or wedge (see Fig. J, Sheet 1); the other by an elevating screw, (see "A" on Sheet 1). All the brass guns used in the field had on the under side two small lugs (see Sheet 1, Gun #4, Fig. 1). Muller says, "...the only difference is, that there is no bed transom here, because screws are used to raise these light pieces instead of wedges; for which reason the center transom is two diameters broad, and but one thick; it is placed in the middle of the height of the cheeks at the center, so that the neck of the cascable answers to the middle of the breadth of the transom, the

screw being fixed there."[64] (See photograph No. 16.) William Stevens uses this same passage.[65] (See Sheet 1, Gun #4, Fig. G. For full size detail see Sheet 3.)

For elevating the gun needing a wedge a small platform had to be constructed (see Sheet 1, Figs. 1, 2 and 3, "F", "G", and the wedge "J").

Some iron guns had a collar of wrought iron placed around the neck of the button (see photograph No. 17), which made them suitable for an elevating screw instead of the coin. The trunnion sockets are, of course, made to fit the individual guns as they often vary even on guns of the same dimensions. All the iron strapping has to be lengthened and shortened according to the cheek plates of the carriage. They begin and end at the same point (see Sheet 2). There is no difference in thickness of metal strappings, but they vary in width and length according to the cheek plates.

The iron axle, boxed in wood, was already in use by the French for their light field artillery and to some extent by the English, but it was still considered an experiment. How much of this the Continental artillery had adopted the writer has never been able to

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64 Muller (1779), op. cit, pp. 113 and 114.

65 Stevens, op. cit., pp. 218 and 219.

definitely establish. On Sheet 1, Figs. 2 and 3 are shown two axles cased in wood; Figs. 1 and 2 use the same axle as do Figs. 3 and 4. On Sheet 2 is shown a wooden axle, if this should be desired. However, for our purpose where the guns have to remain exposed to the elements indefinitely, iron axles are more suitable, as they are not subject to decay like the wooden ones.

The dimensions of wheels would necessarily have to be changed to correspond with the dimensions of the carriage and the weight of the gun. To do so the thickness of the cheek plates of a standard 6-pounder field carriage was divided into twenty-four parts; the wheels were then scaled and the same proportions used in the construction of wheels for the heavier iron cannon carriages.

The differences in the proportions of the wheels for carriages No.'s 1 and 2 (Sheet 1, Drawing NHP Col-10,005) were so slight that the same wheels could be used on both carriages, (see Drawing NHP Col-10,016, Sheet 2).

For wheels on Gun #3 (Drawing NHP Col-10,008), which is that of a standard 6-pounder field carriage.

For wheels on Gun #4 (Drawing NHP Col-4,004) it was necessary to raise the elevation slightly; hence the wheels are the same diameter as on the galloper carriage - 51 inches (see Drawing NHP Col-4,004). All other construction details in regard to the dimensions of nave, spokes, fellows, and iron work are the

same as for the field 6-pounder.

Why Muller suggests that wheels for a galloper carriage be so much heavier than for a 6-pounder field gun, he does not explain; neither does any other authority which the writer has examined. A galloper carriage and gun are much lighter than a standard brass 6-pounder field gun and carriage. A light 6-pounder weighs 546 pounds, whereas a 3-pounder used on the galloper carriage weighs only 94 pounds.

Very little information concerning the actual construction and operation of the elevating screw is given in any of the books on this subject. John Muller gives the following information:

> "A ring of metal is cast under the cascable in these light pieces, as is seen in figure the second, which serves to fasten the head of a screw, that is used instead of coins to raise the piece by; this ring is described from the same center, and with the same radius as the neck; the diameter of the hole to receive the bolt is 5 parts, and the thickness of the ring is 4 parts."[66]

Stevens enumerates the various material and equipment to be taken into the field as follows: "...coins for 12, 9, 6 and 3 pounders; and for howitzers;..."[67] and "...screws for guns 12, 9, 6, and 3 pounders;..."[68]

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66 Muller (1779), op. cit., p. 61.

67 Stevens, op. cit., p. 246.

68 Ibid., p. 247.

From this last description it is known that the American field artillery had carriages with and without the elevating screw or both screw and coin in the same train when taking the field during a period of operation.

None of the engravings in the Muller volumes show the elevating screw, nor have any pictures of the screw in detail been located. The nearest to it is the one shown in photograph No. 18,[69] and this is a plan only, with no construction detail to go by in preparing a drawing. The drawing shown on Sheet 3, Drawing NHP Col-10,016 represents the screw as it possibly might have been. See, also, photograph No. 16, which shows the screw in place on a reconstructed carriage. The following items had to be considered: First, the button when the gun was deflated or elevated, had a circular movement; to allow for this a socket must have been used, resting on a small set of trunnions (see Sheet 3, Fig. 3). This would also allow the handle, Fig. 2, or female screw, to rest on an even surface, regardless of the angle in which the screw was placed. Second, the jar from the recoil, when the gun was fired, was of considerable force; hence, a means must be found to prevent jamming or ruining the tread of the elevating screw; for this the

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69 Taken from Smith, Captain George, op. cit., Plate 7.

socket had to be of sufficient depth to permit a greater surface on which to absorb the shock. The socket, Fig. 3, is of sufficient depth for this purpose; the holes in which the screws slide are smooth and close fitting. Fig. 4 is the bearing in which the socket retains its circular movement; also used for anchoring the entire assembly to the center transom, Fig. 6. Square tread is used on the screw and handle, as shown by Figs. 1 and 2. Both square and standard tread had been in use many years previous to 1750. A gear and wheel cutting lathe had been invented by Dr. Hooke about 1655; and a screw cutting lathe was invented by Hindley of York, England, in 1741; previous to that time they had been cut by hand stock and dye.[70] Photograph No. 19 is of a screw, socket and bearing made after the design just mentioned.

The elevating screw as here described, or one closely resembling it, was in use as early as 1728 by the English, as can be seen in photograph No. 16, which is of an 8-inch howitzer bearing this date. This howitzer is one of the original guns surrendered in Yorktown by Cornwallis in 1781. The gun is now at Yorktown. 8-inch howitzers were considered as only siege guns and belonged to the siege train, although there is record that this type of cannon was brought into the field on occasions unaccompanied by a

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70 Bishop, op. cit., I, 521.

siege train. Their carriage resembled a 12-pounder heavy traveling carriage, except, of course, the cheek plates were much shorter, (see Drawing NHP Col-10,007). Occasionally the English would adopt a contemporary method for elevating their guns and howitzers, particularly if they used guns captured from other nations that did not use the same method of elevating a piece. In Yorktown we have an 8.79-inch howitzer which was cast in Douay, France, by Beringer June 7, 1777 (see photograph No. 20). This howitzer bears the inscription "Surrendered by the Capitulation of Yorktown Oct 19, 1781". Presumably this piece of ordnance was captured either from French or American forces and mounted in the defensive works in Yorktown. To properly use this gun the English would have had to adopt the coin, instead of an elevating screw (see photograph No. 21; also Drawing NHP Col-10,007, Fig. 5). The French method of elevating a howitzer was by a sliding coin, operated by a screw and handle; hence, no lugs were needed on the under side of the button (see photograph No. 22).

Both the French and English howitzer carriages were constructed so that when an angle of 45 degrees was wanted the platform and screw were removed allowing the base ring of the howitzer to rest directly on the center transom, (see "F" on Drawing NHP Col-10,007, and "E" on Drawing NHP Col-10,005, Sheets 1 and 2).

For the larger guns, like the heavy 12-, 18-, and 24-pounders,

used by the Americans for siege purposes, we cite a quotation from artillery recommendations written by Henry Knox,

> "If any circumstances shall happen to render the movement of this army necessary, one hundred covered wagons will be wanted to transport the stores; three hundred strong horses to draw the travelling artillery; (the heavy artillery on garrison carriages..." [71]

Another reference to garrison carriages being used in the field was at the battle of Bunker Hill in 1775.[72] From this information we infer that the American artillery used garrison carriages when iron ordnance was used for siege purposes.

In some of our journals of the siege of Yorktown it is mentioned that horses, oxen, and wagons were procured for hauling the cannon and carriages from the landing to Yorktown. If all the guns were mounted on traveling carriages, they would each have a limber, and only horses or oxen would be needed for hauling them. But if garrison carriages were used, heavy log wagons would be needed for transporting the cannon and ordinary wagons for hauling the carriages. The question arises, should we accept the phrase "for transporting cannon and carriages" literally or only in a general way meaning cannon, carriages, and all accoutrements. For regardless of how the guns were mounted wagons would be needed

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71 Birkhimer, op. cit., p. 5.

72 Ibid., p. 79.

for hauling mortars and other artillery accoutrements and supplies. This question will have to remain unsettled until further information can be found.

On December 12, 1776 General Washington had diverted from its original purpose one of the battalions of artillery and formed it into an artificer-regiment,[73] and on January 16, 1777, Benjamin Flower of Philadelphia was appointed lieutenant-colonel of this regiment, which consisted only of mechanics---wheelwrights, blacksmiths and laboratory workers---who never shouldered a musket or fired a gun in the field. This department was a germ of the ordnance department during the Revolution, and was much esteemed by both Washington and Knox, and though its efficiency to some extent suffered by ignorance in administration, its service was well recognized.[74]

On February 11, 1778 Congress set up a new technical system for the artillery, about which General Knox, on June 5, 1778, wrote complaints:

> "I am expected to do things, and have no means of doing them."[75]

> "By these regulations the commanding officer

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73 Birkhimer, op. cit., p. 149.

74 Ibid., p. 149.

75 Ibid., p. 152.

> of artillery has no power to give the dimensions or construction of any carriages or cannon, however erroneous they may be;..."[76]

A complaint registered by Governor Reed of Pennsylvania against the Carlisle arsenal says:

> "The iron-work of the carriages was most villainously done. I could run my hands into the joints and cracks in the woodwork, and one 18-pounder carriage that I saw broke down under the first fire."[77]

This order was razed by Congress on August 12, 1780.

Not all carriages were constructed by the army artificers. Some were constructed by private individuals; others were turned out by the foundries casting guns. Carriages for both field and ship guns were made by William Lax of Norwich, and Stephen Ranney of Middletown.[78] Unquestionably there are many others whose identities could probably be discovered if old records now filed in State archives could be found. They might, also, reveal drawings and sketches with dimensions. Research in the field of this report is badly in need of such material.

Although many cannon of various sizes and kinds of metal were procured abroad, no carriages, tumbrils, ammunition wagons, or other wheeled artillery vehicles were purchased; all were manufac-

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76 Birkhimer, op. cit., p. 153.

77 Ibid., p. 157.

78 Middlebrook, op. cit., p. 22.

in the colonies.[79] At least, most sources are quite definite in this regard.

In Yorktown where quite extensive archeological excavations and considerable reconstruction have been carried out on several of the French and American fortifications, many facts have revealed themselves in regard to ordnance, particularly in the American section. In American Battery No. 2, second parallel, the spacing from center to center of each gun is very irregular, with some measurements as small as 10 feet, others,12 feet, whereas the least space advocated by authors on fortifications is 15 feet. Now, the overall width of a traveling or siege carriage is 81 inches (6 feet 9 inches).[80] This would leave only a 3 foot 4 inch space between each gun. At least half of the crew assigned to each gun would have to pass through this narrow aisle carrying powder and shot. Also, here would take place the manoeuvreing for loading and bringing the gun forward into firing position from each recoil, for which was usually provided from 3 to 5 feet, according to powder charges used. To move a 24-pounder forward at least three men on each wheel would be necessary, besides five to seven men on the trail. It is apparent how con-

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79 Birkhimer, op. cit., p. 148.

80 Müller (1756), op. cit., p. 164; (1779), p.100.

jested such a narrow space would have been, not to mention the loss of efficiency. According to records, there were mounted in this battery ten cast-iron 18-pounders and one 8-inch howitzer, besides three 8-inch mortars and several Coehorns. Excluding the mortars because of the usual space between a mortar and a gun battery, and counting only the ten guns and one howitzer, there would be needed 110 men for the guns (11 men each) and eight men for the howitzer, a total of 118 men. Surely it seems foolish to have crowded the men and guns together so closely that efficiency would be reduced to a marked degree. It would have been more advantageous and increased the efficiency of handling to mount less guns, giving more space for each. Hence, the use of siege carriages in this battery may be doubted.

If garrison carriages are considered, there is much in their favor. The overall width of each is only 57 inches (4 feet 9 inches), which gives us a space of 5 feet 3 inches between each gun. Besides, the wheel is much smaller, being 18 inches in diameter, whereas the siege carriage wheels are 58 inches in diameter.[81] The width of a garrison carriage wheel was only 6 1/2 inches; in a siege carriage the naves alone was 17 1/2 inches. From the spacing of the guns in this battery, there is much to

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81 Muller (1779), op. cit., pp. 96 and 118.

recommend garrison carriges having been used.

Battery No. 2 is very shallow. It is more what is called a half-sunk battery, though this term is very seldom used, than a sunken battery. Little information as to the length of space permitted for the recoil of the gun, room needed for the gunner aiming the cannon, and whatever necessary manoeuvres are carried out behind the gun, is given us. For this we must go to the American Battery No. 4, second parallel. This is a full sunken battery. In other words, the bottom of the embrasures are practically at ground level; hence, all the height needed for the carriage, gun, and platform had to be excavated. The length of this battery easily permits the placing of the six guns mentioned by journals and maps of the siege, regardless of on what type of carriage. In Battery No. 2 it is the space permitted for the length of each platform, carriage, and men to handle the cannon which favors the use of garrison carriages. In fact, it definitely prohibits the use of traveling carriages. The overall length of gun and carriage when mounted on a traveling carriage is 16 feet 6 inches. Of this about 3 feet protrude into the embrasure when in firing position. At the explosion of the charge the gun recoils from 3 to 5 feet. This is necessary to permit a man to reload. Otherwise, he would have to crawl into a narrow embrasure for each reloading, which, of course, would be out of the question. The most

common distance for recoil was 5 feet, which allowed 2 feet for the gunner to reload. This would add 2 feet to the space required from the interior slope of the embrasure to the trail of the gun. At least 3 feet would be necessary for the gunner and his assistant when using the hand spokes for aiming the gun. This would make the total length for the entire manoeuvre of a cannon mounted on a siege carriage in a battery 21 feet 6 inches. This would not permit men to pass back and forth while the gun was being worked, and powder monkeys and men carrying shot had to do so. The width of the battery as revealed after excavation is only 18 feet 6 inches, 3 feet short of the space needed for the operation of the cannon only. For a garrison carriage the space of 15 feet 9 1/2 inches would be sufficient for the gun and crew, leaving a little more than 2 feet for the men supplying the gun crews with ammunition. We can readily see how much there is in favor of the garrison type of carriage having been used by the American troops during the siege of Yorktown.

From the description already given we know that both garrison and naval carriages were in use. The evidence in the reconstructed area of the Yorktown battlefield has revealed this fact clearly. That iron guns were mounted in this battery is unquestionable. All the journals and maps state this very definitely. Now, the statement made by Henry Knox, quoted by Birkhimer [page 51] that garrison carriages were used by the Americans for their heavy iron

ordnance serves us aptly. The space in the excavated area of this battery is just right.

The garrison, marine, and naval carriages are all alike except for the wheels. On the naval carriage the wheels were entirely of wood. This was to prevent igniting loose powder which might have been spilled on the deck while loading and firing the guns. The garrison or marine carriage had wheels made entirely of cast-iron (see photograph No. 23), or else the wheels were made of wood with an iron rim attached. When garrison carriages were used in the field, the guns were carried on a block carriage, a heavy four wheeler. The carriages were hauled on a separate wagon. In several of the journals horses and wagons are mentioned as being used for hauling the artillery to Yorktown. This again confirms the opinion that garrison carriages were used during the siege.

That some of the bronze 18- and 24-pounders were mounted on regular traveling carriages there is no doubt, because several of the regular government arsenals did contain trained men and were capable of producing first class equipment. There is the possibility, of course, that their production was limited, and that outside sources would have to be depended on, and it is in such sources the responsibility for the miscellaneous equipment and construction rests. We cannot consider the statement made by Tousard (f.n. 58) and the complaint by Governor Reed of Pennsyl-

vania (f.n. 77) when they mention the crudities of the American ordnance and accoutrements, at least as a general practise for the entire Continental artillery. Another source of questionable design would be the several outposts on the frontier, where an old gun would be made serviceable by a new carriage constructed by local labor and ingenuity that probably had never been in contact with regular ordnance rules. That they probably were of heterogeneous design and construction there is no denial. There might even have been several odd looking carriages used aboard privateers and local naval vessels. But such examples could not be charged against the Continental artillery in general. The whole colony was not made up of crude mechanics or men lacking in engineering and scientific skill. That there were men trained in this field of craft who could easily stand shoulder to shoulder with the best of those trained in Europe must be admitted. That those men could adapt their training to the armies' needs there is no doubt. Circumstances might have required them to make needful changes and to use materials at hand were they wood or iron. But when the product was delivered, guns and carriages would fit as closely as the materials on hand would permit. With this assumption, and the little explanation and directions previously mentioned, the writer has proceeded with this treatise and the drawings.

For complete information on the various guns and carriages of the English ordnance regulations, see report entitled, "REPORT ON

GUN CARRIAGES FOR FORT NONSENSE MORRISTOWN NATIONAL HISTORICAL PARK MORRISTOWN, NEW JERSEY", dated December 7, 1938, which should be regarded as an appendix to this treatise. Photographs of all the completed drawings are attached to this report. Additional drawings, when finished, will be photographed and the pictures forwarded to recipients of this report for attachment.

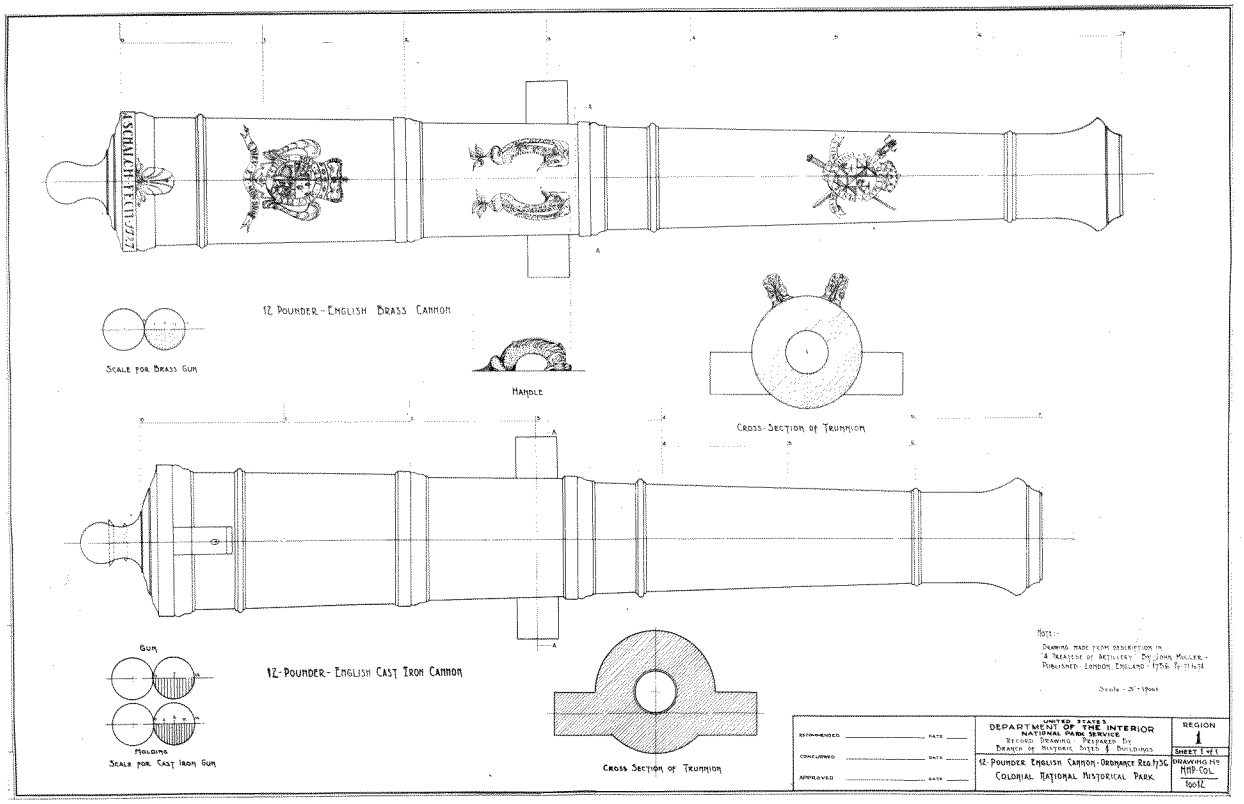
Accompanying this report is a list of sources and their locations dealing with ordnance manufactured in the colonies during the Revolutionary War. To what extent they have been searched for technical data, the writer does not know, but that they must contain an immense amount of material of value for this type of research is certain. What is summarized in this report from brief descriptions of recorded facts may be made clear and definite by these old records. Perhaps some day these records can be checked, which will enable a complete history of the ordnance of the Revolutionary War to be written.

Thor Borresen

Thor Borresen,
Assistant Research Technician.

TB/OLD

December 14, 1939.



Photograph No. 1

[CNHP #6405]

Ship-guns, conſiſting in 42, 36, 32, 24, 18, 12, 9, 6, and 3 pounders.

Garriſon-guns, in 42, 32, 24, 18, 12, 9 and 6 pounders.

Battering-guns, in 24, 18, and 12 pounders.

Field-pieces, in 12, 9, 6, 3, 2, 1½, 1, and ½ pounders, whoſe dimenſions are explained in the following tables, except the ſmall pieces, which differ in length and weight, viz.

TABLE *of Ship-guns, ſettled in* 1753.

Braſs Ship-guns.			Iron Ship-guns.		
Caliber.	Length.	Weight.	Caliber.	Length.	Weight.
42	9 6	61 2 10	42	10 0	55 1 12
32	9 5	55 2 7	32	9 6	53 3 23
24	9 5	51 1 12	24	9 5	48 0 0
18	9 0	48 1 0	18	9 0	41 1 8
12	9 0	29 0 0	12	9 0	32 3 3
9	8 5	26 0 0	9	8 5	23 2 2
6	8 0	19 0 0	6	7 0	17 1 14
3	6 5	11 0 0	4	6 0	12 2 13
			3	4 6	7 1 7

N. B. The length is expreſſed in feet and inches, and the weight in centres, quarters, and pounds.

TABLE *of Garriſon-pieces.*

Braſs Garriſon-pieces			Iron Garriſon-pieces		
Caliber.	Length.	Weight.	Caliber.	Length.	Weight.
42	10 0	64 0 0	32	9 8	56 0 0
32	9 2	49 2 18	24	9 8	48 0 0
24	8 4	37 0 0	18	9 0	36 0 0
18	7 6	27 3 0	12	7 8	24 0 0
12	6 7	18 2 0	9	7 0	18 0 0
9	6 0	13 3 0	6	6 1	12 0 0
6	5 3	9 1 0	4	5 4	8 0 0

Braſs Battering-pieces.

New pieces.		
Caliber.	Length.	Weight.
24	9 8	27 0 0
18	9 0	20 1 0
12	7 8	13 2 0

Braſs Field-pieces.

New pieces.		
Caliber.	Length.	Weight.
12	5 0	8 3 8
6	4 6	4 3 10
3	3 6	2 3 10

The metal of which braſs cannon are made, is in a manner kept a ſecret by the founders; yet, with all their art and ſecreſy, they have not hitherto found out a compoſition that will ſtand a hot engagement without melting, or at leaſt being rendered uſeleſs. Thoſe caſt at Woolwich bid faireſt towards this amendment. The reſpective quantities which ſhould enter into this compoſition, is a point not decided; every founder has his own proportions, which are peculiar to himſelf. The moſt common proportions of the ingredients are the following, viz. To 240 lb. of metal fit for caſting, they put 68 lb. of copper, 52 lb. of braſs, and 12 lb. of tin. To 4200 lb. of metal fit for caſting, the Germans put $3687\frac{42}{41}$ lb. of copper, $204\frac{14}{41}$ lb. of braſs, and $307\frac{28}{41}$ lb. of tin. Others again uſe 100 lb. of copper, 6 lb. of braſs, and 9 lb. of tin; and laſtly, others 100 lb. of copper, 10 lb. of braſs, and 15 lb. of tin. With reſpect to iron guns, their ſtructure is the ſame as that of the others, and they generally ſtand the moſt ſevere engagements, being frequently uſed on ſhip-board. Several experiments have taught us that the Swediſh iron guns are preferable to all others.

CANNON is now generally caſt ſolid, and the cavity bored afterwards by a very curious machine for that purpoſe, where the gun is placed in a perpendicular poſition; but of late theſe machines have been made to bore horizontally, and much truer than thoſe that bore in a vertical form. This new machine was firſt invented at Straſburg, and greatly improved by Mr. Verbruggen, a Dutchman, at preſent head founder at the royal foundery at Woolwich, where probably the beſt horizontal-boring machine in Europe has been lately fixed; it both bores the inſide, and turns and poliſhes the outſide at once.

Names of the ſeveral parts of a CANNON. See Plate VI.

The grand diviſions exterior, are as follow, viz. *Firſt re-inforce*, is that part of a gun next the breech, which is made ſtronger, to reſiſt the force of powder.

Second

Photograph No. 2

[CNHP #5145]

Capt. Geo. Smith, Military Encyclopedia, London, 1779

7. The ſecurity and tranquillity of a *camp* depending upon the vigilance of the guards, the officers who command them cannot be too active in preventing ſurpriſes: a neglect in this particular is often of fatal conſequence. Though an officer ſhould, at all times, be ſtrictly attentive to every part of the ſervice, yet he ſhould be more particularly watchful in the night than in the day. The night is the time moſt favourable for ſurpriſes; as thoſe who are not on duty, are generally aſleep, and cannot immediately afford aſſiſtance; but in the day time, the attention of all the troops is turned to the movements of the enemy; they are ſooner under arms, ſooner in readineſs to march, and in much leſs danger of being thrown into confuſion. Thoſe who wiſh to be better acquainted with the nature and mode of encampments, may read Mr. Lochée's uſeful *Eſſay on Caſtrametation.* *

Concerning the healthineſs of the different ſeaſons of a campaign, the ingenious Dr. Pringle has the following obſervations. The firſt 3 weeks is always ſickly; after which the ſickneſs decreaſes, and the men enjoy a tolerable degree of health throughout the ſummer, unleſs they get wet clothes. The moſt ſickly part of the campaign is towards the end of Auguſt, whilſt the days are ſtill hot, but the nights cold and damp with fogs and dews; then, if not ſooner, the dyſentery prevails; and though its violence is over by the beginning of October, yet the remitting fever, gaining ground, continues throughout the reſt of the campaign, and never entirely ceaſes, even in winter quarters, 'till the froſt begins. He likewiſe obſerves, that the laſt 14 days of a campaign, if protracted 'till the beginning of November, is attended with more ſickneſs than the two firſt months of the encampment. As to winter expeditions, though ſevere in appearance, he tells us, they are attended with little ſickneſs, if the men have ſtrong and good ſhoes, warm quarters, fuel, and proviſions enough.

CANNONADE, in *artillery*, may be defined the application of artillery to the purpoſes of a land war, or the direction of its efforts againſt ſome diſtant object intended to be ſeized or deſtroyed, as the troops in battle, battery, fortreſs, or out-work.

Cannonading is therefore uſed from a battery, to take, deſtroy, burn, or drive the enemy from the defences, &c. and to batter and ruin the works or fortified towns.

CANNON. See this word in the firſt Alphabet.

Dimenſions of all ſorts of braſs CANNON, *as eſtabliſhed by the board of ordnance in* 1764.

Nature		Pders.	Length	Weight	Calibre of the gun	Diam. of the ſhot
			F. in.	C. q. lb.	in. hun.	in. hun.
Braſs guns	Heavy	42	9 6	61 0 0	7.3	6.68
		24	9 6	52 0 0	5.83	5.54
		12	9 0	29 0 0	4.63	4.40
		9	9 0	26 0 0	4.21	4.0
		6	8 0	19 0 0	3.66	3.48
		3	7 0	11 2 0	2.91	2.77
		1½	6 0	5 2 0	2.31	2.20
	Mediums	24	8 0	40 1 21	5.83	5.54
		12	6 6	21 0 14	4.63	4.40
		6	5 0	10 1 0	3.66	3.48
	Light	24	5 6	16 1 12	5.83	5.54
		12	5 0	8 3 18	4.63	4.40
		6	4 6	4 3 14	3.66	3.48
		3	3 6	2 3 4	2.91	2.77

* This gentleman keeps a military academy at Little Chelſea, where youth are well inſtructed in the military ſciences and diſcipline, requiſite for the infantry and cavalry. He is deſervedly patroniſed by his Majeſty, and his mode of education has met with the approbation of the moſt ſkilful officers.

Photograph No. 3

[CNHP #5146]

Dimenſions of all ſorts of iron CANNON, *eſtabliſhed*, 1764.

Nature	Pdrs.	Length F.	Length in.	Weight C.	Weight q.	Weight lb.	Calibre of the gun in. hun.	Diam. of the ſhot in. hun.
Iron guns	42	9	6	65	0	0	7.3	6.68
	32	9	6	55	0	0	6.42	6.10
	24	9	6	49	0	0	5.83	5.54
	24	9	6	47	2	0	5.83	5.54
	18	9	0	40	0	0	5.29	5.3
	12	9	0	32	2	0	4.63	4.40
	12	8	6	31	2	0	4.63	4.40
	12	7	6	29	1	0	4.63	4.40
	9	9	0	29	0	0	4.21	4.0
	9	8	6	27	2	0	4.21	4.0
	9	8	0	26	2	0	4.21	4.0
	9	7	6	24	2	0	4.21	4.0
	9	7	0	23	0	0	4.21	4.0
	6	9	0	24	0	0	3.66	3.48
	6	8	6	23	0	0	3.66	3.48
	6	8	0	22	0	0	3.66	3.48
	6	7	6	20	2	0	3.66	3.48
	6	7	0	19	0	0	3.66	3.48
	6	6	6	18	0	0	3.66	3.48
	6	6	0	16	2	0	3.66	3.48
	4	6	0	12	1	0	3.21	3.4
	4	5	6	11	1	0	3.21	3.4
	3	4	6	7	1	0	2.91	2.77
	½	3	0	1	1	25	1.58	1.52

To lay a CANNON *to a given object.* Firſt find the centre of metal by the perpendicular, then apply your two fore fingers to the baſe centre, and look behind them until you make the muzzle centre cut the centre of the object; then the piece is properly directed. Secondly, having determined upon the neceſſary elevation, place the centre of the quadrant in the bore, and elevate or depreſs the piece 'till the plummet cuts the required elevation; and the piece is laid.

When the object fired at cannot be ſeen from the battery, which is often the caſe with mortars, proceed thus for the direction. Aſcend the neareſt ground in a line between the battery and object, from whence you can ſee them both, and place 2 pickets in ſuch a direction as to cut each mortar and the object it is to be fired at; then make the centres of metal of each mortar cut its proper picket, and it will be properly laid.

CARCASSES. See the firſt Alphabet.

COMPOSITION for each nature of CARCASSES.

Corned powder 30 lb. Swediſh pitch 12 lb. ſalt-petre 6 lb. and tallow 3 lb. The corned powder and ſalt-petre to be well mixed together; the pitch and tallow to be made hot over the fire, and put into another pan; then mixed with the corned powder and ſalt-petre; and laſtly, mix them well together for uſe. When old, they are to be primed with fuze compoſition.

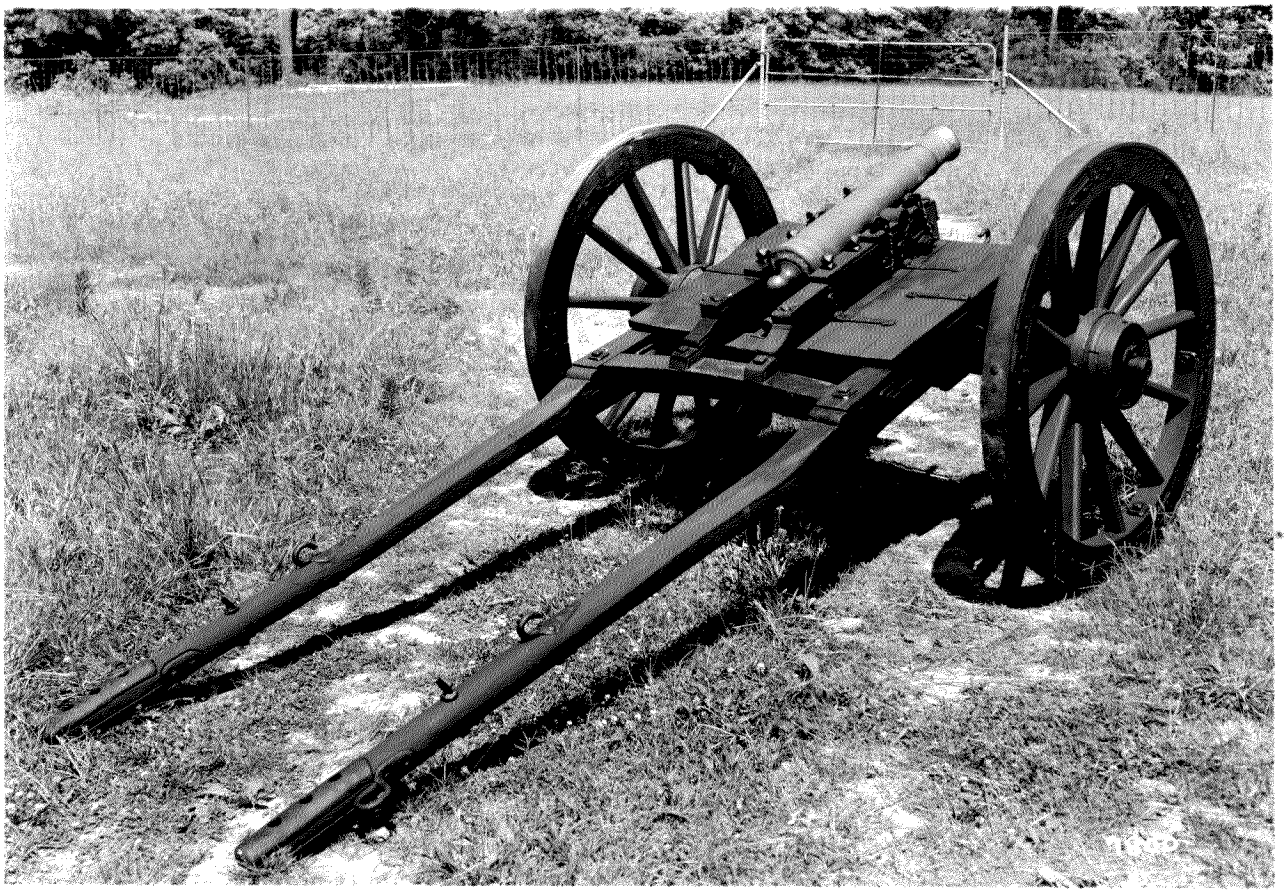
Weight of new oblong hammered CARCASSES, *eſtabliſhed the 22d of April*, 1759.

Diam.	When empty lb. oz.	Coated lb. oz.	Filled lb. oz.	Woulded lb. oz.	Primed lb. oz.	Kitted lb. oz.
10-inch	33 0	33 10	64 14	69 8	70 4	71 2
8-inch	15 12	16 1	32 14	33 2	33 10	34 0
5½-in.	1 8	1 10	8 6		8 9	8 12
4⅔-in.	1 2	1 4	4 9		4 10	4 12

Dimenſions

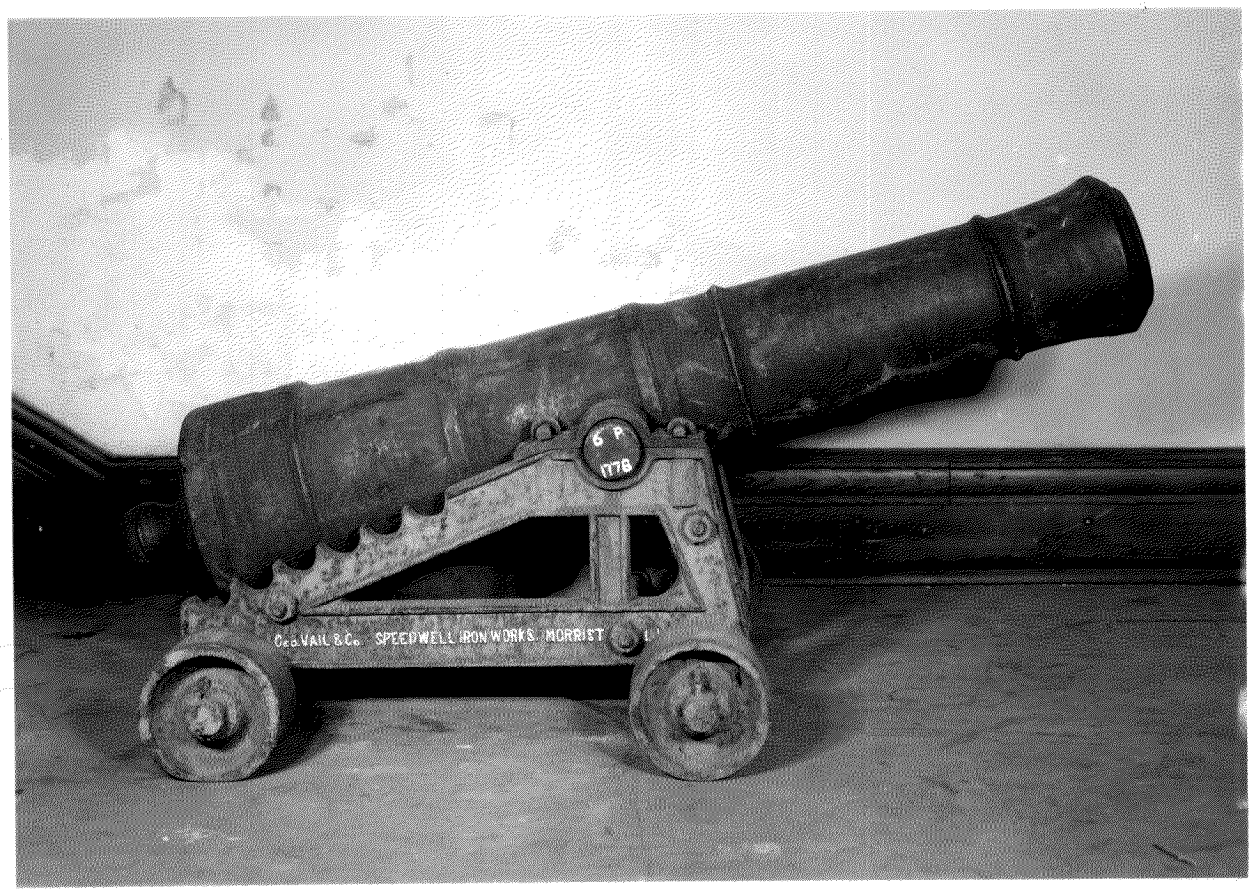
Photograph No. 4

[CNHP #5147]



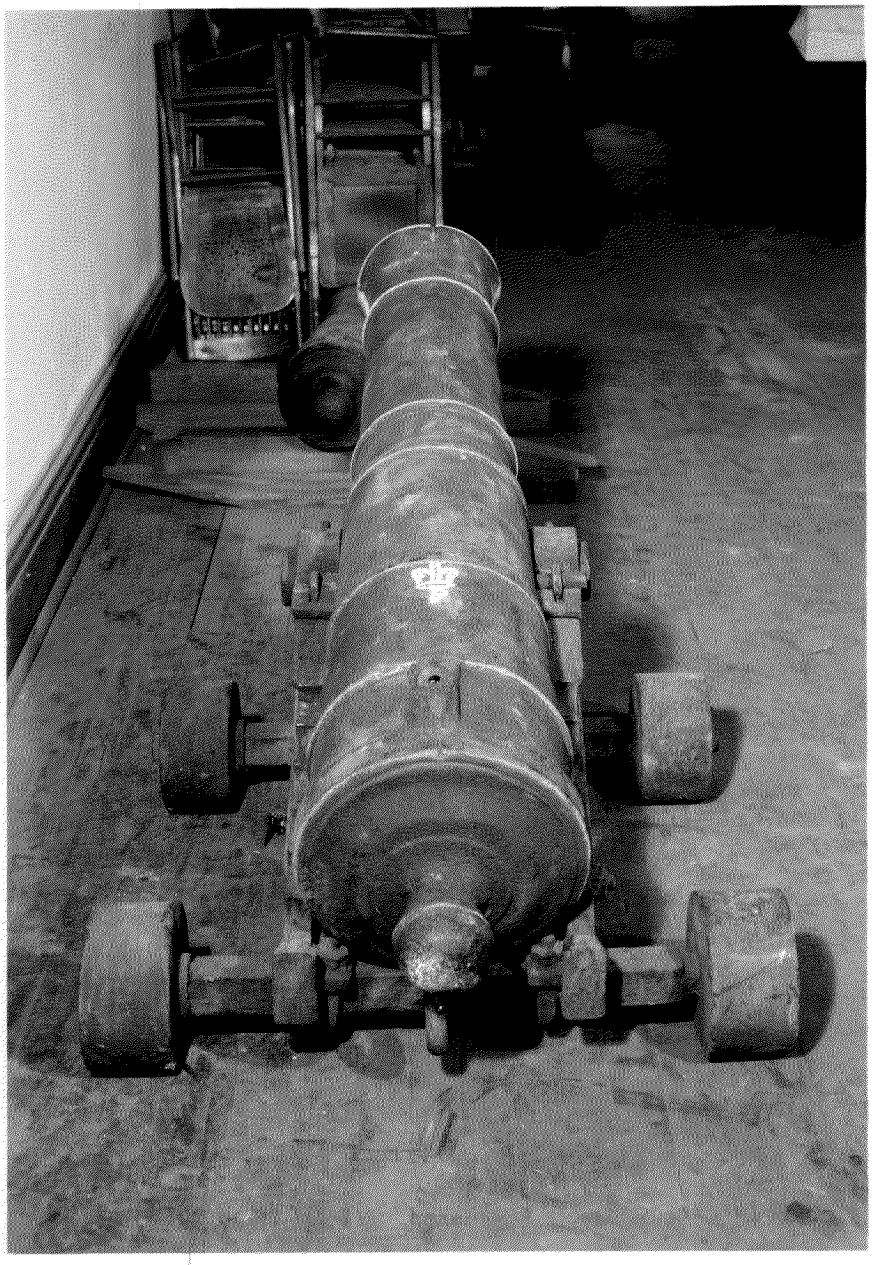
Photograph No. 5

[CNHP #7800]



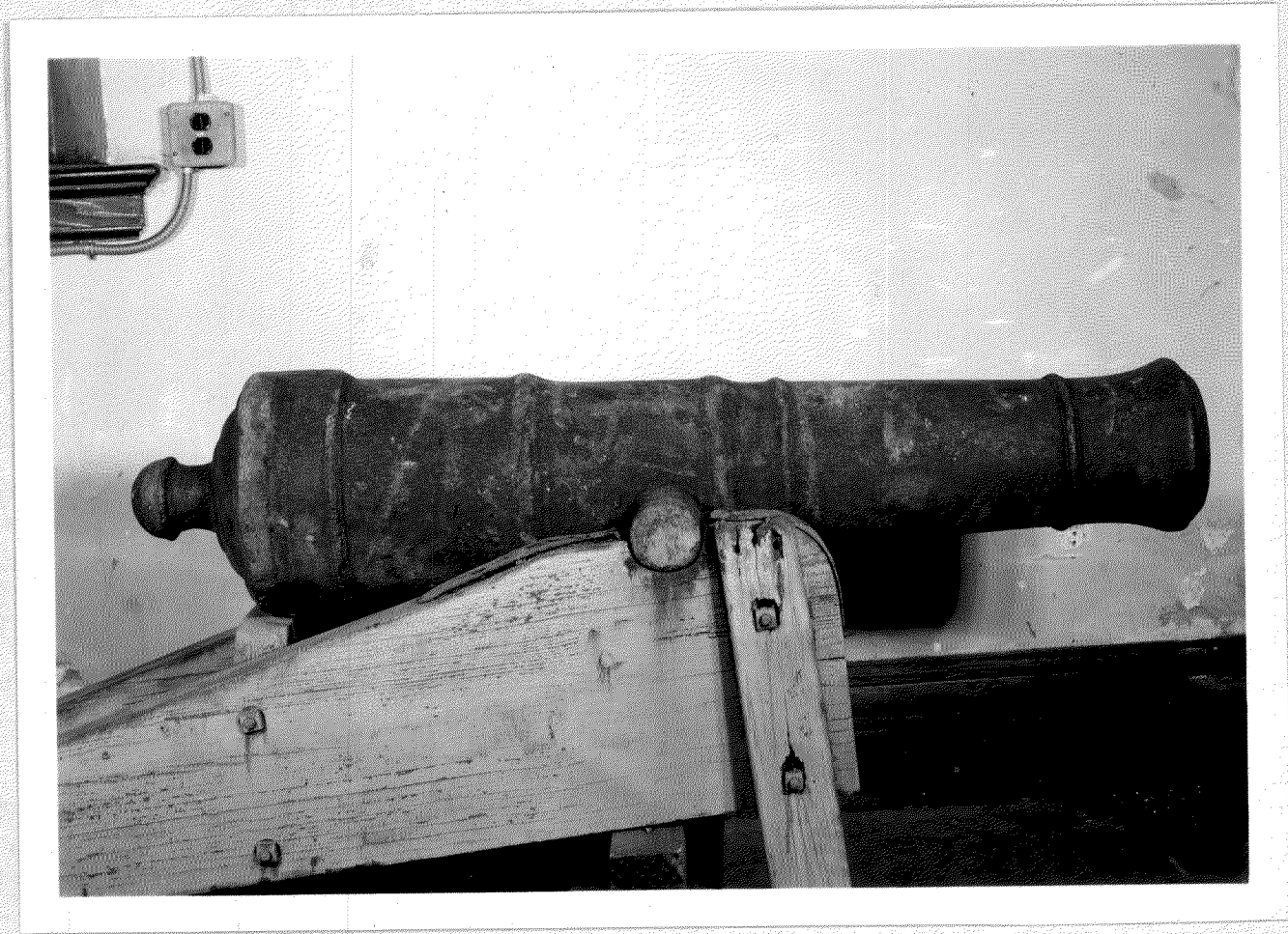
Photograph No. 6

[MNHP #06333]



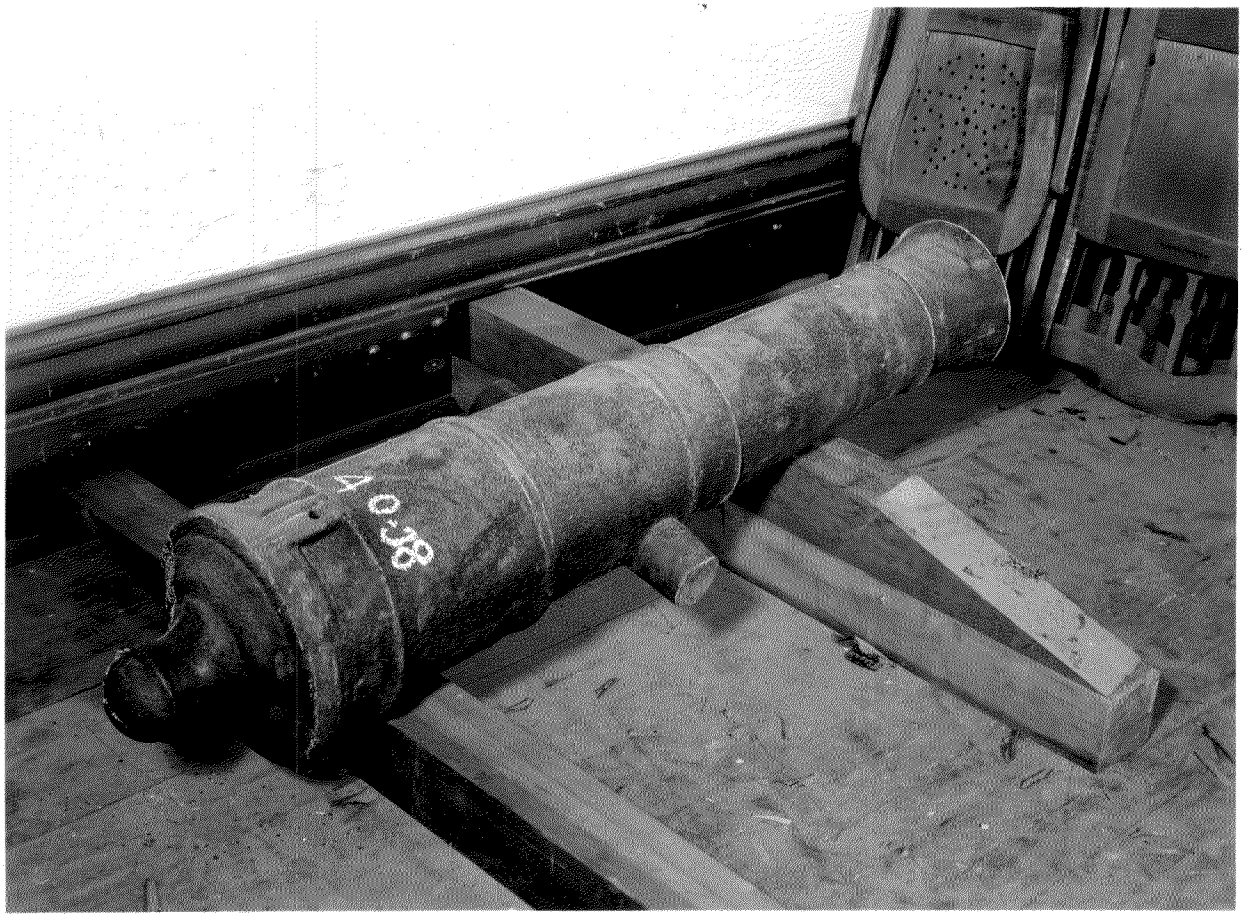
Photograph No. 7

[MNHP #06332]



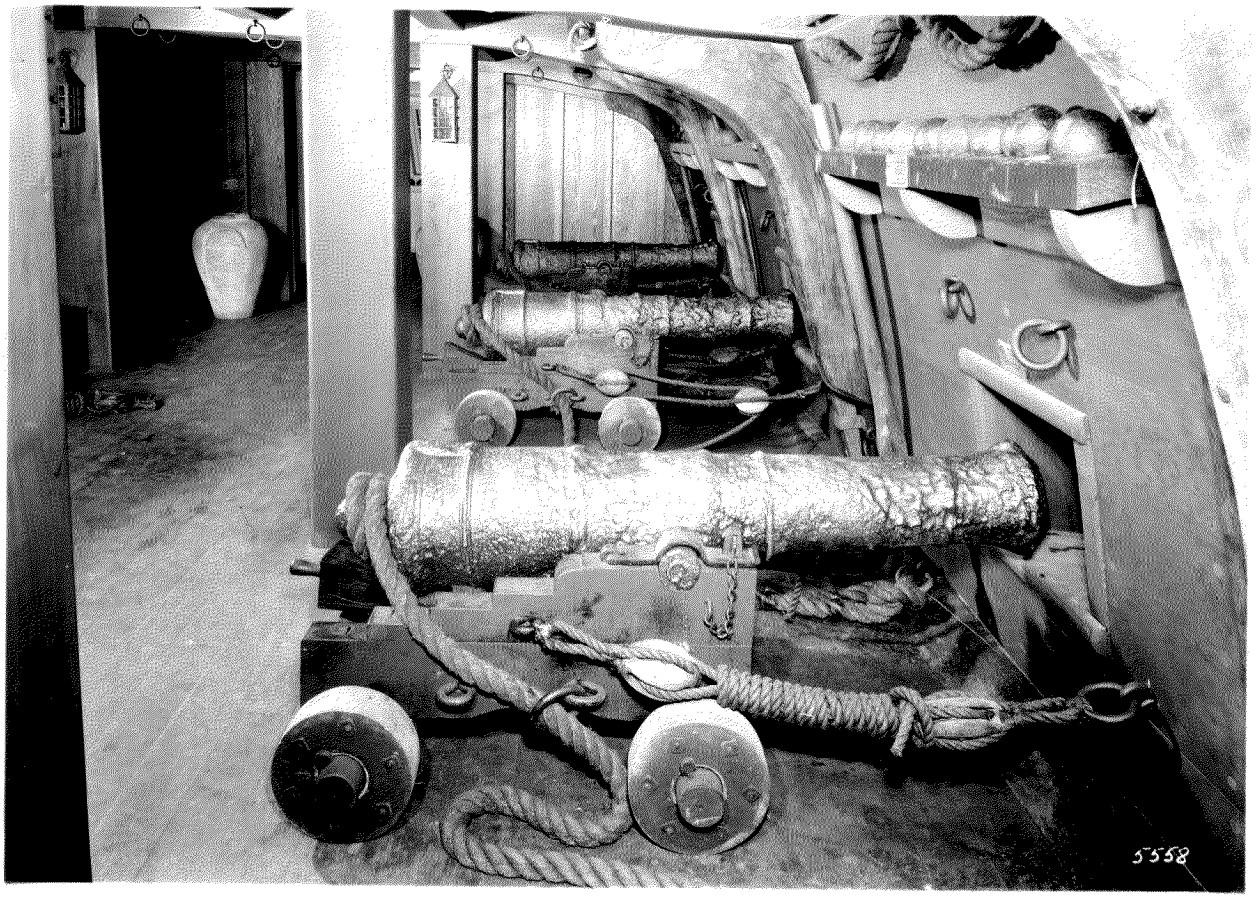
Photograph No. 8

[MNHP #06334]



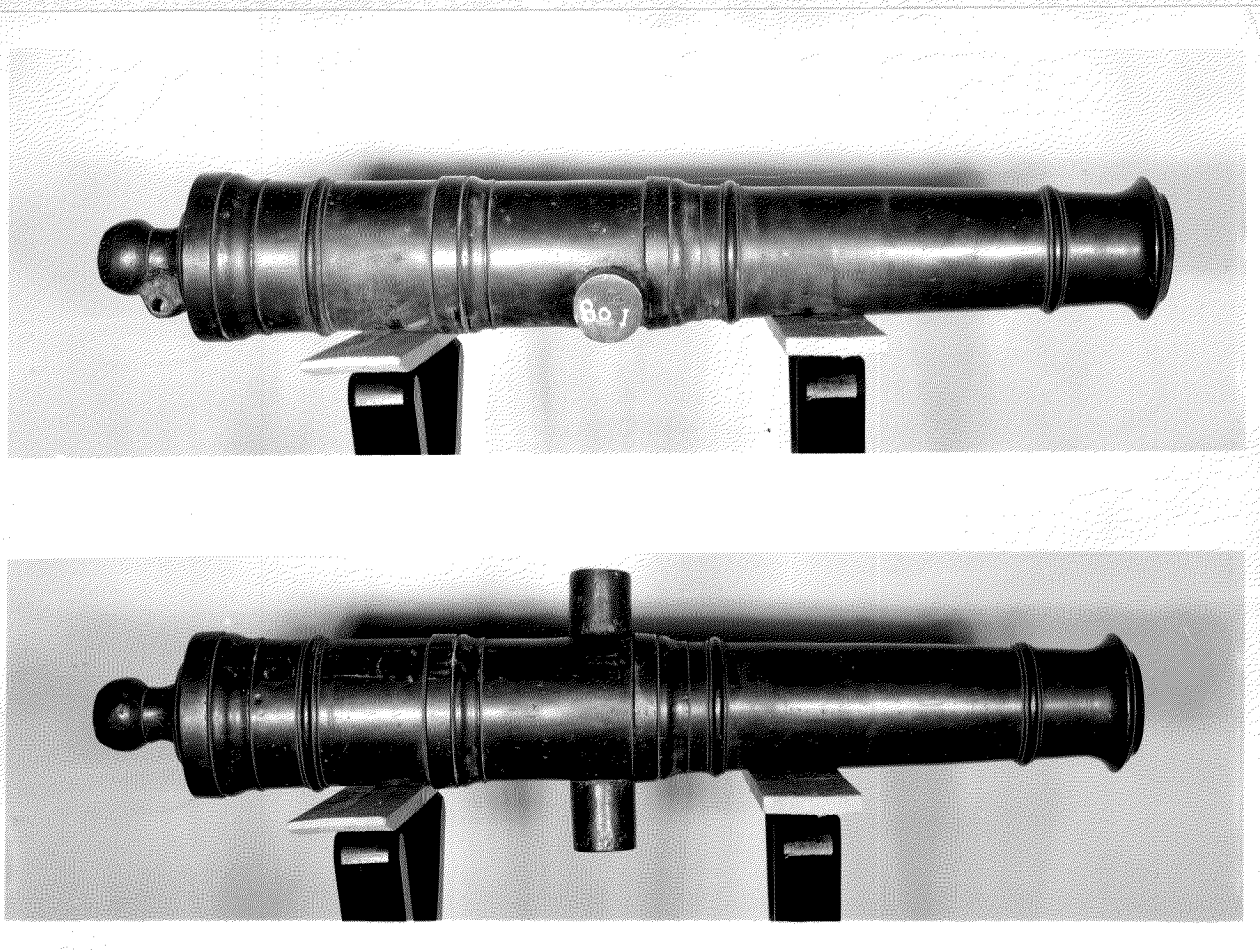
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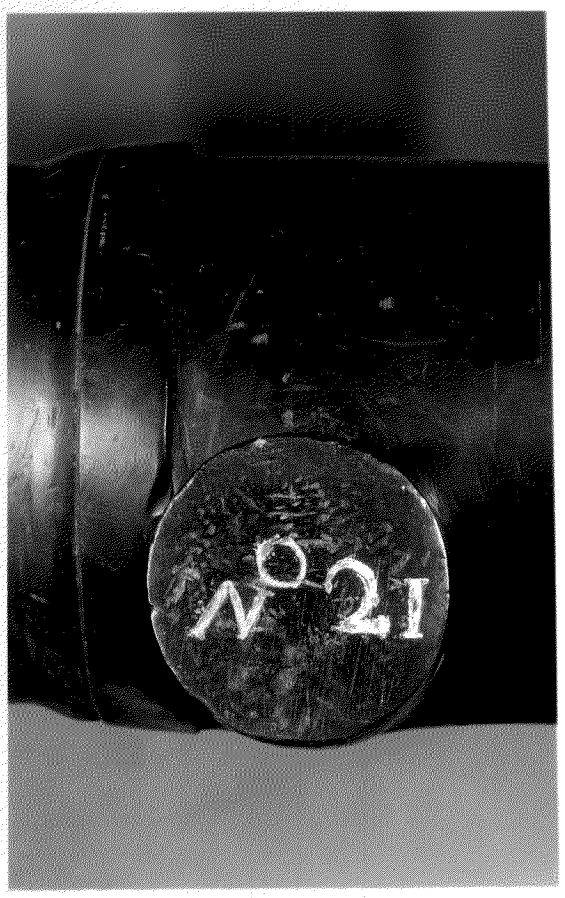
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[CNHP #5558]



Photograph No. 11

[MNHP #06328 A&B]





Photograph No. 12

[MNHP #06330 A&B]



Photograph No. 13

[CNHP #7745]



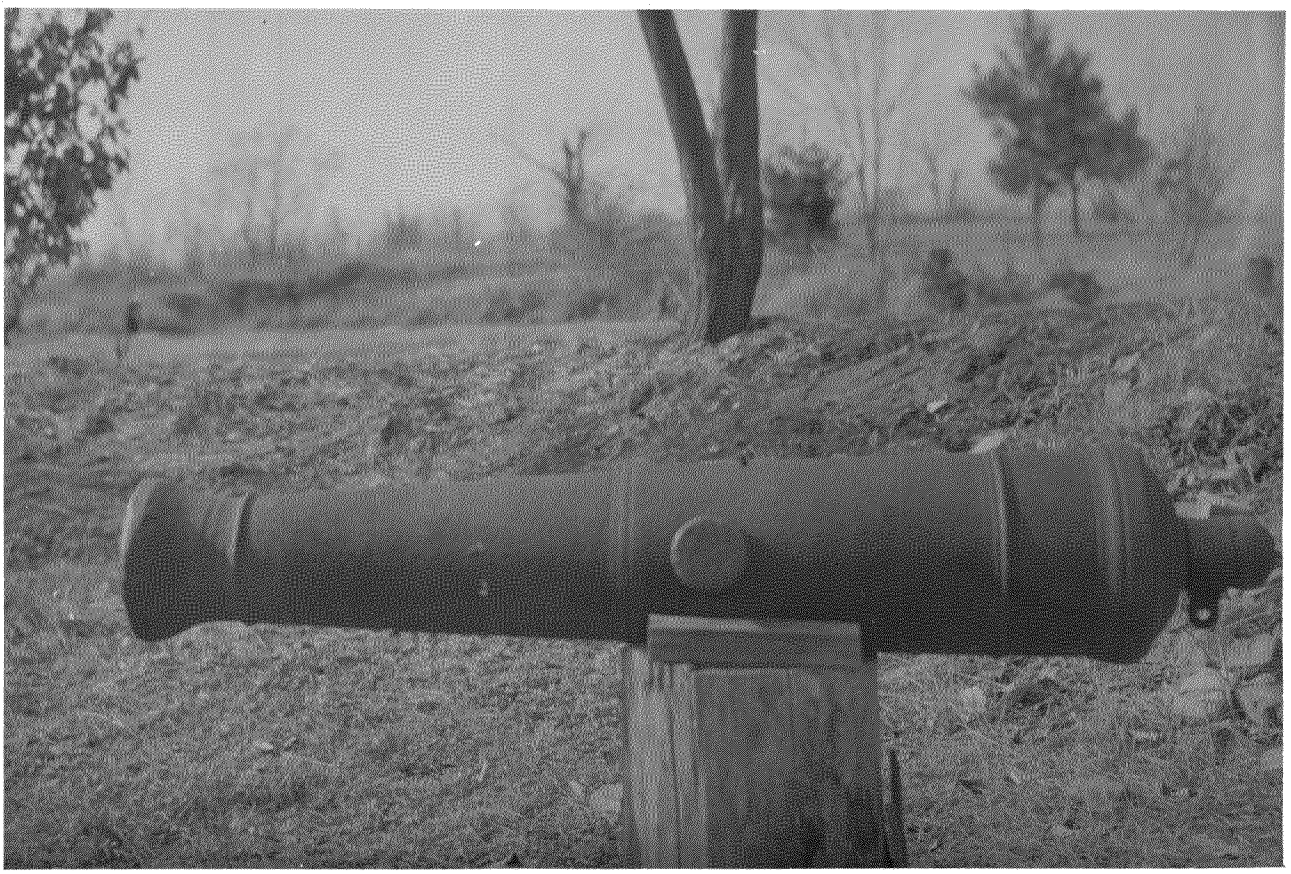
Photograph No. 14

[CNHP #7746]



Photograph No. 16

[CNHP #7722]



Photograph No. 17

[Unnumbered]

Explanation.

Fig 1 Elevation of a field carriage with all the iron work

Fig 2 Plan of the same with the Locker

Fig 3 Elevation of a Limber

Fig 4 Plan of the Limber

A. Elevation of the Locker

a. Plan of the Locker

B. Chain & Pin that fastens the Locker

C. Screw to elevate the Gun by

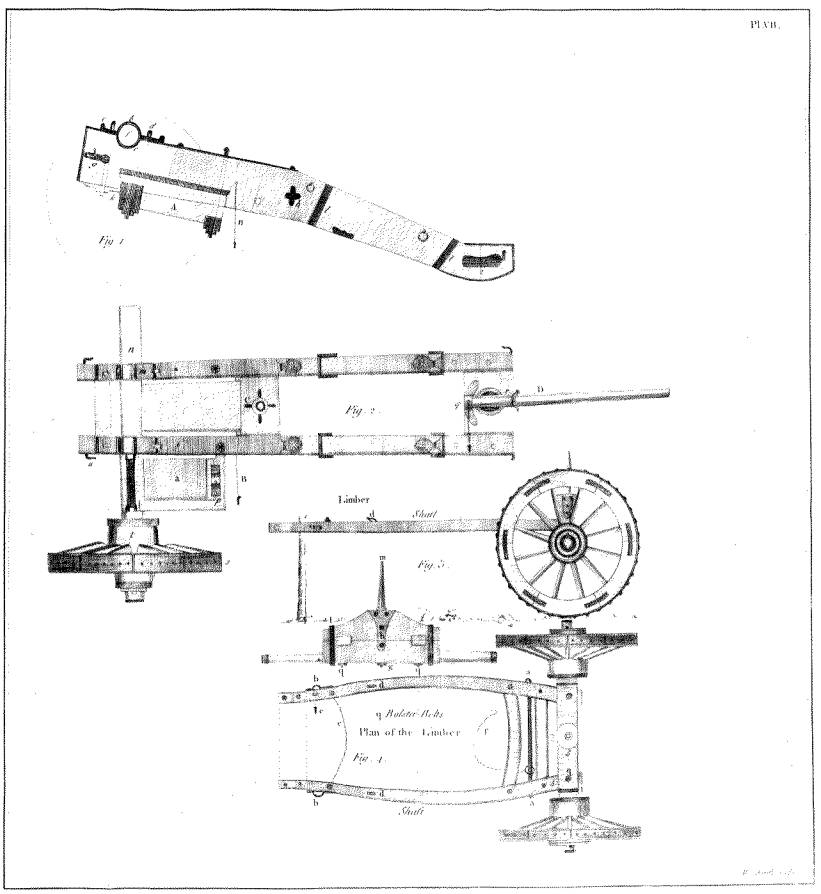
D. Trail shaft to traverse the Gun by

b. Cap square & Aront bolt & Eye bolt
c. Transom plate & Transom bolt
g h i Rear, Center, & Trail Transom bolts
k. Axle tree band & side straps
} Fig. 1.

m. Cap square Joint & Eye bolt
n. Axle tree, o Iron hoops for the Locker
p. Bolt into q. Iron bolt for ditto
} Fig. 2.

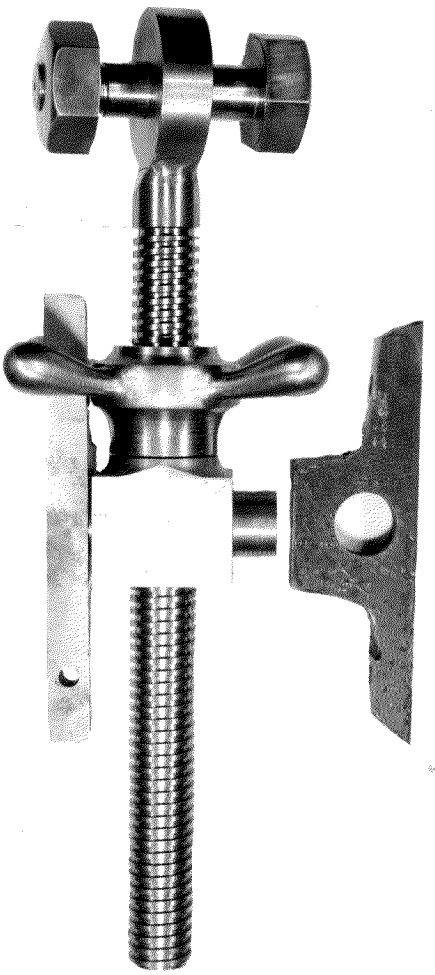
q. Shaft bolt, chain & pin
r. Pintle Plate & Staple
s. Wheel with Iron work
t. Naves & hoops, u. Transom hooks
} Fig. 3.

b c d. Shaft & pins
e. Back band or rufge chain
a. Limber bolt & staple
f. Limber chain m. Pintle n. Washer
} Figs. 3. & 4.



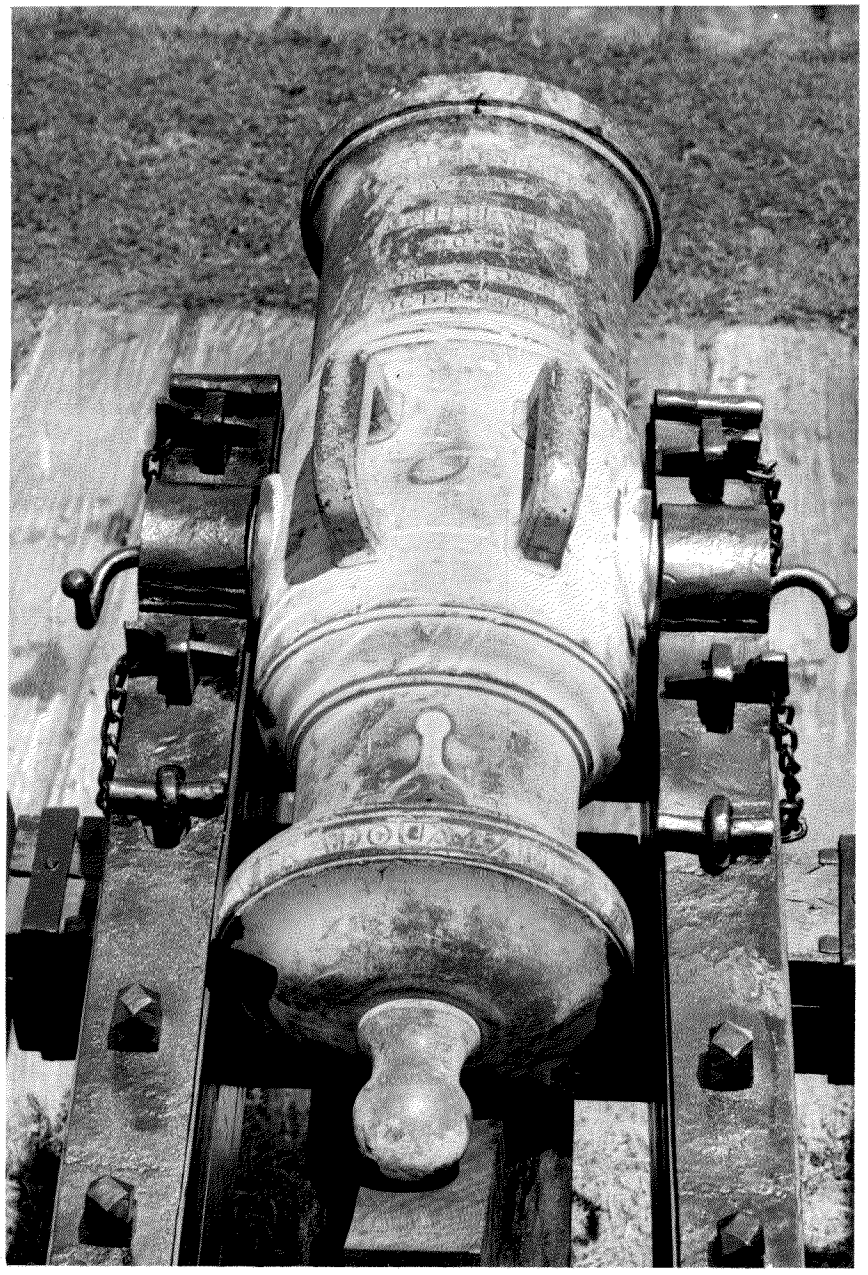
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[CNHP #7738]



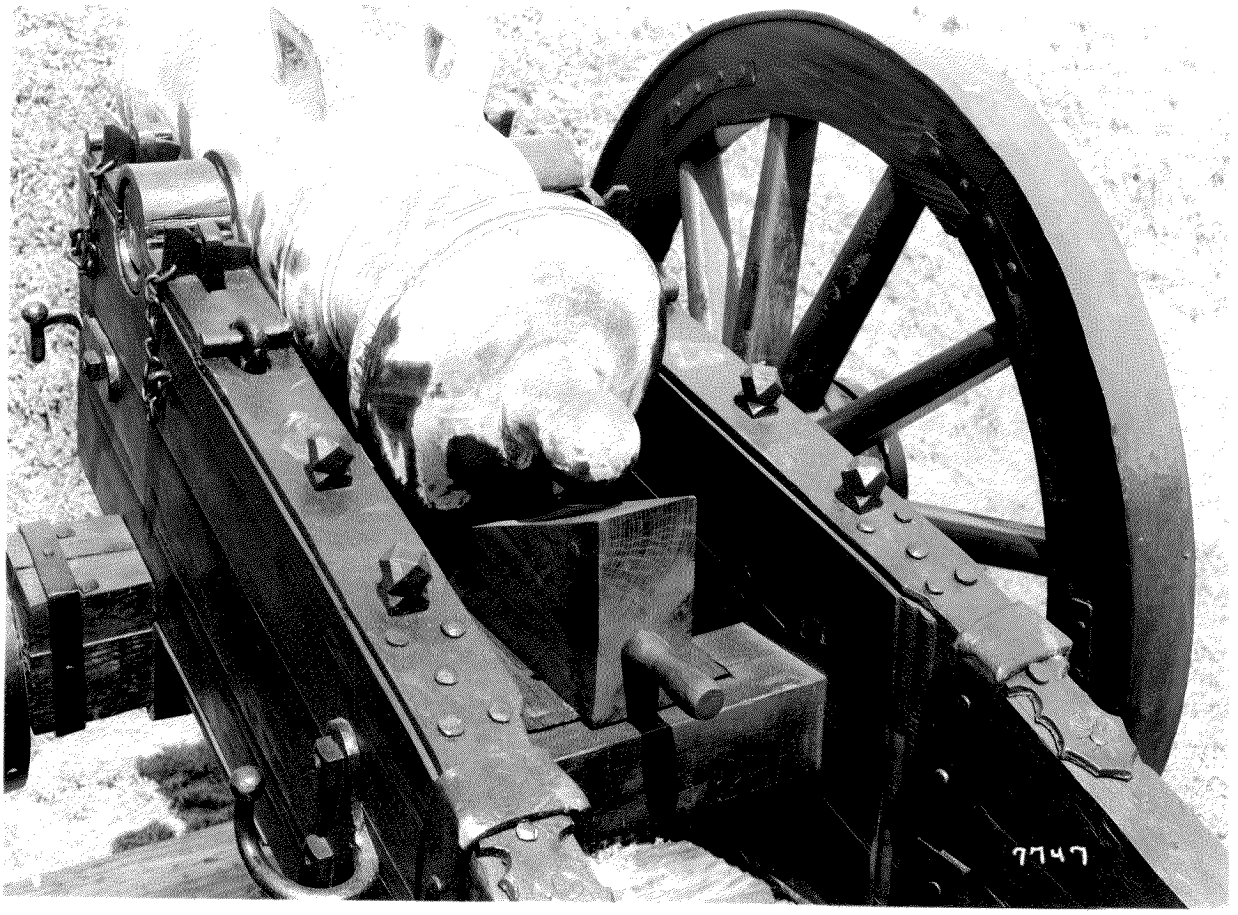
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[CNHP #7830]



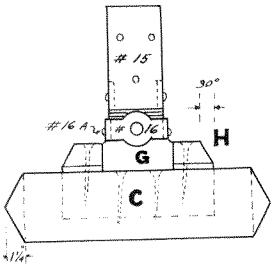
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[CNHP #7801]

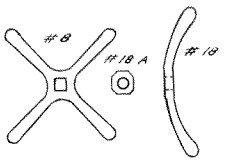


Photograph No. 21

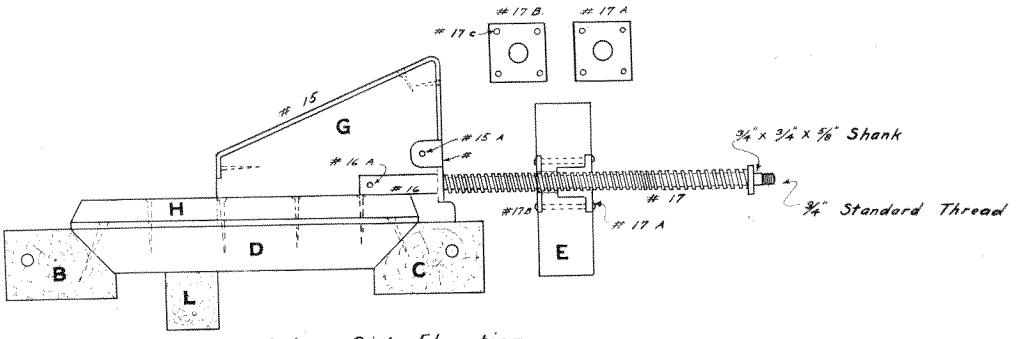
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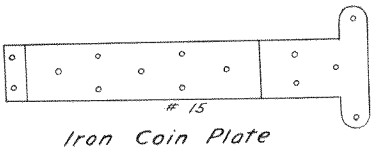
Elevating Coin – Rear Elev.



Elevating Screw Wheel



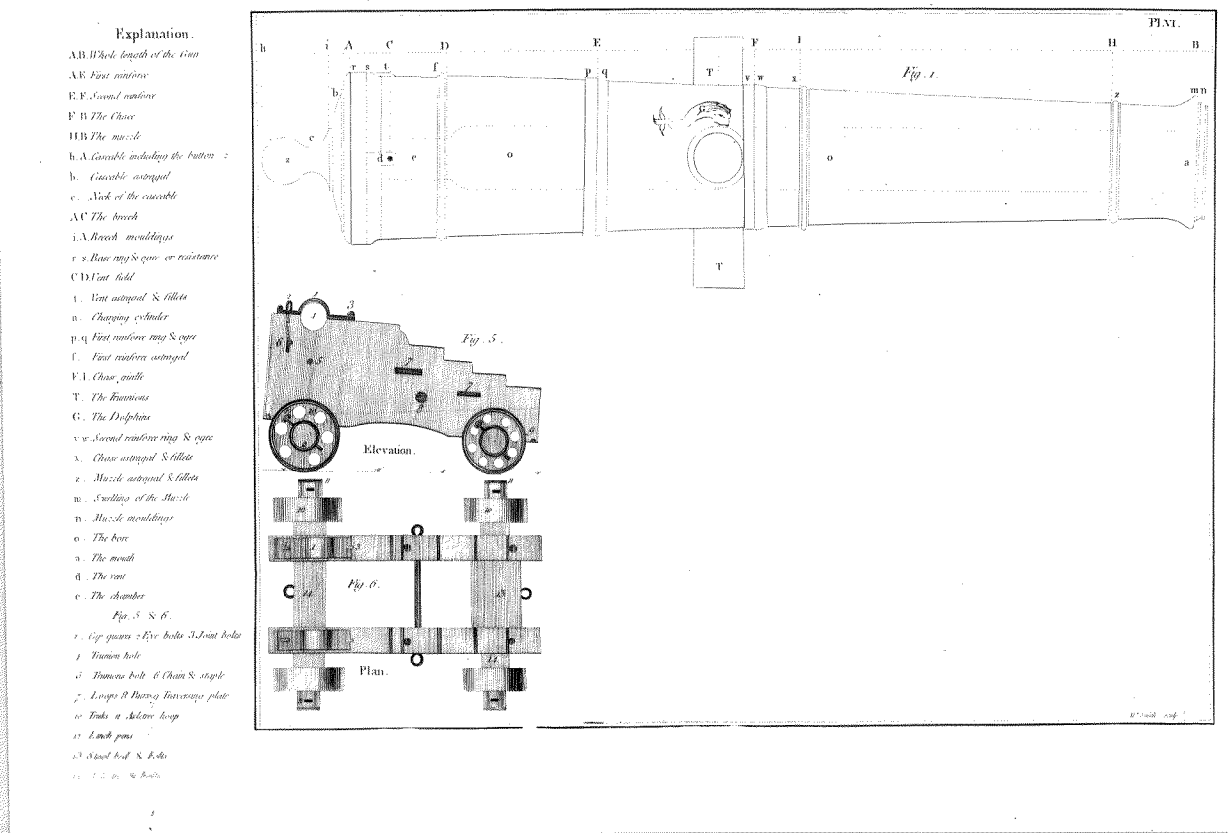
Elevating Coin – Side Elevation



Iron Coin Plate

Photograph No. 22

[CNHP #7679]



Photograph No. 23

[CNHP #7737]



Photograph No. 24---(24-pounder)

[CNHP #3709]

[24-pounder]

In the English ordnance regulations there were three different 24-pounders of brass. One, 9 feet 6 inches long, weighed 53: 0: 9 (5,945 pounds); the second, 8 feet 6 inches long, weighed 41: 3: 2 (4,678 pounds) and the third, a light field piece of 5 feet 6 inches, weighed 16: 3: 13 (1,889 pounds). The caliber of a 24-pounder was 5.824 inches;[1] and the diameter of shot was 5.547 inches. The extreme range of this gun was 3,876 yards;[2] elevation, 45 degrees. It used 16 pounds of powder. This elevation and distance were not practical. The best range and proper charges were powder, 12 pounds, elevation, 5-30 degrees, and a range of 2,212 yards, and a point blank range of only 488 yards, using 8 pounds of powder. At a 5 degree elevation for ricochet fire, using 8 pounds of powder, it had a range of 1,745 yards. In firing grape, the grape consisted of 12 iron balls, each weighing 2 pounds; each ball's diameter was 2.423 inches; total weight of the grape, including the wooden sabot and pin, 25 pounds, 5 ounces.

Tin-case shot, or canister, was small iron shot, (previous to 1755 lead was used), each weighing 4 ounces, or 4 to the pound; diameter of each shot, 1.211 inches; weight of tin can, 13 1/2 ounces, each contained 84 shot, with a total weight of 21 pounds, 13 1/2 ounces.[3] For garrison use, each canister weighed 6 1/4 ounces and diameter of each was 1.410 inches. The case contained 48 shots. For sea service, each canister weighed 8 ounces, with a diameter of 1.526 inches; the case contained 42 shots. Powder charges were from 1/3rd to 1/5th of the shot's weight, according to range desired.

The number of men needed when gun was operated in a field, twenty-two.[4] Half of this number could operate the gun after it

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1 Smith, Captain George, An Universal Military Dictionary, (London, 1779).

2 Ibid.

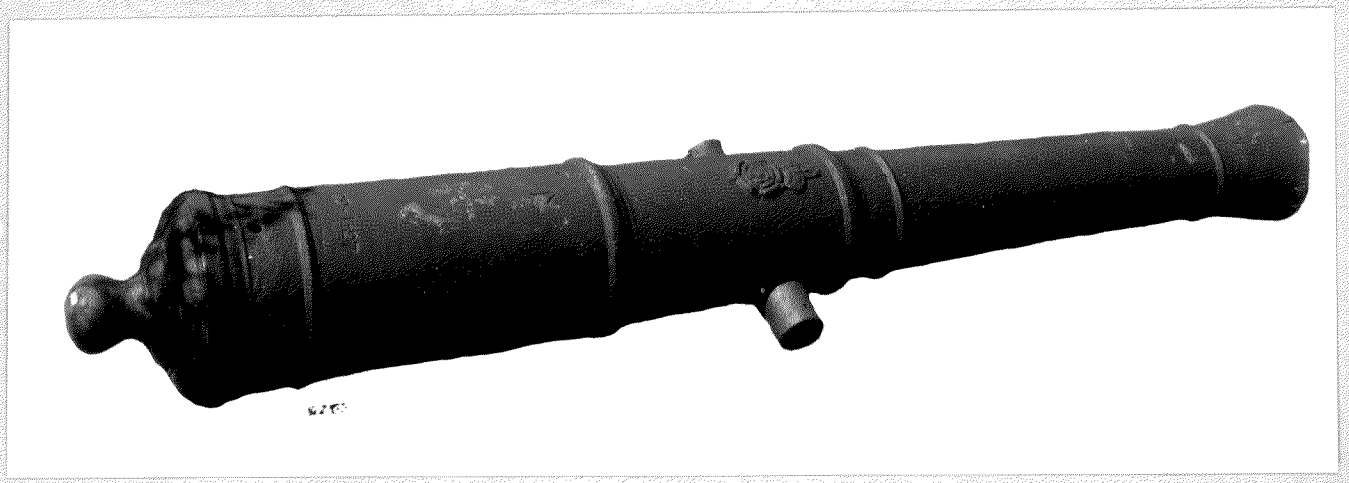
3 Ibid., p. SHE-SHE.

4 Ibid.

was in a battery.[5] Horses needed per gun when traveling: light guns, six; heavy guns, seventeen or eighteen, all in single file.

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5 Adye, Ralph Willet, The Bombardier and Pocket Gunner, (Printed for E. Larkin, No. 47, Cornhill, Boston, by William Greenough, 1804).



Photograph No. 25---(18-pounder)

[CNHP #7600]

[18-pounder]

An 18-pounder gun had a bore of 5.292 inches,[1] and fired a ball 5.040 inches in diameter. It elevated to 45 degrees and had a range of 4,186 yards, using 12 pounds of powder.[2] This elevation and range were impractical, as they could not be controlled. For a range of 2,000 to 2,400 yards, from 6 to 8 pounds of powder were needed; for firing ricochet, from 1 to 12 ounces and up, according to the range. In firing grape, each ball weighed 1 pound, 8 ounces; each had a diameter of 2.201 inches, the total weight of the grape being 10 pounds, 15 1/2 ounces. For firing canister, 2 sizes were used: for land service, each ball weighed 4 ounces, having a diameter of 1.209 inches, the tin case containing 62 balls; for sea service, each ball weighed 6 ounces, with a diameter of 1.387 inches, the tin case containing 43 balls.[3] The powder charges for grape and canister fire were usually from 1/3rd the weight of shot to 1/5th, depending on the range.

Number of men needed when gun was mounted and operated in the field, twenty-two. Half of this number could operate the gun after it was placed in a battery and commenced firing.[4] Horses, needed per gun when traveling in the field: light guns, five; heavy, sixteen or seventeen.[5]

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1 Smith, Captain George, An Universal Military Dictionary, (London, 1779).

2 Ibid.

3 Ibid.

4 Ibid.

5 Muller, John, A Treatise of Artillery, (London, 1756). p. 180.



Photograph No. 26---(12-pounder)

[CNHP #3713]

[12-pounder]

The picture on the opposite page shows a 12-pounder brass gun, cast in 1759. Of a weight known as medium - 21: 1: 24 (2,404 pounds) - the gun has a length of 6 feet 6 inches from the hinder-most part of the base ring to the end of the muzzle. Its length overall, including the cascable or button, was 6 feet 11 inches; the caliber, 4.623 inches;[1] and the diameter of ball 4.403 inches. The difference between the diameter of ball and caliber of bore is called the vantage. With 8 pounds of powder, elevated to 45 degrees, it had a range of 4,089 yards,[2] but in firing for accuracy, with 4 pounds of powder and elevated to 3 degrees, it had a range of 1,189 yards; for ricochet fire, from 10 ounces to 1 pound of powder was used; the first graze at 1 degree elevation, was about 280 yards; at 8 degrees the first graze was from 788 to 1,295 yards, according to the amount of powder used. For firing grape various dimensions of balls were used; using a 1 pound ball, diameter 1.923 inches, only 10 were employed. They weighed about 11 pounds, including the wooden bottom or calotte. Powder charges for firing grape were usually 1/3rd of the weight of shot.

Two types of tin-case shot were used according to the range. One case contained 107 balls, a ball's diameter being .961 inches, each weighing 1 1/2 ounces, with a total weight of 10 pounds, 9 ounces. The other consisted of 84 balls, each shot having a diameter of 1.00 inches, weighing 2 ounces, with a total weight of 12 pounds, 1 ounce, including the wooden bottom or calotte.[3]

Number of men needed when gun was mounted and operated in the field, nineteen.[4] Half of this number could operate the gun

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1 Smith, Captain George, An Universal Military Dictionary, (London, 1779).

2 Ibid.

3 Ibid.

4 Ibid.

after it was placed in a battery and commenced firing.[5] Number of horses needed, when traveling in the field: for light guns, three; for heavy, ten.[6]

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5 Adye, Ralph Willet, The Bombardier and Pocket Gunner, (Printed for E. Larkin, No. 47, Cornhill, Boston, by William Greenough, 1804).

6 Muller, John, A Treatise of Artillery, (London, 1756), pp. 180-181.



Photograph No. 27---(6-pounder)

[CNHP #3715]

[6-pounder]

A 6-pounder, cast in 1761. Its length, from base ring to end of muzzle, was 54 1/2 inches, with an overall length, including the cascable or button, of 59 1/2 inches. Weight, 4: 3: 14, (546 pounds). Extreme range, 3,899 yards,[1] using 4 pounds of powder (degree of elevation not mentioned); diameter of shot, 3.498 inches; and the caliber of bore, 3.668 inches.[2] With a 5 degree elevation, and a charge of 3 pounds of powder, it had a range of 1,097 yards; for ricochet fire, 1 pound and 8 ounces; at a 1 degree elevation, 629 yards; at 2 degrees, 804 yards; and 3 degrees, 991 yards.

In firing with grape using 8 ounce balls, 1.526 inches in diameter, with a total weight of 5 pounds 4 1/2 ounces, the range averaged about 600 yards; using tin-case shot, 56 shots in the tin, each weighing 1 1/2 ounces, diameter .762 inches, total weight 5 pounds, 3 ounces, including the tin-case charges of powder from 2 pounds 8 ounces to 3 pounds 8 ounces, the range was from 300 to 400 yards.[3]

The number of men needed when gun was mounted and operated in the field, fourteen.[4] Half this number could operate the gun after it was placed in the battery and firing commenced. Number of horses per gun when traveling in the field---light, 2 horses; heavy, 7 horses.[5]

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1 Smith, Captain George, An Universal Military Dictionary, (London, 1779).

2 Ibid.

3 Ibid.

4 Ibid.

5 Muller, John, A Treatise of Artillery, (London, 1756), p. 180.



Photograph No. 28---(3-pounder)

[CNHP #3716]

[3-pounder]

A brass 3-pounder, cast in 1775. Length from base ring to end of muzzle, 35 7/8ths inches; overall length, including cascable, 40 inches. Weight of the gun, 0: 3: 10 (94 pounds). Diameter of bore, 2.91 inches,[1] and diameter of shot, 2.77 inches. The extreme range of this gun was 1,600 yards.[2] With grape shot, using 12 ounces of powder and firing a grape weighing 2 pounds 10 1/2 ounces, weight of each shot 4 ounces, diameter of shot 1.207 inches, it was effective at a distance of 500 yards.[3] Using tin-case shot containing 36 shots, each weighing 1 1/4 ounces, and a total weight of 3 pounds, including the bottom, with 8 ounces of powder, it had an effective range of 300 yards. This gun was adopted in 1764.

Number of men needed for the heavy 3-pounder when mounted and operated in the field, eleven.[4] Half of this number could operate the gun after it was placed in a battery and commenced firing. Number of horses needed for this gun when in the field was four.[5] For the light 3-pounder, mounted on a galloper carriage, only four men were needed, the carriage being drawn by one or two horses, hitched in tandem.

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1 Smith, Captain George, An Universal Military Dictionary, (London, 1779).

2 Ibid.

3 Ibid.

4 Ibid.

5 Muller, John, A Treatise of Artillery, (London, 1756), p.180.



Photograph No. 29---(1 1/2-pounder)

[CNHP #5122]

[1 1/2-pounder]

A 1 1/2-pounder swivel gun was one of three used for various types of fire. The diameter of its wall was 2.201 inches.[1] The regular service charge of powder was 12 ounces, the smallest 2 ounces. These figures are for both brass and iron guns. It had a point blank range of 450 yards, and an extreme range, at a 45 degree elevation, of 2,400 yards. For firing canister each shot weighed 1 1/8th ounces, the tin containing 17 shots, each shot having a diameter of 0.953 inches; the complete tin weighed 1 pound 5 5/8ths ounces.[2]

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1 Smith, Captain George, An Universal Military Dictionary, (London, 1779).

2 Ibid.



Photograph No. 30---(1 pounder)

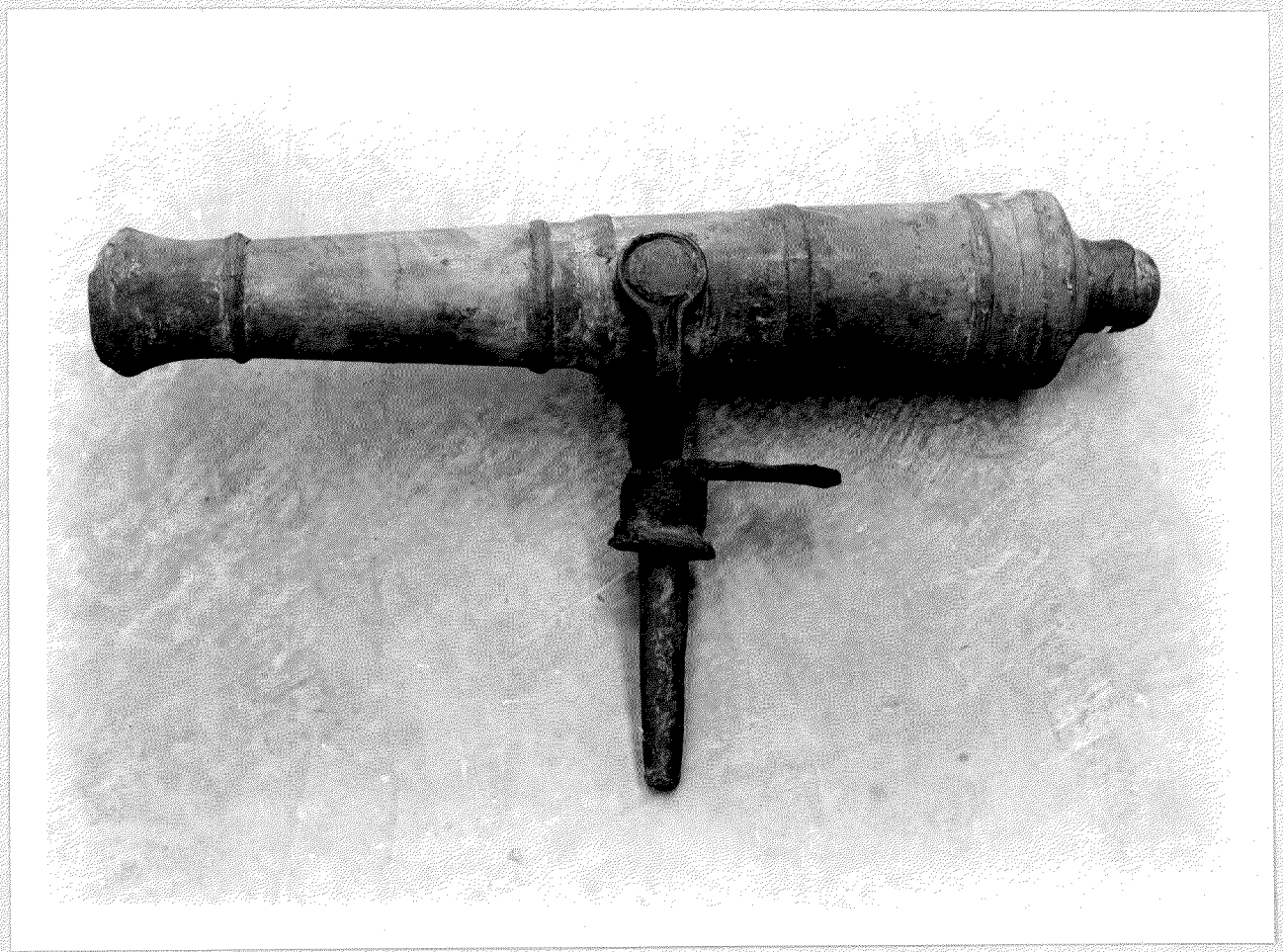
[CNHP #5126]

[1-pounder]

A 1-pounder swivel. The type of shot used in this, although it was called grape, was more like a canister shot. It contained 20 balls about the size of a carabine bullet. There were 17 in the pound, each having a diameter of 0.657 inches.[1] With 6 ounces of powder it had a range of 750 to 900 yards. The diameter of a 1-pounder swivel ball was 1.923 inches; powder charges from 1 1/2 to 8 ounces.

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1 Smith, Captain George, An Universal Military Dictionary, (London, 1779).



Photograph No. 31---(1/2-pounder)

[CNHP #5124]

[1/2-pounder]

A 1/2-pounder swivel gun. Diameter of ball, 1.526 inches.[1] Powder charges were from 1 to 4 ounces. Scatter or case shot used for this small gun was made up of pistol, carabine, and musket bullets. A musket bullet for service had 29 bullets to the pound, each with a diameter of 0.550 inches. The carabine had 20 bullets to the pound for service, each 0.523 inches in diameter. The pistol bullet had 34 to the pound for service, each with a diameter of 0.521 inches. When mounted on a galloper carriage, only one horse was needed. From one to two men were needed to operate it.

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1 Muller, John, A Treatise of Artillery, (London, 1756).



Photograph No. 32---(8-inch howitzer)

[CNHP #3711]

[8-inch howitzer]

Photograph No. 32 shows an 8-inch howitzer, cast in 1727 by Schalch, Woolwich Arsenal, London, England. Weight: 15: 0: 4 (1,684 pounds). Overall length, including cascable, 3 feet 11 1/2 inches. Its spherical shell weighed 42 pounds and contained 2 pounds 4 ounces of powder for bursting.[1] Its greatest range was 1,880 yards.[2] There were no regulated powder charges for this gun. Although its chamber could hold 2 pounds 9 ounces, it all depended on the type of firing to be done and the range. The howitzer could be regulated, in elevation, from 1 to 45 degrees. Elevations used: for cross fire, usually from 1 to 8 degrees; for enfilade, no more than 12 degrees; for reverse fire, and for destroying a traverse, up to 30 degrees. If the howitzer were to take the place of a mortar for vertical fire, it was elevated from 30 to 45 degrees.

The shell weighed from 39 to 42 pounds. The thickness of the walls of the shell was 1.20 inches; diameter of the fuse hole - exterior, 1.22 inches; interior, 1.13 inches.[3] Length of fuse depended on range and time of flight.

The 8-inch howitzer was used mostly during sieges or for defense against a siege. This gun was adopted in the 1736 regulations. At the suggestion of John Muller,[4] the English in 1764 adopted canister for use in the howitzers. They used two different types---one containing 72 shots, each weighing 6 3/4 ounces, with a diameter of 1.410 inches; the other contained 81 shots, each weighing 6 ounces, with a diameter of 1.387 inches. To handle this gun in the field, and to mount and place it in a battery, seventeen men were required. When firing commenced, half this number was sufficient.[5]

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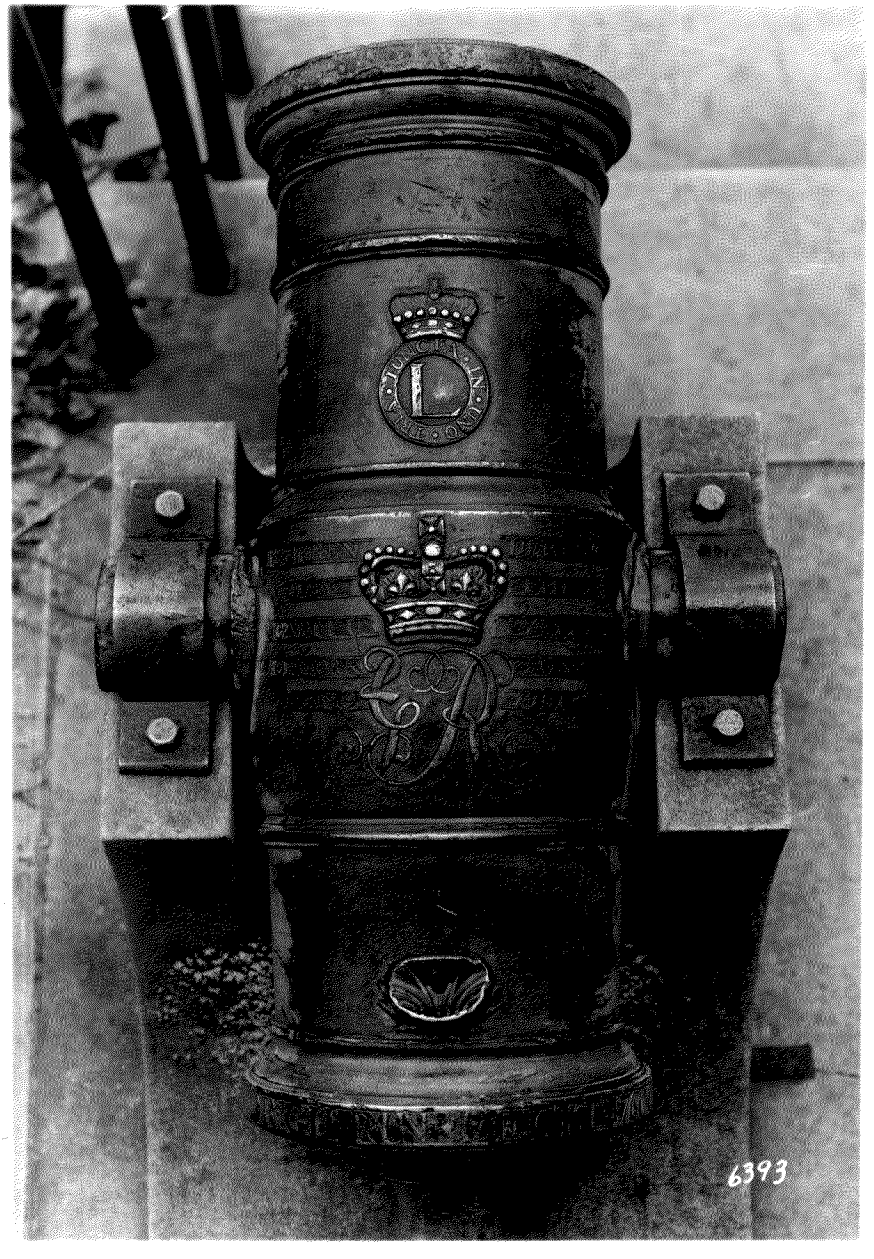
1 Stevens, William, A System for the Discipline of the Artillery of the United States of America, or, The Young Artillerist's Pocket Companion, (New York, 1797), pp. 198-200 and 213.

2 Ibid., and Smith, Captain George, An Universal Military Dictionary, (London, 1779).

3 Tousard, Louis de, American Artillerist's Companion, (Philadelphia, 1809), I, 287 and 296.

4 Muller, John, A Treatise of Artillery, (London, 1756).

5 Smith, op. cit., p. WOR-WOR.



Photograph No. 33---(5.8-inch howitzer)

[CNHP #6393]

[5.8-inch howitzer]

An English, brass, 5.8-inch howitzer. Length from base ring to end of muzzle, 26 1/4 inches; overall length, including button, 32 1/2 inches. Weight: 4: 0: 12 (460 pounds); weight of shell, 15 pounds, with 14 ounces of powder to burst it;[1] its greatest range, 1,600 yards, using 1 pound of powder.[2]

The outside diameter of shell was 5.3 inches; thickness of walls, 0.82 inches; exterior diameter of fuse hole, 0.89 inches; interior, 0.83 inches. The length of the fuse depended on the range and time of flight.[3]

The 5.8-inch howitzers were used mostly as field pieces during a siege, usually in the second or third parallel. The method of handling this gun was the same used for an 8-inch howitzer. The 5.8-inch howitzer had two different types of canister; one contained 55 shots, each shot weighing 3 ounces, and each having a diameter of 1.103 inches; the other contained 70 shots, each with a diameter of 0.961 inches, and weighing 2 ounces.[4]

For manoeuvreing the gun in the field, and to mount it in a battery, twelve men were needed.[5] Only six were needed when actual firing commenced.[6]

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1 Stevens, William, A System for the Discipline of the Artillery of the United States of America, or, The Young Artillerist's Pocket Companion, (New York, 1797).

2 Ibid., and Smith, Captain George, An Universal Military Dictionary, (London, 1779).

3 Tousard, Louis de, American Artillerist's Companion, (Philadelphia, 1809).

4 Smith, op. cit.

5 Ibid.

6 Adye, Ralph Willet, The Bombardier and Pocket Gunner, (Printed for E. Larkin, No. 47, Cornhill, Boston, by William Greenough, 1804).

[13-inch mortar]

A 13-inch mortar weighed 25: 0: 0 (2,800 pounds). The greatest range of a 13-inch mortar was 2,500 yards, with 8 pounds of powder. The shell weighed 193 pounds and contained 9 pounds of powder for bursting.[1] With 6 pounds, 12 ounces, it would throw the shell 1,900 yards, and it took 19.03 seconds for the flight of the shell.

The 13-inch mortar was fixed to its bed at an angle of 45 degrees; hence, its range was regulated by the charge of powder, the smallest charge being 7 ounces, which would throw the shell 100 yards, taking 4.37 seconds for the shell to make the flight.

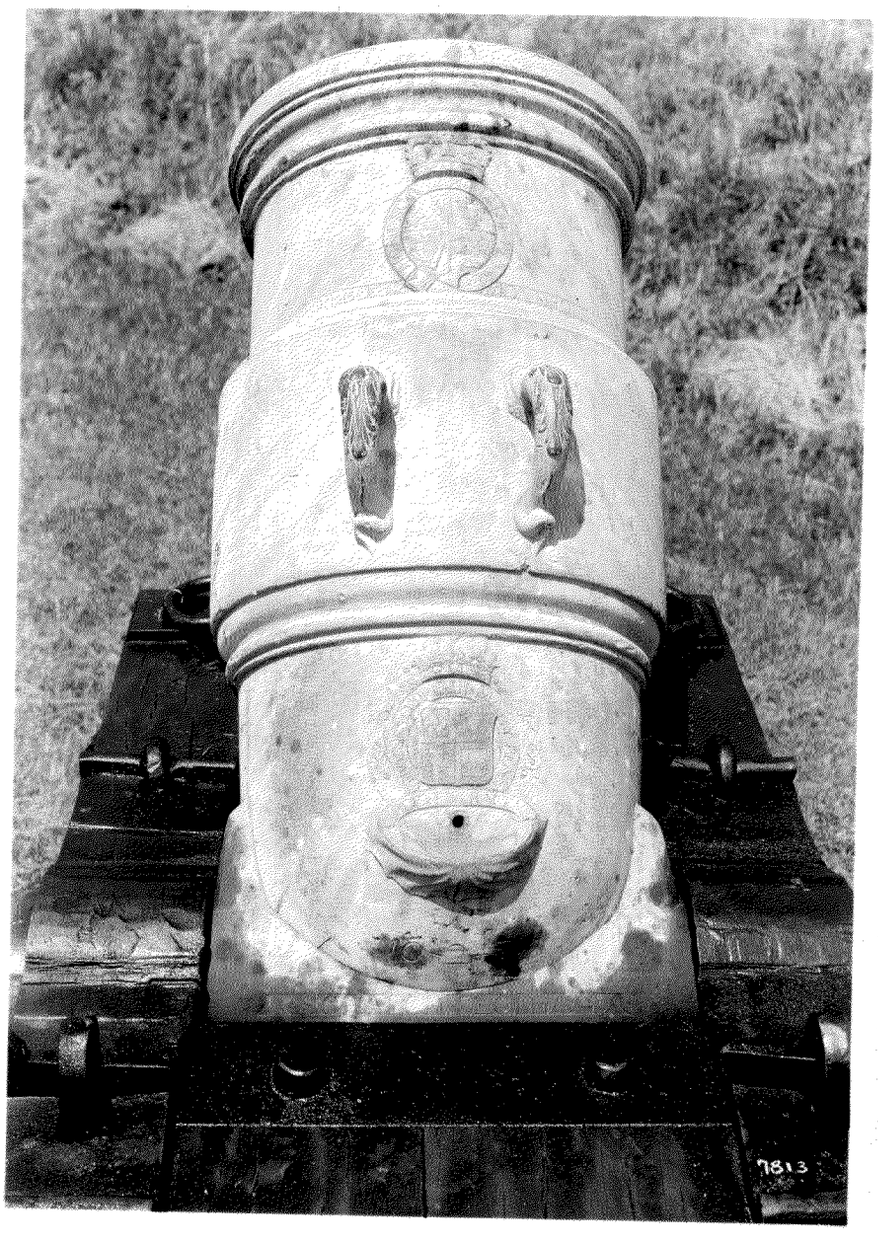
Thickness of walls of a 13-inch shell, 2.05 inches; diameter of fuse hole - outside, 1.837 inches; inside, 1.696 inches.[2] Length of fuse varied according to the range of flight of shell. It took from six to ten men to handle this mortar efficiently when mounted and firing in a battery.[3]

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1 Muller, John, A Treatise of Artillery, (Philadelphia, 1779), pp. 56,67,110,119,134,137,140,141,152; Plates 1, 2 and 3.

2 Adye, Ralph Willet, The Bombardier and Pocket Gunner, (Printed for E. Larkin, No. 47, Cornhill, Boston, by William Greenough, 1804), p. 249.

3 Ibid., p. 115.



Photograph No. 34---(10-inch mortar)

[CNHP #7813]

[10-inch mortar]

This English, brass, 10-inch mortar weighed 10: 2: 7 (1,183 pounds); its powder chamber could hold 5 1/2 pounds of powder. The shell weighed 86 pounds[1] and could hold 4 pounds, 14 ounces of powder,[2] but usually only 3 pounds, 4 ounces were used for bursting it. The greatest range - 3,000 yards - was attained by using a full powder charge of 5 pounds, 8 ounces; with 3 pounds, 9 ounces it would throw the shell 1,900 yards. All the mortars in the English army were fixed permanently in their beds at an angle of 45 degrees. For shorter and longer ranges, the powder charge was adjusted.[3] The fuse for bursting the shell was lighted by the flash when the gun was fired.

Diameter of shell - 9.75 inches; thickness of shell walls - 1.575 inches; outside diameter of fuse hole - 1.219 inches; inside diameter of fuse hole - 1.127 inches; length of fuse depended on the shell's time of flight;[4] from six to ten men were needed in order to operate the mortar efficiently in a battery.[5]

1
Stevens, William, A System for the Discipline of the Artillery of the United States of America, or, The Young Artillerist's Pocket Companion, (New York, 1797), pp. 193; 198-200; 213
and
Muller, John, A Treatise of Artillery, (Philadelphia, 1779), pp. 56, 67, 110, 119, 134, 137, 140-141, 152 and Plates 1, 2 and 3.

2
Muller, supra.

3
Ibid.

4
Smith, Captain George, An Universal Military Dictionary, (London, 1779), pp. ART-ART; CHA-CHA; DIA-DIA; LAB-LAB; MOR-MOR; SHE-SHO; TAB-TAB.

5
Adye, Ralph Willet, The Bombardier and Pocket Gunner, (Printed for E. Larkin, No. 47, Cornhill, Boston, By William Greenough, 1804), pp. 153-162; 200-206; 247-257.

[8-inch mortar]

8-inch mortar. Weight: 4: 0: 0 (448 pounds). The greatest range of an 8-inch mortar was 1,800 yards, with 2 pounds of powder, and the shell weighed 42 pounds and contained 2 1/4 pounds for bursting. For throwing the shell 100 yards, it took 4 ounces and 12 drams. It took 18.72 seconds for the shell to travel the 1,800 yards. The 8-inch mortar was operated the same as the 13-inch mortar. Thickness of walls in an 8-inch shell, 1.02 inches.[1] The diameter of an 8-inch shell was 7.75 inches; the outside diameter of the fuse hole was 1.219 inches; and the inside diameter, 1.127 inches.[2] Length of the fuse depended on the range and the shell's time of flight. From four to five men were needed to handle this mortar when it was placed in a battery for firing.

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1 Adye, Ralph Willet, The Bombardier and Pocket Gunner, (Printed for E. Larkin, No. 47, Cornhill, Boston, by William Greenough, 1804), pp. 153-162; 200-206; 249-257.

2 Ibid.



Photograph No. 35---(5.8-inch royal mortar)

[CNHP #5470]

[5.8-inch royal mortar]

The weight of a 5.8-inch royal mortar was 1: 1: 0 (140 pounds). Its greatest range was 1,500 yards, using 9 ounces of powder. The shell weighed 15 pounds and contained 14 ounces of powder for bursting. It took the shell 17.28 seconds to travel the 1,500 yards. To throw the shell 100 yards, it took 2 ounces and 4 drams of powder. It was fixed to its bed the same as the larger mortars.

Thickness of metal in walls of a 5.8-inch shell, 0.822 inches. Its exterior diameter was 5.25 inches; exterior diameter of fuse hole was 0.89 inches; and the interior, 0.83 inches. Length of fuse depended on range and the shell's time of flight.[1] From two to three men manned this mortar when it was fired.[2]

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1 Tousard, Louis de, American Artillerist's Companion, (Philadelphia, 1809), I, 287 and 296.

2 Adye, Ralph Willet, The Bombardier and Pocket Gunner, (Printed for E. Larkin, No. 47, Cornhill, Boston, by William Greenough, 1804), pp. 153-162; 200-206; 249-257.



Photograph No. 36---(4 2/3-inch Coehorn)

[CNHP #5469]

[4 2/3-inch Coehorn]

A 4 2/3-inch Coehorn weighed 0: 3: 0 (84 pounds). Its greatest range was 900 yards, using 4 1/2 ounces of powder. The shell weighed 8 pounds and contained 7 ounces of powder for bursting. It took the shell 13.72 seconds to travel the 900 yards; to throw the shell 100 yards it took 1 ounce and 8 drams of powder. It was fixed permanently in its bed the same as the large mortar.

Thickness of metal in the walls of a 4 2/3-inch shell, 0.653. The shell's exterior diameter was 4.48 inches; diameter of the exterior of the fuse hole was 0.83 inches; and the interior diameter was 0.77 inches. Length of fuse depended on the range, and time of flight.[1] Three men were needed for this mortar when mounted in battery and firing.[2]

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1 Tousard, Louis de, American Artillerist's Companion, (Philadelphia, 1809), I, 287, 296.

2 Adye, Ralph Willet, The Bombardier and Pocket Gunner, (Printed for E. Larkin, No. 47, Cornhill, Boston, by William Greenough, 1804), pp. 153-162; 200-206; 249-257.

Table 1.

GUNS OF 1793 AND CALIBER

Heavy Ordnance Accumulated Since the Last War in Various Arsenals and Principal Points. From letter by Secretary of War Henry Knox to the Senate, Dated Dec. 16, 1793. Pg. 44.

	CAN.	CAN.	CAN.	CAN.	CAN.	CAN	CAN.	CAN.	CAN.	CAN.	CAN.	CAN.	HOW.	HOW.	HOW.	HOW.	HOW.	MOR.	MOR.	MOR.	MOR.	3 MOR	CAR.	
POUNDERS	½	1	1½	2	3	4	6	8	9	12	18	24	2.85	3½	5½"	8"	4½"	5½"	8"	10"	13"	13.98	18.	
BRASS	0	0	0	1	21	28	70	1	4	11	0	3	4	0	15	19	20	21	3	19	3	1	0	244
IRON	0	7	0	4	8	14	30	0	31	49	36	11	-	47	7	0	0	2	0	0	2	-	20	262
TOTAL	-	7	-	5	29	42	100	1	35	60	36	14	4	47	16	19	20	23	3	19	5	1	20	506

This is 27 guns less than the Survey made in 1789; 16 Brass and 11 Iron guns had been removed. American State Papers, Vol. 12, Military Affairs Vol. 1, pages 44 to 60. Commencing Mar. 3, 1789 to Mar. 3. 1819. Washington - 1832.

T.B. 6/23/39.

COLONIAL NATIONAL HISTORICAL PARK-YORKTOWN, VA.

Photograph No. 37

Photocopy of Table #1 referred to on pages 30 and 31.

[CNHP #8081]

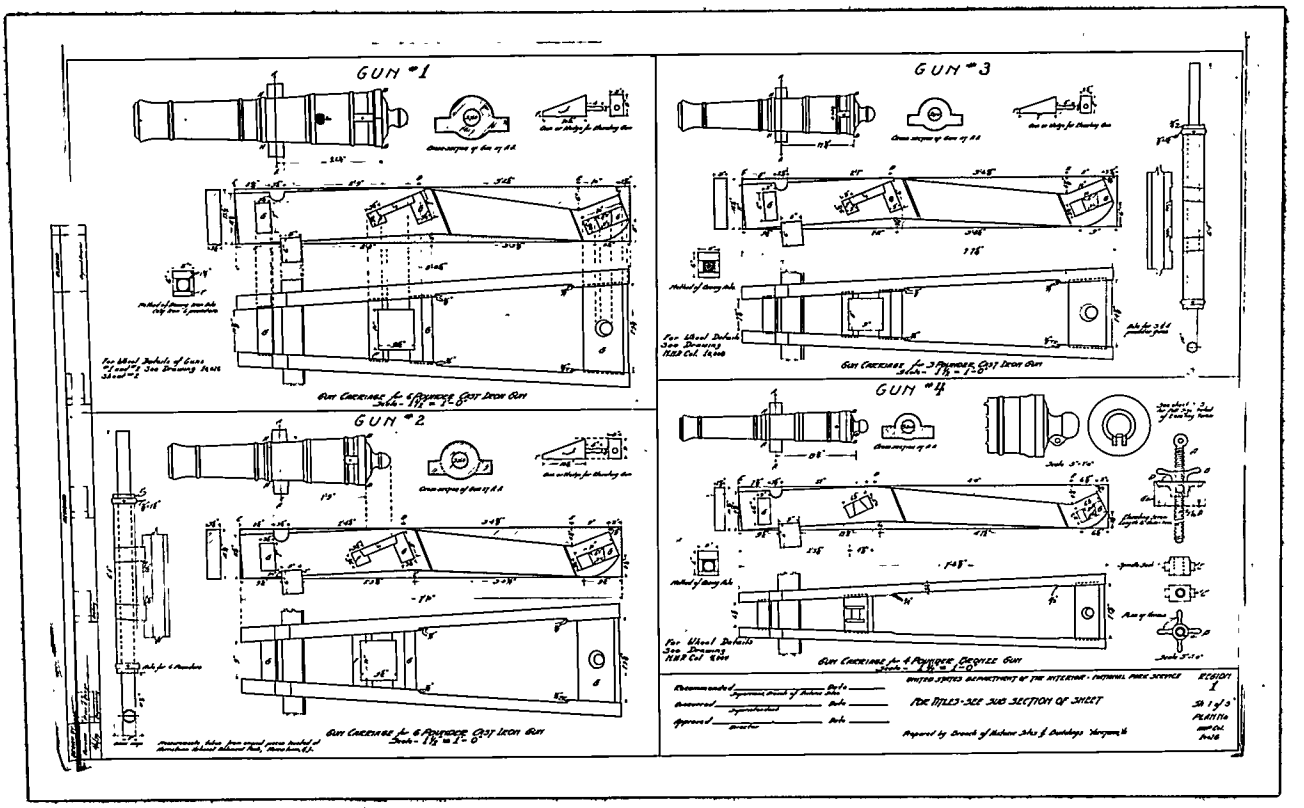
DESCRIPTION OF DRAWINGS

In preparing the drawings it was desired to have each carriage on one sheet. In doing this, it was impossible to detail and dimension each piece separately. To simplify interpretation, all the iron fastenings are numbered and those pieces made of wood lettered. For each plan there is a list giving the dimension of each separate piece of material needed. [Drawing NHP Col. 10,016 has been described in the main report, so only the list of materials and the dimensions of each item are given.]

Each drawing or plate accompanying the report has been prepared for individual guns, and deals only with the carriages for which measurements could be gotten from original cannon of the period. Most of the various pieces are made of brass (bronze) and were cast in a period ranging from 1727-1773. Seven of them are pieces surrendered by Cornwallis at the capitulation of Yorktown in 1781.

The plans have been prepared from John Muller's A Treatise of Artillery, published in Philadelphia in 1779, which is really a reprint of the second edition which was published in London in 1768. The first and original edition was published in 1756, against which all plates have been checked. Muller in his original edition made many suggestions for changes in both cannon and carriages which were nearly all adopted in 1764; hence, his later editions have been checked against the suggested improvements.

Following are brief descriptions of each plate, including a complete list of material needed for construction and the dimensions of each piece.



Photograph No. 38
Drawing NHP Col. 10,016, Sheet 1 of 3

[CNHP #8008]

[Material Lists Follow]

Material for carriage of cast-iron
gun #1, Drawing NHP Col. 10,016,
Sheet 1 of 3.
[Photograph No. 38]

(Wood, White Oak)

2 pieces cheek plates	3 1/2"	x 13 1/2"	x 8' 0 1/2"
1 piece front transom	3 1/2"	x 7"	x 1' 1"
1 " center transom	3 1/2"	x 3 1/2"	x 1' 3"
1 " elevating platform transom	3 1/2"	x 7"	x 1' 5"
1 " trail transom	3 1/2"	x 10"	x 2' 0"
1 " elevating table	2"	x 10"	x 9 1/2"

Wheels

12 pieces fellow	4"	x 9"	x 2' 4"
24 " spokes	2 1/2"	x 3 1/2"	x 1' 8"
2 " naves	12"	x 12"	x 1' 1"

Axle Cover

1 piece top cover	1 3/4"	x 5"	x 3' 9"
1 " bottom cover	1"	x 5"	x 3' 9"
2 pieces sides	1"	x 3"	x 3' 9"

Coin

1 piece coin	3"	x 5"	x 10 1/2"

(Iron)

1 - trunnion socket	(3/8" x 3 1/2" x 2' 6"	..2 pieces
	(1/2" x 3 1/2" x 2' 1"	..2 pieces
2 - cap square	1/2" x 3 1/2" x 2' 3"	..2 "
3 - front cap square bolt	3/4" x 2 1/2" x 4"	.....2 "
4 - rear " " "	3/4" x 2 1/2" x 4"	
5 - cap square eye bolt	3/4" round x 1' 6"	.....2 pieces
6 - garnish bolt	1 1/2" x 1 1/2" x 4"	...2 pieces
7 - front rope hook	3/8" x 3" x 5"	.....2 "
8 - center transom rope hook	3/8" x 5" x 8"	.....2 "
9 - trail " " "	3/8" x 2" x 1' 4"	.....2 "
10 - trail transom eye bolt	3/4" round, see bottom of sheet	(2)
11 - trail strappings	3/8" x 3 1/2" x 4' 8"	...2 pieces
12 - " " tie band	3/8" x 2 1/4" x 2' 3"	...2 "
13 - center tie band	3/8" x 2 1/4" x 2' 7"	...2 pieces
14 - transom bolts	3/4" round, see bottom of sheet	(1)
15 - rope rings and eye bolts	3/4" " " " "	"

16 - wheel tires.....1/2" x 4" x 16' 0".....2 pieces
17 - wheel, fellow dowledges.....5/16" x 1 1/2" x 11".....12 "
18 - hub or nave bands.....3/8" x 1 1/2" x 26'..... 2 wheels
23 - linch washer and rope hook.....3/8" x 1 1/4" x 1' 4"
24 - linch pins.....3/4" round
25 - axle.....3" x 3" x 6' 4"
26 - axle brace.....5/8" x 3 1/2" x 3' 4".....2 pieces
27 (17) - Pintle hole ring top.....1/2" x 1 3/4" x 1' 10".....1 "
Pintle ring bottom.....1/2" x 1 3/4" x 1' 7" .....1 "
" " strap.....3/8" x 2 1/2" x 1' 8".....1 "
Axle band straps.....5/16" x 1 1/4" x 23".....2 pieces
2 bars 3/4" round 20' 0", transom bolts, cap square bolts, etc.
2 bars 5/16" square, for nails, for strap irons, etc.
25 - 3/4" square nuts
2 bars of 3/8" round rivets, for wheels, clamps, etc.
1 piece of chain 3/16" stock, with one inch links made of black iron 2' long
1 piece of G.I. iron pipe Hub box

Material for carriage of cast-iron
gun #2, Drawing NH[illegible] Col. 10,016,
Sheet 1 of 3.
[Photograph No. 38]

(Wood, White Oak)

2 cheek plates.....3 1/2" x 12 3/4" x 7' 10"
1 front transom.....3 1/2" x 7" x 1' 1"
1 center transom.....3 1/2" x 3 1/2" x 1' 3"
1 elevating platform transom.....3 1/2" x 10" x 2' 0"
1 elevating platform.....2" x 10" x 9 1/2"

Wheels
12 pieces fellows.....4" x 9" x 2' 4"
24 " spokes.....2 1/2" x 3 1/2" x 1' 8"
2 " nave.....12" x 12" x 13"

Axle cover
1 piece top cover.....1 3/4" x 5" x 3' 9"
1 " bottom cover.....1" x 5" x 3' 9"
2 pieces sides.....1" x 3" x 3' 9"

1 piece coin.....3" x 5" x 10 1/2"

(Mild Steel)

1 - trunnion socket.....1/2" x 3 1/2" x 2' 0".....2 pieces
3/8" x 3 1/2" x 1' 8".....2 "
2 - cap square.....1/2" x 3 1/2" x 1' 8".....2 "
3 - front cap square bolt.....3/4" x 2 1/2" x 4".....2 "
4 - rear cap " " .....3/4" x 2 1/2" x 4".....2 "
5 - cap square eye bolt.....3/4" round, see bottom of sheet
6 - garnish bolt.....1 1/2" x11 1/2" x 4".....2 pieces
7 - front rope hook.....3/8" x 3" x 5".....2 "
8 - central transom rope hook.....3/8" x 5" x 8".....2 "
9 - trail transom rope hook.....3/8" x 2" x 1' 4".....2 "
10 - " " eye bolt.....3/4" round, see bottom of sheet
11 - trail strapping.....3/8" x 3 1/2" x 4' 2".....2 pieces
12 - " tie band.....3/8" x 2 1/4" x 1' 11".....2 "
13 - center tie band.....3/8" x 2 1/4" x 2' 4".....2 "
14 - transom bolt.....3/4" round, see bottom of sheet
15 - rope rings and eye bolts.....3/4" round " " " "
16 - wheel, tires.....1/2" x 4" x 16'.....2 pieces
17 - Wheel, fellow dowledges.....5/16" x 1 1/2" x 11".....12 "
18 - hub or nave bands.....3/8" x 1 1/2" x 26'...for 2 wheels

23 - linch washers and rope hooks.....3/8" x 1 1/4" x 1' 4".....2 wheels
24 - linch pins.....3/4" round
25 - axle.....3" x 3" x 6' 4".....1 piece
26 - axle brace.....5/8" x 3 1/2" x 3' 0".....2 "
27 (17) - pintle hole ring top.....1/2" x 1 3/4" x 1' 10".....1 "
" " " " bottom.....1/2" x 1 3/4" x 1' 7".....1 "
" " " strap.....3/8" x 2 1/2" x 1' 8".....1 "
Axle band strap.....5/16" x 1 1/4" x 2' 0".....2 "
" washer body.....1/2" x 3/4" x 12".....2 "
1 piece of G.I. iron pipe 3" x
2 bars 5/16" square, nails, etc.
2 " 3/8" round, rivets for dowledges, etc.
2 " 3/4" round, transom bolts, rope rings, eye bolts, etc.
1 piece of chain 3/16" stock, 1" links, 2' 0" long black iron.

Material for carriage of cast-iron
gun #3, Drawing NHP Col. 10,016,
Sheet 1 of 8.
[Photograph No. 38]

(Wood, White Oak)

2 pieces cheek plates.....3" x 12 1/4" x 7' 7 1/8"
1 piece front transom.....3" x 6" x 11"
1 " center transom.....3" x 3 1/2" x 12 1/2"
1 " elevating platform transom.....3" x 6" x 1' 2"
1 " trail transom.....3 1/2" x 10" x 1' 6"
1 " elevating platform.....2" x 8" x 6"

Wheels (see photograph #41)
2 pieces nave or wheel hubs.....12" x 12" x 1' 1"
12 " fellows.....2 1/2" x 7" x 2' 4"
24 " spokes.....2" full x 3" x 1' 8"

Axle cover
1 piece top cover.....1 3/4" x 5" x 3' 9"
1 " bottom cover.....1" x 5" x 3' 9"
2 pieces sides.....1" x 5" x 3' 9"

Coin
1 piece.....2 1/2" x 4" x 7"

(Mild Steel)

1 - trunnion socket.....3/8" x 3" x 22" .....2 pieces
1/2" x 3" x 23".....2 "
2 - cap square.....1/2" x 3" x 23".....2 "
3 - front cap square bolt.....5/8" x 2" x 4".....2 "
4 - rear cap square bolt.....5/8" x 2" x 4".....2 "
5 - cap square eye bolt.....3/4" round, see bottom of sheet
6 - garnish bolt.....1 1/2" x 1 1/2" x 4".....2 pieces
7 - front rope hook.....5/16" x 2 3/4" x 5".....2 "
8 - center transom rope hook.....5/16" x 4 1/2" x 7".....2 "
9 - trail transom rope hook.....5/16" x 2" x 15".....2 "
10 - " " eye bolt.....3/4" round, see bottom of sheet
11 - trail strapping.....3/8" x 3" x 4' 1".....2 pieces
12 - " " tie band.....5/16" x 2" x 1' 11".....2 "
13 - center tie band.....5/16" x 2" x 2' 2".....2 "
14 - transom bolts.....3/4" round, see bottom of sheet
15 - rope rings and eyebolts.....3/4" " " " " "
16 - wheel tires.....1/2" x 2 1/2" x 16' 0"....2 pieces

17 - fellow dowledges.....5/16" x 1 1/4" x 10 1/2"....12 pieces
18 - hub or nave bands.....5/16" x 1 1/4" x 3' 0"..... 8 "
23 - linch washer and rope hook.....3/8" x 1 1/4" x 1' 2"..... 2 "
24 - linch pins.....5/8" round x 4" long..... 2 pieces
25 - axle.....3" x 3" x 6' 4"..... 1 piece
26 - axle brace.....5/8" x 3" x 3' 3"..... 2 pieces
27 (17) - pintle hole ring top.....3/8" x 1 1/2" x 1' 8"..... 1 piece
Pintle hole ring bottom.....3/8" x 1 1/2" x 12"..... 1 "
" " straps.....3/8" x 2 1/2" x 1' 9"..... 1 "
Axle band straps.....1/4" x 1 1/4" x 1' 11"..... 2 pieces
Axle washer - Body.....1/2" x 3/4" x 1' 0"..... 2 "
1 piece of G. I. iron pipe 2 1/2" x 12 3/4" long, sleeve for hub.

3 bars 5/16" square, for nails, etc.
30 feet of 3/4" round, transom bolts, cap square bolts, rope eyes, etc.
2 pieces of chain, 3/16" stock, 1" links, 8" long, black iron chain.
25 3/4" square nuts.

Material for carriage of ~~cast-iron~~ bronze
gun #4, Drawing NHP Col. 10,016,
Sheet 1 of 3.
[Photograph No. 38]

(Wood, White Oak)

2 pieces cheek plates.....2 5/8" x 10 5/8" x 7' 6 3/8"
1 piece front transom.....3" x 6 1/4" x 9"
1 " center transom.....3" x 6 1/4" x 10"
1 " trail transom.....3" x 6 1/4" x 1' 3"

Wheels (see photograph #42)
2 naves or hubs.....12" x 12" x 13 1/2"
12 fellows.....2 1/2" x 8" x 2' 4"
24 spokes.....1 3/4" x 3" x 1' 10"

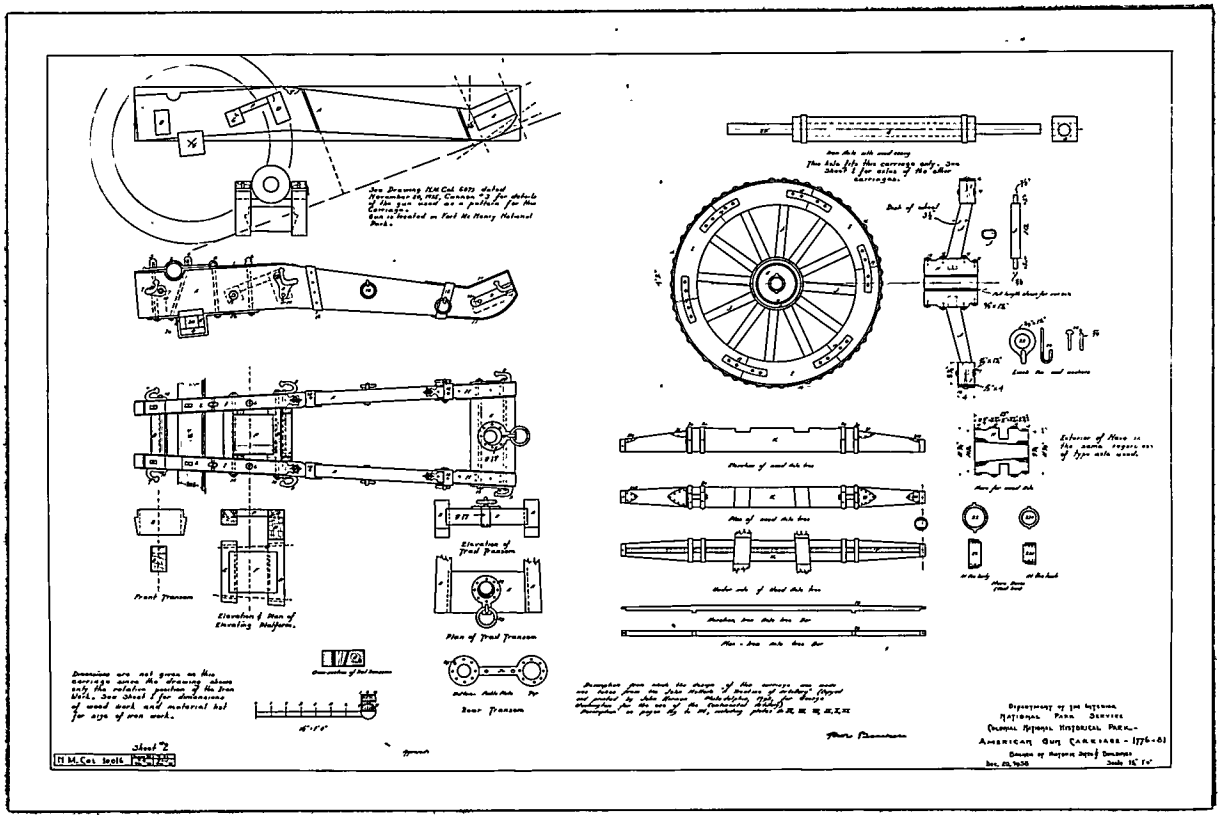
Axle cover
1 piece top cover.....1 3/4" x 5" x 3' 9"
1 " bottom cover.....1" x 5" x 3' 9"
2 pieces sides.....1" x 3" x 3' 9"

(Mild Steel)

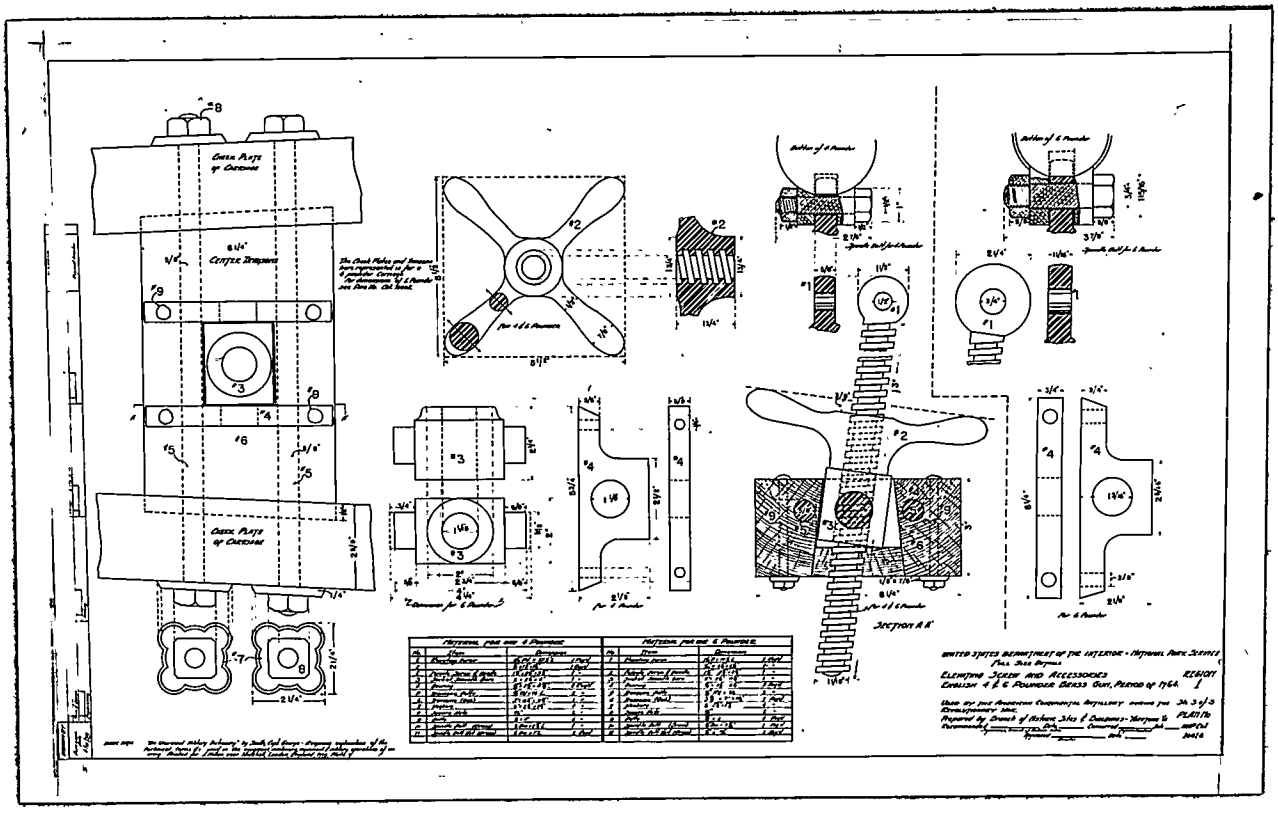
1 -	trunnion socket.....	5/16" x 2 5/8" x 1' 9".....	2 pieces
		3/8" x 2 5/8" x 1' 9".....	2 "
2 -	cap square.....	3/8" x 2 5/8" x 1' 10".....	2 "
3 -	front cap square bolt.....	5/8" x 2" x 4".....	2 "
4 -	rear " " "	5/8" x 2" x 4".....	2 "
5 -	cap square eye bolt.....	5/8" round, see bottom of sheet	
6 -	garnish bolt.....	1 1/4" x 1 1/4" x 4".....	2 pieces
7 -	front rope hook.....	5/16" x 2 1/2" x 5".....	2 "
8 -	central transom rope hook.....	5/16" x 4" x 6 1/2".....	2 "
9 -	trail transom.....	5/16" x 1 1/2" x 1' 3".....	2 "
10 -	" " eye bolt.....	5/8" round, see bottom of sheet	
11 -	" strapping.....	5/16" x 2 5/8" x 3' 4".....	2 pieces
12 -	" " tie band.....	5/16" x 2" x 1' 7".....	2 "
13 -	center tie band.....	5/16" x 2" x 1' 9".....	2 "
14 -	transom bolts.....	5/8" round, see bottom of sheet	
15 -	rope rings and eye bolts.....	5/8" " " " " "	
16 -	wheel tires.....	3/8" x 2 1/2" x 14'.....	2 pieces
17 -	fellow dowledges.....	1/4" x 1 1/4" x 9".....	12 "
18 -	hub or nave bands.....	1/4" x 1 1/2" x 20' 0".....	8 pieces
23 -	linch washer and rope hook.....	3/8" x 1 1/4" x 11".....	2 pieces

24 - linch pins.....5/8" round x 4" .....2 pieces
25 - axle.....3" x 3" x 6' 4".....1 "
26 - axle brace.....1/2" x 2 5/8" x 2' 8".....2 "
27 (17) pintle hole ring top.....5 1/6" x 1 1/2" x 1' 6".....1 piece
Pintle hole ring bottom.....5/16" x 1 1/2" x 1' 5".....1 "
Pintle hole ring straps.....5/16" x 2 1/2" x 12".....1 "
Axle band straps.....1/4" x 1 1/4" x 2" 4".....2 pieces
Axle washer, Body.....5/8" x 5/8" x 1' 0".....1 "
1 piece of G.I. iron pipe 2 1/2" x 13 1/2" sleeve for nave

2 bars 5/16" x 5/16", nails, etc.
30 feet 5/8" round transom bolts, cap square bolts, rope eyes and eye bolts.
2 pieces of chain, 3/16" stock, 1" links, 8" long black iron
24 square 5/8" nuts.

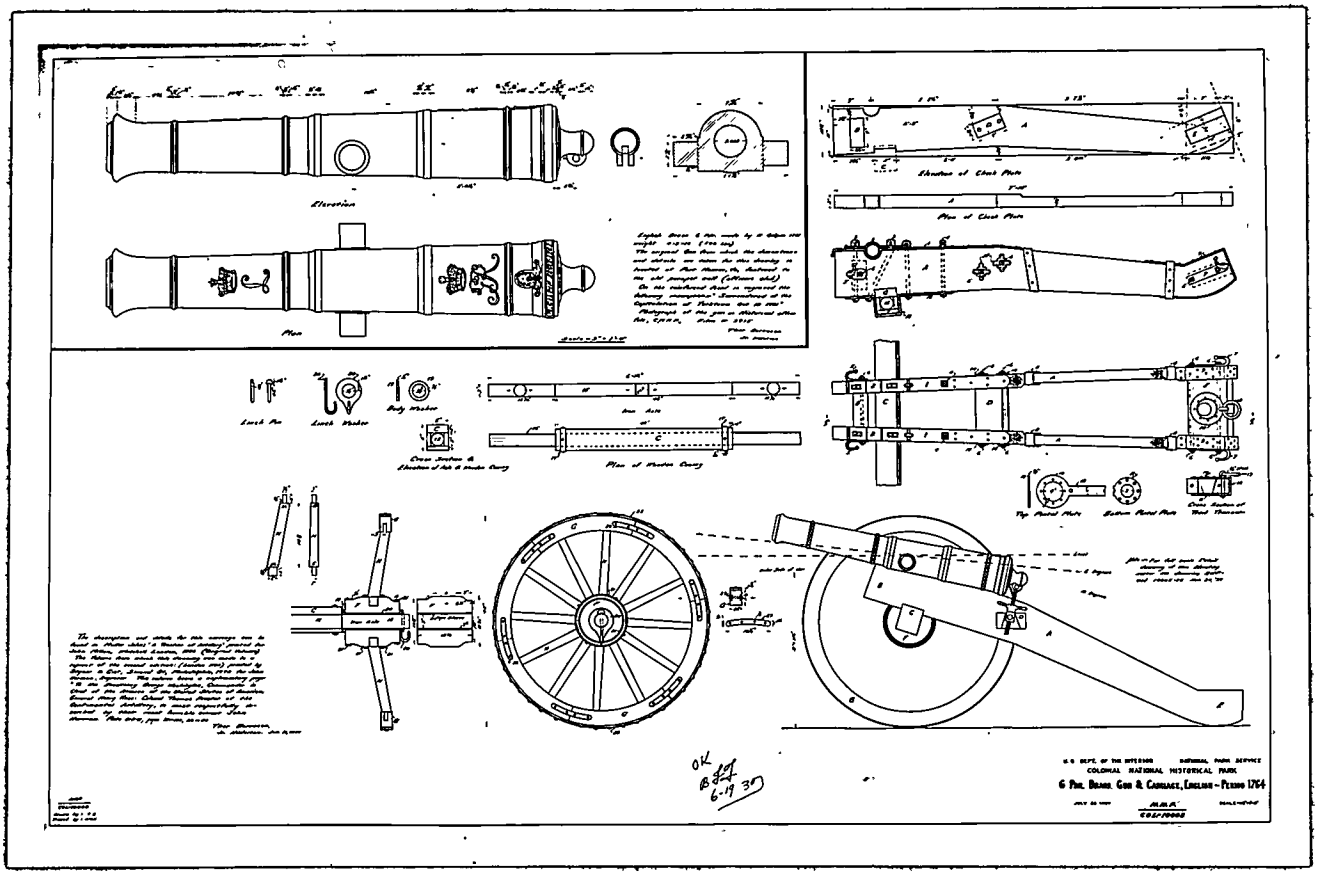


Photograph No. 39
Drawing NHP Col. 10,016, Sheet 2 of 3
[CNHP #8009]



Photograph No. 40
Drawing NHP Col. 10,016, Sheet 3 of 3

[CNHP #8010]



Photograph No. 41
Drawing NHP Col. 10,008

[CNHP #6402]

[Description and material lists follow]

Carriage of
English 6-pounder brass gun, Drawing
NHP Col. 10,008.
[Photograph No. 41]

Description

English 6-pounder brass gun and carriage. The gun is of the 1753 regulation; cast in 1761 by R. Gilpin, Master Founder of Woolwich Arsenal, London. It was surrendered by Cornwallis at the capitulation of Yorktown, 1781. The carriage has been prepared from plates shown in Muller, 1779 edition.. For detailed drawing of the elevating screw see Drawing NHP Col. 10,016, Sheet 3 of 3.

Material

(Wood)

A.	Cheek plate	2 pieces	3" full x 12 1/2" x 8' 6"
B.	Front transom	1 "	3 1/2" x 7" x 0' 10"
C.	Wood covering for axle	1 piece	2 1/2" x 5" x 3' 6"
		2 pieces	1" x 3" x 3' 6"
		1 piece	1" x 5" x 3' 6"
D.	Center transom	1 "	3 1/2" x 7"x 1' 1"
E.	Trail transom	1 "	3 1/2" x 10" x 1' 4"
F.	Nave	2 pieces	12" x 12" x 1' 1"
G.	Fellow	12 "	2 1/2" x 7" x 2' 4"
H.	Spokes	24 "	2" full x 3" x 1' 8"

(Mild Steel)

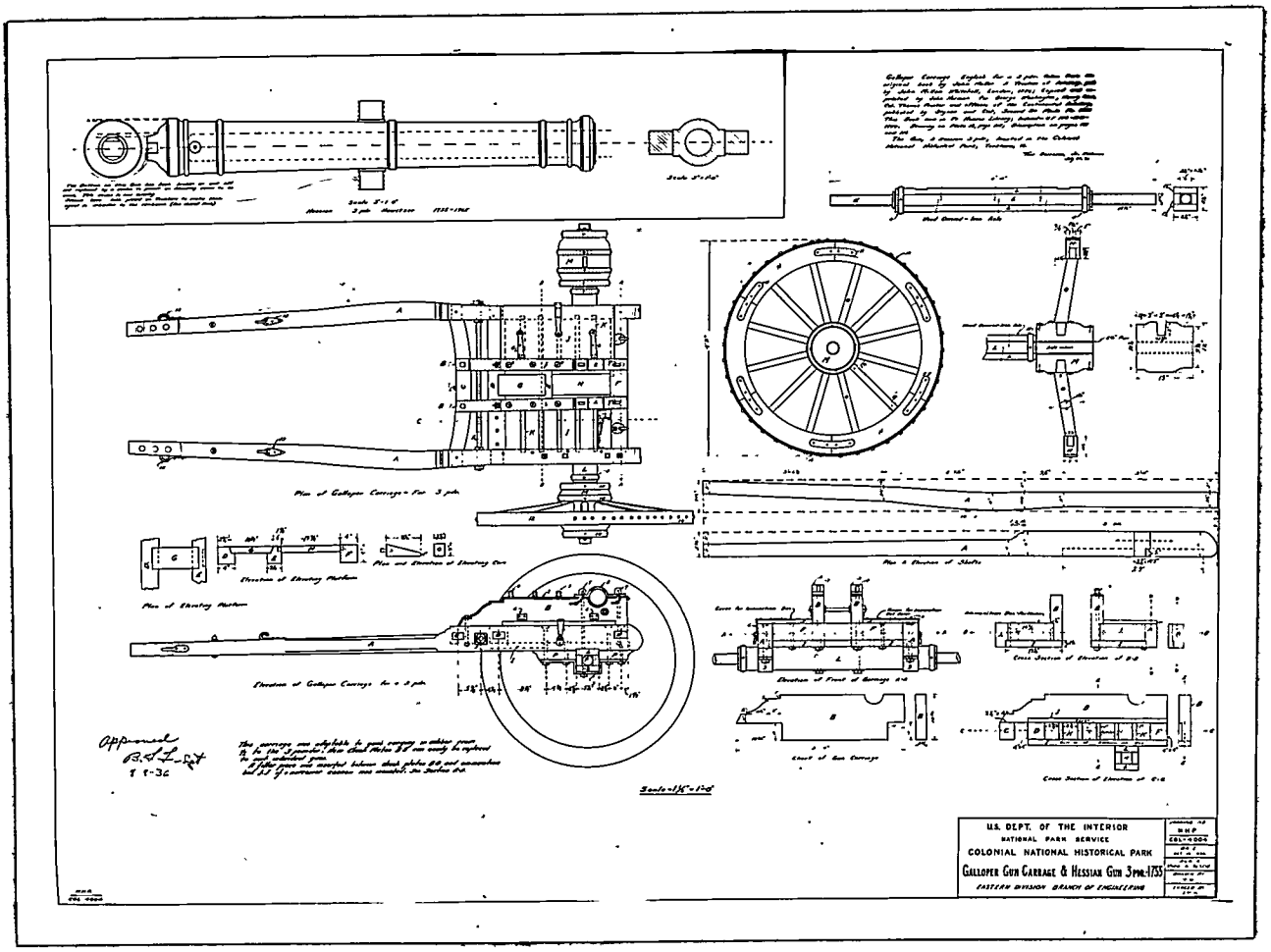
1.	Trunnion socket and strap	2 pieces	1/2" x 3" x 1' 8"
		2 pieces	3/8" x 3" x 2' 4"
2.	Cap square - trunnion clamp	2 "	1/2" x 3" x 2' 8"
3.	" " bolts	4 "	3/4" x 2" x 0' 3"
		4 "	3/4" x 3/4" x 1' 3"
4.	Garnish bolt	2 "	1 1/2" x 1 1/2" x 0' 3"
		2 "	3/4" x 3/4" x 1' 3"
5.	Rope hooks	2 "	3/8" x 2" x 0' 5"
6.	Transom bolts	1 piece	3/4" round x 9' 0"
7.	Rope hooks - trail	2 pieces	3/8" x 2" x 1' 0"
8.	Cheek bands	4 "	3/8" x 2" x 2' 4"
9.	Trail strap	2 "	3/8" x 3" x 4' 0"
10.	Pintle plate - top	1 piece	3/8" x 8" x 0' 9"
11.	Pintle plate - bottom	1 "	3/8" x 6 1/2" x 0' 7 1/2"
12.	Trail plate strap	1 "	3/8" x 2" x 0' 10"
13.	Trail plate ring bolt	1 "	3/4" round x 2' 0"

14.	Transom bolt washers.....	4 pieces	1/4" x 3 1/2" x 0' 3 1/2"
15.	Iron axle.....	1 piece	3" x 3" x 6' 1 1/2"
16.	Axle casing straps.....	2 pieces	1/4" x 1 1/4" x 1' 11"
17.	Axle strap.....	2 "	1/2" x 3" x 3' 4"
18.	Axle washer - body.....	2 "	1/2" x 3/4" x 1' 0"
19.	Axle washer - linch.....	2 "	3/8" x 1 1/4" x 1' 2"
20.	Nave hoops.....	8 "	5/16" x 1 1/4" x 3' 0"
21.	Tire - wheel.....	2 "	1/2" x 2 1/2" x 16' 0"
22.	Fellow dowledge.....	12 "	5/16" x 1 1/4" x 0' 10 1/2"
23.	3" pipe sleeve.....		12 3/4" long.

3 rods of 3/8" square 16' long for nails, etc.
3 rods of 3/8" round 16' long for rivets, etc.

Iron for elevating screw

Screw 1 1/16" diameter x 14 1/2" long	- 1	required
Screw head 11/16" x 2 1/4" x 2 1/4"	- 1	"
Female screw and handle	1 3/4" x 2 1/2" x 2 1/2"	- one required
Socket	2" x 2 1/4" x 4 1/4"	- " "
Bearings	3/4" x 2 1/8" x 6 1/4"	- two "
Bolts	3/8" x 4"	- four "
Spingle bolt (brass)	3/4" diameter x 3 5/16"	- one "
Nuts (brass)	5/8" thick by 1 15/16" diameter	- two required



Photograph No. 42
Drawing NHP Col. 4,004

[CNHP #8074]

[Description and material lists follow]

Galloper
Carriage of Drawing NHP Col. 4,004
[Photograph No. 42]

Description

The galloper carriage here shown was the smallest field carriage used in the English and American armies. The carriage in itself is rather flexible as to the guns it mounts; the largest gun used on this type of carriage is the light 3-pounder, and the smallest a 1/2-pounder swivel. The carriage on the whole remained the same in all dimensions; only the dimensions of the cheek plates and the space between each differed. Each gun of a different caliber differs in both length and circumference; hence, it was necessary to bring the two cheeks "B.B" closer together. If the gun was of the smallest type, smaller material for the cheek plates was used. A filler piece was fitted between the ammunition box cover "J" and the cheek plates "B", to make up for the additional space if the carriage was converted from one type gun to another.

The gun shown on the drawing is one of the early Prussian experimental cast-iron guns, which would fire both solid and hollow shot. It dates from around 1755 to 1765. Photograph No. 5 shows an English brass 3-pounder mounted on a reproduced garrison carriage. When in use in the field, one to two horses were used, according to the road conditions, the horses hitched in tandem.

Material

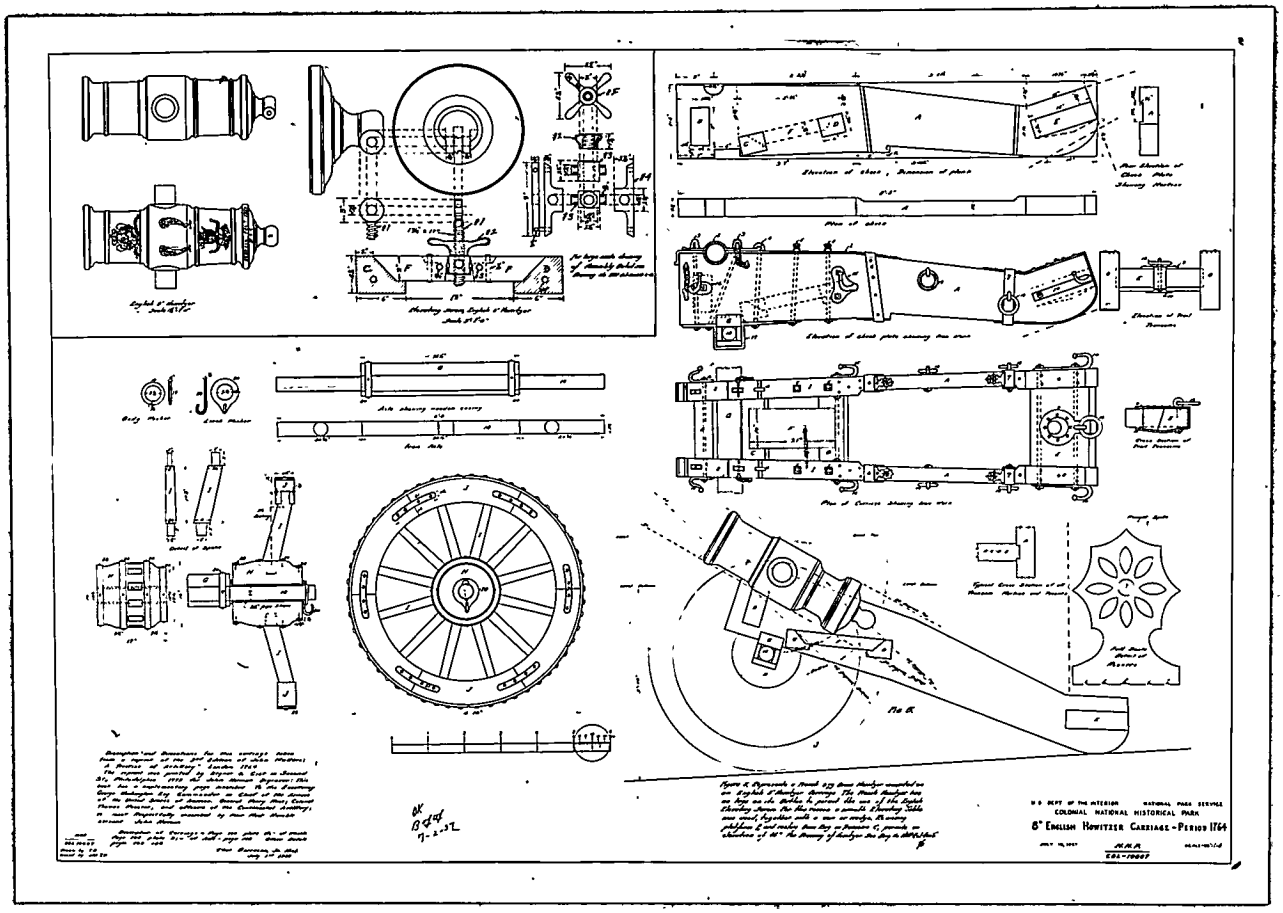
(Wood)

A.	2 pieces	shafts	5" x 7 1/2" x 10' 1"
B.	2 "	cheeks	2 3/4" x 10 3/4" x 3' 4"
C.	1 piece	front cross bar	3 1/2" x 5 1/2" x 3' 4"
D.	1 "	elevating transom	4" x 4" x 3' 4"
E.	1 "	center transom	3" x 4" x 1' 2"
F.	1 "	front transom	4" x 4" x 3' 4"
G.	1 "	elevating plate	1 1/2" x 5" x 1' 0"
H.	1 "	Table	1 1/2" x 5" x 1' 4"
I.	2 pieces	bottom of ammunition box	1 1/2" x 13 1/2" x 2' 10"
J.	2 "	top of ammunition box	1" x 13 1/2" x 3' 7"
K.	10 "	partitions of ammunition box	1" x 4 1/2" x 1' 0"
L.	2 "	axle covering	1 1/2" x 5 1/2" x 4' 0"
L.	2 "	axle covering	1 1/2" x 2 1/2" x 4' 0"
M.	6 "	fellow	3 1/2" x 8" x 2' 4"

N.	2 pieces	nave	12" x 12" x 13 1/2"
O.	12 "	spokes	1 3/4" x 3 1/2" x 1' 10"
P.	2 "	shaft dead piece	2 1/4" x 3 3/4" x 2' 0"

(Mild Steel)

1.	2 pieces	cheek plate straps	3/8" x 2 3/4" x 5' 6"
2.	2 "	trunion plates	1/2" x 2 3/4" x 2' 0"
3.	2 "	axle strap	1/2" x 2 3/4" x 2' 6"
4.	2 "	axle hoops	5/16" x 1 1/4" x 2' 4"
5.	1 piece	front transom bar	1" round x 3' 8"
6.	1 "	hinges and hasps	1/4" x 1 3/8" x 8' 0"
7.	1 "	trunnion bolts, top	1/2" x 2" x 2' 0"
8.	1 "	rope hooks	5/16" x 2 1/2" x 1' 0"
9.	1 "	garnish bolts	1 3/8" x 1 3/8" x 2' 0"
10.	1 "	nave hoops	1/4" x 1 1/2" x 20' 0"
11.	1 "	fellow straps	5/16" x 1 1/2" x 20' 0"
12.	2 pieces	tire	1/2" x 3" x 14' 0"
13.	1 piece	harness hooks	1/4" x 2 1/2" x 4' 0"
14.	1 piece	shaft plate	1/4" x 3 1/2" x 4' 0"
15.	1 "	iron axle	2 1/2" x 2 1/2" x 6' 4"
	1 bar		1/2" x 3/4" x 20' 0"
	3 bars		3/4" round x 20' 0"
	2 bars		1/2" " x 20' 0"
	30	3/4" square nuts	
	30	1/2" square nuts	
	24	5/8" square nuts	
	6	1 " square nuts	



Photograph No. 43
Drawing NHP Col. 10,007

[CNHP #8075]

[Description and material lists follow]

Carriage of
English 8-inch brass howitzer,
Drawing NHP Col. 10,007
[Photograph No. 43]

Description

This drawing is of an 8-inch English brass (bronze) howitzer, cast in 1727 by A. Schalch, Master Founder of the Woolwich Arsenal, London. The drawing of the carriage was copied from Muller's 1779 edition, Plates 3 and 17, pages 65, 69, 82 and 124. No separate drawing has been prepared for the elevating screw, but the general design is the same as shown on Drawing NHP Col. 10,005, Sheet 2 of 2 [Photograph No. 45]. The material, however, is larger and is attached to the material list for the 8-inch carriage.

Material

(Wood)

A.	Cheek plates	2 pieces	4 1/2" x 18" x 8' 5"
B.	Front transom	1 piece	4 1/2" x 9" x 1' 5"
C.	Elevating transom	1 "	4 1/2" x 6" x 1' 6"
D.	Center transom	1 "	4 1/2" x 6" x 1' 8"
E.	Trail transom	1 "	6" x 15" x 2' 0"
F.	Elevating platform	1 "	3" x 10" x 1' 9"
G.	Axle, wood casing	1 "	3" x 6" x 3' 2 1/2"
	" " "	1 "	1 3/8" x 6" x 3' 2 1/2"
	" " "	2 pieces	1 3/8" x 3 1/2" x 3' 2 1/2"
H.	Nave (Hub)	2 "	16" x 16" x 1' 6"
I.	Spokes	24 "	2 1/2" x 4" x 1' 8 1/2"
J.	Fellows	12 "	4 1/2" x 10" x 2' 7"

(Mild Steel)

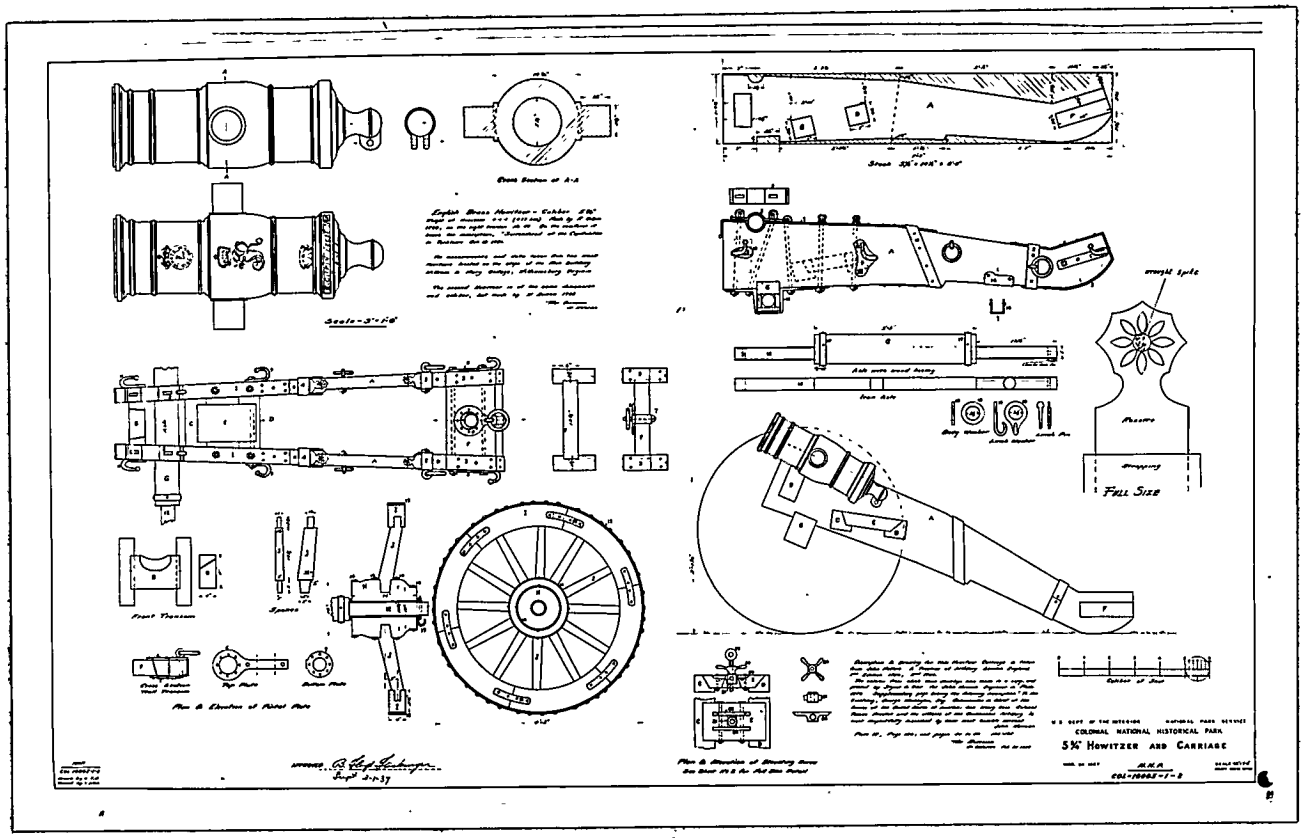
1 -	Trunnion socket	2 pieces	5/8" x 4 1/2" x 2' 5"
	" "	2 "	1/2" x 4 1/2" x 1' 2"
	" "	2 "	3/8" x 4 1/2" x 1' 8"
2 -	Cap Square (trunnion clamp)	2 "	5/8" x 4 1/2" x 2' 2"
3 -	Cap Square bolt	4 "	3/4" x 2 1/2" x 0' 4"
	" " "	4 "	3/4" x 3/4" x 2' 8"
4 -	Pintle cap square	2 "	3/4" round x 2' 0"
5 -	Garnish bolts	4 "	1 1/2" x 1 1/2" x 0' 4"
	" "	4 "	3/4" x 3/4" x 1' 6"
6 -	Cheekplate strap (upper)	2 "	3/8" x 2 1/2" x 3' 10"

7 - Cheekplate strap (lower).....2 pieces.....3/8" x 2 1/2" x 2' 10"
8 - Cheekplate strap (trail).....2 " .....3/8" x 4 1/2" x 5' 8"
9 - Pintle plate (top).....1 piece .....1/2" x 8 1/2" x 0' 9"
10 - " " (bottom).....1 " .....1/2" x 7" x 0' 8"
11 - " " strap.....1 " .....3/8" x 3" x 0' 11"
12 - " ring and pin.....1 " .....3/4" round x 2' 6"
13 - Rope rings.....4 " .....5/8" round x 9"0"
14 - Rope hook (trail).....2 " .....1/2" x 2" x 1' 6"
15 - " " (center).....2 " .....1/2" x 6" x 0' 9"
" " " .....2 " .....7/8" round x 0' 7"
16 - " " (front).....2 " .....1/2" x 3" x 0' 6"
" " " .....2 " .....7/8" round x 0' 7"
17 - Axle strap.....2 " .....3/4" x 4 1/2" x 3' 4"
18 - Iron axle.....1 " .....3 1/2" x 3 1/2" x 6' 8"
19 - Body Washer (axle).....2 " .....1/2" x 3/4" x 1' 2"
20 - Linch " " .....2 " .....3/8" x 1 1/4" x 1' 4"
21 - Dowledges (wheel) .....12 " .....3/8" x 1 1/2" x 1' 0"
22 - Nave hoops..... 8 " .....3/8" x 1 1/2" x 4' 0"
23 - Tire..... 2 " .....1/2" x 4 1/2" x 18'0"
24 - Axle casing strapp..... 2 " .....5/16" x 1 1/2" x 2' 5"

1 bar of 7/8" round 20 feet. Transom bolts
4 bars of 3/8" x 3/8" 20 feet Nails, spikes, etc.
12 3/4" square nuts
8 7/8" " "
4 5/8" " "
8 3/8" " "

Elevating screw

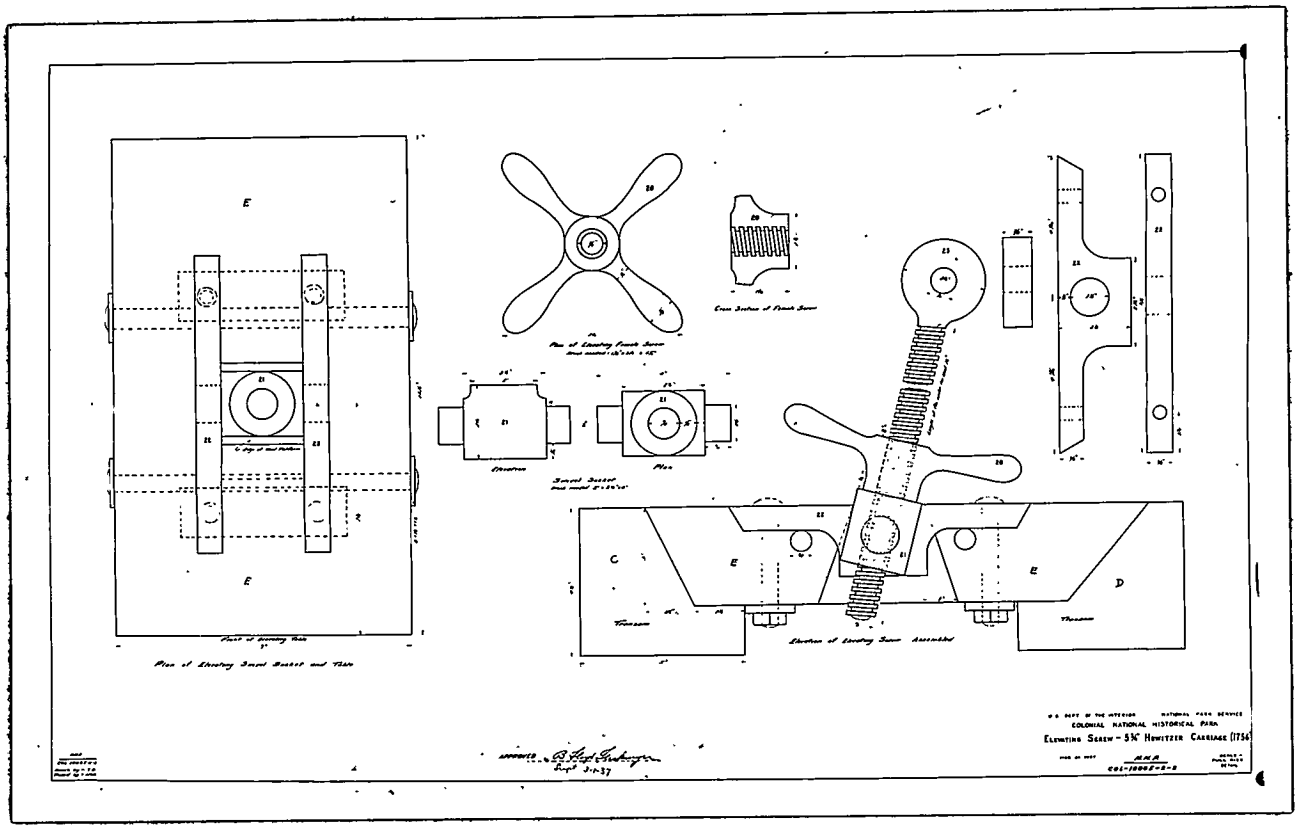
1 elevating screw (round) 1 3/16" x 18" square tread 3/16" x 3/16"
" " head 1" x 3" x 3"
2 elevating screw handle 1 3/4" x 5 1/2" x 5 1/2"
3 elevating screw socket, 2" x 2 1/2" x 2 1/2"
4 elevating screw bearing 3/4" x 2 3/8" x 9"
5 transom bolts, 3/4" x 12"
2 - 1/2" x 3 1/2" rivets
2 - 3/4" square nuts



Photograph No. 44
Drawing NHP Col, 10,005, Sheet 1 of 2

[CNHP #8076]

[Description and material lists follow]



Photograph No. 45
Drawing NHP Col. 10,005, Sheet 2 of 2

[CNHP #8077]

[Description and material lists follow]

Carriage of
English 5.8-inch brass howitzer,
Drawing NHP Col. 10,005
[Photographs 44 and 45]

Description

An English 5.8-inch brass (bronze) howitzer, cast in 1760 by R. Gilpin, Master Founder of Woolwich Arsenal, London. The drawing of the carriage was copied from Muller's 1779 edition.

A howitzer carriage is constructed in such a manner that it is possible to fire from a deflation angle of 12 degrees to a high angle of 45 degrees. By removing the elevating platform "E" and resting the base ring of the howitzer on transom "C", an angle of 45 degrees was obtained. By resting the button of the howitzer on platform "E", an angle of 30 degrees was obtained. For all other elevations the elevating screw had to be used. Therefore platform "E" was never fastened to the transom.

Material

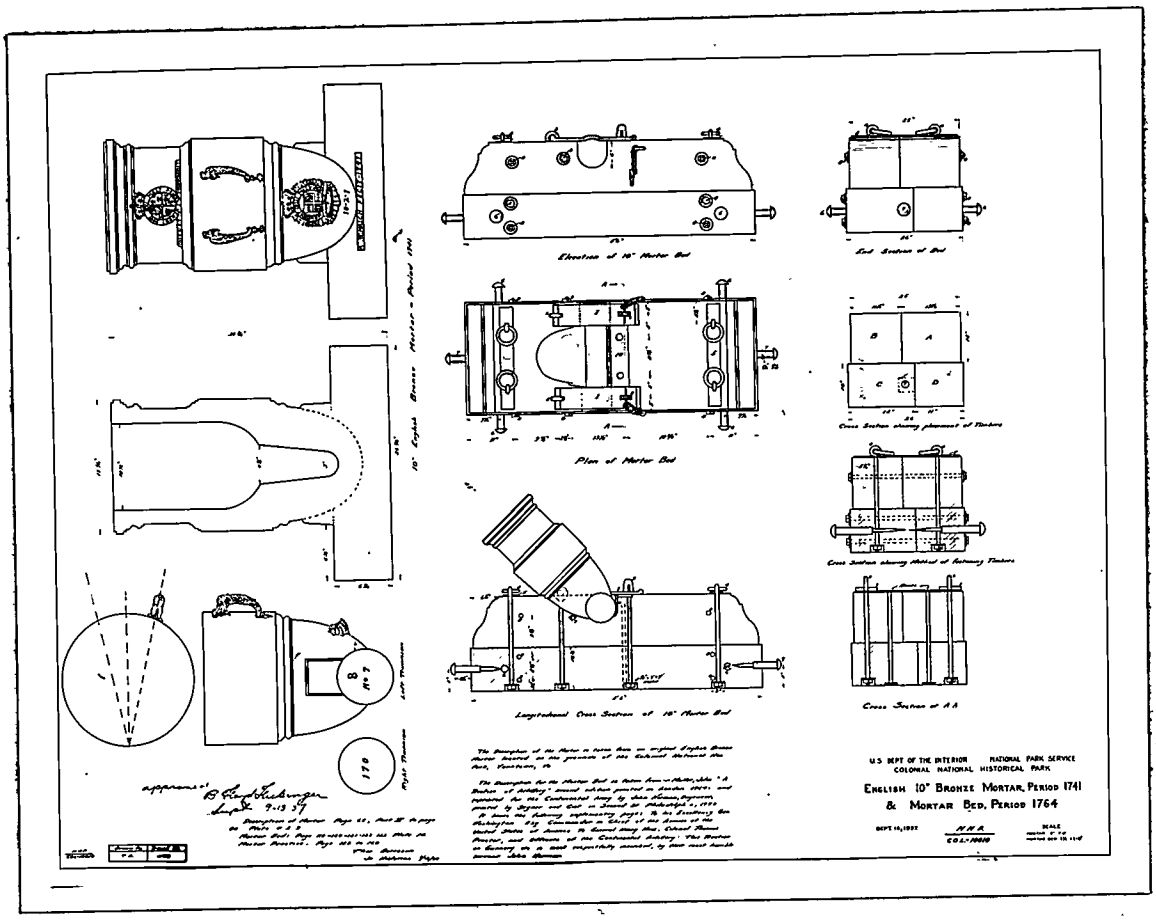
(Wood)

A.	Cheek plate	2	pieces	3 1/2" x 14 1/2" x 8'
B.	Front transom	1	piece	4" x 8" x 1' 1"
C.	Center transom	1	"	4 1/2" x 5" x 1' 2"
D.	" " No. 2	1	"	4 1/2" x 5" x 1' 3"
E.	Elevating table	1	"	3" x 9" x 1' 3"
F.	Trail transom	1	"	4" x 12" x 1' 8"
G.	Axle covering	1	"	3" x 5 1/2" x 3' 5"
		2	"	1 1/4" x 3" x 3' 5"
		1	"	1" x 5 1/2" x 3' 5"
H.	Nave	2	"	14" x 14" x 1' 4"
I.	Fellow	6	"	4" x 8 1/2" x 2' 3"
J.	Spoke	12	"	2" x 3 1/2" x 1' 6"

(Mild Steel)

1 - 2	pieces	- trunnion socket and strap		1/2" x 3 1/2" x 3"
2	"	- " " " "		3/8" x 3 1/2" x 3'
2 - 2	"	- " clamp		1/2" x 3 1/2" x 2'
3 - 2	"	- trail strap		3/8" x 3 1/2" x 6'
4 - 2	"	- center cheek strap		3/8" x 2 1/2" x 3' 6"

5 - 2 pieces - trail cheek strap.....3/8" x 2 1/2" x 3' 8"
6 - 1 piece - pintle plate top.....1/2" x 7 1/2" x 8"
7 - 1 " - " " bottom.....1/2" x 7 1/2" x 8"
8 - 2 " - rope hooks trail.....1/2" x 2" x 1' 4"
9 - 2 " - " " center.....1/2" x 8" x 6"
10 - 2 " - " " front.....1/2" x 3" x 6"
11 - 2 " - axle tree strap.....3/4" x 3 1/2" x 3' 2"
12 - 1 " - axle iron.....3" x 3" x 6' 5 1/2"
13 - 4 " - tire wheels.....3/8" x 4" x 18' 0"
14 - 1 " - nave hoops (8).....3/8" x 1 1/2" x 28' 0"
15 - 1 " - fellow straps (24).....5/16" x 1 1/2" x 24' 0"
16 - 2 " - wheel chafing iron.....1/4" x 10" x 7"
17 - 1 " - axle tree strap.....5/16" x 1 1/2" x 4' 8"
18 - 1 " - washers, linch.....1/2" x 1 1/4" x 2' 0"
19 - 1 " - " hooks, linch.....3/8" x 1 1/4" x 2' 6"
20 - 1 " - elevating wheel.....5 1/2" x 5 1/2" x 1 3/4"
21 - 1 " - elevating socket.....2" x 2 1/4" x 4"
22 - 2 " - elevating bearings.....3/4" x 2" x 9"
23 - 1 " - elevating screw..... 7/8" round 16" long
24 - 3 bars of 3/4" round 20' long
25 - 4 " 3/8" x 3/8" x 20' long
26 - 1 " of 5/8" round 20' long
27 - 2 " of 3/8" round 20' long



Photograph No. 46
Drawing NHP Col. 10,010.

[CNHP #8078]

[Description and material lists follow]

Carriage of
English 10-inch brass mortar,
Drawing NHP Col. 10,010
[Photograph No. 46]

Description

A 10-inch English brass (bronze) mortar, cast in 1741 by A. Schalch, Woolwich Arsenal, London.

All land mortar beds for English mortars were made in one solid piece. The larger pieces like the 8-inch, 10-inch and 13-inch were made of four pieces as shown on the drawing. All mortars fastened at an angle of 45 degrees (see commentary on method of firing).

Material

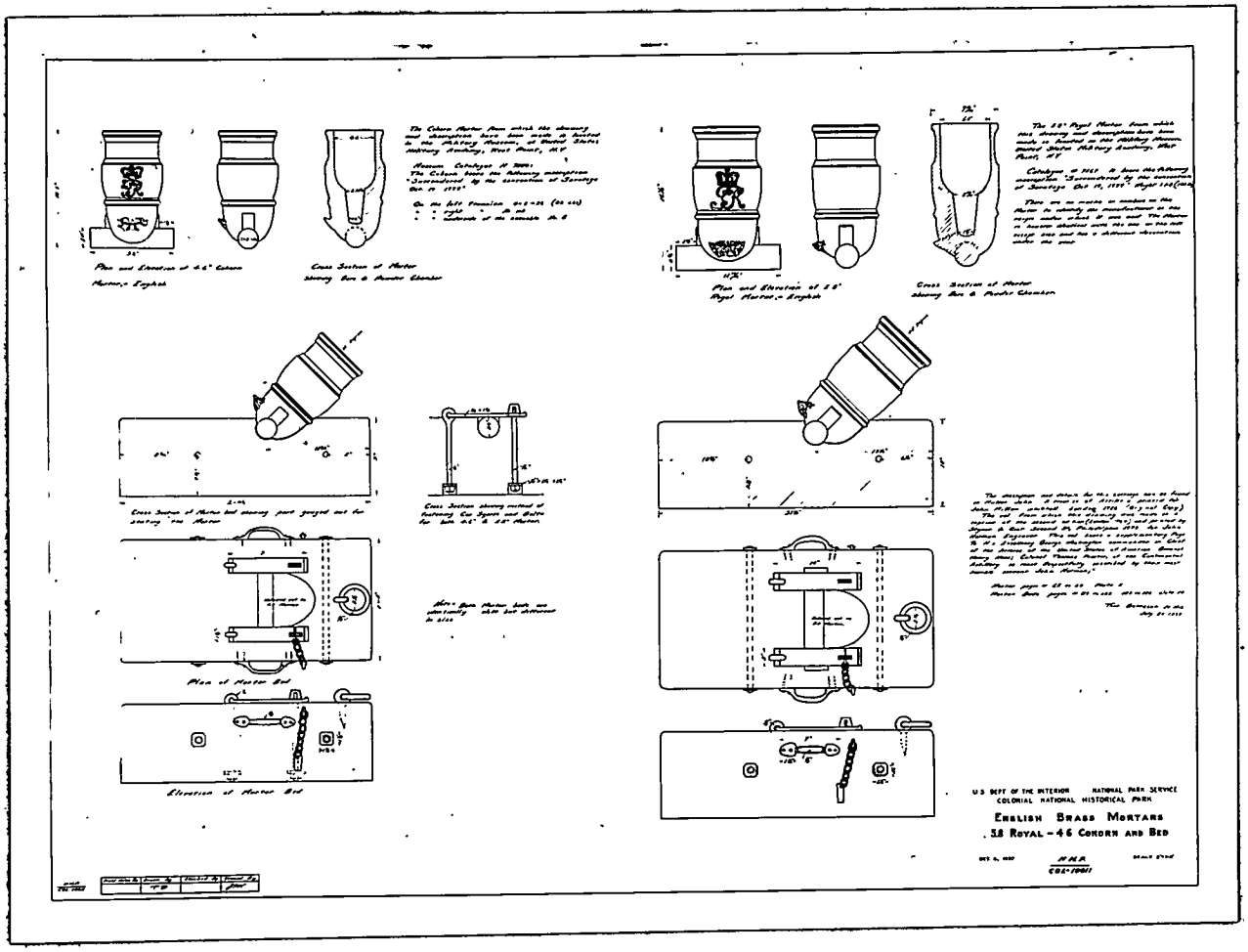
(Wood)

A. 1 piece .....12" x 13 1/2" x 5' 6"
B. 1 " .....12" x 11 1/2" x 5' 6"
C. 1 " .....10" x 15" x 5' 6"
D. 1 " .....10" x 11" x 5' 6"

(Mild Steel)

#1 - 2 pieces.....3/4" x 5" x 2' 0".....cap square
#2 - 2 " .....3/4" round x 2' ..... " " eye bolt
#3 - 2 " .....3/4" x 2 1/2" x 4" ..... " " bolts
#3 - 2 " .....3/4" round x 2'
#4 - 4 " .....5/8" round x 3' 3".....rings and eye bolts
#5 - 2 " .....3/8" x 3" x 2' 0" .....ring bolt plate
#6 - 4 " .....1 1/2" round x 11" .....pivots
#6 - 2 " .....3/4" round x 2' ..... "
#7 - 2 " .....1 1/2" round x 12" .....end pivot
#8 - 6 " .....3/4" round x 2' 3" .....transom bolts
#9 - 1 " .....1" round x 2' 5".....center transom bolt
#10 - 1 " .....3/8" x 4" x 5" x 2' .....trunnion support (angle iron)

12 - 3/4" nuts
4 - 5/8" nuts
1 - 1" nut
1 - piece 3/8" x 3" x 3' (washers, etc.)



Photograph No. 47
Drawing NHP Col. 10,011

[CNHP #6404]

[Description and material lists follow]

Carriages of
5.8 inch Royal and 4.6 inch Coehorn mortars,
Drawing NHP Col. 10,011
[Photograph No. 47]

Description

Two small mortars. The one of 5.8 inches is a royal mortar, the other of 4.6 inches is a Coehorn mortar. Both were surrendered at Saratoga by General Burgoyne in 1777. The Coehorn dates back to George II, the other is nearer the period of George III.

The mortar beds for both mortars are one solid block of wood, either elm or white oak. Each mortar is fastened at an angle of 45 degrees.

Material [for 5.8 inch royal mortar]

(Wood)

A. 1 piece, Elm or oak.....10" x 1' 4" x 31 1/2"

(Mild Steel)

1.	Trunnion clamp	1/2" x 2" x 12"	2 required
2.	" " eye bolt	5/8" round by 16"	2 required
3.	" " bolts for keys	5/8" round x 12"	2 "
	" " " " "	1/2" x 1 1/2" x 2"	2 "
4.	Ring bolt	5/8" round x 10"	1 "
	" "	5/8" " x 10"	1 "
5.	Transom bolts	5/8" round x 1' 6"	2 "
6.	" washers (4)	3/8" x 1 1/2" x 7"	1 "
7.	Handles	5/8" round by 12"	2 "
8.	Chain keys	5/16" x 1" x 4"	1 "
	"	1/4" stock, 1" links, x 6" long	2 required

4 - 5/8" hexagon nuts
4 - 1/2" x 1 1/2" x 1 1/2" washers

Material [for 4.6 Coehorn mortar]

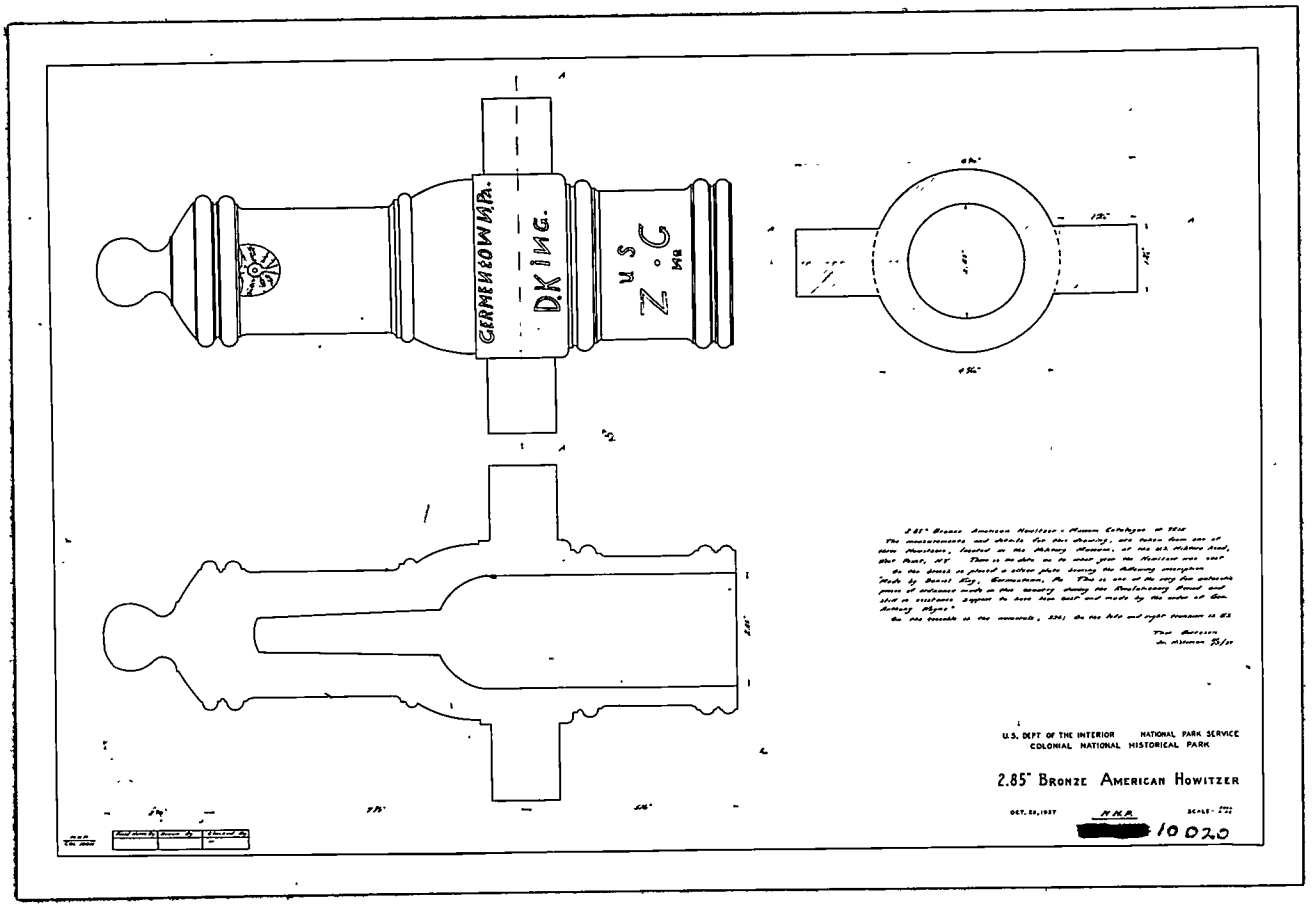
(Wood)

A. 1 piece of elm or white oak.....9" x 1' 2" x 2' 4 1/2"

(Mild Steel)

#1 -	Trunnion clamp	3/8" x 1 5/8" x 11"	2 required
2 -	Eye bolts.....	1/2" round by 15"	2 "
3 -	Eye bolts with keys....	1/2" round by 11".....	2 "
	" " " "	3/8" x 1 3/8" x 1 3/8".....	2 "
4 -	Ring bolt.....	5/8" round by 10".....	1 "
	" "	5/8" round by 10".....	1 "
5 -	Transom bolts.....	5/8" round by 16".....	2 "
6 -	" Washers (4)....	1/4" x 1 3/8" x 7".....	1 "
7 -	Handles.....	5/8" round x 12".....	2 "
8 -	Chain keys.....	5/16" x 1" x 4".....	1 "

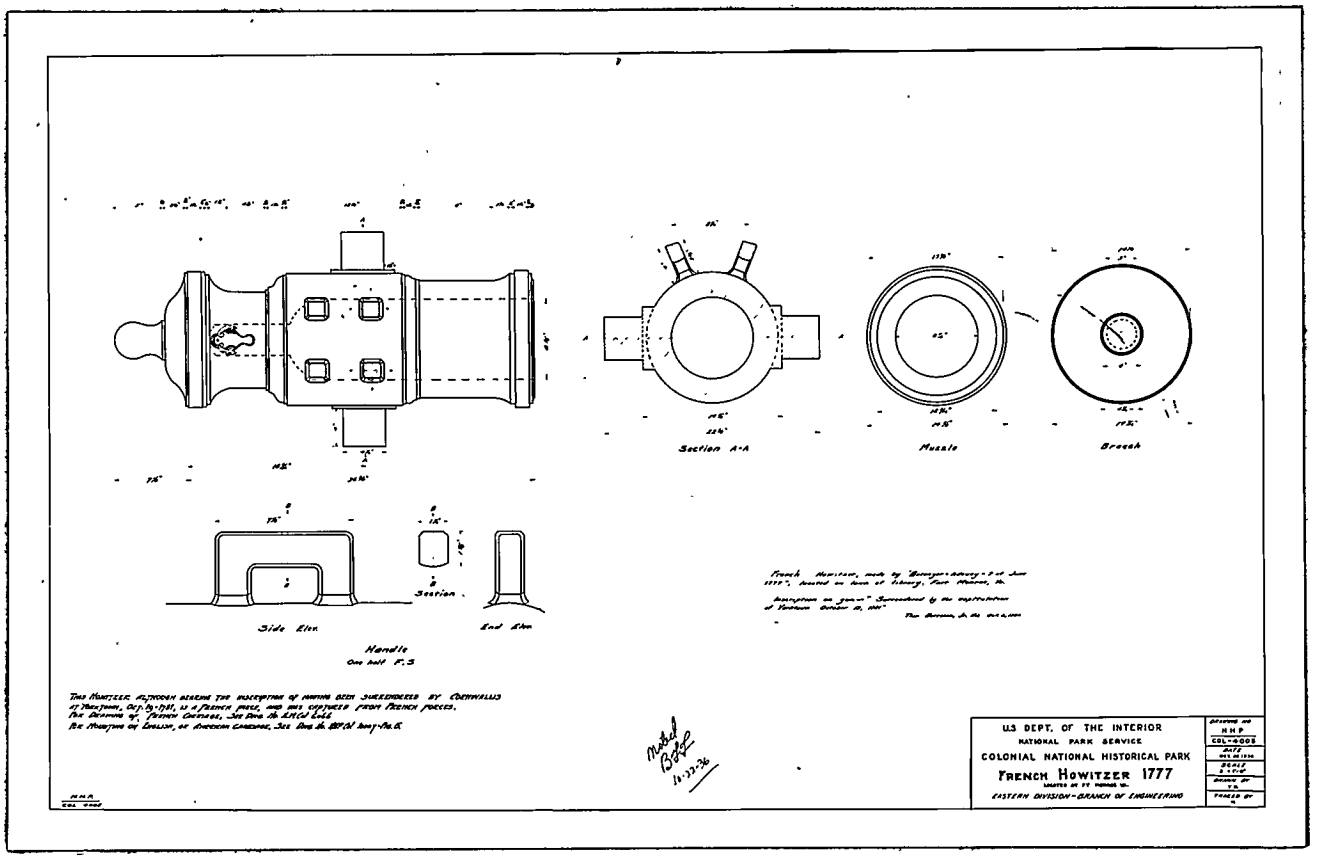
Chain keys, chain 1/4" stock, 1" links, 6" long.....2 "
4 - 1/2" hexagon nuts
4 - 1/4" x 1 1/2" x 1 1/2" washers.



Photograph No. 48
Drawing NHP Col. 10,020

[CNHP #8079]

Drawing of Daniel King gun shown in Photograph No. 15.



Photograph No. 49
Drawing NHP Col. 4,005

[CNHP #8080]

Drawing of French howitzer (1777) shown in Photograph No. 20.

Louis de Tousard, American Artillerist's Companion, 2 vols., Philadelphia, 1809 - 13.

Vol. II, Chapt. 12 (p.351 ff.)

OF SHIP OR NAVY GUN CARRIAGES, Plate 50

SHIP CARRIAGES, affuts de bord. This is the denomination which is given to the carriages of guns employed in the navy. They are composed of two flasks, or cheeks, AA, fig. 1 & 2, mounted on two axletrees, bb; four wheels, C; and joined together with a transom, d. The French carriages, which had formerly a sole, or bottom, on which the flasks were pinned, have at present a piece of timber, yy, jointed into the axletree, which partly answers the same purpose. All these pieces are strongly bolted together: g is the transom bolt, which passes through the cheeks and transom, and rivetted on a ring (it is sometimes fixed somewhat back and below this transom); i is the hinder bolt; h fore-lock bolts, goupilles, which are rivetted underneath the fore axletree; l the hinder axletree bolts which fasten the flasks with the hinder axletree, the two hindermost are eye-bolts; f eye bolts, to which the gun tackles are hooked, they are rivetted inside of the flasks; k the breeching bolts, through which, in the English navy, the breechings are passed. In the French navy, instead of these last bolts, a hole is pierced in each flask, through which they pass these breechings; e are the cap-squares, forelocked upon the trunnions to keep them fast on the carriage; n the esses which contain the wheels.

The length of the flasks is nearly equal to the length of the gun from the cascabel, or pomiglion, to the axis of the trunnions, with the addition of half the diameter of the fore wheels. The distance between the flasks, which are in a vertical situation, is equal to the diameter of the corresponding parts of the gun, allowing 0.27 inch play on each side: their thickness is to be seen in the following table. The height of the said flasks, from underneath the wheels, depends on the height of the scills of the port from the deck, with the addition of two - fifths of the height of the port hole. Those of the lower tier ought to be such, that, when the breech of the gun lies upon the hind axletree, the muzzle of the gun should touch above the port hole, in order that it may not push the port open, when the ship rolls in stormy weather. The degrees of the flasks begin at three - fifths of their length from the head; the flasks for, and other calibres above, eighteen pounders, have five degrees; for, and lower than, twelve pounders only four degrees: these are made to serve as a point of appuy for the handspikes, or crow-bars, which are used to raise the cascabel.

The diameter of the spindles of the fore axletree is equal to the thickness of the flasks, and their length twice their diameter; the square part of the axletree is one inch higher than the diameter of the spindles, and its breadth nearly twice their diameter, in order that they may receive on each side two bolts, which pass through the flasks: the thickness of the wheels is equal to that of the flasks. The

hinder axletree and wheels may be constructed on lesser dimensions.

The transom is of the same thickness as the flasks, and placed below the trunnion notches, encastrement, somewhat inclined towards the hinder part of the carriage. It is hollowed so as not to impede the swinging of the gun, and let into the thickness of the flasks, about one inch deep.

We have mentioned that the bolt g passes through the cheeks and transom; the hinder bolt, i, is placed at one - fifth of the height of the flasks, from the bottom of the carriage, vertically below the first degree.

The eye - bolts are fixed at one third of the height of the flasks, vertically below the second degree.

The hole for the breechings is pierced at two - fifths of the flask's length, from the hinder part to the front, and nearly in the middle of its height from the bottom of it.

The trunnion notch, encastrement, has for its diameter that of the trunnions, and for its depth one third of the same diameter.

TABLE OF FRENCH SHIP CARRIAGES.

CALIBRES	Thickness of the flasks	Diameter of the wheels	Thickness of the bolts	Thickness of the great, & the eye, bolts	Weight	Cost
	INCHES				POUNDS	DOLLARS
36	6.39	19.18	1.33	1.24	1283	25.40
24	5.86	18.12	1.24	1.15	936	21.63
18	5.33	17.15	1.15	1.07	735	18.81
12	4.79	14.92	1.07	0.98	547	16.18
8	4.53	13.85	0.98	0.89	437	13.56
6	4.26	12.79	0.89	0.80	332	11.29
4	4.00	11.72	0.80	0.71	262	9.41

Tousard, page 379 (Vol. II)

The breech of the gun bears upon a bed, coussin, and upon a coin, coussinet, which are placed on the bottom of the carriage: the upper and inferior surfaces of the first are parallel; the second is cut in the form of a wedge, so that, by pushing or withdrawing it, the gun may be either raised or depressed, as the different positions of the ship may render it necessary. Thus, to fire the gun direct, if to windward, the coin ought to be pushed, and withdrawn if to leeward. Exclusive of that coin, coussinet, a pointing coin is made use of, which, having one handle, is more handy, and serves to insure the precision of the shot after the first coin has served to give nearly a proper elevation to the gun. The following is a table of the dimensions of these beds, coins, and pointing coins.

INCHES

CALIBRES			36	24 &18	12 & 8	6 & 4
Beds, coussins, with parallel surfaces	length		19.18	17.05	14.92	12.79
	breadth		12.79	11.72	9.59	8.52
	height		0.80	7.46	6.39	5.33
Coins, or coussinets, lessened at one end	length		17.05	15.98	14.92	12.79
	breadth	(thick end)	9.59	8.52	7.46	6.39
		(small end)	7.46	6.39	5.33	4.26
	height	(thick end)	7.46	6.39	5.33	4.26
		(small end)	5.33	4.26	4.26	2.13
Pointing Coins with a handle 4.26 inches	length		12.79	10.66	9.59	8.52
	breadth		5.33	5.33	4.26	3.20
	height		5.33	4.26	4.26	2.13