historic furnishings study

ARMAMENT AND FURNISHINGS OF THE
FORT VANCOUVER BASTION

FORT VANCOUVER

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ARMAMENT AND FURNISHINGS
OF THE
FORT VANCOUVER BASTION

by

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PREFACE

The construction, the armament, and the other furnishings of the bastion at Fort Vancouver were discussed in some detail in volume I of the Historic Structures Report, Historical Data, Fort Vancouver, which was submitted during June, 1972. When actual planning for the rearmament of the blockhouse was begun, however, it was found that more information would be required. The present writer was asked to conduct additional research and to submit a more extensive report covering primarily the guns, their carriages, their ammunition, and their side arms as they existed in 1845. The work was conducted under authorization of Work Order No. PX200030920. The present study is the product of that research.

The most significant additions to knowledge of the bastion's armament came as the result of further searching of the Hudson's Bay Company Archives through the use of the microfilm copies in the Public Archives of Canada. For permission to use and to quote from these records the writer is indebted to the Hudson's Bay Company and, in particular, to Mrs. Joan Craig, Archivist, Hudson's Bay Company, London. Special thanks are given to Mrs. Craig and to members of the Archives staff for research assistance concerning the firm's purchase of the guns for the Fort Vancouver bastion.

Many persons have generously assisted in the preparation of this report. As always, the staff of the Public Archives of Canada, and especially Mrs. J. Haynes and Mr. Garry Maunder of the Manuscript Division, offered a warm welcome and provided indispensable guidance. Mrs. Jean E. Soper, Librarian, Canadian War Museum, Toronto, gave free access to the splendid collection of books on armaments in her care and provided photographic reproductions of plates from rare volumes. Particular thanks are given to Mr. William M. Pigott, President, and to Miss Joan Halloran, Research, of National Heritage Limited, Toronto, who made that firm's comprehensive research files available; and to Mr. Ross Wilson of the National Heritage staff who most generously supplied valuable data on 3-pounder guns.

Dr. Willard E. Ireland, Provincial Archivist and Librarian, Provincial Archives of British Columbia, and his efficient staff once more made available the riches of that institution. Dr. Herbert P. Plasterer, of the Fort Victoria Museum, and Mr. W. R. Smith, Manager, Victoria Foundries Ltd., both of Victoria, British Columbia, provided much useful information on the techniques of reproducing 19th century cannon. Additional facts on British naval guns and how to obtain plans for them were kindly supplied by Col. J. W. D. Symons, Director and Curator, Maritime Museum of British Columbia. The staff of the Victoria Public Library went out of its way to facilitate the speedy copying of

illustrative materials.

In Toronto, Mr. Alan Howard, Curator, Marine Museum of Upper Canada, gave sound advice as to courses of inquiry. Mr. J. A. McGinnis, Managing Director, Toronto Historical Board, generously provided information and photographs relating to the musket racks in the Fort York blockhouse. In Ottawa, once again the staff of the Canadian National Historic Sites Service offered assistance from their abundant knowledge. Mr. Wayne Colwell, Curator, was of major help with regard to a number of technical questions.

In Washington, D. C., Dr. A. R. Mortensen, Chief Historian, and Mr. Harry W. Pfanz, of the Office of History and Archeolgy, National Park Service, facilitated use of the Library of Congress; and Mr. Mike Musick, of the NNMO staff at the National Archives, was particularly efficient in finding pertinent materials. Particular thanks are given to Mr. Harold L. Peterson, Chief Curator, National Park Service, and to Dr. E. Raymond Lewis of Washington, D. C., both acknowledged experts on artillery, who assisted greatly not only in the actual research but also by pointing out additional sources to examine elsewhere. Mr. Peterson has kindly given permission to use illustrations from his book Round Shot and Rammers (Stackpole Books, 1969). Mr. Edwin C. Bearss and Mr. James Sheire, National Park Service historians in Washington, contributed to the general field of the Fort Vancouver study.

Mr. David Hull, Librarian, and Mr. Keith Lamble of the San Francisco Maritime Museum were of major assistance in the research, particularly by providing bibliographical suggestions and by permitting convenient access to important bibliographical materials. At the Denver Service Center, National Park Service, Mr. Merrill J. Mattes, Mangager, Historic Preservation Team, Mr. F. Ross Holland, Jr.; and Mr. Erwin N. Thompson have facilitated this study in numerous ways.

John A. Hussey

Piedmont, California
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CHAPTER I

SPECIFIC AVAILABLE DATA

All of the direct, specific documentary evidence and testimony thus far uncovered concerning the armament and furnishings in the Fort Vancouver bastion relate solely to items which were located on the octagonal third floor of that structure. Not a single mention has been found of any musket stands or other accessories which, from the known practice at other Hudson's Bay Company posts in the Pacific Northwest, might logically have been found on the two lower stories.

As has been pointed out in volume I of the Historic Structures Report, Historical Data, Fort Vancouver, the erection of a bastion at that post had been under consideration by Hudson's Bay Company officers for several years before construction actually began during February, 1845.[1] It can now be shown that steps toward this end possibly were in motion considerably earlier than had hitherto been understood.

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1. John A. Hussey, Historic Structures Report, Historical Data, Fort Vancouver National Historic Site, Washington, vol. I (National Park Service, Denver Service Center, 1972), 35-36.

On March 19, 1842, Chief Factor James Douglas, second in command at Fort Vancouver, signed the indent or requisition of trade goods for the Columbia District for Outfit 1845 (mid-1845 to mid-1846). This document represented the annual order sent to London for all the imported articles needed to carry on the operations west of the Rockies for an entire year. The goods ordered at this time were to be shipped from England in 1843.

In this long list of items there appeared an unusual entry:

> 8 Long 3 pounder Guns, without Carriages, which will be made here, uncertain about the price.[2]

If a letter of explanation went along with this order it has not yet come to light. Lacking such testimony, it is not possible to state the proposed use of the guns with any assurance, but a reasonable assumption might be

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2. Hudson's Bay Company, Account Book, Fort Vancouver, 1832-1852 [Requisitions], in Hudson's Bay Company Archives, B. 223/d/207, MS, fol. 87d. Hereafter the Hudson's Bay Company Archives are cited as H.B.C.A. All quotations from Hudson's Bay Company records are made with the kind permission of the Hudson's Bay Company through the courtesy of Mrs. Joan Craig, Archivist. No attempt has been made in citations to distinguish between the original documents in the Company's Archives in London and the microfilm copies in the Public Archives of Canada, since often both versions of a single document were consulted.

that planning for the Fort Vancouver bastion was already well advanced.[3]

The indent was sent across the continent by express canoe to York Factory on Hudson Bay. There the item for cannons escaped the blue pencil of the authorities of the Northern Department, and the requisition was forwarded by ship to London, where it arrived during the late summer

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3. It is possible that the guns were intended for installation at another post than Fort Vancouver. For instance, the construction of a new depot (later called Fort Victoria) on southern Vancouver Island had been ordered by Governor Simpson on March 1, 1842, and the man intended for the command of that post was James Douglas. These facts undoubtedly were known to Douglas when he signed the requisition on March 19, 1842. An octagonal bastion was actually erected at Fort Victoria during the fall of 1843.

On the other hand, Simpson had also decided as early as November 25, 1841, to abandon three posts on the Northwest Coast, two of them during the summer of 1843. This step was certain to provide an abundance of surplus artillery for the protection of the new depot. And, as a matter of fact, Fort Victoria was armed with such surplus guns. Further, Chief Factor McLoughlin, in charge of the Columbia District, did not favor the erection of the new depot and made every effort to keep it as small as possible, and he resisted the proposal to abandon the coastal forts. Thus it seems unlikely that Governor Simpson and the London Committee would have approved any order for guns which might have held the implication that the northern posts were not to be abandoned.

The view that the guns were intended for Fort Vancouver from the start seems supported by the information in the indent that the carriages were to be made there. Yet, until more facts become available, it is necessary to recognize that the guns may have been ordered originally for Fort Victoria and that they were to be mounted on carriages at Vancouver where the main blacksmith and carpenter shops were located, but that after their arrival at Vancouver in 1843 it was found they were no longer needed at Victoria because of the availability there of other weapons.

or early fall of 1842. The Governor and Committee must have approved the request for cannons, because the Company inquired of Jukes Coulson & Co., a firm from which it rather regularly obtained "Ironmongery," as to the availability and price of iron guns.[4]

The reply is highly informative:

12 Clements Lane
13th Decr 1842

Messrs Jukes Coulson & Co. present their respectful Compts to the Hudsons Bay Company & beg to quote prices as under for Cast Iron Guns &c Vizt

3 Pounder New Iron Guns 3ft 6ins long about 5 Cwt 7 lbs each at	22s/9d per Cwt
3 Pd ditto Round	11s/0 per Cwt
3 Pdr Cannister Shot	10d each

less 5% discount

Can be Shipd immediately.[5]

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4. H.B.C., Merchandise Exported 1842-1854, H.B.C.A., A.25/7, MS, fols. 8d-9, 22d-26. No firm named Jukes Coulson & Co. appears among the British gun founders listed by the standard authority on the subject; but persons interested in the history of artillery recognize that much more work remains to be done in this field. See Charles Ffoulkes, The Gun-Founders of England, With a List of English and Continental Gun-Founders from the XIV to the XIX Centuries (Cambridge, England: Cambridge University Press, 1937). Since Jukes Coulson & Co. was a retailer, it probably did no founding itself.

5. H.B.C.A., A.10/15, MS, fol 465. For a copy of this letter and permission to reproduce it the writer is indebted to the Hudson's Bay Company and, particularly, to Mrs. Joan Craig, Archivist. Thanks are also extended to the members of the Archives research staff who combed the firm's records for information on the purchase of the guns.

The guns were received in time to be shipped to the Columbia River in late December, 1842, on the chartered barque Diamond. The cost of the "Cannon &c." was £50.1.1.[6]

The Diamond, Bartholomew Fowler, master, arrived at Fort Vancouver on June 30, 1843, and delivered her cargo in good condition.[7] The guns were invoiced under the heading of "Naval Stores" and described as "8 long three pounder Guns w. g. [weighing] 40-26/112 Cwt" (4506 lbs., or 563.25 lbs. each). No "side-arms," accoutrements, or other equipment for the guns were listed. The only ammunition identifiable as pertaining to these guns consisted of:

50 Canister Shot
100 round do. w. g. 2.2.16 [296 lbs.][8]

For some reason as yet unknown the construction of a bastion to house these guns was not begun upon their arrival,

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6. H.B.C.A., A.25/7, MS, fols. 8d-9.

7. E. E. Rich, ed., The Letters of John McLoughlin from Fort Vancouver to the Governor and Committee, Second Series, 1839-44 (Publications of the Champlain Society, Hudson's Bay Series, VI, Toronto, 1943), 108.

8. H.B.C., Account Book, Fort Vancouver, 1843-1844, H.B.C.A., B.223/d/150, MS, pp. 42-43. For indicating the weight of cannon and shot the British employed a series of three sets of figures, separated by single or double periods. The first set indicated the number of hundredweights (112 lbs.); the second indicated the number of quarter-hundredweights (28 lbs.); the third indicated the number of pounds. Thus 2.2.16 would be 224 lbs. plus 56 lbs. plus 16 lbs., or 296 lbs.

nor were they shipped out to some other post for which they may have been intended. Instead they were placed in a warehouse at the Fort Vancouver Depot where they were listed under the heading "Naval Stores at fixed Prices" in the regular inventory made in the spring of 1844 as follows:

8 long 3 pound Guns wg. 40.. 0.. 26 [priced at] £45.15.3
. . . . . .
50 Canister Shot 3 lbs.
11-1/4 Cwt round Shot [no caliber given]
2-72/112 " " do. 3 lbs.[9]

By the end of March, 1845, as has been recounted in detail in volume I of the Fort Vancouver Historic Structures Report, at least one of the guns probably had been mounted in the newly constructed bastion.[10] These weapons do not appear in the 1845 depot inventory under the classification of goods remaining on hand, nor for some unknown reason are they included under the heading "Articles in Use."

The present writer has been unable to find any inventory of articles in use at Fort Vancouver for the spring of 1846, and that for 1847 does not mention the bastion, nor are the guns listed under "Naval Stores." Not until the spring of 1848 do the 3-pounder guns reappear on the Fort Vancouver inventories, but their listing on that occasion reveals

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9. H.B.C., Account Book, Fort Vancouver, 1844 [Inventories], H.B.C.A., B.223/d/155, MS, p. 128.

10. Hussey, op. cit., 36-37.

information highly significant to one interested in refurnishing the bastion.

Under the general catagory of "Articles in Use, Fort Vancouver Depot," there appears a subheading, "Cannon &c," which was employed infrequently in inventories at Fort Vancouver during this period. The items under this subheading are as follows:

2 long 18 pound Guns } on carriages
8 " 3 " Do } with tackling &c
2 small swivel Do
94 round 18 pound Shot
75 " 9 " Do
94 " 6 " Do
94 " 3 " Do
16 cannister Shot pr 9 pounders
29 " Do " 6 "
50 " Do " 3 "
2 Cwt grape Do [no caliber given]
8 sponges and Rammers pr 3 pounders
1 Worm pr Do
1 scoop pr Do
1 sponge & Rammer pr 18 pounders
2 scoops " Do
2 hand spikes " Do[11]

It is readily apparent that not all of this armament was in the bastion. The two 18-pounders, at least part of the round shot for them, and their attendant side arms (sponge and rammer, scoops, and handspikes) were on prominent display in front of the chief factor's residence.[12] The two small swivel guns were inventoried as being "in use" in the

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11. H.B.C., Account Book, Fort Vancouver, 1848, H.B.C.A., B.223/d/181.

12. See Hussey, op. cit., 134-135.

depot stores in 1844 and 1845, and they probably continued there during at least the next year or two.[13]

Thus, eliminating these items, the related ammunition, and that for the 6 and 9-pounders (which probably was kept in one of the warehouses), there were left for the bastion the eight 3-pounders, 94 round shot and 50 canister shot for the same, possibly some of the grape shot, eight sponges and rammers, one worm, and one powder scoop. Beyond these items the documentary record thus far examined does not reveal the existence of a single, solitary piece of armament or equipment in the bastion.

Before proceeding to an analysis of what considerable information the specific data outlined above actually reveal, there is another matter which requires discussion. During a period of eight years following the erection of the bastion a series of visitors, some of them professional soldiers and sailors, had occasion to mention the number of guns mounted in the bastion. Not too surprisingly, they did not always agree.

On October 26, 1845, after having spent two months at Fort Vancouver, Lieutenants Henry J. Warre and Mervin Vavasour, British army officers, made a report to the Secretary of State for the Colonies in which they stated that the blockhouse contained six 3-pound iron guns. In

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13. H.B.C.A., B.223/d/155, MS, p. 143; B.223/d/160, MS, 131.

March of the next year Vavasour told the commander of the Royal Engineers in Canada that the same structure contained eight 3-pound iron guns. To add to the confusion, Lieutenant William Peel of the Royal Navy visited Fort Vancouver during September, 1845, and reported to his superior that there were seven small 3-pounders in the bastion. Dr. Henry A. Tuzo, who reached Vancouver in 1853 to take up his duties as post surgeon, later testified that at the time of his arrival the blockhouse mounted "eight small cannon" in its third story.[14]

Since seven guns were reported in September, 1845, six guns in October of that year, and eight in March of 1846, a hypothesis that the guns were installed in succession as carriages were manufactured does not seem entirely tenable. Yet something of the sort may have occurred, since properly made ship or garrison carriages required special, seasoned wood and more complicated ironwork than a layman would imagine. On the other hand, the discrepancies may be due partly or entirely to the well-known fact that human beings tend to be faulty witnesses. Considering the total evidence, it seems reasonably safe to assume that all eight 3- pounders were mounted in the bastion at least by very early 1846.

It is to be noted that the Hudson's Bay Company records

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14. For source citations to support the statements in this paragraph see Hussey, op. cit., 45.

thus far examined make no mention of the metal -- bronze or iron -- of which the guns were made, except for what may be inferred from the fact that "Ironmongery" was obtained on other occasions from Jukes Coulson & Co., suppliers of the weapons. The only positive statements that the guns were of iron are contained in the descriptions of Fort Vancouver made in 1845 and 1846 by Lieutenants Warre and Vavasour. Since they were army officers, one must assume that they knew whereof they spoke.[15]

Analysis of the Specific Data

Although at first glance the specific data presented above may seem quite meager, in actuality they reveal much more than had previously been known. This fact becomes obvious when attention is focussed upon the following points:

1. Guns. The specific data reveal that the guns were iron 3-pounders, were 3 feet 6 inches in length, weighed about 563.25 lbs. each, were listed on occasion as "Naval Stores," and were trained by tackle (rather than by hand-spikes as land-service garrison guns usually were). From these facts certain conclusions may be made:

a. The weapons very probably were ship or sea service

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15. The exact words of Warre and Vavasour in this regard are to be found conveniently in Joseph Schafer, ed., "Documents Relative to Warre and Vavasour's Military Reconnoissance in Oregon, 1845-6," in Quarterly of the Oregon Historical Society, X (March, 1909), 46, 85.

guns.[16] Their listing as naval stores and the fact that they were trained by tackle point toward such a design. Also, iron 3-pound land service guns became obsolete in the British Army by the period 1800-1820.[17] Of course foundries may have continued to turn out this type of gun made to private design or specifications, but the largest private market probably was for ship guns to meet the needs of merchant vessels.

b. Though the guns probably were of sea service design, they evidently were not British government-pattern weapons. The lengths and weights of naval ordnance were "settled" in 1753. Declared "standard" at that time was a 3-pound iron ship gun 4'6" long and 7.1.7 (819 lbs.) in weight.[18] These specifications were slightly modified by the Board of Ordnance in 1764, when a length of 4'6" and a weight of 7.1.0 (812 lbs.) was "established" for "all sorts" of iron

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16. The design differences between sea service and land service guns are treated in Chaper II.

17. B. P. Hughes, British Smooth-Bore Artillery: The Muzzle Loading Artillery of the 18th and 19th Centuries (Harrisburg, Pa.: Stackpole Books, 1969), 30-31.

18. George Smith, An Universal Military Dictionary, or A Copious Explanation of the Technical Terms &c. Used in the Equipment, Machinery, Movements, and Military Operations of an Army (London, 1779), 47.

3-pound cannon.[19] The 1764 specifications, with some modifications, seem to have prevailed as long as this type of smooth-bore gun continued in service.[20] Thus the length of 3'6" apparently was not applicable to iron 3-pounders of government pattern. Also, a weight of 536.25 lbs. seemingly does not correspond with that of any standard government-pattern iron 3-pounder of the time.

c. Since the cannon evidently were not made according to government pattern, they probably were designed and manufactured by a private gun founder. The variety of weapons offered for sale by such founders is amply illustrated by the following advertisement issued by the Carron Company

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19. Smith, op. cit., 285-286. In 1804 the only size of English iron 3-pounder mentioned by Captain Ralph Willett Adye in his The Bombardier, and Pocket Gunner (1st American ed., Charlestown, Mass., 1804), 155, was the 4'6" gun. In 1756 the English evidently had a 3'6" iron field gun, but it possibly was considered obsolete even by that date. During that same year John Müller proposed an iron ship 3-pounder 3'6" long, but it is not certain that his suggestion was adopted. Albert Manucy, Artillery through the Ages: A Short Illustrated History of Cannon . . . (National Park Service Interpretive Series, History No. 3, Washington, D. C.: GPO, 1955), 44-45.

20. For brass 3-pounders on the other hand, there was a large variety of sizes and lengths between 1753 and 1860, identified by such descriptions as "heavy," "long," "common," "light," etc. Hughes, op. cit., 28-29.

of Falkirk, Scotland, about the time of the Napoleonic Wars:

> Cohorns 3, 4, 6, 9 and 12 pounders, Carronades 3 to 132 pounders, Guns of Light New Construction 3 to 24 pounders from 3 ft. 7 inches to 8 ft. 6 inches long and Guns of Government Pattern, proved from 3 to 42 pounders together with ordinary shot, Langridge shot, Shell shot, hand grenades, grape shot, bar shot, chain shot and carcasse.[21]

It is reasonable to suppose that the 3-pounders in the Fort Vancouver bastion were not unlike the "Guns of Light New Construction" offered by the Carron Company.

2. Carriages. The specific data show that the carriages for the 3-pounders at Fort Vancouver were not received from England and that it was intended to manufacture them locally. This fact would imply a certain variance from the fairly standard designs specified for Royal Navy carriages and for garrison carriages. Yet the variance could not have been very great, because the standard design was not only hallowed by tradition but dictated by practical considerations based on long experience. As shall be seen in Chaper III, the design of the carriage was largely controlled by the dimensions of the gun and by the height of the port through which the weapon was to be fired.

3. Training tackle. The mention of "tackling" in the inventory of 1848 is sufficient to close off debate as to

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21. Ffoulkes, op. cit., 83.

whether the guns were trained like sea guns, with blocks and tackles (assisted by handspikes), or like garrison carriages with handspikes alone. The omission of handspikes for the 3-pounders from the inventory serves to strengthen the case for equipping the guns in the restored bastion with tackle.

4. Ammunition. Since 94 round shot and 50 canister shot, with possibly 224 pounds of grape shot, seem to have constituted the entire supply of projectiles for the 3-pounders, it seems reasonable to assume that most, if not all, of this precious hoard was kept in the bastion where it would have been ready for action. Powder, on the other hand, was probably kept in the magazine until required. Company employees were particularly alert to the dangers of fire and explosion.

5. Side arms and accessories. The inventoried allotment of eight sponges and rammers, one worm, and one powder scoop for the eight 3-pounders seems a bit spare, particularly if the guns were seriously intended for defense. The Company's ships on the Pacific at the time used cartridges for loading their guns, so perhaps Fort Vancouver had a supply also.[22] Thus one powder scoop, an object that was practically obsolete by the

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22. For example see the inventory of gunner's stores on the barque Vancouver, 1843, in H.B.C.A., B.223/d/150, MS, p. 49.

1840's, was probably sufficient to load the saluting guns, remove shot, etc. One worm might have sufficed, though on the Company's ships the usual ratio seems to have been more ample.[23]

But even for saluting a water bucket would have been required for wetting the sponge. If the guns were to be aimed, handspikes would probably have been needed for raising the breech, even for guns of such small caliber, and for aid in shifting the carriages. And, as shall be discussed in detail in Chapter IV, there were other accessories which were virtually essential to the proper operation and servicing of smooth-bore artillery, even that used primarily for saluting.

In short, it is very probable that the 1848 inventory of "Cannon &c" does not present a complete picture of the bastion furnishings as they existed at that time.

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23. H.B.C.A., B.223/d/150, MS, p. 49; B.223/d/155, MS, p. 183.

CHAPTER II

COMPARATIVE DATA: GUNS

General characteristics of British guns, 1750-1850.

By 1750 the ornate cannon of the Elizabethan period had evolved into a gun of much cleaner line, generally marked by a slightly flared or bell-shaped muzzle.[1] The barrels or tubes were cast, either of iron or bronze (called brass in 18th century English military parlance), but due to tradition they still bore at intervals several rings or hoops which were carry-overs from the days when guns were built up by rings of wrought iron shrunk over a core of iron bars.

The result was a piece which appeared to be made of three truncated cones placed end to end. Ornamental molded bands or rings, in the forms of fillets, astragals, and ogees (various shapes of architectural moldings) marked the points of juncture of these cones and perfected the

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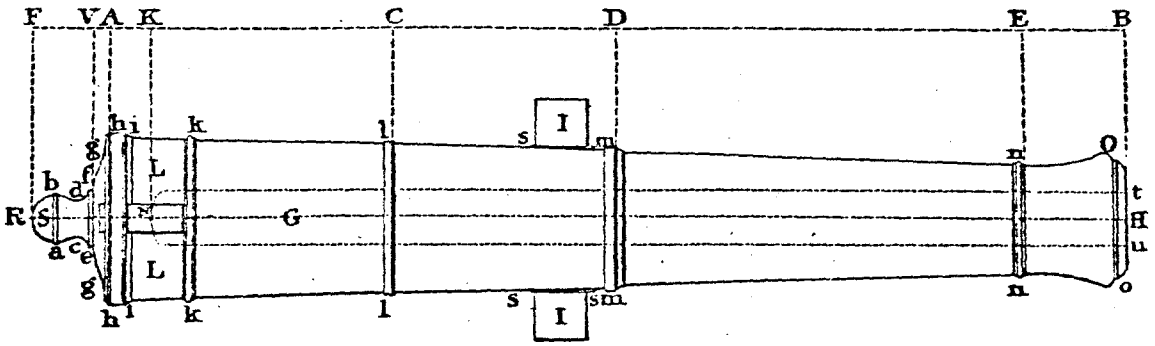
1. This discussion is confined to the type of cannon defined by British ordnance manuals as "guns," that is "those pieces which have a length of at least 12 calibres." Other types of cannon, such as carronades, mortars, and howitzers are not treated in the discussion of Fort Vancouver armament, since there were none in the bastion. However, carronades were mounted on at least some of the Company's vessels.

illusion of built-up sections. The tube was thickest, of course, at the breech end, where the exploding powder exerted the greatest force. It tapered toward the muzzle where the pressure of the expanding gases bore less heavily on the walls of the gun.

For the purposes of this study it is not necessary to go into great detail concerning the theory and practice of gun design and manufacture. But it will be essential for the reader to understand the parts of a gun and their names. Figure 1 provides a top view of a typical gun of the period 1750-1850 and gives the names of the parts.



NAMES OF THE SEVERAL PARTS OF A GUN.

AB	*Length of the Gun*	L	*Vent Field*	h	*Base Ring*
AC	*First Reinforce*	N	*Vent*	i	*Base Ring Ogee*
CD	*Second Reinforce*	O	*Swell of the Muzzle*	k	*Vent Field Astragal & Fillets*
DE	*Chase*	VAK	*Breech*	l	*First Reinforce Ring*
EB	*Muzzle*	S	*Button*	m	*Second Reinforce Ring & Ogee*
FA	*Cascable*	a b	*Button Astragal*	n	*Muzzle Astragal & Fillets*
GH	*Bore*	c d	*Neck*	o	*Muzzle Mouldings*
RH	*Axis of the Piece*	e f	*Neck Fillet*	s	*Shoulder of the Trunnion*
I	*Trunnions*	g	*Breech Ogee*	t u	*Diameter of the Bore or Calibre*

Figure 1

A British brass gun, c. 1750-1860. (From Capt. F.A. Griffiths, The Artillerist's Manual . . . [2nd ed., Woolwich, England, 1840], facing p. 47.)

Plate I is a larger and beautifully detailed plan of a 12-pounder ship gun of 1791, but unfortunately the explanatory text which once accompanied it has been lost. Working drawings for a 9-pounder of about the same period will be found in Plate XXIII, in the end pocket of this report.

For the purposes of this study an important definition concerns the length of a gun. The length of a gun is not the overall length as might be expected but the distance from the rear of the base ring (sometimes called the breech ring) to the face of the muzzle (the distance AB in Figure 1).

The cascabel was the part of the gun to the rear of the base ring. The round ball or button at the very end of the piece was used to secure one arm of a sling when lifting the gun off its carriage; the other arm of the sling was held by a handspike protruding from the bore.

The trunnions were the short cylindrical arms protruding from the sides of the gun which served to support the piece on its carriage. The trunnions were of solid metal, and they were of the same length and diameter as the diameter of the gun's bore. Before about 1760 the trunnions tapered slightly away from the gun, but after that general time they were straight-sided.[2]

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2. Harold L. Peterson, Round Shot and Rammers (Harrisburg, Pa.: Stackpole Books, 1969), 41.

On British guns the trunnions were generally placed slightly below the axis of the piece (line RH in Figure 1). This situation is well illustrated in Plate I and in Figure 2.

When a gun rested on its trunnions, the breech end was slightly heavier than the muzzle end. This "breech preponderance," as it was termed, was generally at this time from 1/11 to 1/15 of the total weight of the gun, although one historian of British naval armament has stated that a preponderance of only about 1/20 of the weight of the gun was given to the breech end.[3]

The vent, which Captain George Smith, the great military lexicographer of the 18th century, said was "vulgarly" called the touchhole, was a small hole pierced from the top of the gun to the rear end of the bore by which fire was transmitted to the charge. The square plate of metal around the outer end of the vent was called the vent patch. "The internal diameter of the vent was a standard 0.2 in. in the British Service."[4]

The diameter of the bore was determined by the diameter of the solid iron round shot to be fired from it.

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3. Frederick Leslie Robertson, The Evolution of Naval Armament (London: Harold T. Storey, 1968), 150.

4. Smith, An Universal Military Dictionary . . . (London, 1779), 48; Hughes, British Smooth-Bore Artillery, 22.

For example, a shot weighing three pounds had a diameter of 2.775 inches. But the diameter of the bore could not be exactly that of the ball, since there had to be a certain freedom of movement, and the risk could not be taken of the shot becoming stuck upon some slight obstruction. Therefore, the bore diameter was always slightly greater than that of the shot. The specified bore diameter of a 3-pounder was 2.913 inches.

The difference between the diameter of the shot and that of the bore was known as windage. The windage of British guns was generally greater than that of comparable American and French pieces, but over the years between 1750 and 1850 there was a progressive reduction in the windage. By 1800 the windage for all sizes of British ordnance was about 0.25 inch, but for 3-pounders it was only 0.138 inch.

The diameter of the bore of a firearm is termed the caliber. Thus the caliber of a 3-pound gun was 2.913 inches. The caliber of a gun was also expressed in terms of the weight of the ball that was fired from it. Thus the caliber of a gun firing a three-pound shot was often given as "3-pounder" or "3."[5]

By the middle of the 18th century the ancient custom of giving cannon individual names or of designating types

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5. Manucy, Artillery through the Ages, 45; Smith, op. cit., 47.

and sizes by such fanciful terms as falcon and dragon had long been discarded. Pieces were designated by the weight of the ball they discharged. Thus a gun that shot a ball of 24 pounds was called a 24-pounder. A 3-pounder discharged a shot weighing three pounds.[6]

The lengths of British guns were theoretically determined by multiples of the bore diameter. During the period under consideration here these multiples for military and naval iron guns were generally 15 or 16.[7] The tables of specifications, however, gave the lengths in feet and inches.

Little information seems to be available on the outside diameters of British guns. They also were computed in terms of calibers or bore diameters. The extreme outside diameter "near the vent" was usually about 3-1/2 calibers; "near the muzzle" it was about 2-1/4 calibers.[8]

When members of the Corps of Royal Engineers in Dublin set about compiling their exhaustive Aide-Mémoire to the

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6. Smith, op. cit., 46.

7. S. James Gooding, An Introduction to British Artillery in North America (Ottowa: Museum Restoration Service, 1972), 18; Peterson, op. cit., 41. "Long" brass guns sometimes were as long as 24.7 calibers. F. A. Griffiths, The Artillerist's Manual, and British Soldier's Compendium (2nd ed., Woolwich, England, 1840), 62.

8. James Inman, An Introduction to Naval Gunnery (Portsea, England, 1828), 3.

Military Sciences in the mid-1840's, they found that available information on gun measurements was inadequate, so they actually measured a sampling of all the types and sizes of guns then in service. Unfortunately for our purposes, the smallest caliber iron gun included in their tables was a 6-pounder land service piece, six feet long and weighing 17 hundredweight. But, bearing in mind that the caliber of a 6-pounder was 3.668 inches, their diameter measurements are of some use in giving an idea of the diameter proportions at various key points along the length of the gun:

Base ring	15.06 in.
Vent field astragal	14.60 in.
First reinforce ring	13.00 in.
At center of trunnions	12.15 in.
Second reinforce ring	11.85 in.
Breech end of muzzle	8.70 in.
Swell of muzzle	11.45 in.
Face of muzzle	8.80 in.[9]

In this case it will be seen that the diameter of the base ring was about 4.1 calibers in diameter.

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9. Aide-Mémoire to the Military Sciences: Framed from Contributions of Officers of the Different Services, and Edited by a Committee of the Corps of Royal Engineers in Dublin, 1845-1846 (3 vols., [n. p.], 1846-1852), I, [56-57]. Except as otherwise indicated this discussion of guns in general was based on Gooding, op. cit., 16-21, 27-29; Hughes, op. cit., 17-22; Manucy, op. cit., 41-46.

Ship guns. Prior to the latter part of the 18th century the guns used for land service and for sea service were of the same general design, though according to the specifications "settled" by the Ordnance officials in 1753 there were differences in lengths for certain calibers of guns depending upon whether the intended service was on shipboard, in fixed fortifications, or in the field. In 1764 new tables were issued for "all sorts" of cannon, and seemingly the distinction was no longer made between iron ship and garrison pieces.[10]

Toward the end of the century, however, Sir T. Blomefield introduced a new pattern gun for use on shipboard and other confined spaces. His design was in general the same as that used previously except that a loop or ring was cast immediately above the cascabel button so that the heavy breeching rope used to check recoil could be rove through it and thus affixed firmly to the gun (see Figure 2 and Plate I).[11]

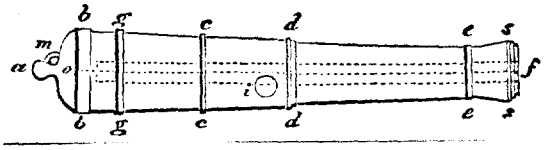

Figure 2

Typical British ship gun, 1828. The letter "m" indicates the breeching loop or button ring. (From Inman, An Introduction to Naval Gunnery, 2.)

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10. Smith, op. cit., 47, 285-286.

11. Gooding, op. cit., 19, 29; Hughes, op. cit., 20. Some garrison pieces also had the breeching loop.

As is shown by Plate I, this gun was being manufactured as early as 1791. It was in quite wide use during the Napoleonic Wars, but one writer seems to indicate that it was not universally employed throughout the Royal Navy until about 1830-1834.[12] At any rate, the breeching ring became the chief mark by which sea service guns were distinguished from those designed for land service.

British government-pattern 3-pounder iron guns. By 1753 the British government had made much progress in standardizing the types and calibers of guns used for both land and sea service. In that year it was determined that ship guns were to be cast in 3, 6, 9, 12, 18, 24, 32, 36, and 42-pound calibers. Garrison cannon were to be 6, 9, 12, 18, 24, 32, and 42-pounders. "Battering" or siege guns came in 12, 18, and 24-pound calibers. Field pieces were to be 1/2, 1, 1-1/2, 2, 3, 6, 9, and 12-pounders. Thus the only types of 3-pounders employed in the British services at that time were ship guns and field guns. All the field guns were of "brass" or, in actuality, bronze, but ship guns were made of both brass and iron.[13]

Since in this study we are interested only in iron guns, all discussion of brass pieces will cease at this point. It is important to bear in mind, however, that

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12. J. D. Moody, "Old Naval Gun-Carriages," in The Mariner's Mirror, XXXVIII (November, 1952), 307.

13. Smith, op. cit., 47.

3-pounder brass field guns of several lengths continued in use well past our arbitrary terminal date of 1850.

The table of 1753 established a length of 4 ft. 6 in. for iron ship 3-pounders (no 3-pound iron land service pieces were listed). These guns weighed seven hundredweights, one quarter-hundredweight, and seven pounds (written in artillery parlence as 7.1.7). In 1764 the specifications were slightly revised, and 3-pounder iron guns of "all sorts" retained the 4 ft. 6 inch length, but the weight was reduced to 7.1.0. The diameter of the bore was 2.91 inches; that of the shot 2.77 inches.[14]

It perhaps should be noted that in 1756 an English iron 3-pounder field piece 3 ft. 6 inches long was listed by John Müller, mathematician for British ordnance, as still in use, but if such was the case it became obsolete before the end of the century. In fact it is not even listed in one scholarly compilation for the period 1750-1800. Müller at the same time proposed that the 4 ft. 6 inch iron ship gun should be shortened to 3 ft. 6 inches, but evidently his suggestion was not adopted.[15] Such, seemingly, is the conclusion to be drawn from the fact that "at the beginning of the nineteenth century" the only 3-pounder listed among English naval guns was the iron

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14. Smith, op. cit., 47, 286.

15. Hughes, op. cit., 30-31; Manucy, op. cit., 44-45.

3-pounder, 4 ft. 6 inches long, weighing 7.1.0.[16]

After 1800 the iron field 3-pounder (4 ft. 6 inches long, weighing 7.1.0) became obsolete.[17] Thus the only iron 3-pounder remaining in use in the British services was the ship gun.

Private-pattern British iron 3-pounder ship guns. As has already been pointed out, it is known that the 3-pounders installed in the Fort Vancouver bastion were 3 ft. 6 inches long and weighed an average of 563.25 pounds each. Clearly these pieces were not Royal Navy 3-pounders, nor were they privately founded guns made to government pattern. They must have been one of the many types of guns designed and manufactured by private firms to meet the considerable demands of merchant shipping.

Unfortunately, there appears to be no literature on these private-pattern guns. Queries to museums and foundries in England and Scotland have thus far elicited no response. Nor has the writer been able to locate a gun which matches the known lengths and weights of the Fort Vancouver pieces.

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16. Donald Macintyre and Basil W. Bathe, Man-of-War: A History of the Combat Vessel (New York: McGraw-Hill Book Company, 1965), 40.

17. Hughes, op. cit., 30-31. In 1804 the only English government-issue iron 3-pounder listed was the standard 4'6" long, 7.1.0 weight weapon. Ralph Willett Adye, The Bombardier, and Pocket Gunner (1st American ed., Charlestown, Mass., 1804), 155. This book was examined through copies of pertinent pages selected and copied by Mr. Harold L. Peterson.

The closest approximation of the weapons sought thus far located is a small iron ship gun now on exhibit at the Maritime Museum of British Columbia on Bastion Square, Victoria. It has a bore diameter of approximately three inches which, allowing for a bit of corrosion, corresponds closely to a 3-pounder's specified 2.913 inches. The gun length, however, is only 34-1/16 inches, thus falling almost eight inches short of the 3'6" length of the Fort Vancouver pieces.

This weapon possesses a well formed breeching loop, but the trunnions are only 2-1/4 inches in diameter, and they are located directly in the center of the second reinforce ring instead of behind it as was usual in government-pattern guns.

The writer had no instruments for exactly measuring the diameter of the gun at various points, but a few approximate diameters are as follows:

Base ring	9 in.
First reinforce ring	8-1/2 in.
Muzzle astragal	5-1/2 in.
Swell of muzzle	5-1/4 in
Face of muzzle	4-1/4 in.

The vent field was extremely short, and thus the vent plate extended over the vent field astragal. The length

of the cascabel was about six inches. For a photograph of this gun see Plate II.[18]

When Dr. Herbert P. Plasterer reconstructed the Fort Victoria bastion at his Fort Victoria Museum in Victoria, he commissioned the Victoria Foundries Ltd. to make a pattern from the gun in the Maritime Museum and to cast three replicas for his use.[19] These replicas are now at the Fort Victoria Museum and are shown in Plates III to VI.

The replicas are not exact in all respects, but they do demonstrate that reproductions of muzzle-loading cannon can be made quite easily and reasonably. Mr. W. R. Smith, Manager of Victoria Foundries Ltd., states that he would make castings from his mold for $82 each.[20] This figure is quoted merely to give a general idea of costs, since the existing mold would not produce a gun of the size required at Fort Vancouver.

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18. Measurements taken by the writer, May 6, 1973. The gun is labeled a 6-pounder, but the bore diameter does not approach the 3.66 inches specified for a gun of that caliber.

19. Telephone interview, Dr. H. P. Plasterer with J. A. Hussey, Victoria, May 8, 1973.

20. interview, Mr. W. R. Smith with J. A. Hussey, Victoria, May 9, 1973.

CHAPTER III

COMPARATIVE DATA: GUN CARRIAGES AND TACKLE

When designing carriages for the 3-pound guns to be placed in the reconstructed Fort Vancouver bastion, four important basic considerations should be kept in mind:

1. The construction of gun carriages, even for use on vessels of the Royal Navy and in military garrisons, was not an exact science. Certain minor variations in design occurred as the result of circumstances of manufacture, conditions under which the guns were to be used, experiments by officers, etc. For instance, the height of a carriage was frequently varied to meet the requirements of the ports of an individual vessel, since "an old rule of thumb required the center of the trunnions to be 1/2 caliber below the center of the port."[1] Thus the elaborate official and unofficial tables of specifications which were drawn up to govern the manufacture of carriages can be considered as giving theoretical standards and establishing general dimensions but not as invariably indicating the exact sizes of carriages actually in use.

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1. M. A. Edson, Jr., "18th Century Gun Carriages and Fittings," in Nautical Research Journal, vol. 12, no. 3 (Fall, 1962), 113.

2. The official specifications for carriages were based upon the assumption that guns of standard lengths, diameters, and weights were to be mounted. If weapons of different design were used, as seems to have been the case at Fort Vancouver, adjustments undoubtedly would have been necessary to assure that the guns could be operated at maximum efficiency. Obviously, for example, the side pieces or brackets would have to be far enough apart to permit the free raising and lowering of the breech.

3. Although the general design of wooden ship and garrison carriages for smooth-bore, muzzle-loading guns remained fairly constant from about the middle of the 18th century until they became obsolete around the 1860's, there was a fairly steady succession of minor changes during that hundred or more years which seem not to be reflected in the available tables. Several of these changes, relating to various types of "horns," buffers, and side cleats, were too technical and too short-lived to concern us here, but others, such as in the placement of tackle loops and breeching ring-bolts, must be considered.[2] The point being made in this paragraph is that an accurate table of dimensions or a detailed set of plans at one date during this time span is not necessarily applicable in all particulars to a carriage dated even a few years later.

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2. For a discussion of such changes, see J. D. Moody, "Old Naval Gun-Carriages," in The Mariner's Mirror, XXXVIII (November, 1952), 306-310.

4. In addition to the facts that carriages did not always conform to specifications and that available specifications sometimes did not reflect currently authorized designs, there is at Fort Vancouver the probability that the carriages were constructed upon the basis of obsolescent data or even upon the basis of no data other than what could be obtained from examination of the carriages in the Company's vessels or the general knowledge of employees.

The inventories of Company-owned books in the library at Fort Vancouver for the years 1844 and 1845 note the presence of a volume described as "1 pocket Gunner."[3] Although the identity of this work is not certain, it quite possibly was The Bombardier, and Pocket Gunner, by Captain R. W. Adye, R. A. Evidently eight editions were published between 1800 and 1827.[4]

Adye's manual contained a "mass" of information about guns and other artillery equipment of the time; but, at least if one can judge by the American edition of 1804, it contained little in the way of specifications for ship or garrison carriages. And even that little may have been out of date, because according to General B. P. Hughes, an

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3. H.B.C., Fort Vancouver, Account Book, 1844, H.B.C.A., B.223/d/155, MS, fol. 76; H.B.C.A., B.223/d/160, MS, pp. 132-133.

4. Hughes, British Smooth-Bore Artillery, [137].

authority on British ordnance, Adye's manuals "tend to include older equipments which may have been obsolescent at the time of publication."[5] And certainly, if the 1827 edition was the last issued, any specifications contained therein would have been at least moderately out of date by 1845.

On the other hand, there is no absolute certainty that the "pocket Gunner" was in fact Adye's book; and even if the identification can be established, there is no proof that the carpenters and blacksmiths at Fort Vancouver actually used it when constructing the 3-pounder carriages.

Type of carriage used in the Fort Vancouver bastion. If these cautionary words are kept in mind, there should be no great difficulty in arriving at a carriage design which would approximate with reasonable accuracy that employed for the 3-pounder mounts at Fort Vancouver. During the late 18th and early 19th centuries iron guns of the type and size under consideration were, in ordinary circumstances, mounted on only three types of carriages: field, garrison, and ship. Although field carriages, designed for mobility and usually marked by a single pair of large wheels, were occasionally employed at fixed fortifications, they can be eliminated as far as the Fort Vancouver bastion is concerned. The reference

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5. Hughes, op. cit., [137].

to "tackling" in the post inventory of 1848 virtually guarantees such a conclusion.

Garrison carriages were employed to mount guns in permanent fortifications. They were ordinarily aimed and moved into firing position by the use of handspikes rather than by blocks and tackles. Ship carriages, as the name implies, were used to mount guns in sea service. They were maneuvered by tackles, with the assistance of handspikes.

The mention of "tackling" in the 1848 inventory would appear to be a clear indication that the guns in the Fort Vancouver bastion were mounted on ship carriages. But there is another factor to take into consideration. Although Adye's The Bombardier, and Pocket Gunner would have been of little use as guidance in designing the carriages at the post, it is possible that another of the several artillery manuals or dictionaries in circulation at the time might have been consulted by the artisans at Fort Vancouver. Since, like Captain Adye, the authors were mainly army artillerymen, the dimensions and specifications given in their books would refer principally to field and garrison carriages. Thus garrison service specifications could have been used for the major carriage parts.

As a matter of fact, it would have made little difference which tables were employed. Wooden garrison

carriages (many were of iron by 1845) and wooden ship carriages (practically the only kind employed at sea) were in most cases almost identical in design. The difference was largely in the trucks, as the four small wheels were termed. For ship carriages these were made of wood; those for garrison carriages were of cast iron. Other, minor, differences included the number and placement of the rings or loops for affixing ropes of various types. There were also variations in the design of "the smaller fittings and stores."[6]

On the basis of the meager evidence available, it seems reasonable to conclude that the guns in the Fort Vancouver bastion were mounted either on sea carriages or on garrison carriages modified for the use of side tackles, train tackles, breeching, and, probably, wooden trucks.

General characteristics of wooden ship and garrison carriages. As Albert Manucy has pointed out in his very useful study, Artillery through the Ages, the basic proportions for garrison and ship carriages "were obtained by

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6. Gooding, An Introduction to British Artillery in North America, 5, 27-30. There were also differences in the types of woods used. Ship carriages were made of elm, except for oak axletrees. Garrison carriages were made entirely of oak. Adye, The Bombardier, and Pocket Gunner, 277. The fact that no mention has been found in Company records of sending cast iron carriage wheels from England to Fort Vancouver is added reason for believing that the mounts in the bastion were ship carriages.

measuring (1) the distance from trunnion to base ring of the gun, (2) the diameter of the base ring, and (3) the diameter of the second reinforce ring. The result was a quadrilateral figure that served as a key in laying out the carriage to fit the gun"[7] A general rule of thumb held that the length of the carriage should be about half the length of the gun mounted on it.[8] Other determinants, as has already been indicated, would be such matters as the height of the gun port through which the piece was to be fired.

In 1756 John Müller, the ordnance theorist at the Royal Arsenal at Woolwich, published his highly informative Treatise of Artillery. It contained specifications for constructing truck (four-wheeled) carriages for 3 to 42-pounders.[9] As J. D. Moody points out, the carriages described by Müller showed distinct differences from those of the

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7. Manucy, Artillery through the Ages, 49. The average extreme diameter of a gun at the base ring was generally about 3-1/2 calibers, and thus the distance between the carriage sides opposite the base ring would be just enough more than 3-1/2 calibers to allow the breech to move up and down freely. Inman, An Introduction to Naval Gunnery, 2-3.

8. Inman, op. cit., 2-3.

9. Manucy, op. cit., 50.

17th century, the last previous ones about which detailed information is available. The mounts described by Müller were "the true 'common ship carriages,'" which with minor changes continued in service for more than one hundred years.[10]

Müller's carriages were formed of two side pieces, known as brackets (sometimes called cheeks) held vertical and separated in front by a large block of wood called the transom and by the front axletree into which they were bedded a short distance. In the rear the brackets were held firm by being bedded in the rather massive hind axletree and by a transverse bolt known as the bed bolt. The transom was countersunk or morticed into the brackets, and all the main parts of the carriage were firmly tied together by a series of iron bolts, resulting in a mount which was well able to resist the shock of recoil. For illustrations of carriage parts see Figures 3 and 4, and Plates VII, VIII, XXIII.

British ordnance specifications in the mid-18th century required brackets and transoms to be made of dry elm, which being resilient provided good resistance to splitting. By 1804 British garrison carriages were of oak, with iron trucks; but ship carriages had brackets and transoms of elm, axletrees of oak, and trucks of elm. These

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10. Moody, op. cit., 305.

specifications were still in force in 1840. In actuality, however, young oak was sometimes employed throughout the carriage.[11]

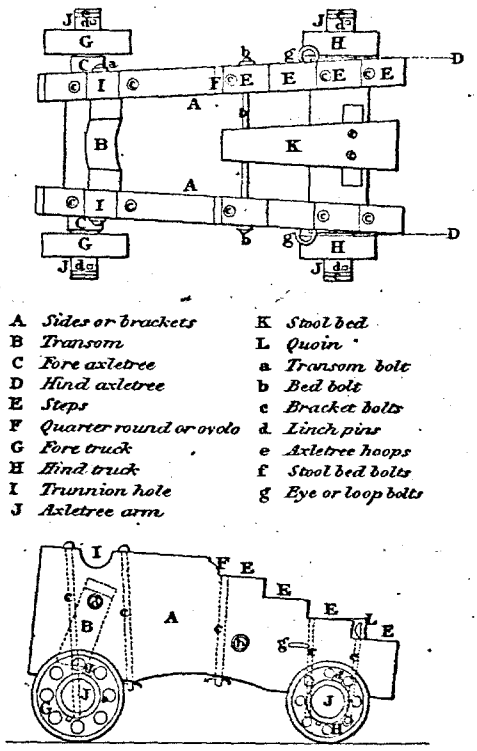

Figure 3

Plan and elevation of a British garrison carriage, c. 1840. (From F. A. Griffiths, The Artillerist's Manual, facing p. 197.)

The brackets were heavy and substantial, being the thickness of the caliber of the gun they were to support.

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11. Adye, op. cit., 277; Griffiths, The Artillerist's Manual, 63; Manucy, op. cit., 49; Robertson, The Evolution of Naval Armament, 148. A 3-pounder wooden garrison carriage with iron trucks weighed 724 lbs. Griffiths, op. cit., 69.

Sometimes the caliber was expressed in carriage specifications as the diameter of the bore but more often as the diameter of the shot, a very minor difference as far as the bracket width was concerned. Except possibly for the very smallest sizes, the brackets of British carriages were not made of a single huge plank but were built up of two planks morticed and dowelled together. American carriages were constructed in the same general manner, with an externally visible jog along the line of juncture (see Figure 4). It has been intimated that this same method might have been used in British carriages, but available drawings give no evidence of the fact (see Figure 5).[12]

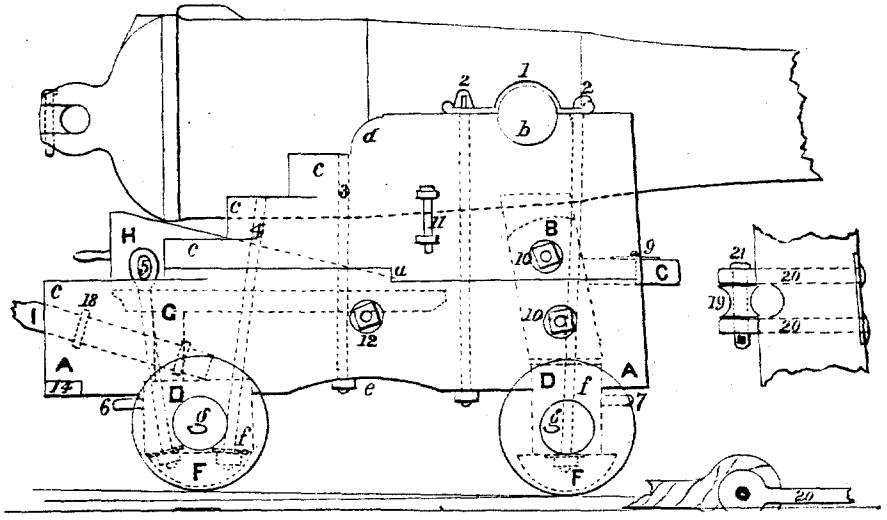

Figure 4

U. S. naval gun carriage, 1852. (From United States, Navy Department, Ordnance Bureau, Instructions in Relation to the Preparation of Vessels of War for Battle . . . [Washington, 1852], p. [134A].)

12. Manucy, op. cit., 50.

An arch was hollowed in the bottom of each bracket in order to reduce its weight. Steps were cut in the upper rear surface of the bracket to permit the use of hankspikes to adjust the elevation of the breech.

The gun was nearly on balance between the brackets, resting on its trunnions which were set into the tops of the brackets above and partly to the rear of the front axletree. The breech end of the gun being slightly heavier than the muzzle end, it would have dropped down onto the rear axletree were it not for a device known as the stool bed, a rectangular piece of wood, the rear end of which rested on a bed block or bolster which, in turn, rested on the rear axletree, and the front end of which was supported by the bed bolt.

When the gun was aimed it was held at the proper elevation by a wedge, called the quoin, which could be moved back and forth on the stool bed. To depress the gun the quoin was pushed in towards the muzzle, and to elevate it the quoin was pulled out towards the rear.

The fore and hind axletrees were of the same length. The front wheels or trucks, on the other hand, were normally slightly larger in diameter than the rear. This disparity was due to the need to compensate for the sloping decks of ships or the platforms of fortifications (which often slanted upwards behind the guns to increase resistance to

recoil). When the guns were placed on flat surfaces, however, the trucks ideally should have been of equal size, since it was important to have the carriage on a horizontal plane when firing.

Ship carriage trucks of the 18th century appear to have been made of one piece of wood. They were one caliber thick. Specifications mention no ironwork for wheels, thus the implication is that there was none at that time. When cast-iron garrison trucks were used, on the other hand, copper "clouts" were placed on the bottom sides of the axle arms "to diminish the friction of the iron against the wood."[13]

The arched bands of iron which held the trunnions in place were called cap-squares. By the latter part of the 18th century they were hinged to facilitate removal of the gun from the carriage. The front bolts that held the cap-squares in place ran down through the entire depth of the bracket and served to fasten the fore axletree. They were made secure on the bottom by means of washers and "forelocks" or wedges of iron passing through a mortice in each bolt. All the other bolts traversing the brackets vertically were fastened in the same manner. The two cross or transverse

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13. Smith, An Universal Military Dictionary, 52.

bolts in the carriage, the bed bolt and the breast bolt, were riveted over "burrs."

For sea carriages a ring bolt (breeching ring) was placed above the arch on the outer surface of each bracket to support the breeching or heavy rope used to limit recoil. There were also two eye bolts, called loops, in each side for the attachment of the side tackles or outhauls. The lower loop was for use when the gun was in service; the upper was employed in housing or securing the gun so as not to obstruct the fitting of a second or "preventer" breeching often rigged to keep the gun stationary at sea. Another loop at the front of the carriage, ordinarily placed in the transom but sometimes in the fore axletree, was for affixing lines to move the gun from place to place. Still another in the center of the hind axletree was for the training tackle. Garrison carriages seldom had the breeching ring, and often they had only one loop on each side instead of two.[14]

The following figure (Figure 5) illustrates a typical British "common ship carriage" of the late 18th century. Other diagrams, differing slightly in details, of the same type of carriage for the same period will be found in

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14. This section is based very largely upon Moody, op. cit., 305-306; with certain additional material from Gooding, op. cit., 5; and Manucy, op. cit., 45-51.

Plates VII and XXIII. A plan for a typical British garrison carriage of the same era is given in Plate VIII.

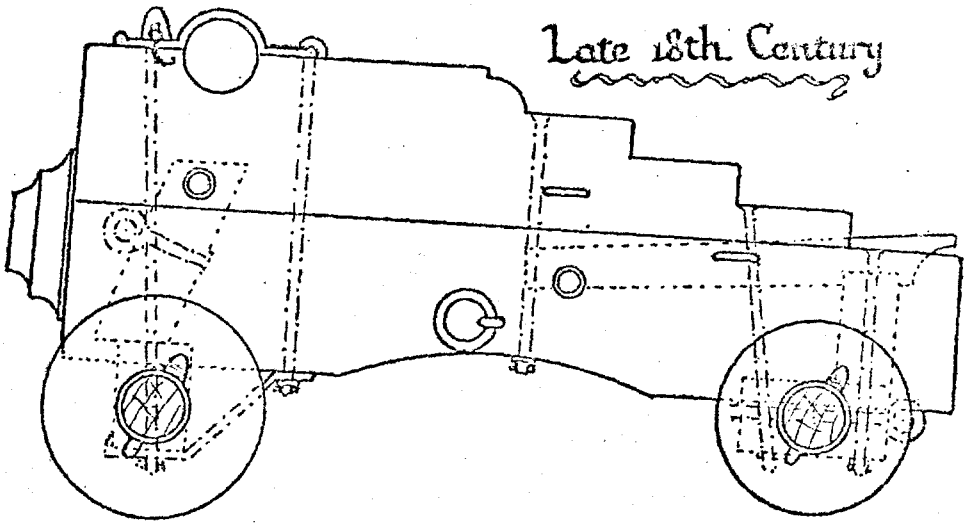

Figure 5

Typical British "comman ship carriage" of the late 18th century. (From Moody, "Old Naval Gun-Carriages," in The Mariner's Mirror, XXXVIII [November, 1952], 305.)

Changes in carriage design, 1800-1845. Müller's specifications by no means represented the ultimate in the design of British ship and garrison carriages. Experiments were conducted from time to time in attempts to improve gun mounts, and various alterations were made as the result of practical experience. Some of these related to "horns" or projections added to the front edges of the brackets to butt against the port sill and thus keep the fore trucks

clear of the waterways along the edge of the deck. By 1829 the general use of a chock attached to the port sill largely ended the need for buffers of various types on the carriage, though there is some evidence that such devices occasionally were employed by the British as late as 1860 (buffers were standard on United States sea carriages).

Unfortunately, data concerning such changes are only fragmentary. Thus any discussion of them must be rather indefinite, and in any case most of them have little interest in connection with the armament at Fort Vancouver. For instance, from about 1800 to about 1830 side cleats -- triangular pieces of wood nailed to the outer faces of the brackets in front of the breast bolt -- seem to have been applied to naval carriages, though their use is not now understood. But other changes probably are applicable to the situation at Fort Vancouver.

1. Axletrees. At some time between 1800 and 1830 -- Moody's discussion is not clear at this point -- "the fore axletree was shortened, so that the fore-trucks were closer together than the hind, and this change persisted with all later carriages."[15]

2. Tackle loops. Another change related to the side tackle loops. At an unstated date these were placed

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15. Moody, op. cit., 307.

vertically on the last step of the bracket, "being the upper end of the rearmost hind-axletree bolts."[16] About 1827 it is known that these upright loops and the old horizontal ones were both in use on the same carriage, but later the old sideloops disappeared, being replaced by the new "endloops."

3. Breeching rings. With carriages of 18th century design, the breeching "passed from the cascabel [of the gun] down through the carriage ringbolts, and thence to the ringbolts at the port sides. This caused a reaction on recoil that tended to lift the fore-trucks from the deck, and led to frequent criticism. No change was made, however, until guns of Blomefield's pattern, with their cast breeching loops at the cascabel, had replaced the older styles which relied on a strapped-on thimble to hold the breeching to the gun."[17] The new guns were substantially installed on Royal Navy vessels between 1830 and 1834. After that time the breeching no longer passed through the carriage ringbolts. Thus the latter were omitted in subsequent models.

4. Trucks. At an unknown date, "probably by the 1840's," ship carriage wheels or trucks ceased to be made of a single

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16. Moody, op. cit., 307.

17. Ibid.

piece of wood. The replacements were constructed from two pieces or "layers" of wood "with the grain at right angles, and fastened together by a series of small bolts."[18] Some accounts state that the wooden trucks had "iron thimbles or bushings driven into the hole of the hub." They add that the British put copper on the bottom of the spindle on which the wheel revolved in order to "save the wood of the axle-tree."[19]

As a result of such changes, the British ship carriage by about 1840 presented a slightly different appearance than did that of the late 18th century. A comparison of Figures 5 and 6 reveals the extent of the changes.

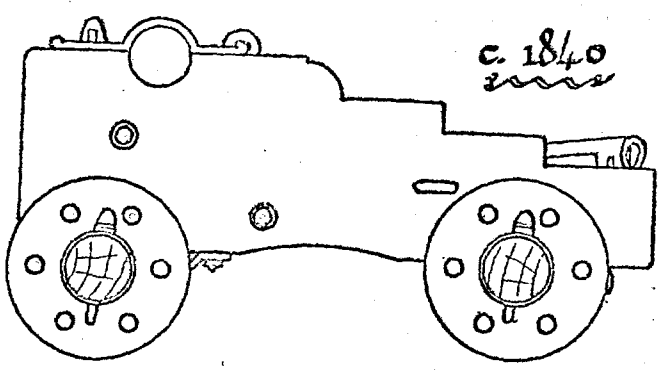

Figure 6

Typical British "common ship carriage" of about 1840. (From Moody, "Old Naval Gun-Carriages," 308.)

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18. Moody, op. cit., 307-308.

19. Manucy, op. cit., 50.

Specifications for carriage parts. Müller's basic specifications of 1756 were unavailable for purposes of this study, but Captain George Smith's An Universal Military Dictionary, published in London in 1779, contains a table which represents the official standards of that time. His specifications are for garrison carriages, but as has been seen they are generally applicable to ship carriages except for the trucks. Smith's figures refer to cast iron trucks.

The following list gives in inches and decimals the measurements of the principal parts and includes, Smith assures us, "the names of every article thereto belonging." He further states, "the arms of the hind axle-tree, having the same dimensions as those of the fore ones, are omitted, as also the height behind the side pieces." Although the complete table includes data for 3-pounder to 42-pounder carriages, only the figures for the 3-pounder gun carriage are reproduced here.

PARTS OF A BRITISH 3-POUNDER GARRISON CARRIAGE, 1779

Width inclosed	before	9.0	inches
	behind	12.5	"
Fore axle-tree length		32.5	"
Body	length	19.5	"
	height	8.3	"
	breadth	4.0	"

Arms	length	5.3 inches
	diameter	3.5 "
Hind axle-tree length		32.5 "
Body	length	19.5 "
	height	4.0 "
	breadth	12.0 "
Fore-trucks	diameter	14.0 "
	breadth	3.0 "
Hind-trucks	diameter	10.0 "
	breadth	3.0 "
Side-pieces	height before	13.6 "
	length	37.5 "
	breadth	3.0 "
Trunions [sic] from the head		6.0 "

Names of all the iron-work of a garrison-carriage, together with the quantity of each sort:

Cap-squares	2
Eye-bolts	2
Joint-bolts	2
Transom-bolts	1
Bed-bolt	1
Bracket-bolts	2
Hind axle-tree bolts	4
Burs [sic]	2
Loops	6
Dowel-pins	4
Square riveting-plates	8 [?]
Rings and keys	10
Traversing-plates	2
Linch-pins	4
Axle-tree hoops	2
Axle-tree stays	2
Keys, chains, and staples	2
Stool-bed bolts, &c.	2[20]

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20. Smith, An Universal Military Dictionary, 51-52.

The carriage to which Smith's specifications pertain is pictured in Figure 7.

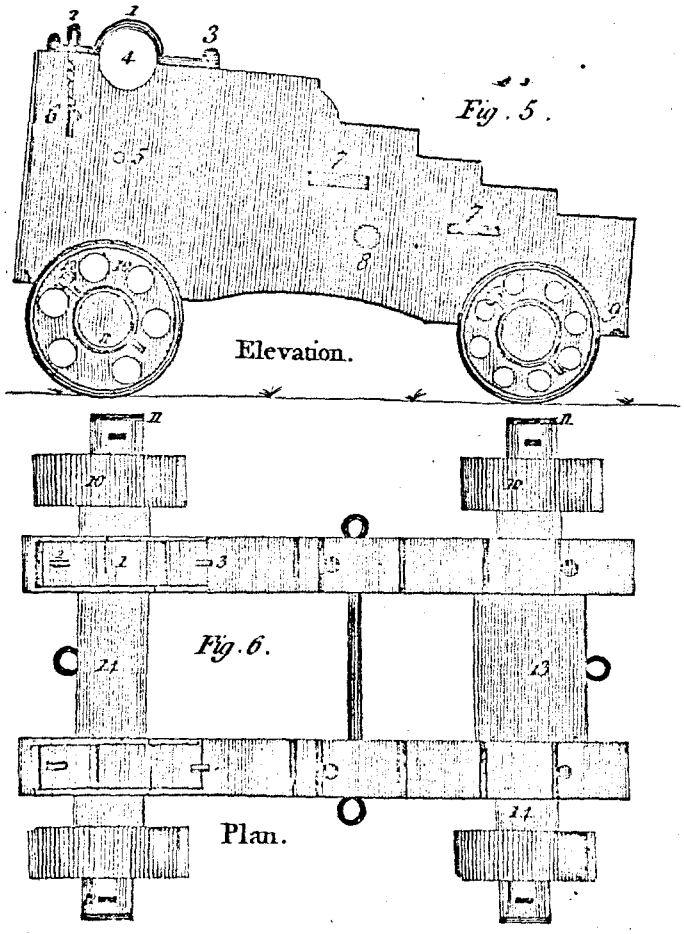

Figure 7

A British garrison carriage, 1779

1. Cap-squares
2. Eye bolts
3. Joint bolts
4. Trunnion hole
5. "Trunions" [transom?] bolt
6. Chain & staple
7. Loops
8. Burrs
9. Traversing plate
10. Trucks
11. Axletree hoop
12. Linchpins
13. Stool bed & bolts
14. Axletree & bolts

(From Smith, op. cit., plate VI)

In 1775 John Robertson published a "Table of general Dimensions of the Parts of a Ship Gun Carriage in Calibres of the respective Shot" which set forth a "theoretical standard" for the sizes of British gun carriages, their wooden parts, and their hardware. When reproducing this compilation for the benefit of today's model makers and students of naval artillery, M. A. Edson, Jr., remarked that this table, "empirical though it may be, establishes general sizes which can be used to govern the drafting of a naval gun carriage for armed ships of the latter part of the 18th century." He points out, however, that the table provides only general guidance for producing a well proportioned carriage for a gun of a particular caliber and does not give official specifications at any fixed date.[21]

Robertson's table, as reproduced and expanded by Edson, does not include carriages for guns smaller than 4-pounders, but since Robertson gave his dimensions in terms of multiples of the caliber or diameter of the shot, and since the diameter of a 3-pound shot was 2.775 inches, the measurements of the parts in inches are easily calculated. Most of the parts named can be identified by reference to Figures 3 and 7 and Plates VII-XIII and XXIII.

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21. M. A. Edson, Jr., "18th Century Gun Carriages and Fittings," in Nautical Research Journal. vol. 12, no. 3 (Fall, 1962), 113. Robertson's table appeared in John Robertson, Treatise of Such Mathematical Instruments as are usually put into a Portable Case . . . and The Description of Ship-Guns and Sea Mortars (London, 1775).

GENERAL DIMENSIONS OF THE PARTS OF A 3-POUND SHIP GUN CARRIAGE

(Adapted from John Robertson, Treatise . . . [London, 1775], as transcribed by M. A. Edson, Jr., "18th Century Gun Carriages and Fittings," in Nautical Research Journal, vol. 12, no. 3, pp. 115-116. Dimensions in inches calculated by J. A. Hussey.)

PART	SHOT DIAMETERS	INCHES
THE BRACKETS		
Length	12.522	34.749
Thickness	1.000	2.775
Breadth [height], before	4.686	13.004
Breadth, behind	2.343	6.502
Distance at the Trunnions	2.992	8.303
Distance at middle of hind axtrees	3.695	10.254
Distance, center of Trunnion fr. front	1.983	5.503
Diameter of Trunnion Hole	1.082	3.000
Center sunk in side	0.045	0.125
Radius of the Oualo	0.500	1.388
Excavation -- Length of chord	5.000	13.875
In Bottom -- Distance from front	3.500	9.712
THE AXTREES		
Whole length	9.735	27.015
The Arms -- Length	1.767	4.903
The Arms -- Diameter	1.118	3.102
Breadth between the Brackets at the Fore	1.226	3.402
Breadth between the Brackets at the Hind	2.163	6.002
Breadth between Brackets and Arms	1.226	3.402
Depth in the middle of Fore	1.659	4.603
Depth in the middle of the Hind	1.226	3.402
Distance betw. middle of the Axtrees	8.684	24.098
Dist. of middles fr. the Bracket Ends --		
" (1) Fore	1.622	4.501
" (2) Hind	2.215	6.147
Depths of Axtrees let into Brackets	0.432	1.199
THE TRUCKS		
Their thickness	1.000	2.775
Their Diameter -- Fore	3.245	9.005
Their Diameter -- Hind	2.884	8.003
CAP SQUARE		
Whole length	2.974	8.256
Breadth	0.721	2.001
Thickness	0.125	0.347

PART	SHOT DIAMETERS	INCHES
CAP SQUARE (continued)		
Bend	1.082	3.002
Fore Flat	1.171	3.250
Hind Flat	0.721	2.001
Head of Joint Bolt -- Length	0.631	1.751
Head of Joint Bolt -- Breadth	0.216	0.599
Head of Eyebolt -- Length	0.415	1.152
Head of Eyebolt -- Breadth	0.216	0.599
Rounding at ends of Cap-Square	0.216	0.599
Joint Bolt projects out of Cap-Square	0.207	0.574
Thickness of the Key	0.054	0.150
BOLTS		
Their Diameter	0.270	0.759
Diameter of Burrs & Heads	0.360	0.999
Diameter of Burr Ring [Washer]	0.486	1.349
LOOPS		
Inner Diameter	0.300	0.833
Outer Diameter	0.721	2.001
BREACHING [BREECHING] RING		
Inner Diameter	0.800	2.220
Outer Diameter	1.300	3.607
STOOL BED		
Whole Length	5.822	16.156
Thickness	0.721	2.001
Breadth -- Behind	1.803	5.003
Breadth -- Before	1.082	3.002
Bolster -- Length	2.974	8.253
Bolster -- Breadth	1.000	2.775
Depth	1.250	3.469
Let in	0.090	0.250
Fore Notch -- Breadth	0.342	0.949
Fore Notch -- Depth	0.234	0.649
Fore Notch -- Distance from front	0.613	1.701
The Transom -- Length	3.000	8.325
The Transom -- Thickness	1.000	2.775[22]

It will be noted that the dimensions given in Robertson's table never correspond exactly with those given for the corresponding parts in Smith's specifications, and in a few cases there are rather marked differences. The hind axletrees,

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22. Edson, op. cit., 115-116.

particularly, seem to have been of different design. For the most part, however, the variations do not appear significant.

A plan of a ship carriage drawn to Robertson's specifications will be found in Plate VII. Working drawings for constructing a British ship carriage for a 9-pounder, date unspecified but evidently between about 1800 and about 1827, will be found in Plate XXIII, in the envelope at the end of this report. It was drawn by Harold A. Underhill, of Glasgow, an acknowledged authority on ship guns and ship carriages, but no supporting evidence is provided with the drawing.

A pattern for a British garrison carriage for a 32-pound iron gun, of the period 1760-1790, will be found in Plate VIII. Between 1791 and 1793 Charles William Rudyerd, a student at the Royal Military Academy, made a remarkable series of colored drawings showing the garrison carriage for a 24-pounder. Unfortunately the keys for the identification of the parts seem to have been lost, but the clarity of the drawings makes it desirable to reproduce them nevertheless in this report. They will be found in Plates IX-XIII.[23]

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23. The original manuscript notebook is in the Army Museum, Halifax, Nova Scotia. It has recently been published as : Charles William Rudyerd, Course of Artillery at the Royal Military Academy as Established by His Grace the Duke of Richmond . . . 1793 (Ottawa: Museum Restoration Service, 1970).

Painting guns and carriages. Even for armament on Royal Navy vessels and at British military garrisons there remains some question as to the colors used in painting guns and carriages. According to S. James Gooding, however, "generally speaking the ironwork on all cannons was painted black while carriages were painted grey, or as it was known, the common colour."[24] The ironwork on the carriages was also black.

Tackles and breeching. The fact that "tackling" was employed in connection with the 3-pounders in the Fort Vancouver bastion is established by Hudson's Bay Company records, and both tackles and breeching have been mentioned a number of times throughout this report. But for today's readers it is possible that the meanings of these terms might be obscure.

Without getting too technical, tackle is an assemblage of ropes and pulleys for hoisting or pulling. Breeching, in the sense employed here, is a heavy, three-stranded rope used to check the recoil of a gun and to secure it for bad weather.[25]

Ordinarily a ship gun mounted for action was equipped with one breeching, two side tackles, and one train tackle. The locations respectively occupied by these items are shown in Figure 8.

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24. Gooding, op. cit., 37.

25. William N Jeffers, Jr., A Concise Treatise on the Theory and Practice of Naval Gunnery (New York, 1850), 197.

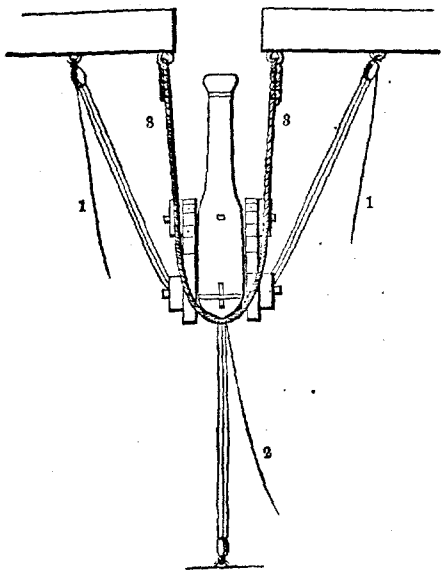

Figure 8

Simplified diagram of tackles and breeching. This drawing omits three blocks and is inaccurate in other respects. (From Edward Barrett, Gunnery Instructions . . . U. S. Navy . . . [New York, 1862], p. 33.

Breeching. The heavy line which formed the breeching was attached to a ringbolt at one side of the gun port. Then it was passed around the cascabel (rear end) of the gun and made fast to a ringbolt on the other side of the port. Its length was such as to permit the muzzle of the gun, upon recoil, to clear the inside of the port by sufficient distance to permit loading (on shipboard loading space was usually quite limited).[26]

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26. Jeffers, op. cit., 197.

The operation of the breeching was well described by James Inman in 1828: "When the gun has been run out [for firing] . . . the rope [breeching] . . . becomes loose on each side of [the cascabel] . . . ; and, as the recoil takes place, it is stretched and stops the gun at its full length, when the recoil may be supposed to be nearly completed."[27] The methods by which breeching was employed to assist in firmly securing the guns in place at sea do not appear germane to the present study.

During the 18th century the breeching rested on top of the cascabel button and was attached to the gun by a strapped-on thimble. It then ran through a ringbolt on each side of the carriage before being made fast to the ringbolts at the sides of the gun port. This system of rigging the breeching is illustrated by Figure 9.

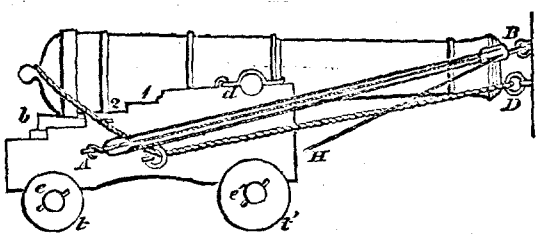

Figure 9

Method of affixing breeching prior to the introduction of the button ring. The breeching is the rope attached to ringbolt "D." (From Inman, An Introduction to Naval Gunnery, 3.)

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27. James Inman, An Introduction to Naval Gunnery (Portsea, England, 1828), 4.

At a date which the present writer has been unable to determine (certainly prior to 1791), the practice of casting an iron loop or ring immediately above the cascabel button for the purpose of affixing the breeching to the gun was introduced.[28] This device was termed the breeching ring, the breeching loop, the button ring, or the cascabel ring.

The method of running the breeching during the first four decades or more after the introduction of the button ring is shown by Figure 10. It will be noted that the breeching, in addition to passing through the button ring, continues to run through the side ringbolts on the carriage.

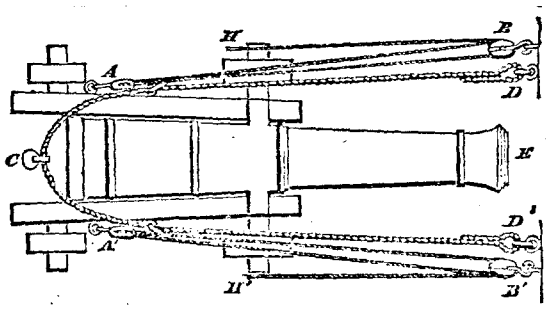

Figure 10

Method of affixing breeching in the Royal Navy, 1828, after introduction of the button ring, "C." (From, Inman, An Introduction to Naval Gunnery, 4.)

According to J. D. Moody, the general adoption of the button ring resulted, between 1830 and 1834, in a change in

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28. See Plate I. Guns with button rings are illustrated in Lieut. Col. William Congreve, An Elementary Treatise on the Mounting of Naval Ordnance . . . (London, 1811), plate 2.

the method of running the breeching, at least on vessels of the Royal Navy. Thereafter, states Moody, the breeching no longer passed through the carriage ringbolts, and the latter ceased to be installed.[29]

The breeching for a 3-pounder would be a three-strand rope with a diameter to fit fairly loosely through a ring with an inner diameter of 2.22 inches.

Side tackles. There were two side tackles, one on each side of the carriage. Ordinarily each was fastened to the side of the vessel by an eyebolt fixed close to the edge of the port. Each was also attached to another eyebolt or loop on the outer surface of the carriage bracket.

If both tackles were pulled on with equal pressure, the gun would be run straight out through the middle of the port until stopped by the post sill or a buffer. If unequal pressure were applied to the tackles, the gun could be pointed to one side or the other. If a gun were to be trained to the side, however, it was the usual practice first to run it out square and then to turn it obliquely by hauling in on one of the side tackles and by wedging it about through the use of handspikes.

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29. Moody, "Old Naval Gun-Carriages," 307. It must be noted, however, that the practice of running the breeching through carriage ringbolts -- or shackle bolts by the 1850's -- continued in the U. S. Navy until at least 1852 and probably as long as wooden carriages continued in use. This practice was considered necessary to hold the breeching clear of the trucks. Jeffers, op. cit., 197; U. S., Navy Dept., Instructions in Relation to the Preparation of Vessels of War for Battle, 135.

To make the process of oblique aiming easier, the side tackles, particularly in times of action, were frequently hooked to other eyebolts on the side of the ship placed farther out from the port than the usual ones, and also to loops on the carriage behind those ordinarily employed. In the American navy these additional eyes on the ship's side were called "fighting bolts."

Side tackles ordinarily consisted of a double and a single block, single strapped, at least in the American service. In the British navy there are some mentions of "three strings at the block."[30] The American practice was to hook the double block, point of the hook up, to the eyebolt in the ship's side and the single block, point in, to the side tackle bolt on the carriage. The length of the fall was three times that of the gun.

Train tackle. Another, similar, set of tackle was hooked to the rear of the carriage for "drawing the gun from the port within board, and in preventing it in certain cases from running toward the port."[31] American practice, at least, was to hook the double block to the train bolt in the hind axletree of the carriage and the single block to an eyebolt or ringbolt fixed in the deck directly behind the center of the gun. When the gun was to be aimed

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30. Inman, op. cit., 5.

31. Ibid.

obliquely deck eyebolts farther to the sides were employed.[32]

The layouts of the breeching and tackles during times of action are well illustrated by Figure 11.

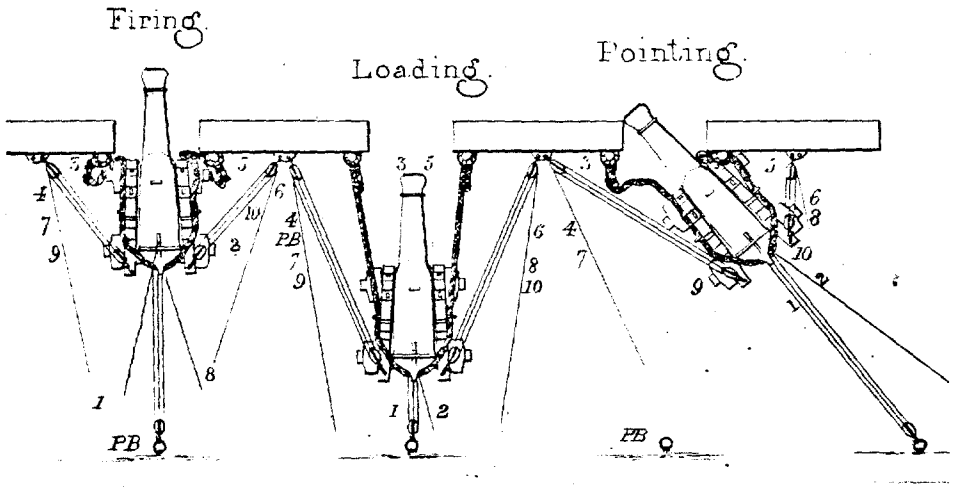

Figure 11

Positions of breeching and tackles during action, U. S. Navy, 1852. (From U. S., Navy Dept., Ordnance Bureau, Instructions in Relation to the Preparation of Vessels of War for Battle, following p. [28].)

With all these lines and blocks required to operate muzzle loading artillery in sea service, it is little wonder that writers on British naval history have described the surroundings of the guns as a "maze of ropes and trappings" dangerous to the crews in peace and war.[33]

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32. This discussion of tackles and breeching is based largely on Inman, op. cit., 4-5; Jeffers, op. cit., 197-198; and Moody, op. cit., 307.

33. Robertson, The Evolution of Naval Armament, 147.

CHAPTER IV

COMPARATIVE DATA: AMMUNITION, "SIDE ARMS," AND ACCESSORIES

The loading and firing of a muzzle loading cannon during the period under discussion (1750-1850) were exacting but essentially simple procedures. First, the correct amount of powder, either loose or in a cartridge, was placed in the breech end of the bore by means of a specially designed ladle if the propellant was loose powder, or by a rammer if it was in a cartridge. Next, the charge was packed firmly by means of a wad of hay, straw, rags, or oakum rolled into a cylinder or ball the size of the bore and tamped into place by the rammer. Then the projectile was rammed down on top of the powder. If the projectile was a round ball and if the gun muzzle was in a depressed position, another wad would be tamped in to prevent the shot from rolling out.

The loading having been accomplished, a priming rod or pricker was, if a cartridge had been used, pushed down the vent to pierce the cartridge cover. Then the priming rod was removed and the vent filled either with priming powder or one of several types of "tubes." These tubes contained powder or quick match. Finally, the piece was aimed, and

the priming was ignited by use of a port fire or flint lock.

Ammunition. Hudson's Bay Company records, as has been seen in Chapter I, clearly show that only round shot and canister shot were purchased for the 3-pounders destined for Fort Vancouver. The post inventory, however, reveals that a modest supply of grape shot was also kept at the depot, though its caliber is unknown. Assuming that at least some of the grape shot may have been suitable for use in 3-pounders, the ammunition employed in the Fort Vancouver bastion probably was as follows:

1. Powder and powder barrels. British gunpowder of the period was largely of a fixed composition: 75 parts of saltpeter, 10 parts of sulphur, and 15 parts of charcoal. Experience had shown that this combination produced a powder which would be entirely consumed on explosion, leaving no residue which might cause a premature ignition of the next charge.[1]

The Hudson's Bay Company in 1844, and probably for a number of other years, purchased its powder in London from Curtis & Harvey and the firm of Pigons & Wilks (or Pigow & Wilks).[2] Columbia District inventories show that the

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1. Hughes, British Smooth-Bore Artillery, 43.

2. H.B.C.A., A.25/7, MS, fols. 22d-26; H.B.C.A., B. 239/n/71, MS.

Company bought at least four types or grades of powder for use on the Pacific Slope: canister gunpowder, battle gunpowder, cannon gunpowder, and TPF gunpowder (evidently for small arms). This powder arrived at Fort Vancouver in 100-pound barrels or whole barrels, 50-pound barrels or half-barrels, and kegs weighing 66-2/3 pounds.[3]

Powder barrels made for the British Army at this time had the following dimensions:

	100-lb. Whole barrels	50-lb. Half-barrels
Depth	20-1/2 in.	16-3/4 in.
Dia. at top	15-1/2 in.	12-1/4 in.
Dia. at bulge	16-1/2 in.	13-1/4 in.
Dia. at bottom	15-1/2 in.	12-1/4 in.[4]

According to an authoritative compilation of information on British military practices in 1779, the weight of powder used in loading an iron 3-pounder for actual field

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3. H.B.C.A., B. 239/n/71, MS, fol 158; H.B.C.A., B.223/d/155, MS, pp. 101-102. For the British Army at this time whole powder barrels were made to contain 100 lbs., but only 90 lbs. were placed in them; 50-lb. half-barrels were loaded with only 45 lbs. of powder. Griffiths, The Artillerist's Manual, 85. It is not known that this practice was followed with powder sold to the H.B.C.

4. Griffiths, op. cit., 85.

service was one pound. For saluting, the charge was 12 ounces.[5]

Before the introduction of cartridges, powder was loaded into the barrel by means of a gunner's ladle or powder ladle. This was a simple copper scoop designed to hold the correct amount of powder for a given gun. The loader would scoop the ladle full of powder from a powder bucket and insert it carefully in the barrel, open side up. When the end of the bore was reached the ladle would be revolved, dumping the charge in the desired place. The charge then had to be packed by a wad tamped down by the rammer.[6]

After it was found that powder charges could be transported and handled much more conveniently by packaging them in cartridges, the use of loose powder was largely discontinued, particularly by regular armies and navies. But the old method long continued in use for small-scale, private armaments, and it may have been employed at Fort Vancouver for such purposes as saluting.

2. Cartridges. There is no positive proof that cartridges were used in firing Fort Vancouver's 3-pounders. The depot inventories do not appear to list such items. Yet "flannel Bag Cartridges" and "Cartridge Bags" were

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5. Smith, An Universal Military Dictionary, 49.

6. Gooding, An Introduction to British Artillery in North America, 53; Manucy, Artillery through the Ages, 25, 73-74.

kept in stock as part of the gunner's stores aboard Company vessels.[7] By 1845 the cartridge had long been generally accepted as the device to be used for introducing the powder charge into the gun. Cartridges could easily be made locally. Thus it seems reasonable to assume that they were employed at Fort Vancouver, at least occasionally.

Since the invention of cannon men had sought ways to increase the rate of fire. The idea of packaging the charge of powder prior to loading was one of the results of this effort, and by the 1630's powder bags were widely used in Europe, although in England the old method of ladling the powder continued to hold favor. By the mid-18th century the cartridge was generally standard even in England, but it was not until the beginning of the next century that the powder ladle was considered obsolete. And even then and for decades afterwards loose powder was employed under certain circumstances and for certain occasions, such as saluting.

The earliest cartridges appear to have been made of paper or parchment, but many other materials such as linen, flannel, and canvas were tried. By 1800 flannel began to come to the fore in England as the most desirable material for this purpose, though it was supplanted by serge. But during the first half of the 19th century, our period of

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7. H.B.C., Fort Vancouver, Account Book, 1844, H.B.C.A., B.223/d/155, MS, pp. 33, 183.

immediate interest, flannel was the standard material employed in the British land and sea services.[8] And certainly, as has been indicated, the Hudson's Bay Company was using flannel cartridges on its ships in 1844.[9]

Ordinarily the flannel to be used for cartridges was boiled in a glue sizing to stiffen it somewhat and to assure that powder dust would not escape. Then a bag of the correct size to fit the caliber gun for which it was intended was sewn, filled with the specified amount of powder (1 lb. for a service charge for a 3-pounder), and the top closed. James Inman, writing about British naval cartridges in 1828, said this closure was make by sewing the bag up with worsted; Gooding, a present-day authority, says the top was "tied closed."[10]

According to a British military handbook of 1779, the cartridge for a 3-pounder was 7.42 inches long.[11] Specifications of about 1845 gave the weight of the completed

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8. This short history of cartridges is based on Gooding, op. cit., 39-40; Hughes, op. cit., 43; Manucy, op. cit., 25. For military handbooks making clear the primacy of the flannel cartridge in the British services at such widely scattered dates as 1828 and 1846 see Inman, An Introduction to Naval Gunnery, 5; and Aide-Mémoire to the Military Sciences . . . 1845-1846 (3 vols., [n. p.], 1846-1852), I, 33. Adye, The Bombardier, p. 78, continued to give specifications for paper cartridges as late as 1804. The paper cartridge for a 3-pounder was 1 ft. 7 in. long.

9. H.B.C.A., B.223/d/155, MS, p. 183.

10. Inman, op. cit., 5; Gooding, op. cit., 39-40.

11. Smith, op. cit., 49. Adye, in 1804, gave the length of a 3-pounder flannel cartridge as 8 inches.

3-pounder flannel cartridge as 1 lb. 1/2 oz. Cartridges were packed for stowage and transport 30 to the box, in boxes whose exterior dimensions were 2 ft. 6-1/4 in. long, 10-1/4 in. wide, and 10 in. deep. The box weighed 26 lbs. empty and 56 lbs 15 oz. filled.[12]

3. Round shot. From the time of the earliest artillery pieces the most common projectile was a solid sphere. At first these balls were made of stone, but by the period of our interest, 1750-1850, the solid shot were almost universally made of iron, cast in round molds. The solid cast-iron sphere of fixed weight was so universal, in fact, that it formed the standard by which the caliber of the gun was determined. Nearly all iron balls showed small mold marks, but they mattered little since the shot were not intended to fit the bore tightly.[13]

The diameter of a 3-pound shot was 2.775 inches. The bore diameter of a 3-pound gun was 2.913 inches.[14] The space between the ball and the surface of the bore was called the windage.

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12. Aide-Mémoire, I, 33. These figures were for both land and sea service. Flannel cartridges were loaded into the gun bottom first. Inman, op. cit., 5.

13. Gooding, op. cit., 40, 47; Manucy, op. cit., 63.

14. Gooding, op. cit., 18, reproducing a table from John Müller's A Treatise of Artillery (London, 1780). See also Smith, op. cit., 49.

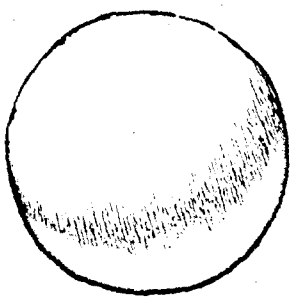

Figure 12

Typical round or solid shot. (From Harold L. Peterson, Round Shot and Rammers, 26.)

By 1845 it was the usual practice for field and garrison artillery to attach the ball to a wooden bottom or sabot. These bottoms served to keep the ball from rolling and helped to seal the explosive gases behind the projectile. Prior to about 1850 they were attached to the ball by tin straps. The sabot had the same diameter as the shot, and it was hollowed or dished to accept about half the ball. It was made of hard wood, usually elm or alder in Britain. There were two types: one with the grain of the wood running across the bottom, and the other with the grain lengthwise.[15]

No evidence has been found of the use of strapped shot at Fort Vancouver. Indeed, the practice does not appear to have been common in the sea service. For this reason the sabot is not treated in great detail in this report. But to complete the record it might be noted that about 1845

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15. Gooding, op. cit., 47; Hughes, op. cit., 52.

strapped 3-pound round shot, each weighing 3 lbs. 1 oz., were packed for storage and transport 30 to the box, in boxes 1 ft. 4-3/4 in. long, 10-3/4 in. wide, and 10-3/4 in. deep (external measurements). Empty, the box weighed 18 pounds; full it weighed 109 lbs. 14 oz.[16]

4. Canister shot. Round shot was of limited effectiveness when fired against persons from a frontal position. To meet the need for an anti-personnel weapon several types of artillery projectiles which would produce a scattering of bullets over a considerable distance were developed. One of these was the canister or case shot.

After much experiment with different types of pellets, the British armed services by the latter part of the 18th century had reasonably well standardized the form of the case shot as it was then termed. It consisted of a cylindrical tin case or canister, the diameter of which was slightly less than that of the gun bore. This case was filled with a number of small iron shot (lead bullets were sometimes used as late as 1779). A tin top was then soldered on the cylinder, and a wooden bottom was attached to the opposite end, in 1840 at least, by "strips of tin soldered down." It was considered necessary to have the filled canister weigh

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16. Aide-Mémoire, I, 33.

approximately the same as the round shot for the same gun.[17]

From about the end of the 18th century to around 1850 a number of refinements were made in the cylinder. For instance, a sheet iron bottom was introduced for use in iron guns, but the wooden bottom continued in service for bronze guns.[18] A technique was developed of filling the spaces between the individual balls in the canister with sawdust for those case projectiles intended for field service. For all other uses the balls were loosely thrown into the case.[19] And evidently by 1845 the weight of the completed canister shot had been increased to somewhat more than that of the corresponding solid shot.[20]

But during the entire period under discussion, from about 1750 to about 1850, there appears to have been continued experimentation to determine the most effective size and number of shot to be placed in the canister. Little is available concerning this matter, but apparently as a result the specifications underwent frequent change. Such, at any

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17. Griffiths, op. cit., 91; Smith, op. cit., 141.
18. Gooding, op. cit., 42-46.
19. Ibid.; Griffiths, op. cit., 91.
20. Aide-Mémoire, I, 33.

rate, is the conclusion which can be drawn from the fragmentary data found in various manuals. A sampling of such statistics is found below (all data for British 3-pounder canister shot):

1779. Table of Tin-Case Shot

Weight of each shot	1-1/8 oz.
No. of shot in case	34
Weight of tin case	2-1/4 oz.
Length of case	4 in.
Weight of case filled	2 lbs. 9-5/8 oz.

1779. Specifications for Tin-Case Shot -- Land Service

Weight of each shot	1-1/4 oz.
No. of shot in case	34
Weight of tin case	2 oz. 4 dr.
Length of case	3.9 in.
Length of wooden bottom	2.4 in.
Depth of groove in bottom	0.5 in.

1779. Specifications for Tin-Case Shot -- Sea Service

Weight of each shot	1-1/2 oz.
No. of shot in case	31
Length of wooden bottom	2.4 in.
Depth of groove in bottom	0.5 in.
[other figures not given][21]	

1804. Table of English Case Shot -- Sea Service

Weight of each shot	2 oz.
No. of shot in case	20
Weight of case filled	2 lbs. 15 oz.

1804. Table of English Case Shot -- Common Land Service

Weight of each shot	1-1/4 oz.
No. of shot in case	52 [sic ?]
Weight of case filled	2 lbs. 14 oz.[22]

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21. Smith, An Universal Military Dictionary, 141, 230.

22. Adye, The Bombardier, 256.

1829. Case Shot for Sea Service

Weight of each shot	2 oz.
No. of shot in case	20
Weight of case filled	2 lbs. 15 oz.[23]

1840. Shot, Common Case or Canister

Weight of each shot	1-1/2 oz.
No. of shot in case	34
Weight of case filled	3 lbs. 9 oz. 3 dr.[24]
"Wood Tampeon" [bottom?]	

1845. Case Shot, Land or Sea Service

Weight of case filled	4 lbs. 3-1/2 oz.

[Packed 30 to the box in boxes 2 ft. 6-1/4 in. long, 10-1/2 in. wide, and 8-3/4 in. deep (exterior measurements), each box weighing 25 lbs. empty and 151 lbs. 9 oz. filled.][25]

Figure 13 illustrates typical case or canister shot.

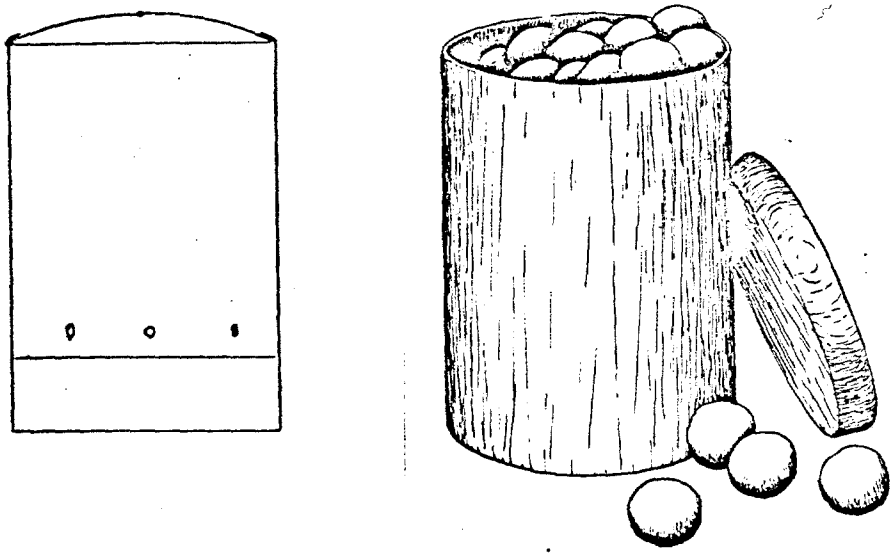

Figure 13

Two types of case or canister shot. Left: British case shot (From Gooding, op. cit., 41). Right: case or canister shot (From Peterson, op. cit., 26).

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23. Howard Douglas, A Treatise on Naval Gunnery. . . . (2nd ed., London, 1829), 303.

24. Griffiths, op. cit., 92.

25. Aide-Mémoire, I, 33.

5. Grape shot. Another type of anti-personnel weapon which functioned in much the same manner as canister shot was grape shot, so named because of its resemblance to a bunch of grapes. In 1779 the British armed services evidently made this projectile by sewing up thick, course canvas into a small bag the diameter of the ball for the gun in which it was to be used. Into this bag was placed a wooden bottom of a diameter to fit the bag tightly. A number of small shot were then put into the bag and corded or quilted together with a strong pack thread which kept them from moving.[26]

Apparently this type of construction did not last long, if indeed it had not already been superseded. Instead, the canvas bag containing the shot was placed around a wooden spindle which was attached to a wooden bottom. This bottom, also called a tampion, was below the bag, not inside it (see Figure 14). The top of the bag was drawn in tightly beneath the top of the spindle, and heavy cord was used to quilt the shot firmly into place. Sometime about 1800 the bottom and spindle came to be made of iron instead of wood.[27] Such projectiles were damaging to the bores of bronze ordnance and thus were employed almost exclusively with iron guns.

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26. Smith, op. cit., 140.

27. Gooding, op. cit., 42; Hughes, op. cit., 53.

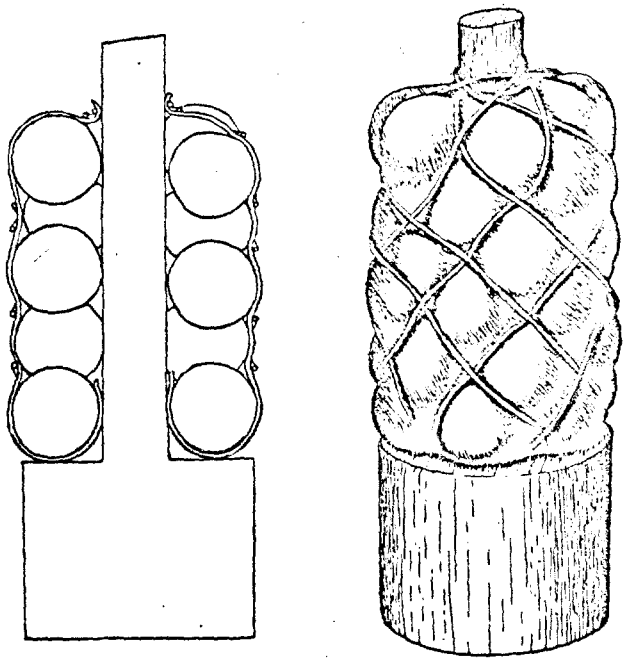

Figure 14

Quilted grape shot, wooden bottom and spindle. (From Peterson, Round Shot and Rammers , 26.)

About the middle of the 19th centurey this quilted grape shot was replaced by tier or Caffin's grape shot. The new form was made up of a number of cast iron balls arranged around an iron spindle in three tiers separated by circular iron plates. There were also an iron top disk and an iron bottom.[28] Since it seems quite probable that

28. Gooding, op. cit., 42; Hughes, op. cit., 53-54.

this new type of grape shot had not reached the Pacific Coast of North America by 1845 it is not described in greater detail here.

As with canister shot, there was a great variation in the size and number of balls placed in a grape shot. As early as 1779, however, it was decreed that the number of balls for sea service should "always" be nine. For land service, on the other hand, any practicable number and size were employed. As one military authority of that time wrote, it had not yet been determined which number and size answered best, nor had experiments yet proved what powder charges were most effective.[29]

A sampling of specifications, however, reveals that the composition of 3-pounder grape shot apparently remained fairly stable, at least during the first half of the nineteenth century. The specified number of nine balls for sea service grape shot seems to have been adopted for 3-pounder land service projectiles also, although it is well to bear in mind that after about 1800 3-pounder iron guns were obsolete for land service. All figures in the following tables refer to grape shot for 3-pounder iron guns:

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29. Smith, op. cit., 140-141.

1779. Experimental grape shot
A shot with a total weight of 5 lbs. performed well in test firing.[30]

1804. Table of Grape Shot, for Sea and Land Service

Weight of each shot	4 oz.
No. of shot	[9] [estimated]
Weight of complete grape	2 lbs. 10-1/2 oz.[31]

1829. Grape Shot for Sea Service

Weight of each shot	4 oz.
No. of shot	[9] [estimated]
Weight of complete grape	2 lbs. 10-1/2 oz.[32]

1840. Shot, Grape

Weight of each shot	8 oz. [sic, 4 oz.?]
No. of shot	9
Weight of complete grape	2 lbs. 9 oz.[33]

1845. Grape Shot, Land or Sea Service

Weight of complete grape	2 lbs. 9 oz.

[Packed 30 to the box in boxes 2 ft. 6-1/4 in. long, 10-1/2 in. wide, and 8-3/4 in. deep (exterior measurements), each box weighing 25 lbs. empty and 101 lbs. 14 oz. filled.][34]

6. Wads. When separarate components (powder and shot) were loaded into the gun, a wad was used to consolidate the powder. A number of materials were used for this purpose, among them hay, straw, and oakum. The most common material, probably, was rope yarn, known as "junk."[35] The material was rolled into a tight ball or cylinder of the same diameter as that of the bore for which it was intended.

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30. Smith, op. cit., 140.

31. Adye, op. cit., 257.

32. Douglas, op. cit., 303.

33. Griffiths, op. cit., 92.

34. Aide-Mémoire, I, 33.

35. Gooding, op. cit., 48-49; Jeffers, A Concise Treatise on the Theory and Practice of Naval Gunnery, 202; Manucy, op. cit., 67.

In the U. S. Navy about 1850, at least, the junk was beaten in a mold and wrapped with other yarn to prevent the resultant wad from losing its shape.

Another type of wad was used to keep round shot from rolling out of the barrel when it was depressed. The British called this the grommet wad. It was a ring of bore diameter formed of a piece of rope with the ends neatly spliced together. Two rope cross pieces, one passing through the strands of the other, were placed at right angles across the ring and then sewed and lashed into place with string. In the American navy this wad was made of what was called "selvagee," yarns formed into a ring.[36]

Side arms. Ordinarily each gun had a set of "side arms," a term employed in artillery parlance to indicate those pieces of equipment used in the loading, maneuvering, and firing of the piece. They included a rammer, a sponge, a wad hook or worm, handspikes, a powder scoop or ladle (seldom used after the general acceptance of cartridges), a linstock, and a port fire.

It has been seen, however, that the Fort Vancouver inventories mention only the following equipment for the

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36. In 1844 the Fort Vancouver depot had 87-1/2 hundredweight of "Cable Junk" in storage. H.B.C.A., B.223/d/155, MS, p. 126.

3-pounders:

8 Sponges and Rammers

1 Worm

1 Scoop

Since, as has already been pointed out, the guns could have been operated only with much difficulty unless several other instruments were available, it is probably safe to assume that certain items were not inventoried. Handspikes, for instance, were undoubtedly made at the fort and thus were not carried on the regular lists of items "on hand" (i. e. in stock) or "in use."

Thus all of the usual side arms are described below with the thought that there was probably, in addition to the eight rammers and sponges, at least one of each of the others in the bastion.

1. Rammer. The rammer was composed of two parts: the head and the staff. The head was a wooden cylinder (of elm in the British services; of "any tough wood" in the U. S. Navy) whose diameter and length were equal to or a very bit less than than the diameter of the shot of the gun for which it was intended. The head was hollowed at one end "to receive the ball" and to enable the grommet wad to be rammed "close home." The other end was fastened to the stave with wooden pins.

The British staff was made of ash and was about 14

inches longer than the bore for which it was intended. In the American navy the staff was only six inches longer than the length of the bore. To prevent faulty or double loading, marks were often placed on the staff to indicate to the loaders when the different parts of the charge were properly seated.

Very frequently the rammer head was placed on one end of the staff and the sponge on the other. As is shown by the post inventories, there were eight of these combined "sponges and rammers" in the Fort Vancouver bastion.[37]

A sponge and rammer is illustrated in Figure 15. A splendid example of this dual side arm can be seen in the naval history exhibit in the Museum of History and Technology, Smithsonian Institution, Washington, D. C.

2. Sponge. The sponge, which was dipped into water before use, was pushed down the bore to quench any smoldering grains of powder or other materials which might have remained from the previous firing. Like the rammer, it was composed of a head and a staff. The head was, in the British services, a cylinder of elm wood about 8 inches to 1 foot long with a diameter somewhat less than that of the bore of the gun it was intended to serve. The head was covered with lambskin, wool side out, which was attached

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37. Gooding, op. cit., 52; Jeffers, op. cit., 199-200; Manucy, op. cit., 74; Smith, op. cit., 48.

with glue or nails.[38]

The staff was like that for the rammer, and as has been seen, the sponge was often placed on the opposite end of the same staff as that used for the rammer. Sometimes the worm was seated at the extremity of the sponge head in order to save the time involved when a separate worm was employed to remove the remains of the cartridges.[39]

A typical sponge is illustrated in Figure 15. What appear to be four original sponges, with staffs about four feet long, are to be seen in the navigation and exploration exhibits in the British Columbia Provincial Museum, Victoria, B. C.

3. Worm. The worm, wormer, or wad hook as it was variously known is a difficult device to describe, but it is easily comprehended through illustration (see Figure 15). One authority has aptly termed it "a double screw, something like a pair of intertwined corkscrews."[40] An earlier writer

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38. The present writer has found no specific data on the dimensions of the sponge head. Manucy says it was about one foot long and "the same diameter as the shot." In the U. S. Navy in 1850, however, the head was 8 inches long and one inch less in diameter than the caliber of the gun. In view of the thickness of the lambskin with which the head was covered, the latter diameter would seem the more reasonable. Jeffers, op. cit., 199; Manucy, op. cit., 73.

39. In addition to the sources cited in the previous note, this description of the sponge is based upon Gooding, op. cit., 199; and Smith, op. cit., 48.

40. Manucy, op. cit., 73.

described it as composed of two spiral branches pointed and turned in opposite directions, secured by rivets to a staff.[41]

At any rate, when pushed down the bore and twisted, it caught any pieces of wad or cartridge bag remaining in the barrel. An accumulation of such fragments could block the base of the vent and thus make the gun inoperable.

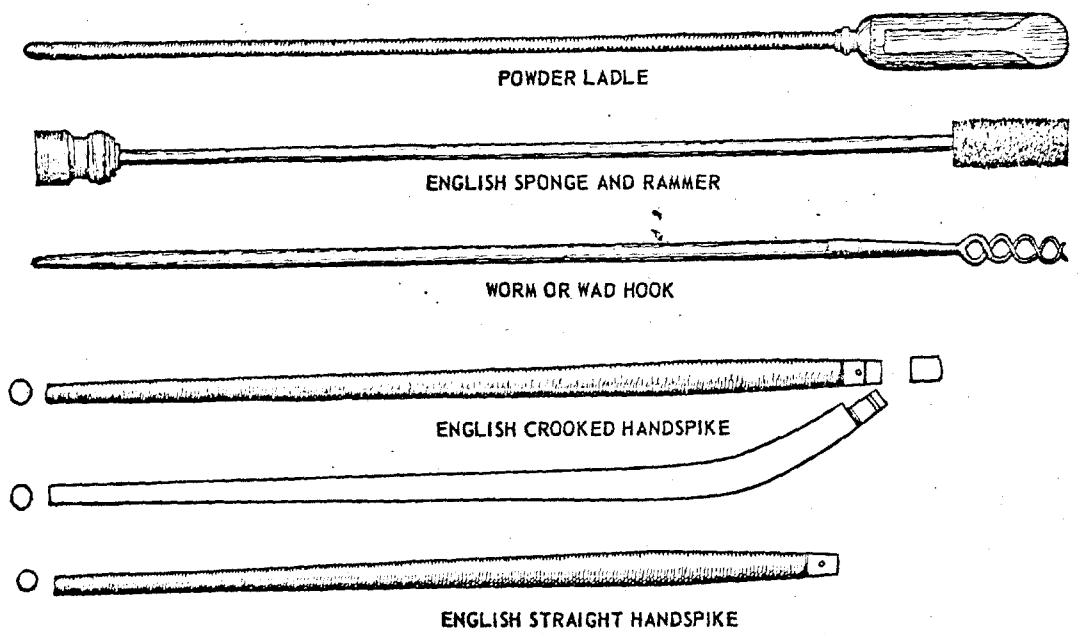

Figure 15

Typical side arms employed in the service of smooth-bore, muzzle-loading ordnance. (From Harold L. Peterson, Round Shot and Rammers, 37.)

4. Handspikes. In essence, handspikes were merely levers or "big pinch bars" employed to move the gun carriage

41. Jeffers, op. cit., 200; see also Gooding, op. cit., 52.

and to lift the breech of the gun so that the quoin could be adjusted. There were a number of types of handspikes, but basically they were stout wooden poles about six feet long shod at one end with iron.

British artillery handspikes were made of ash. They were sometimes round, six to seven feet long, with a rather small iron-shod tip at one end (see Figure 15). Such spikes weighed about ten pounds each.

A more usual British type, evidently, was an ash bar five feet long. The top part of this staff was round in cross section, the diameter measurement at the tip being 1.25 inch. The bottom 1 foot 9 inches of the bar was square in cross section, the diameter being 2.75 inches. Evidently this bottom portion was covered with iron, though it is not so stated in Griffiths's 1840 artillery manual which describes the lever. This handspike weighed 6.4 lbs.[42]

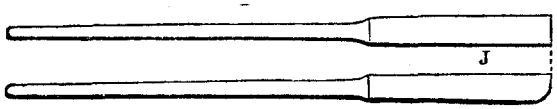

Figure 16

U. S. Navy handspike, 1862. (From Edward Barrett, Gunnery Instructions . . . [New York, 1862], 14.)

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42. Griffiths, The Artillerist's Manual, 85.

In the American navy about 1862 the handspike was of oak or hickory. Beginning at one end and for about one-third of its length the lever was rectangular in cross section and shod with an iron shoe. The remaining portion was round in cross section, smaller in diameter, and unshod (see Figure 16).[43]

5. Powder ladle. The function of the powder ladle or powder scoop has already been described, so it will suffice to repeat here the words of one authority who wrote, "it was not only the measure for the powder but the only way to dump the powder in the bore at the proper place."[44] The ladle was simple in construction: a copper scoop mounted on a cylindrical wooden head or wooden disk which in turn was attached to a staff of the same type and size as that of the rammer (see Figure 15).

But though uncomplicated, the ladle had to adhere rigidly to design standards and specifications. The length of the copper scoop had to be such that the ladle would hold exactly the correct charge for the gun involved. After 1750 this length generally was three times the shot diameter. The diameter of the scoop had to be such that it fit the bore of the gun quite closely. The thickness or

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43. Gooding, op. cit., 53; Jeffers, op. cit., 20; Manucy, op. cit., 75. A photograph of an incomplete but original British handspike is to be found in Hughes, op. cit., 47.

44. Manucy, op. cit., 73.

gauge of the copper was the same as the windage of the gun, "that is, the copper was just thick enough to fit between ball and bore."

After the general acceptance of the cartridge, the scoop was seldom used for loading loose powder, except for salutes and at places where cartridges were not readily available. It was retained, however, for extracting shot and to remove loose powder from a torn cartridge.[45]

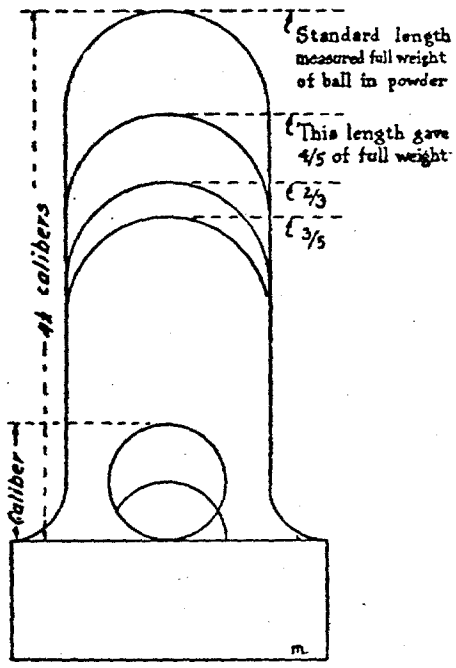

Figure 17

Pattern for a 16th century powder scoop. After 1750 the length was generally reduced to about three times the shot diameter. For a 3-pounder the scoop held one pound of powder for a service charge (to fire a ball). Twelve ounces was the charge for saluting. (From Manucy, Artillery through the Ages, 75.)

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45. Gooding, op. cit., 53; Jeffers, op. cit., 200; Manucy, op. cit., 73.

6. Linstock. The earliest method of exploding the charge in a muzzle-loading cannon was to pour loose powder down the vent and ignite it by applying a hot piece of iron. Since the heating of irons was inconvenient, this method was superseded by the use of a slow-burning match. Once lit by flint and steel or some other means, the slow match would remain alight for hours, always ready at hand for igniting the charge.

The match by 1800 usually consisted of three loosely woven strands of hemp boiled in lees of old wine or soaked in a solution of saltpeter or wood ash and treated with lead acetate and lye, the whole wrapped with an outer layer of hemp strands. Sometimes cotton rope was used for these purposes. A rope so treated would burn at the rate of only about one yard in eight or nine hours.

The slow match was carried wrapped around a wooden staff. In the American navy in 1850 this staff, called a linstock, was of turned wood, about 2-1/2 feet long, with a ferule and point at one end. The other end was pierced by a mortice 6 inches long. The match was wound around this staff with one end placed through the mortice, where it was secured by a peg.

Some linstocks were similar in nature but had forked heads so that two matches could be held. British army

linstocks were sometimes quite long, with ornamental heads shaped something like those of halberds. Several types of linstocks are illustrated in Figure 18.

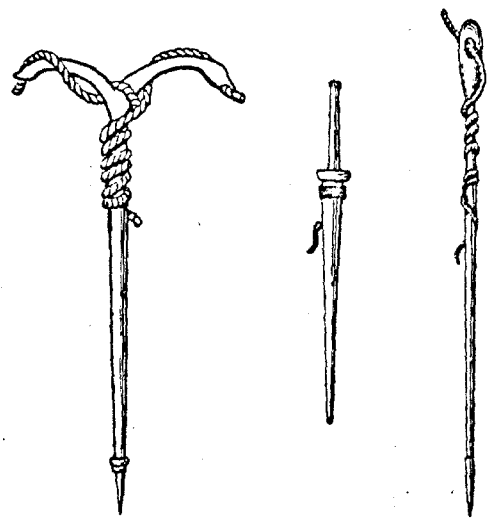

Figure 18

Typical linstocks and a portfire. Left: Forked linstock. Middle: Portfire and English style stock. Right: Linstock with hole. (From Peterson, Round Shot and Rammers, 37.)

Evidently the linstock was often used direclty to set off the charge. For that reason the stick was long enough to permit the cannoneer to avoid the gun and carriage during recoil. But by the 19th century the more usual arrangement, at least in the British service, was to set up the linstock near two or more guns and to carry the flame to the vent of

the individual weapon by a device called the portfire.[46]

7. Portfire. The portfire was "a stiff tube made of layers of paper 16-1/2 in. long, and contained a composition which burned at a rate of one inch in about a minute." When about to fire, the gunner ignited his portfire from the linstock and applied it to the vent when the order was given. To keep the gunman free of the recoil, the portfire was carried in a portfire holder (see Figure 18).[47]

It is not known that linstocks and portfires were employed at Fort Vancouver. They certainly could have been, since they represented a common method of igniting a cannon charge in the British army, at least up to about 1840. On the other hand, it is possible that a simpler method was considered sufficient at Fort Vancouver.

It should be noted, also, that about 1790 a flint lock attached to the breech of the gun began to be substituted for the linstock and portfire at sea. This device had to be fitted and attached to the priming area of the breech. Since such firing devices are not mentioned

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46. This description of the linstock is based closely upon Hughes, op. cit., 48; Jeffers, op. cit., 200; and Manucy, op. cit., 26. A photograph of the halberd-like linstock will be found in Hughes, op. cit., p. 47.

47. Hughes, op. cit., 48.

as being purchased with the 3-pounders for Fort Vancouver, it seems unlikely that the Company considered them necessary. For this reason flint locks are not treated in this study.[48]

Racks for side arms. The larger side arms for the two 18-pounders that stood in front of the chief factor's house at Fort Vancouver were stored horizontally on brackets affixed to the face of the front porch. In the bastion they may have been stored in a similar manner on the interior walls above the ports. Simple wooden pegs set into the walls on a slant probably sufficed for racks. Evidently the usual practice on warships, where space was more limited, was to house the side arms vertically, but the rather elaborate racks required were undoubtedly not considered necessary at Fort Vancouver.

Accessories. Ordinarily a battery of artillery or a vessel of war was supplied with a number of additional pieces of equipment which were needed in order to keep the guns in action over an extended period. Such items included scrapers and "searchers" for examining the bore for cracks or holes, and drills and augers for clearing the vents. But since the Fort Vancouver inventories do not mention such specialized items, it must be assumed that, for the most part, they were not present. Guns whose principal

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48. This account of the portfire is based almost exclusively on Hughes, op. cit., 48-49.

anticipated use was saluting could be expected to remain serviceable for a considerable time without such auxiliary equipment.

But there were other secondary accoutrements, also not inventoried, which almost any battery of guns at that period might be expected to have at hand. Undoubtedly the guns could have been operated without them, but they were virtually essential for efficient or safe firing. Among such articles were the priming wire, primer tubes, water bucket, budge barrel, passing box, match tub, and tompion. Since most of these items could easily have been fabricated in Fort Vancouver's own shops, they perhaps were not considered as items to be inventoried.

1. Priming wire. The priming wire, also known as the vent pricker or the gunner's pick, was employed to clear the vent and also to prick a hole in the cartridge so the priming fire could reach the charge. It had several different forms. Generally it was simply a heavy iron wire, sufficiently hardened to be stiff yet not so brittle as to break if accidently hit by the rammer. One end was terminated by a loop or ring which served as a handle; the other end was sharpened to a point. Sometimes the wire was attached to a wooden handle much like that on a modern

ice pick, except that it was round and formed to fit the hand.[49]

If cartridges were not used at Fort Vancouver, a priming wire might not have been essential. Yet the need for an occasional clearing of the vents would have made one or more highly desirable.

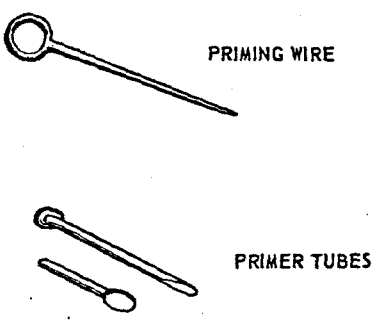

Figure 19

Typical priming wire and priming tubes. (From Peterson, Round Shot and Rammers, [65].)

2. Primer tubes. The usual early method of "charging the vent" was simply to pour enough powder from a horn or flask down the touch hole to fill it and then ignite it with a linstock or portfire. In an effort to improve the rate of fire the Venetians as early as the 14th century introduced a powder-filled tube which could be pushed into

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49. Jeffers, op. cit., 199; Manucy, op. cit., 26. A photograph of a vent pricker with a wooden handle is to be found in Hughes, op. cit., p. 48.

the vent.

By about 1765 the British had adopted a tube made of tin, about five to six inches long and 2/10 inch in daimeter. The bottom end was cut on a slant, "in the form of a [quill] pen," and strengthened with solder so that it could pierce the cartridge without bending. A quick (fast-burning) match was then threaded through the tube and sealed in place at the top with mealed powder moistened with spirits of wine. A cap of paper or flannel, steeped in spirits of wine, was tied over it to prevent the mealed powder from falling out.[50]

By 1778 the tin tube had largely been replaced by one of goose quill. It operated on the same method except that by 1800 the quick match had been replaced by a mixture of mealed powder "mixt stiff with spirits of wine," which was more reliable.[51] This form of the tube seems to have been that employed quite generally up to nearly the middle of the 19th century, and it probably was the form used at Fort Vancouver if tubes were used there at all.

It has been seen that the Douglas flint lock mechanism was used to ignite artillery in the 1780's or 1790's, but for many years it was widely adopted only at sea. Detonating quills, ignited by a blow from a lock, were introduced in the

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50. Smith, op. cit., 141. A somewhat different description is given in Gooding, op. cit., 50. Hughes, op. cit., 49, gives the formula for making quick match.

51. Hughes, op. cit., 49.

British service between about 1840 and 1845, but they probably were not employed at Fort Vancouver at that time. Friction tubes were not introduced until about 1853, so they played no part in the armament at the Company's western headquarters on the Columbia.[52]

3. Water bucket. In the British services, the bucket used to hold the water for moistening the sponge was made of leather.[53] Although specifications are not readily available, it was shaped like the one shown in Figure 20.

On vessels of war and, it may be assumed, in fortifications, there was need to take precautions against conflagrations during action. Thus a fire bucket was usually part of the equipment of each gun. In the American navy about 1850 the fire bucket was of leather, with a

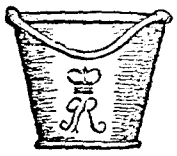

Figure 20

English water bucket. (From Peterson, Round Shot and Rammers, p. 37.)

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52. In addition to Hughes and Smith, this discussion of tubes is based on Gooding, op. cit., 50-51; and Manucy, op. cit., 26-27.

53. Rudyerd, Course of Artillery . . . 1793, plate 42. The use of the leather bucket for this purpose may have applied only to field artillery. On vessels of war the match tub was filled with water when clearing for action, and it may have been used to moisten the sponge.

leather-covered rope handle. When not in use for extinguishing fires it hung upon a hook between the gun ports.[54]

On shipboard it was the usual practice to drop the bucket on a line through the port into the sea to get water, but such a handy source was seldom available at inland posts such as Fort Vancouver. It would appear logical, therefore, that water barrels were kept full at all times in the bastion for use during fire and emergencies.

4. Budge barrel. The budge barrel, on American warships of 1850 at least, was a copper-hooped wooden keg supplied with a cover of bag leather which was pursed or drawn together by a cord drawn through holes in the cover. The cord also passed through a cap or hood which closed the aperture. It was used for bringing loose powder from the magazine for such purposes as firing salutes.[55]

5. Passing box. The passing box or powder bucket was, in the days when loose powder was employed, a rather small leather container, described as a "covered bucket," used to bring the charge to the gun. From it the loader filled his ladle. Even after the use of cartridges became

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54. Jeffers, op. cit., 201.

55. Ibid., 202.

general the passing box was retained for carrying the powder bags.

In 1850 the passing box in the United States Navy was a leather cylinder the inside diameter of which equalled the caliber of the gun. Its length was defined as "sufficient to contain the charge." It had a cover secured by a lanyard. It was used to protect the cartridge from accidental fire during transit from the magazine to the gun.[56]

Figure 21

American budge barrel. (From Peterson, Round Shot and Rammers, [65].)

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56. Jeffers, op. cit., 200; Manucy, op. cit., 25.

6. Match tub. In the American navy the match tub was a wooden container, shaped like a truncated cone. It had a round wooden cover pierced by several holes. It served to hold the match when the gun was not in use, but during the process of clearing for action it was filled with water.[57]

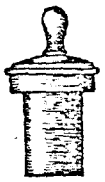

Figure 22

British artillery tompion. (From Peterson, Round Shot and Rammers, 37.)

7. Tompion. The tompion was a wooden cover which closed the muzzle of the gun and prevented the entrance of moisture. It fitted loosely into the bore, but it was attached by a lanyard to a wad which fitted the bore tightly.[58]

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57. Jeffers, op. cit., 200-201.

58. Ibid., 201.

CHAPTER V

COMPARATIVE DATA: MUSKET RACKS, ARMS CHESTS, AND OTHER FURNISHINGS

During the spring of 1849 new bastions were erected at Fort Nisqually, a Hudson's Bay Company post at the southern end of Puget Sound. The post journal on May 7 recorded: "Cowie finishing Bastions within, Linklater making two 'arm chests.'" Three days later it was noted that these two men were "furnishing Bastions inside setting up stands for Musketoons &c."[1]

Father A. G. Morice, the pioneer historian of the British Columbia interior, visited several Company posts during the 1880's while they still retained their defensive works. He recorded that each bastion contained "a stand of large muskets."[2] The Fort Langley journal for November 14, 1827, mentions that two men were "Cleaning the arms in the bastion."[3]

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1. Victor J. Farrar (ed.), "The Nisqually Journal," in Washington Historical Quarterly, X (July, 1919), 215.

2. A. G. Morice, The History of the Northern Interior of British Columbia (reprint ed., Fairfield, Washington: Ye Galleon Press, 1971), 113.

3. Douglas Leechman, Notes and Comments on Hudson's Bay Company Trading Posts . . . (typescript, 1958), section on bastion, p. 2.

Thus, although no positive evidence has yet come to light to show that small arms were kept in the Fort Vancouver bastion, there is ample testimony to the effect that such a practice was at least not unusual at Company posts in the Columbia District. And it seems reasonable to assume that some provision would be made for keeping rifles, muskets, and other small arms ready at hand in the bastion during times of emergency even if such weapons were not stored there on a permanent basis.

Indeed, such records as are available tend to show that small arms were not kept in the Fort Vancouver bastion as a regular procedure, though the evidence is certainly inconclusive. In the first place, the present writer has found no inventories for the bastion as such. As has been seen, the 3-pounders were listed either as "naval stores" or as "Cannon &c," under both of which headings were also recorded many items known not to have been in the blockhouse.

Of course the fort sales shop, the Indian trade shop, and the warehouses contained numerous rifles, muskets, trade guns, and other weapons. But these items were part of the Company's stock in trade and were not considered as being weapons kept on hand for the defense of the establishment, though undoubtedly they would have been employed had the

post been attacked. The only small arms which properly can be considered as Company property designed specifically for defensive purposes were "46 Muskets, old," "2 boarding Pikes," and "2 small swivel Guns" which appear on various inventories of "Articles in Use -- In Stores" between 1844 and 1848.[4]

The inference to be drawn from this fact is that these weapons were kept in one or more of the warehouses (which the H.B.C. called "stores"). There is no certainty about this matter however...It is possible that muskets physically located in the bastion would still be inventoried as "In Stores."

Under the circumstances the only safe conclusion seems to be that, in view of the known practice at other Western posts, the officers at Fort Vancouver would have made provision for storing small arms in the bastion even if these weapons were not to be housed there during times of peace. In addition to arms chests and musket racks, there quite possibly were other "furnishings" in the blockhouse, principally to keep the work ready for emergency action.

Diligent research has uncovered no specific information about the design of these chests, racks, and other furnishings.

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4. For examples, see H.B.C.A., B.223/d/155, MS, p. 143; H.B.C.A., B.223/d/181, MS, p. 157.

in bastions at other Hudson's Bay Company posts. The only original wooden blockhouse which survives is at Nanaimo, B. C., and it has been much altered inside. It has been necessary to turn to military sources for comparative data, and how far these are applicable is highly uncertain. The following paragraphs present what little information has thus far been uncovered.

Arms chests. No specifications or drawings of British military or naval arms chests have thus far been seen by the present writer. In fact, it is not even possible to suggest dimensions for such chests, since there seems no way of knowing which model or models of gun the "46 Muskets, old," were. Even if it could be demonstrated that they were government-pattern muskets, there were several types of "Brown Bess" muskets in circulation at that time, with barrel lengths being, for the most common models, either 42 inches or 39 inches.[5] Indian trade muskets also appear to have varied

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5. The earliest Long Land Pattern Musket ("Brown Bess") had a barrel 46 in. long, but about 1765-1768 a new musket, the Short Land, with a barrel 42 in. long was adopted for standard military use. Under the exigencies of the wars with France the so-called India Pattern Musket, with a 39-in. barrel, was adopted between 1794 and 1797, and hundreds of thousands of muskets of this size were produced before the Board of Ordnance returned, briefly, to the 42-in. barrel about 1802-1803. The 39-in. barrel was soon reinstated, however. After 1814 both 42-in. and 39-in barrels were manufactured. Howard L. Blackmore, British Military Firearms, 1650-1850 (London: Herbert Jenkins, 1961), 44; Anthony D. Darling, Red Coat and Brown Bess (Ottawa: Museum Restoration Service, 1970). 19, 36, 40, 52; William Greener, The Gun (reprint ed., Forest Grove, Oregon: Normount Technical Publications, 1971), 206-207

in length.[6]

In short, the best way to approach the matter of arms chests would seem to be to first acquire several muskets of the period (or reproductions) for display in the cases. Then the arms chest could be built to fit these weapons along the general lines of gun cases in use by the military today (or in the pattern of the earliest chests that can be located).

Musket racks. It has been seen that bastions in Western Hudson's Bay Company posts frequently contained racks for two types of small arms: muskets and musketoons. Pictures of these weapons will be found in Plates XV and XVI. No musketoons seem to have been carried on the Fort Vancouver inventories, however, so only racks for muskets will be considered here.

When designing racks for muskets, the dimensions of those weapons should be taken into consideration. But, as we have seen, the lengths varied. However, for purposes of discussion, a musket with a 39-inch barrel -- a frequently employed length -- will be taken as standard. Such a gun had an overall length of about 54 inches. The butt plate was 4-3/4 inches long.[7]

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6. Carl P. Russell, Guns on the Early Frontiers . . . (Berkeley: University of California Press, 1957), 103-121.

7. The overall and buttplate dimensions were measured by the writer from an actual specimen at Fort York, Toronto, May 15, 1973.

Several original British army racks for this type of musket were in the blockhouse at Fort York, Toronto, when restoration of that military post was begun in 1932. Reproductions were made and are now to be found placed at about 2-1/2-foot intervals around the insides of the blockhouse walls.[8]

This structure was built in 1813 and was occupied by troops until at least 1841. Thus it was not very far separated in time from the Fort Vancouver bastion. Further, at least two of the Company's "gentlemen" in the Columbia District had served in Canadian regiments during the War of 1812 and perhaps could have brought this idea for a musket rack with them.[9]

Each musket rack in the Fort York blockhouse consists of two main parts: (1) a rest or holder for the gun butt chiseled into one of the heavy planks which form the top of the firing step, and (2) a wrought iron bracket affixed to the blockhouse wall 37 inches above the butt rest (see Figure 23 and Plate XVII).

The butt rest is a slanting recess cut into the top of the firing step. The long dimension, 5 inches, runs

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8. J. A. McGinnis (Managing Director, Toronto Historical Board) to J. A. Hussey, Toronto, July 25, 1973, MS.

9. It should be noted, however, that these men, William Kittson and Pierre Pambrun, were both dead by 1845 when the Fort Vancouver bastion was built.

parallel to the blockhouse wall; the width of the recess is 2 inches; the depth slants from nothing at the end away from the bracket to 3/4 inch to 1-1/4 inch at the end immediately under the bracket.[10] The end under the bracket is rounded to hold the stock of the gun. The recess is set out about four inches from the wall (see Figure 23).

The wrought iron bracket consists of a 1/2-inch half-round bar, the ends of which taper and curve outward to form semi-circular hooks (see Figure 24 and Plates XVIII and XIX). This bar is welded to an iron plate 1/8 inch thick and measuring 4-3/4" x 1-3/4". The plate, in turn, is affixed by screws to a 6" x 3" wooden base which has beveled edges on the outer surface. The screws are an anachronism. In the early 1800's square-headed nails would have been used.

The bracket is not centered over the butt rest. Rather, the deep end of the butt rest is directly under the end of the right arm of the bracket (as viewed from the front).

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10. Evidently the depth of the recess varies. The one measured by the present writer was about 1-1/4 inch deep. Seemingly another measured by Mr. J. A. McGinnis was only 3/4 inch deep.

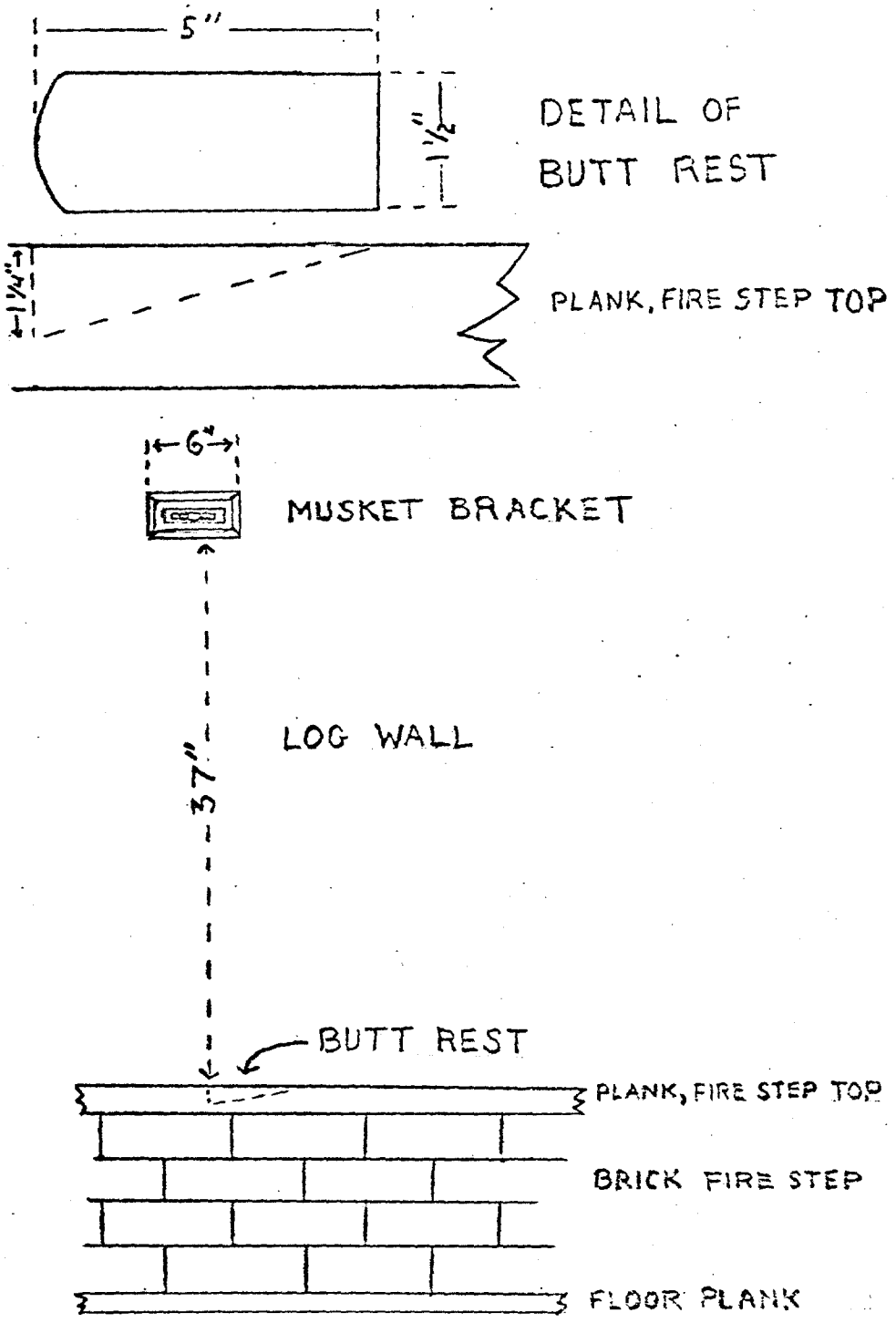

Figure 23

Musket rack, Fort York Blockhouse. Toronto. Lower portion: View of rack from front, showing fire step with bracket on wall above butt rest. Upper portion: Detailed top and side views of butt rest.

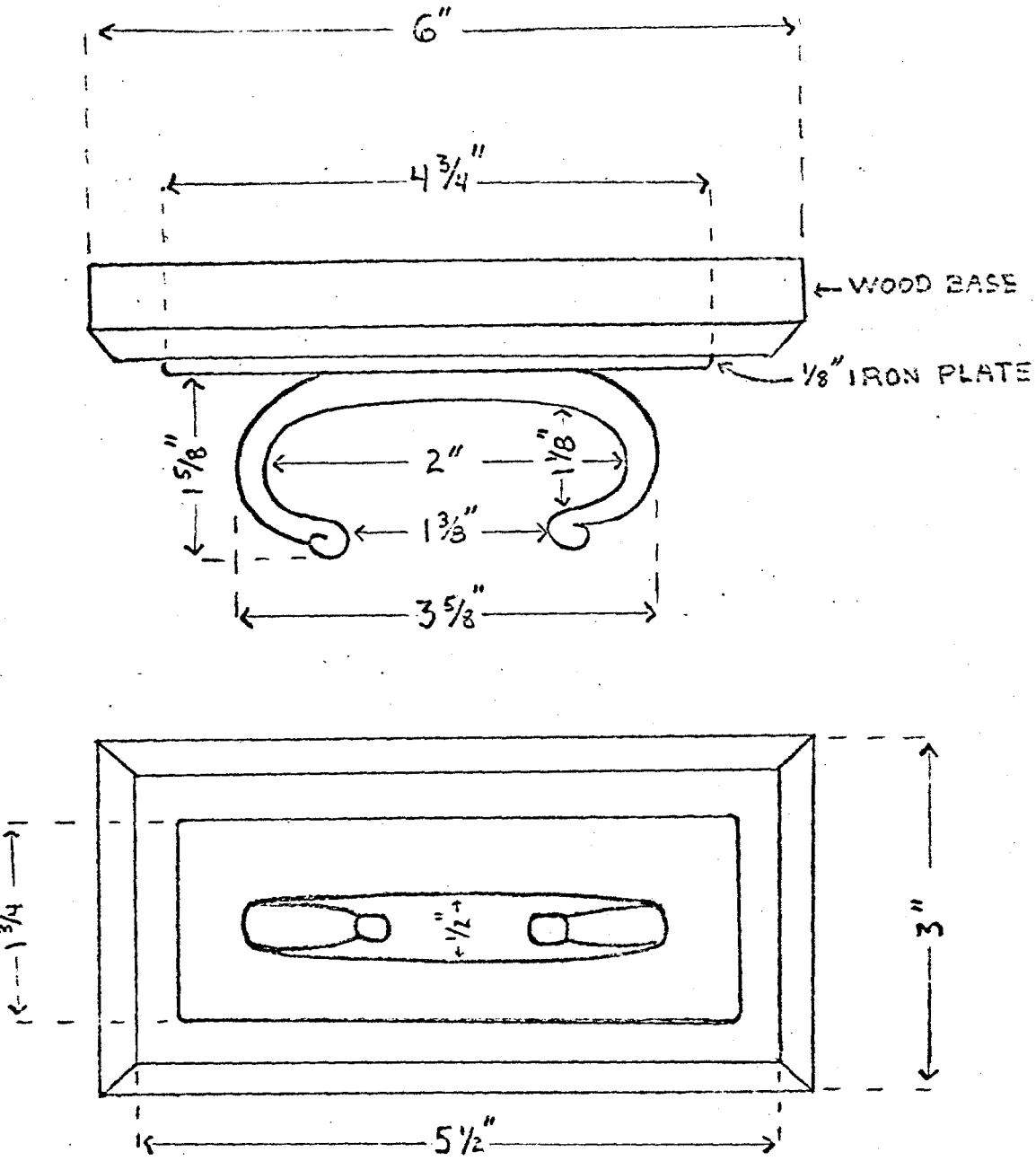

Figure 24

Musket bracket, Fort York Blockhouse, Toronto
Upper: Plan of bracket from the top.
Lower: Elevation of the bracket from the front.

As far as is known, there were no fire steps at Fort Vancouver. Thus if the Fort York type musket rack is selected for the reconstructed bastion, the butt rests will have to be cut into the wooden floors of the upper two stories. On the ground story, which in the reconstruction will have a compacted earth floor, some other arrangement will be necessary. Some type of shelf or bracket seems indicated.

No British model for such a butt rack having been found as yet, a plan for an infantry musket rack in a French army barracks, about 1854-1856, is presented in Plates XX and XXI. It is not suggested that this plan be followed or even adapted for use at Fort Vancouver. The French rack, which evidently was supported by a metal bracket, is much too elaborate for a Hudson's Bay Company post. But it is thought that the plan might indicate in a general way how a wooden rack might be shaped to support a wooden shelf into which the Fort York type of butt rest might be cut.

It perhaps should be noted here for the record that the gun ports and gun slits on the ground floors of military and frontier blockhouses ordinarily were placed rather high, so that persons could not easily shoot through them from the outside. Therefore the defenders inside the blockhouse,

in order to be able to shoot out of them, had to be in an elevated position, achieved by a fire step or by a floor raised above ground level.

There is another available British military gun rack which might be considered for adaptation for use at Fort Vancouver, though it is of a later period. The barracks at English Camp on San Juan Island, Washington, occupied by Royal Marines during the 1860's still stands. Before restoration was undertaken by the National Park Service, a remnant of the original gun rack was found. A plan of the remaining portion is given in Plate XXII.

Since the existing section of the rack, designed to hold the gun muzzles, was affixed to the wall 5 feet 11 inches above the floor, it is obvious that the butts of the weapons must have rested on a shelf or bracket. For a 54-inch musket, since only the barrel would fit into the upper bracket of the San Juan rack, the butt rest would have to be about 18 or 19 inches above the floor. And, for this type of rack, the long axis of the excavated butt rest would have to be at right angles to the wall.

Lighting arrangements. Although no mention is made in available inventories or descriptions of any lanterns, lamps, or other means of artificial lighting in the bastion, it is not unreasonable to suppose that some provision

was made to that end. While the interior of the octagonal cap would have been fairly light during the daytime if the gun ports were opened, the two lower stories must have been quite dark even on the brightest days. And since the bastion was at least partly intended for defensive purposes, some provision might well have been made to supply light on short notice for night actions.

Thus it is not unlikely that each floor of the bastion contained one or more lanterns. And since oil lamps were not often installed in the Company's posts during the 1840's, it is virtually certain that the source of illumination in any such lanterns would have been candles.

There seems no way of determining what type of lantern might have been used for this purpose, but again it seems reasonable to suppose that the flame would have been well protected in an area where gunpowder was employed. Naval vessels had battle lanterns for use in such locations, and the Hudson's Bay Company may well have followed this precedent. In the United States Navy during the 1850's, at least, the battle lantern was made of a hexagonal copper frame, glazed.[11]

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11. Jeffers, op. cit., 201.

Typical lanterns used in Canada during the period 1763 to 1830 are shown, among other lighting devices, in Figure 25. Since such items had long periods of use at Hudson's Bay Company posts, these types of lanterns would not necessarily have been outmoded at Fort Vancouver.

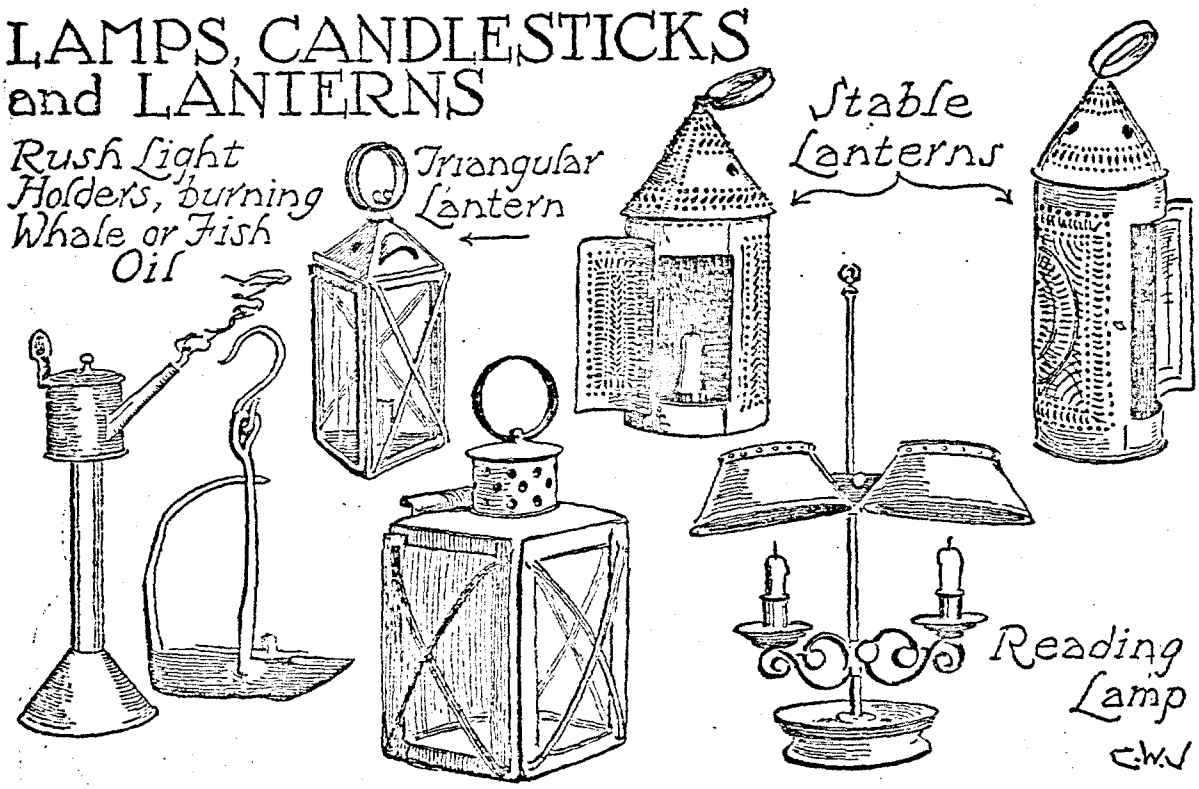

Figure 25

Canadian lighting fixtures, 1763-1830. (From C. W. Jeffreys, The Picture Gallery of Canadian History [3 vols., Toronto: The Ryerson Press, 1942-1950], II, 203.)

Water barrels. No mention is made in the available records of the presence of water barrels in the bastion. Yet water would have been required in modest quantity for wetting the sponges during firing. Also the Hudson's Bay Company, almost above all other dangers which might threaten its posts, feared fire. It seems reasonable to suppose that a supply of water for the immediate suppression of any flames that might break out would be kept on hand at such a vulnerable location as the bastion. For these reasons there is a good possibility that one or more barrels of water were kept constantly full on each floor of the blockhouse.

The Canadian Historic Sites Service in Ottawa has made a study of barrels at Hudson's Bay Company posts and has developed a source of supply for such containers made in the old style. If it is decided to place barrels in the bastion, it is suggested that inquiry be made of that Service.

CHAPTER VI

ADDITIONAL NOTES ON BASTION CONSTRUCTION

Since the completion of volume I of the Fort Vancouver Historic Structures Report a few fragments of information have become available which throw additional light upon details of bastion construction. The present report seems a convenient place to note this data so that they may be considered before reconstruction has reached its final stages.

Gun port lids. On page 43 of the Historic Structures Report, Historical Data, vol I, attention was called to the fact that the 1860 photograph of the bastion appeared to show that there may have been round holes or ports in the shutters or lids which closed the gun port openings but that the picture was not sufficiently clear to make certain.

During May, 1973, the present writer had an opportunity to examine what apparently is one of the original or very early prints of this picture in the Provincial Archives of British Columbia (Photograph No. 11074). It is now possible

to state that each lid definitely contained a round port, though each appeared to be plugged by a light-colored material when the photograph was taken in 1860.[1]

Tackle for opening gun port lids. In the Historic Structures Report no precise method was suggested for opening the square gun port lids. These lids, or shutters, were hinged along the top and opened outward from the bottom; and it was supposed that, like those at Nanaimo, they were raised from within by ropes. The installation of iron rings on the outside of each shutter near its lower edge was recommended.[2] But the exact method of arranging the tackle to accomplish the raising of the lid was left unmentioned.

There has been an implication throughout the present report that many features of the artillery at Fort Vancouver closely paralleled corresponding features in the ships of the Royal Navy. There is no proof of this similarity, but its existence is a reasonable assumption when one considers the weight of precedent and example in determining conduct.

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1. Not entirely ruled out, however, is the possibility that these ports were painted on the shutters, though in such case why they appeared so fresh in 1860, when the fort had not received maintenance for several years, is difficult to explain. To settle this question, it is suggested that the Royal Engineers Archives, Brampton Barracks, Kent, England, be asked to make an enlargement from the pertinent section of the original glass negative. In fact, it would be well to get a series of enlargements showing every building in the three 1860 photographs on a large scale.

2. Hussey, Historic Strucures Report, Historical Data, Fort Vancouver, vol I, pp. 42-43.

D6215-CD-THP

OCT 4 1973

Memorandum

To: Regional Director, Pacific Northwest Region

From: Manager, Denver Service Center

Subject: Fort Vancouver Furnishings Study

In fulfillment of a 1973 project, implemented by our purchase order of April 13 last, Dr. John A. Hussey has completed a manuscript report entitled "Armament and Furnishings of the Fort Vancouver Bastion." We are pleased to supply your office with a Xerox copy. The Superintendent was given a copy by Mr. Mattes when he visited the reconstruction project on September 7. Other limited distribution is indicated below.

There will be no distribution of this report outside the Service, and those copies distributed in-house should be restricted to in-house professional use. The reason for this restriction is that a substantial part of the research was done in Hudson's Bay Company records and permission to do such research was contingent upon such limited use. Meanwhile we are asking the H.B.C. Archivist in London to clarify the extent of these restrictions.

We are impressed with the thoroughgoing professionalism and gratifying specifics of Dr. Hussey's report on a very difficult subject. It is so thorough that we question that a separate "Furnishings Plan" by Harpers Ferry is needed; rather, it seems, curatorial services can proceed whenever funded. Meanwhile, certain furnishings and armaments which might affect details of the current building reconstruction--especially on the gun deck--are being studied by this office.

(Sgd) Glenn O. Hendrix
Glenn O. Hendrix

Enclosure
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Director, OAHP, WASO, w/encl.
Superintendent, Fort Vancouver NHS, w/encl.
Manager, Harpers Ferry Center, w/encl.
Harold Peterson, Springfield, Va., w/encl.
CD-THP

MJMattes:ak 9/17/73

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CD-THP

MJMattes:ak 9/17/73

Thus it is possible that the arrangements made for raisng gun port lids on British naval vessels may also have been used at Fort Vancouver.[3] Dudley Pope in his book, Guns, provides a drawing which depicts the Royal Navy's lid tackle at about the time of the Napoleonic Wars.[4] The sources upon which it is based are not indicated. For what it is worth, an adaptation of the picture is provided in Figure 26. It shows the tackle as made fast when the lid was raised.

Since Pope does not provide a view of the outer face of the gun port lid, the mechanics of the arrangement are difficult to reconstruct. It would seem to the present writer that it would have been more efficient to place the holes through which the tackle entered higher on the side of the ship. There apparently is room for further research on the point.

In United States ships of the line the gun ports were "triced up" by the "port tackle" which was hooked to a "pendant" which passed through the side. In other U. S. Navy vessels "port lanyards" were employed to haul up and secure the "half ports."[5] Again, the exact mechanics of these arrangements are not apparent.

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3. It is worth noting that H.M.S. Modeste was anchored off Fort Vancouver for three weeks during July, 1844, the very period during which serious planning for the bastion began.

4. Dudley Pope, Guns (London, Spring Books, 1969), 146.

5. Jeffers, A Concise Treatise on the Theory and Practice of Naval Gunnery, 198.

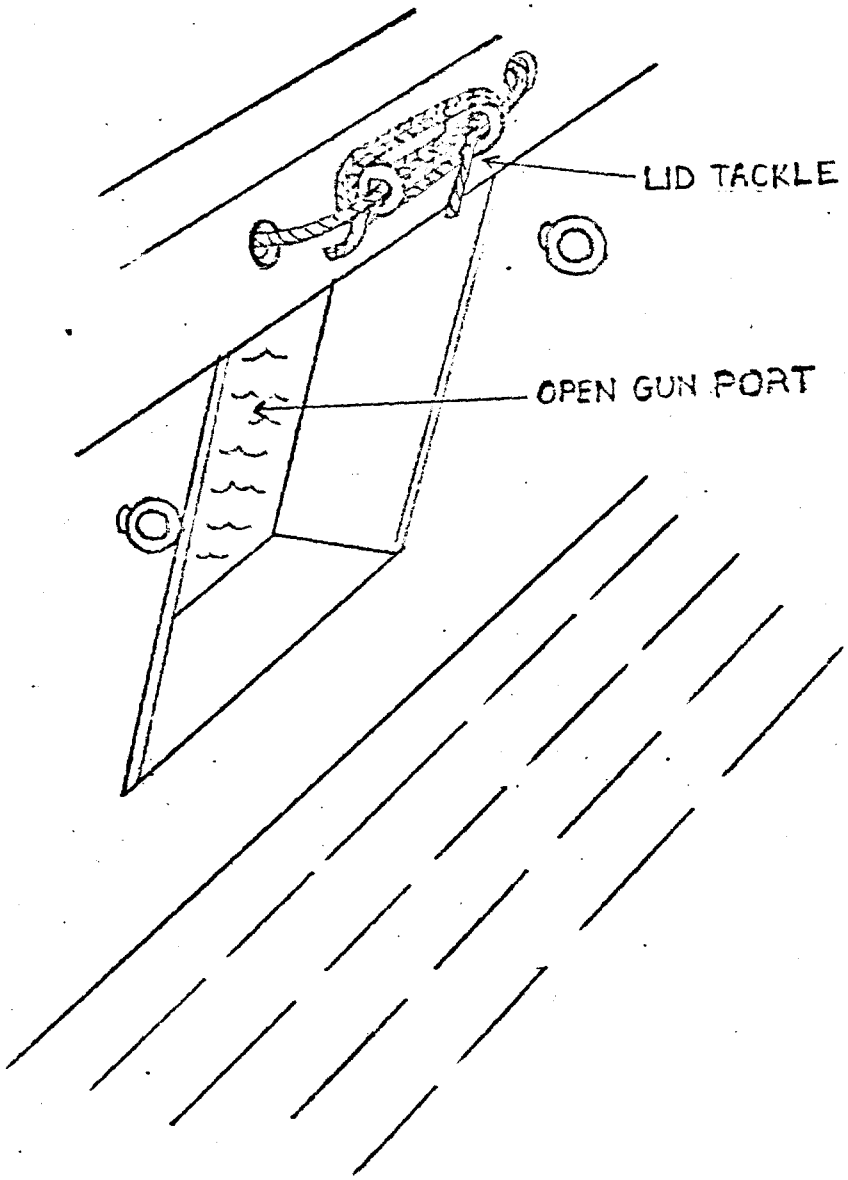

Figure 26

Method of fastening port lid tackle in the Royal Navy during the Napoleonic Wars. (Adapted from Dudley Pope, Guns [London: Spring Books, 1969], p. 146.)

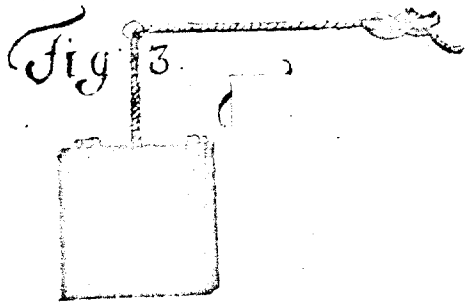

Figure 27

Arrangement for raising the smaller-sized gun port lids on a Swedish warship, 1705. (From Donald Macintyre and Basil W. Bathe, Man-of-War: A History of the Combat Vessel [New York: McGraw-Hill Book Company, 1969], p. 45.)

The persistence of tradition in maritime matters is well demonstrated by contemporary drawings of a Swedish warship of 1705. These show that the port lid was raised by a rope attached to a ringbolt placed low on the outer surface of the lid. The rope passed through a hole in the side of the ship and was made fast to a cleat on the inside. A stop or block on the rope kept the lid from being drawn completely upright (see Figure 27). This arrangement probably approximates quite closely that used at Fort Vancouver.

CHAPTER VII

RECOMMENDATIONS

1. It is suggested that a diligent effort be made through circularizing gun dealers, museums, and other sources known to National Park Service curators to purchase an English iron ship gun 3'6" long and weighing about 560 pounds. With one such gun as a pattern, the remaining seven could easily be founded.

2. Failing the discovery of a gun to purchase, every effort should be made to locate a piece of the correct size and weight in a public or private collection. Once located, an expert pattern maker could be employed to take all the measurements necessary to make an accurate mold.

3. If no such gun can be purchased or located, the Service should send a gun expert and/or a pattern maker to the Maritime Museum of British Columbia in Victoria to measure the 3-pounder Hudson's Bay Company gun on exhibit there. With these measurements as a base, a pattern could be made for a gun approximately eight inches longer. In other words, that 34-inch gun could be stretched out to 42 inches. The 3-pounder field pieces at several locations

in Canada could not be used for patterns even though their lengths might be correct since, as far as can be learned, they are of bronze, and bronze guns were somewhat smaller in diameter than iron pieces of the same caliber. Also, it is believed that these guns do not have the breeching loop.

4. The carriages should be ship carriages of the general design for those of about 1840 described on pages 43-45 and pictured on page 45 of this report. The dimensions of the parts should be as given in Robertson's table (pages 50-51 of this report) but modified where necessary in accordance with the dimensions of the guns and the height of the gun ports.

If elm is not available for the larger wooden parts (except for the oak axletrees), oak should be used throughout. The trucks should be of wood, and all should be of the same size.

5. The guns and the iron parts of the carriages should be painted black; the wooden parts of the carriages should be grey.

6. The guns and carriages should be equipped with breeching and tackles as described in this report. The breeching should be a three-strand, hand-made rope with a diameter which would fit easily through an iron ring with an inside diameter of 2.22 inches. The tackles should

be installed as described on pages 57-59 of this report.

7. Ninety-four round shot, 3-pound caliber, should be distributed among the eight guns. The round shot should be in small symmetrical piles, the bases of which should be kept in place by low confining frames of wood. The 50 canister shot, packed 30 in one box and 20 in the other, should be at convenient locations on the third floor of the bastion. See page 71 of this report for dimensions of the boxes. These shot undoubtedly will have to be replicas, although several small balls have been found at Fort Vancouver. A few 3-pounder grape shot might also be exhibited in the bastion if desired, but since the caliber of the post's stock of grape shot is not known, it probably would be best to omit grape shot.

8. No large powder barrels should be on exhibit in the bastion. They undoubtedly were kept in the magazine.

9. The following side arms, fabricated according to the data in this report or, better, duplicating actual museum specimens, should be exhibited on the third floor of the bastion:

8 combination sponges and rammers

1 worm

1 powder scoop

8 handspikes

1 linstock

2 portfires, with holders

10. The above side arms should be distributed, as far as that is possible, among the guns and stored horizontally on wall brackets, one set of brackets above each gun port.

11. The following accessories should be in the third story:

8 leather water buckets (hung on hooks between the guns)

1 budge barrel

1 passing box

4 priming wires

8 wooden match tubs

8 tompions

12. Racks for 46 muskets should be placed in the bastion, divided about as follows: 16 on the top floor, 16 on the second floor, and 14 on the ground floor. The racks should be either like those at Fort York or like those at English Camp, San Juan Island. If the ground floor is to have an earth floor, a shelf will have to be provided as a butt rest for each rack on that story.

13. If a suitable pattern for an arms chest can be found, one chest should be placed on each floor of the bastion. The dimensions of the chests will depend to

some extent upon the type of musket obtained for exhibit purposes.

14. At least two lanterns, lighted by candles and similar in design to naval battle lanterns, should be hung on each floor of the bastion.

15. Two water barrels should be placed on each floor of the bastion. These must be old-style, hand-made barrels.

16. Cleats should be provided beside each gun port for making fast the ropes or lanyards used to raise the port lids. Probably the Hudson's Bay Company used rope for lifting the lids rather than chain.

17. Iron rings should be attached to the outer sides of the port lids for affixing the ropes used to raise the lids.

18. Round holes, sufficiently large to take the muzzles of the guns, should be cut in the port lids. These holes should be surrounded by narrow rings of white metal, probably tin; or, to put it another way, the rings should have a protective lining of metal. The size and appearance of these holes should be determined only after further studies are made of the 1860 photograph showing the bastion as suggested on page 110 of this report. The diameter of the gun muzzle and the elevation of the gun above the sill of the port will also be determining factors.

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APPENDIX

Letter from Mr. J. Munday, August 10, 1973

After the main text of this report was completed, the following kind letter was received from Mr. J. Munday, Deputy Keeper, Department of Weapons and Antiquities, National Maritime Museum, Greenwich, England. On the whole, it appears to confirm conclusions arrived at independently in this report, but it contains additional information which makes the inclusion of this valuable letter advisable.

NATIONAL MARITIME MUSEUM

Greenwich

London SE10 9NF

Our Ref: H73/2825 10 August 1973

Mr. J. Hussey
Woodland Way
Piedmont
California
United States of America

Dear Mr. Hussey

BLOCKHOUSE GUNS

Thank you very much for your enquiry, which is most interesting.

I am afraid the truth is that we know very little about

commercially produced guns of the 1840s. The fact that they are spoken of as ship's guns, means that they were the armament carried by merchant ships and their shape and design at this late period could be considerably different from Service ordnance.

I have consulted The Armouries at the H. M. Tower of London, which is the national collection in this respect, and, unfortunately, they too are unable to give any help. A weapon of only 5cwt. is obviously lighter than a service piece of the same size.

It looks to me as if the 3 pounder iron gun had gone out of use in the British Army by 1820. Certainly it is not mentioned in an 1848 list of the armament of H. M. Ships, even as a boat's gun. It would be useful if one could find an illustrated catalogue of the wares of the iron founders, Coulson Dukes & Company, but this so far I have not been able to discover.

I do not see why a ship gun need be on a ship carriage. We have one or two here which are mounted on garrison carriages and numbers exist in old fortresses round the coast of England. Very often the only difference seems to be the provision of iron trucks, or wheels, in place of wooden ones.

It is interesting that the Carron Company of Falkirk, Scotland is producing replicas of their eighteenth and early nineteenth century guns and carronades for ornamental purposes only. But they only make, what they call a signal gun, which is 39-1/4 inches overall, on a cast iron carriage at £60, and an 8ft. gun, also on a cast iron skeleton carriage, at £450, called a Waterloo pattern

If I can come across anything further, I shall let you know. I am sorry not to be of more help.

Yours sincerely

/s/

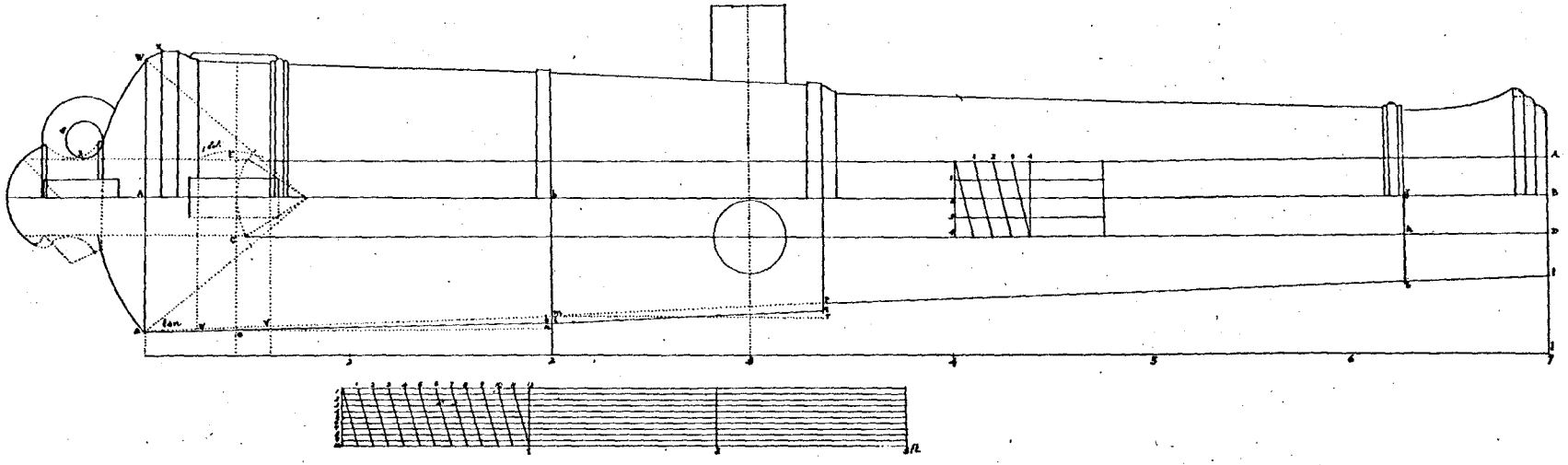
J. Munday
Deputy Keeper
Department of Weapons and Antiquities

Plate I. Plan of a British 12-pounder ship gun, 1791. This diagram clearly reveals that the breeching ring had been introduced by that date and that the trunnions were no longer tapered. Note the positioning of the trunnions below the axis of the gun.

From Charles William Rudyerd, Course of Artillery at the Royal Military Academy . . . (Ottawa: Museum Restoration Service, 1970), plate 11.

Pl. 11.

Draught of an Iron 12 Pounder Sea Service Gun of 7½ feet in length shewing the general Principle upon which Iron Sea Service Guns are constructed



R.M. Academy Oct.r 17th 1791

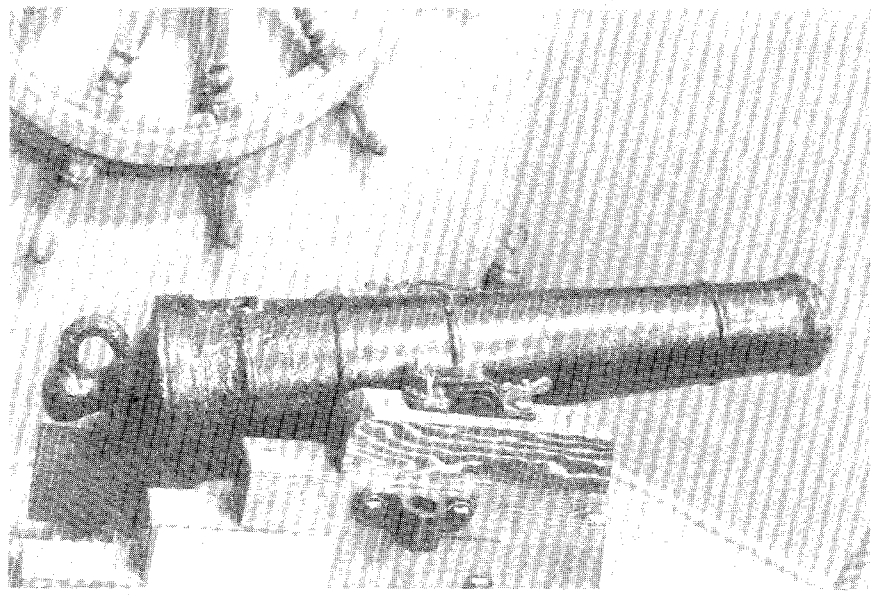
W.m Rudyerd

Plate II. Iron 3-pounder ship gun on display in the Maritime Museum of British Columbia, Victoria. It is said to have once belonged to the Hudson's Bay Company. Its length of 34-1/16" proves that it could not have been one of the weapons in the Fort Vancouver bastion.

Photograph by J. A. Hussey

Plate III. Replica of the 3-pounder in the Maritime Museum of B. C. made for Dr. H. P. Plasterer by Victoria Foundries Ltd. It will be noted that the replica is not exact in all particulars.

Photograph by J. A. Hussey



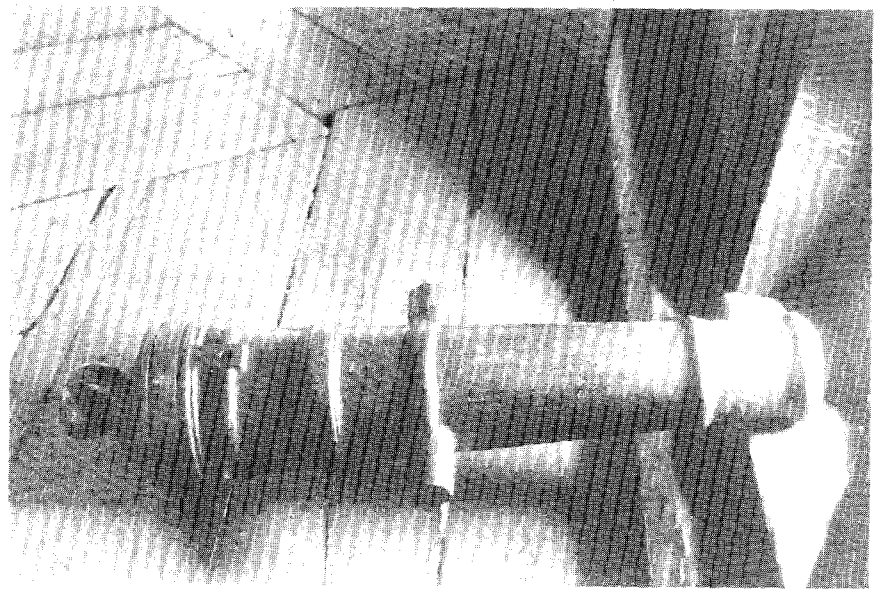
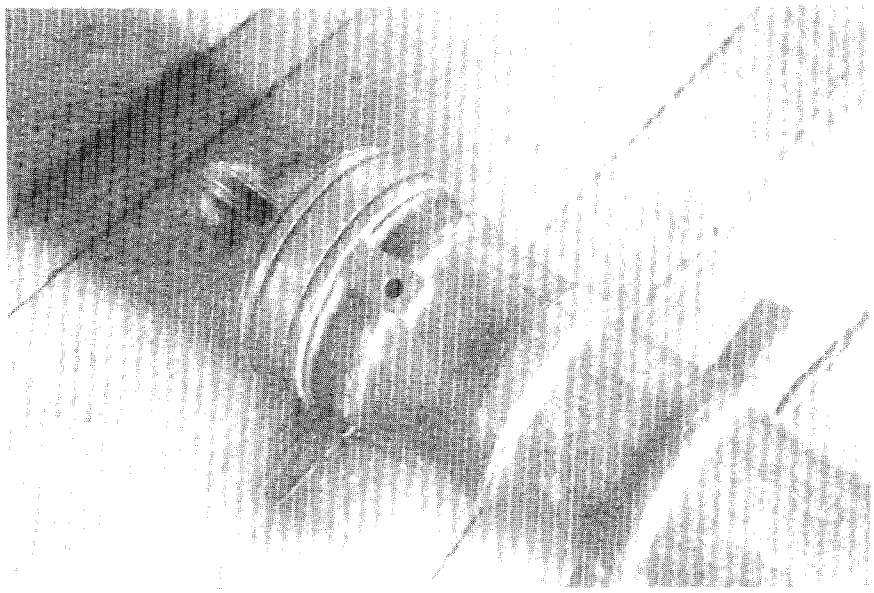


Plate IV. Breech end of replica 3-pounder in Dr. H. P. Plasterer's Fort Victoria Museum, Victoria, B. C.

Photograph by J. A. Hussey

Plate V. Breech end of replica 3-pounder at Fort Victoria Museum showing breeching loop and button. Note how much higher the trunnions appear to be than those on the original gun shown in Plate II.

Photograph by J. A. Hussey



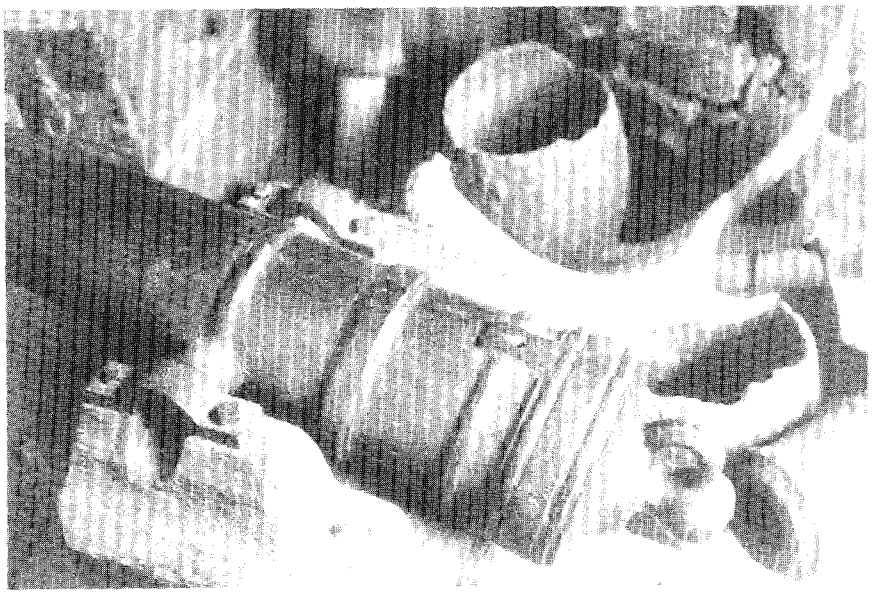


Plate VI. Replica 3-pounder at Fort Victoria Museum. The trunnions appear to be centered on the axis of the gun instead of below it as was usual on British guns of the period.

Photograph by J. A. Hussey

Plate VII. Plan of a British ship carriage for an iron 24-pound gun, c. 1775. Drawn by M. A. Edson, Jr., from specifications in John Robertson, Treatise of Such Mathematical Instruments As Are Usually Put into a Portable Case . . . (London, 1775).

From Nautical Research Journal, vol. 12, no. 3, p. 114.

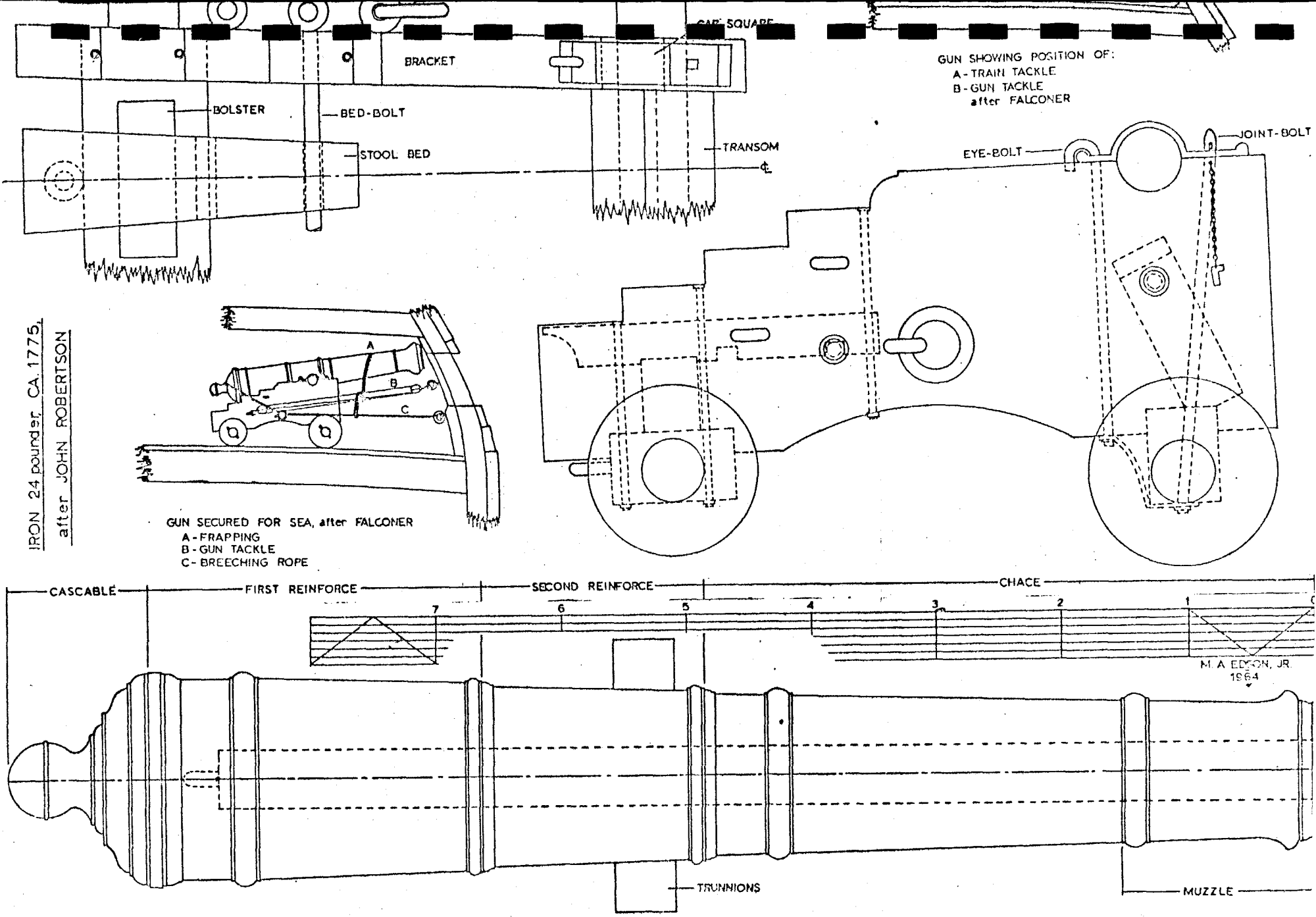
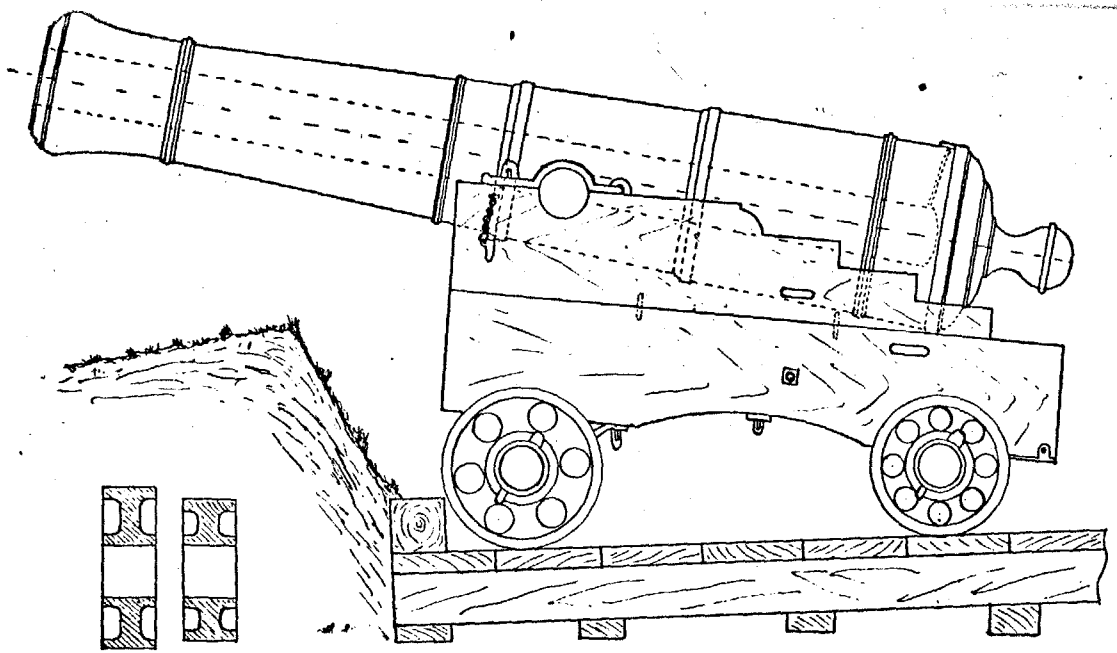
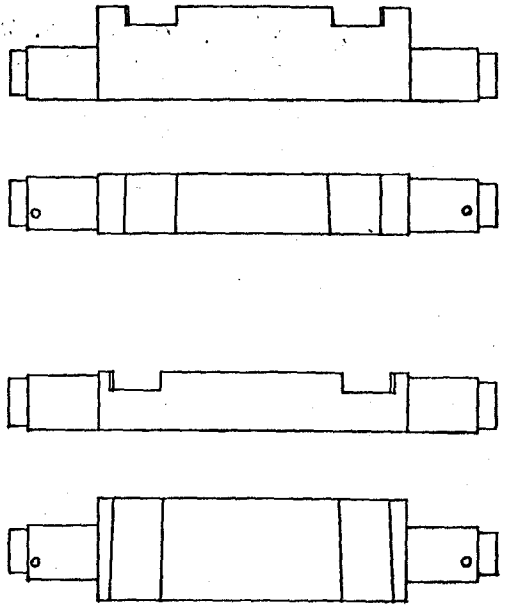
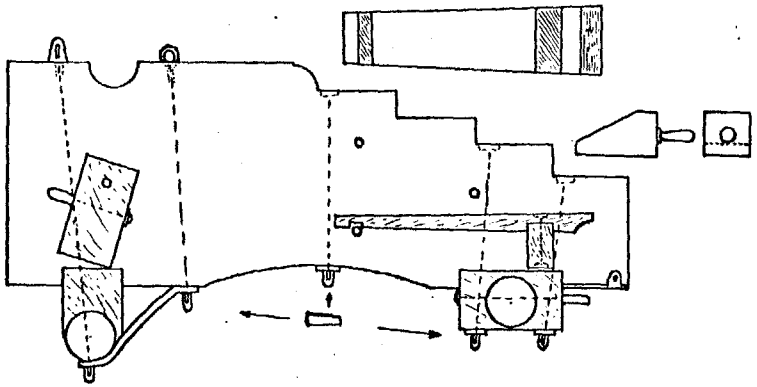

CAP SQUARE
BRACKET
BOLSTER
BED-BOLT
STOOL BED
TRANSOM
GUN SHOWING POSITION OF:
A - TRAIN TACKLE
B - GUN TACKLE
after FALCONER
JOINT-BOLT
EYE-BOLT
A
B
C
GUN SECURED FOR SEA, after FALCONER
A - FRAPPING
B - GUN TACKLE
C - BREECHING ROPE
IRON 24 pounder, CA. 1775,
after JOHN ROBERTSON
CASCABLE
FIRST REINFORCE
SECOND REINFORCE
CHACE
7
6
5
4
3
2
1
M. A. EDSON, JR.
1964
TRUNNIONS
MUZZLE

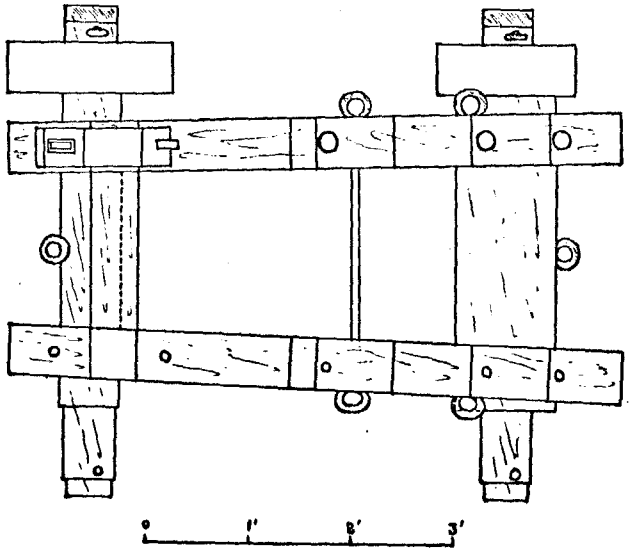
Plate VIII. Pattern for a British garrison carriage for a 32-pound iron gun, 1760-1790.

From Harold L. Peterson, Round Shot and Rammers (Harrisburg, P.: Stackpole Books, 1969), p. 37.









PATTERN FOR ENGLISH 32-PDR IRON GUN AND GARRISON CARRIAGE, 1760 - 1790

Plate IX. Elevation of a British 24-pounder garrison carriage, 1791.

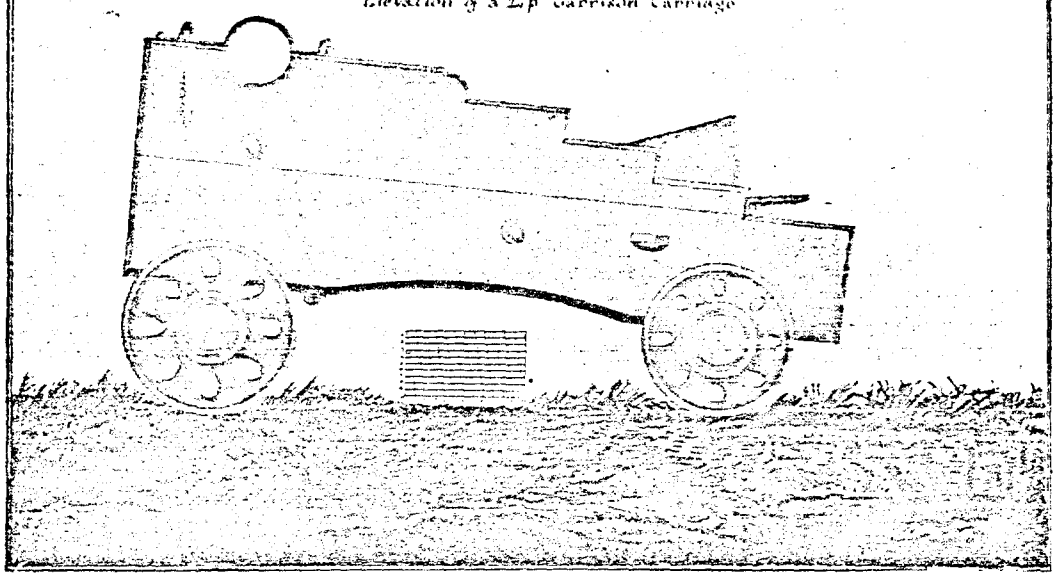
From Rudyerd, Course of Artillery, plate 49.

Plate X. Plan of a British 24-pounder garrison carriage, 1791.

From Rudyerd, Course of Artillery, plate 48.

Pl.49

Elevation of a 24ᵖ Garrison Carriage



Pl.48

Plan of a 24 Pᵗ Garrison Carriage.

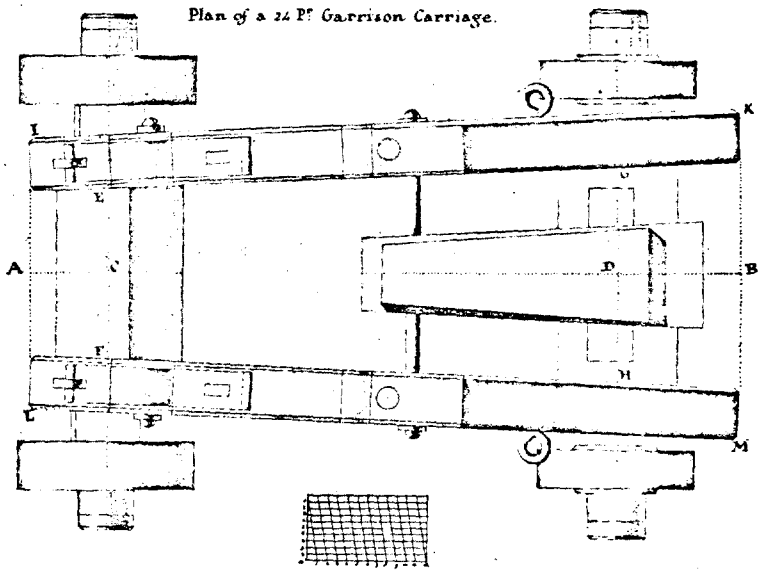
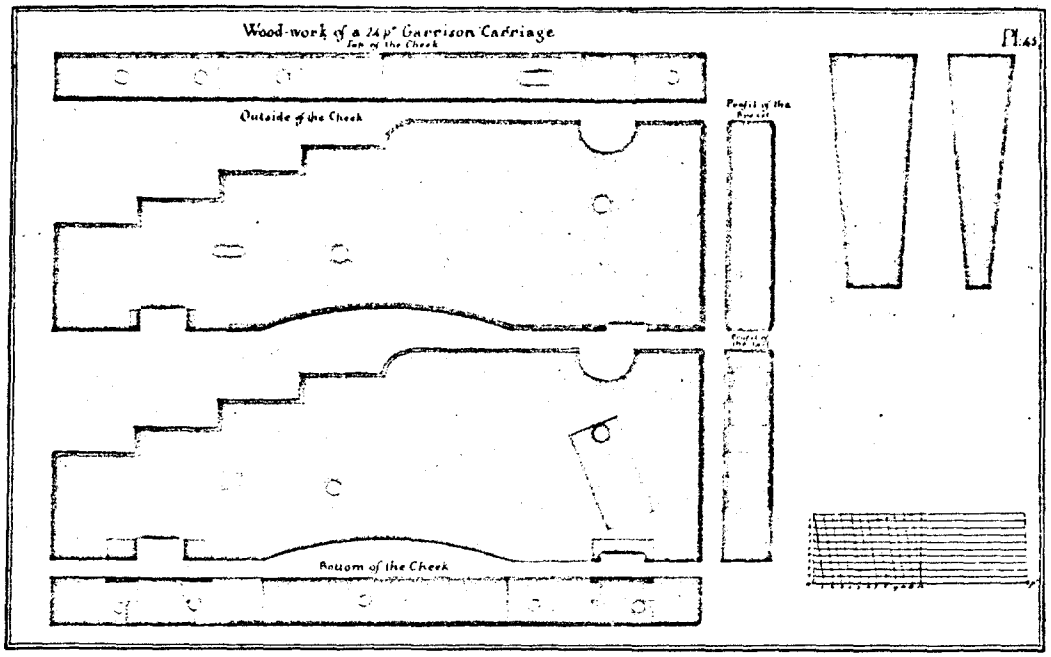


Plate XI. Larger wooden parts of a British 24-pounder garrison carriage, 1792.

From Rudyerd, Course of Artillery, plate 45.

Plate XII. Smaller wooden parts of a British 24-pounder garrison carriage, 1792.

From Rudyerd, Course of Artillery, plate 46.


Wood-work of a 24ᵖʳ Garrison Carriage
Pl.45
Outside of the Cheek
Bottom of the Cheek

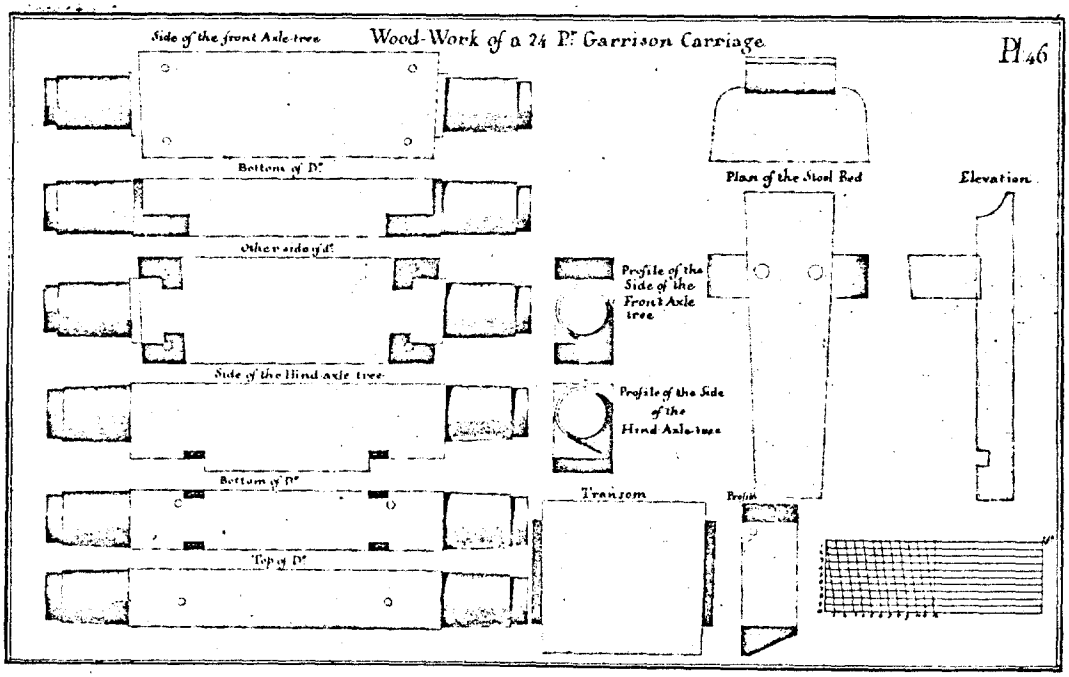
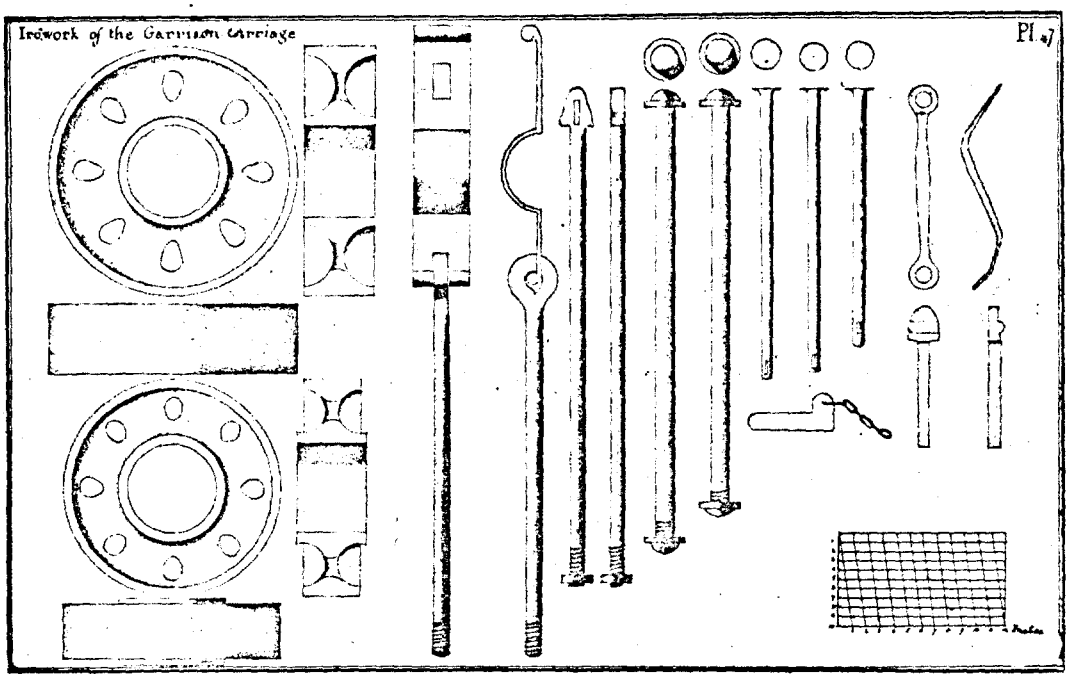

Side of the front Axle-tree
Wood-Work of a 24 Pr Garrison Carriage
Pl.46
Bottom of Dr
Other side of dr
Side of the Hind Axle tree
Bottom of Dr
Top of Dr
Plan of the Stool Bed
Elevation
Profile of the Side of the Front Axle tree
Profile of the Side of the Hind Axle-tree
Transom

Plate XIII. Ironwork of a British garrison carriage, c. 1792.

From Rudyerd, Course of Artillery, plate 47.

Plate XIV. Side arms of a British 6-pounder field gun, 1792.

From Rudyerd, Course of Artillery, plate 43.


Ironwork of the Garrison Carriage
Pl. 47

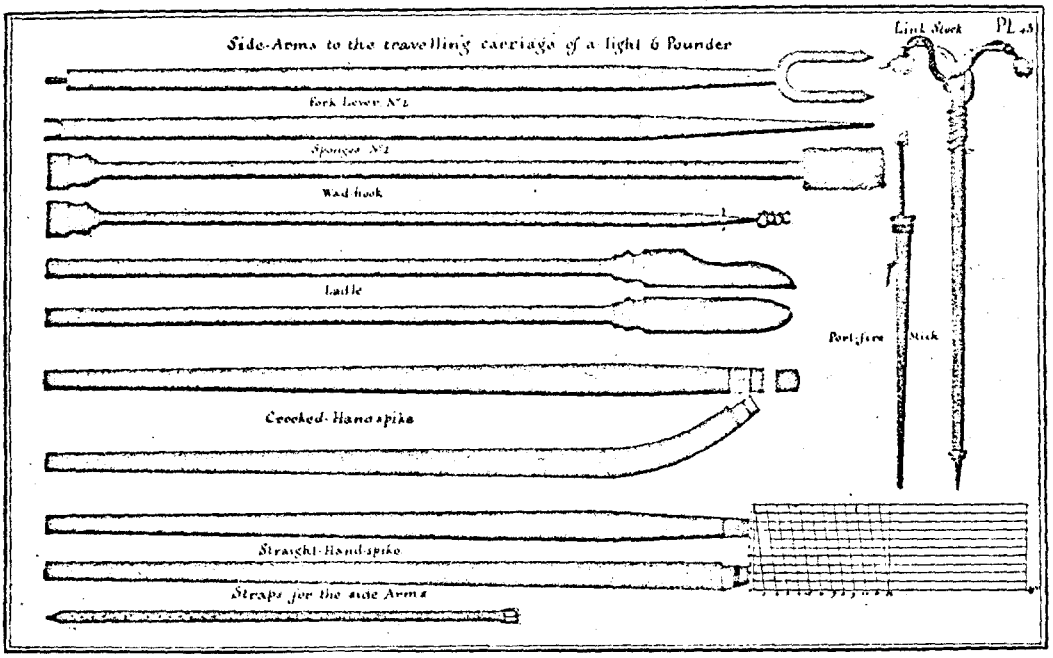

Side-Arms to the travelling carriage of a light 6 Pounder
Pl. 48
Link Stock
Fork Lever N°2
Sponge N°2
Wad hook
Ladle
Portfire Stick
Crooked Handspike
Straight Handspike
Straps for the side Arms

Plate XV. India Pattern Musket (left). The India Pattern Musket, with 39-inch barrel, was the standard British army musket from the 1790's to the end of the Napoleonic Wars. So many were manufactured that they continued in public and private use for many years. The overall length of this gun was about 54 inches. The weapon on the right is a muzzle-loading rifle.

From Blackmore, British Military Firearms, p. 146.

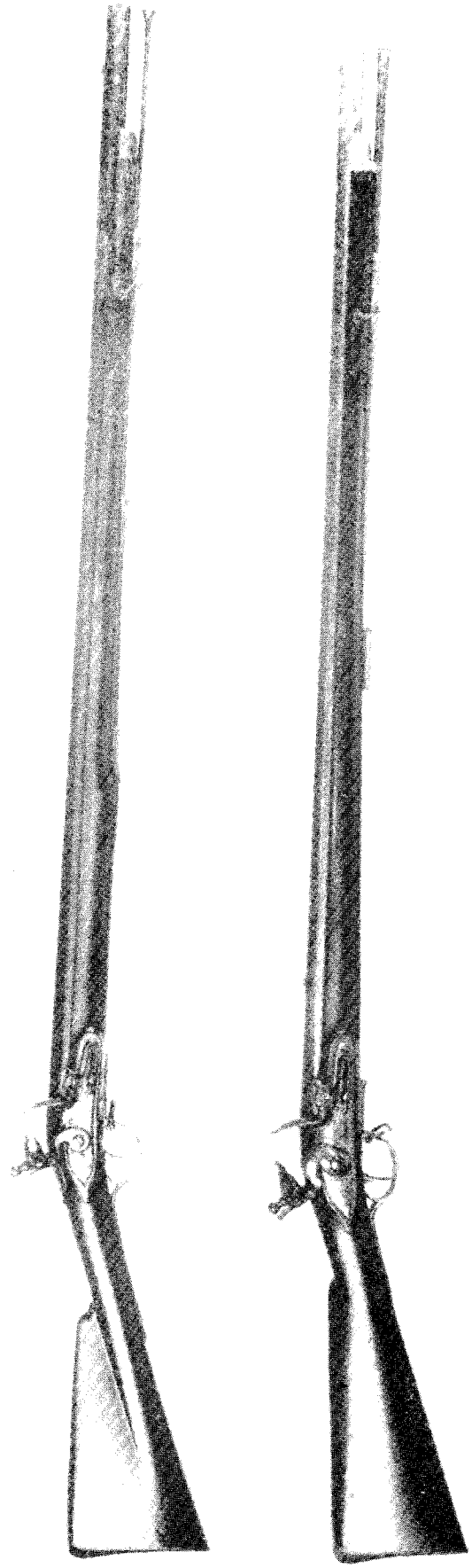


Plate XVI. Musketoons. The musketoon was a short smooth-bore gun which threw a charge of up to about 12 bullets. The sizes of these examples may be estimated from the fact that the one on the right had a 16-inch barrel.

From Blackmore, British Military Firearms, p. 99.

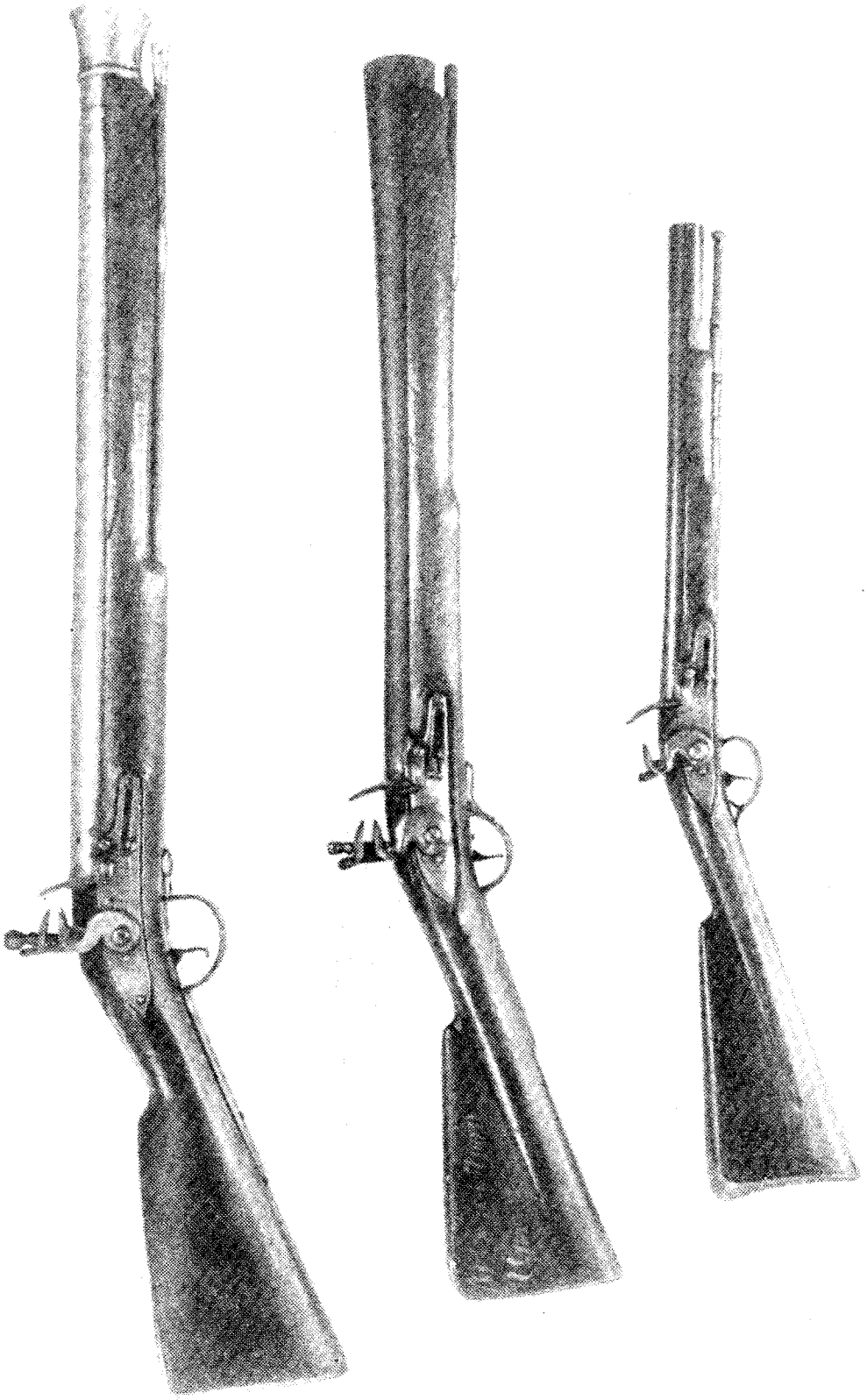


Plate XVII. Musket racks, Fort York Blockhouse, Toronto. The two brackets shown are reproductions of originals found in the blockhouse when restoration was begun in 1932. Fort York, a British army post, was destroyed in 1813 but soon rebuilt. It was the main garrison for the Toronto area until 1841. The butt of the musket rested in a slanting recess cut in the fire step. The base of the iron bracket is 37 inches above the fire step.

Photograph by J. A. Hussey

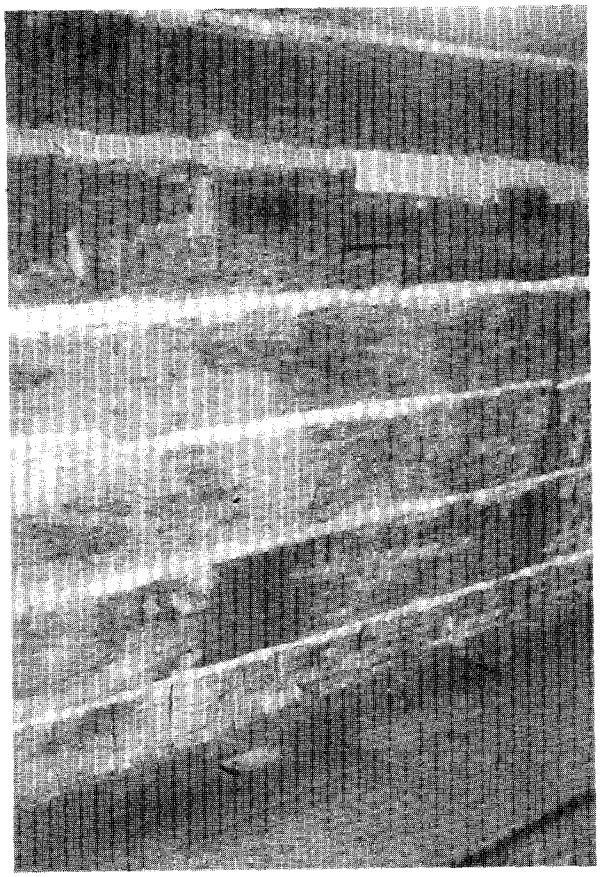
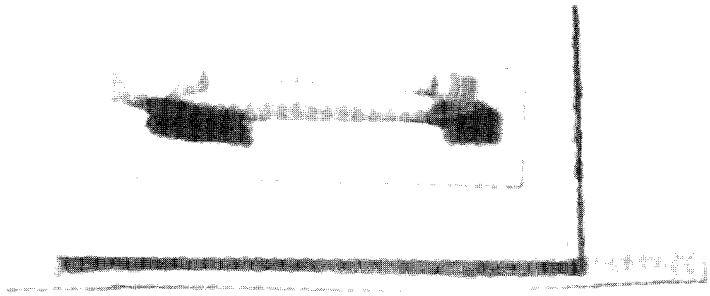


Plate XVIII. Musket rack bracket, Fort York Blockhouse, Toronto. View from front. This reproduction wrought iron bracket is welded to an iron plate, which in turn is affixed to a wooden base. The screws used to attach the iron plate to the base obviously are anachronisms.

Photograph courtesy of Mr. J. A. McGinnis, Managing Director, Toronto Historical Board.

Plate XIX. Musket rack bracket, Fort York Blockhouse. View from top. This bracket is affixed to the inner side of the blockhouse wall 37 in. above the fire step.

Photograph courtesy of Mr. J. A. McGinnis, Toronto Historical Board.



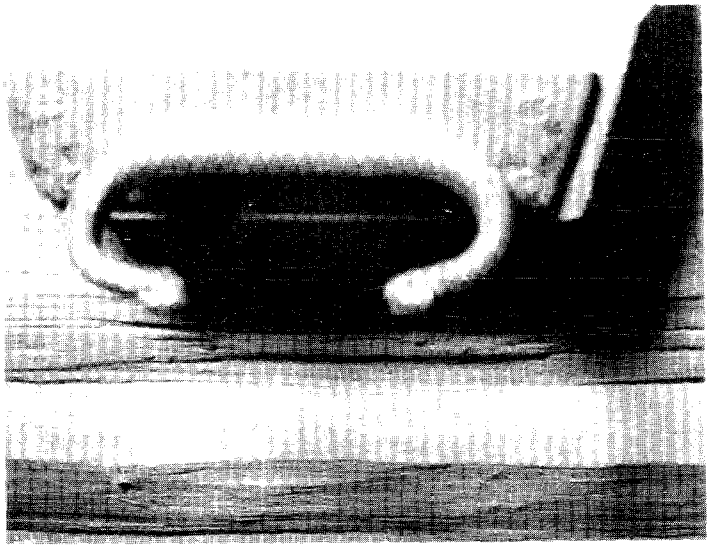


Plate XX. Arm rack in French military barracks, 1854-1856. This versatile rack could be used for guns of various lengths by adjusting the position of the butt rack. Measurements on the plan are in metres.

From Maj. Richard Delafield, Report on the Art of War in Europe in 1854, 1855, and 1856 (36 cong., 1 Sess., Senate, Ex. Doc. 59 [Serial 1036], Washington, D. C., 1860), plate 39.

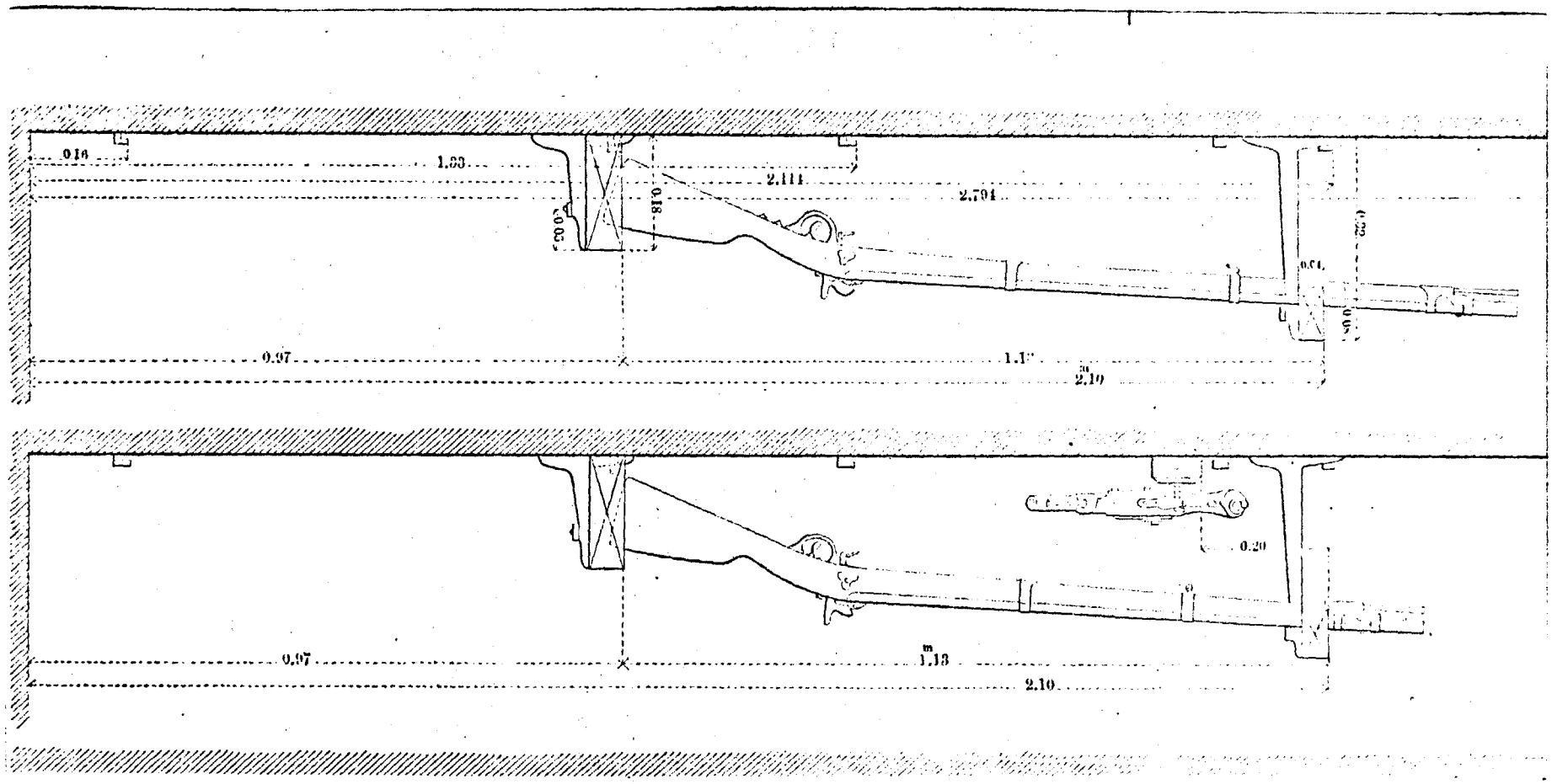
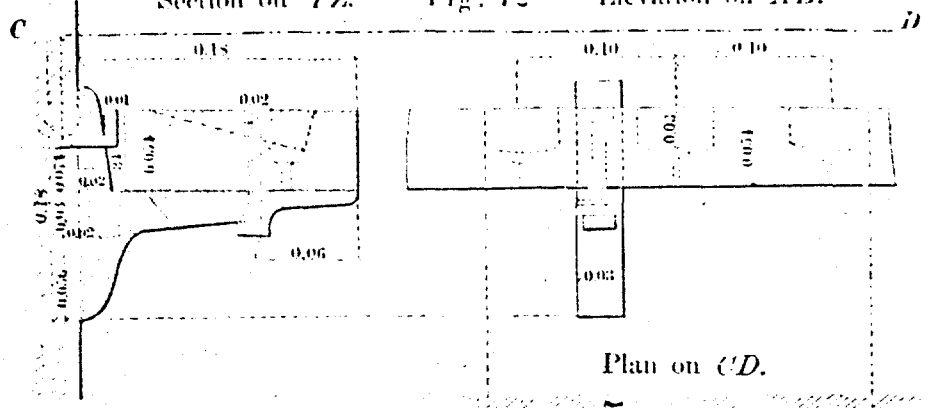

0.16
1.33
2.111
2.794
0.18
0.05
0.22
0.04
0.08
0.97
1.13
2.10
0.20
0.97
1.13
2.10

Plate XXI. Details of French arm rack, 1854-1856. The three upper diagrams provide details of the butt rack and shelf. The lower diagram is a plan of the barrel bracket as viewed from the top. When the arm rack was used for muskets, the top of the barrel bracket was 1.13 metres above the top of the butt rack shelf.

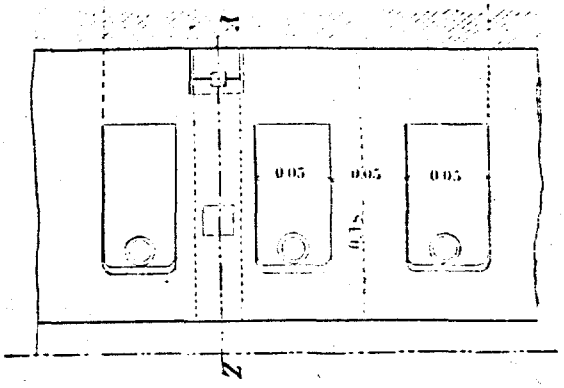
From Delafield, Report on the Art of War in Europe, plate 39.

Details of the Butt Rack and of its Shelf.

Section on *YZ*. Fig. 12 Elevation on *AB*.



Plan on *CD*.



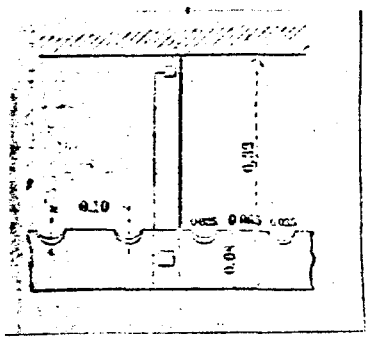
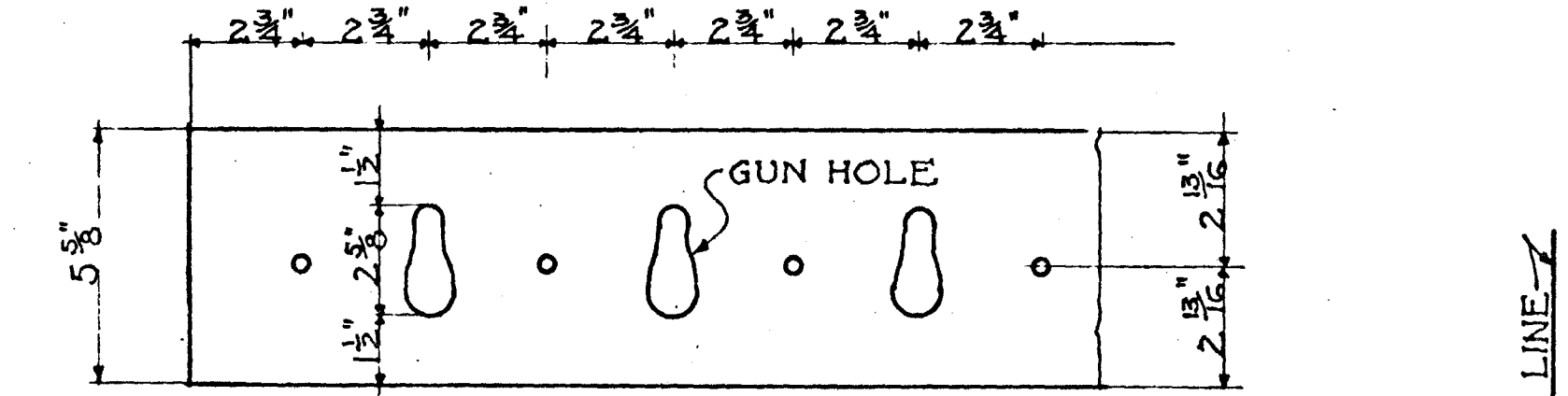
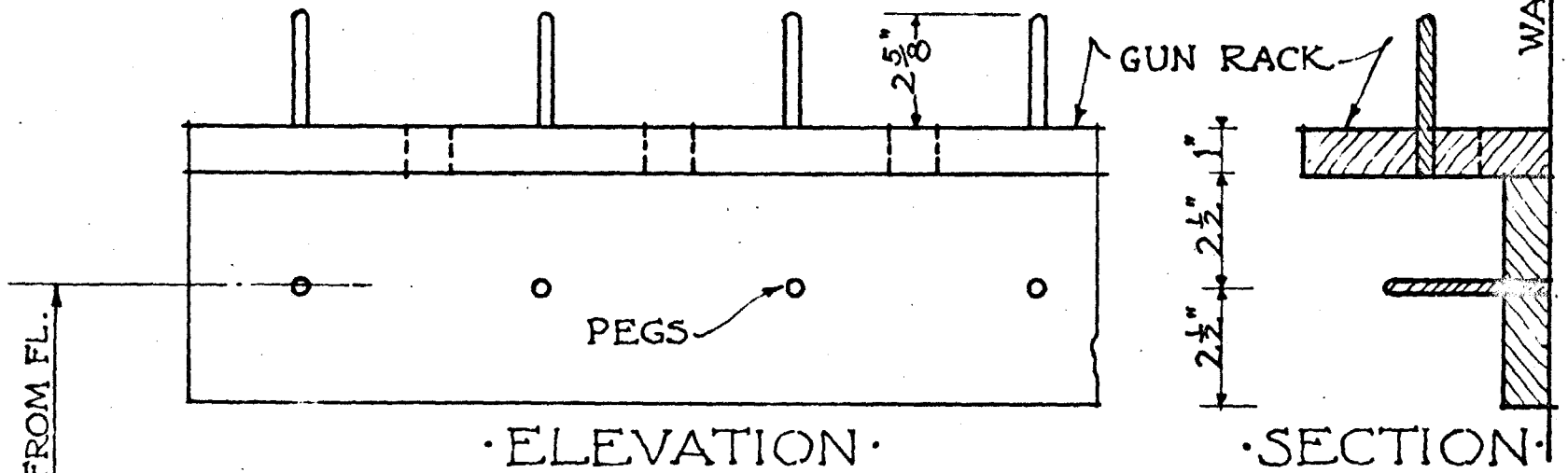


Plate XXII. Diagram of surviving portion of gun rack in Royal Marines Barracks, English Camp, San Juan Island, Washington. This structure dates from the 1860's. The scale of diagram is 1/4 inch equals 1 foot.

From National Park Service, Branch of Plans and Design, Historic American Buildings Survey, Survey No. 39-W-17, Sheet 7, Barracks Building, English Camp, F. C. Stanton, del.



·PLAN·LOOKING·DOWN·



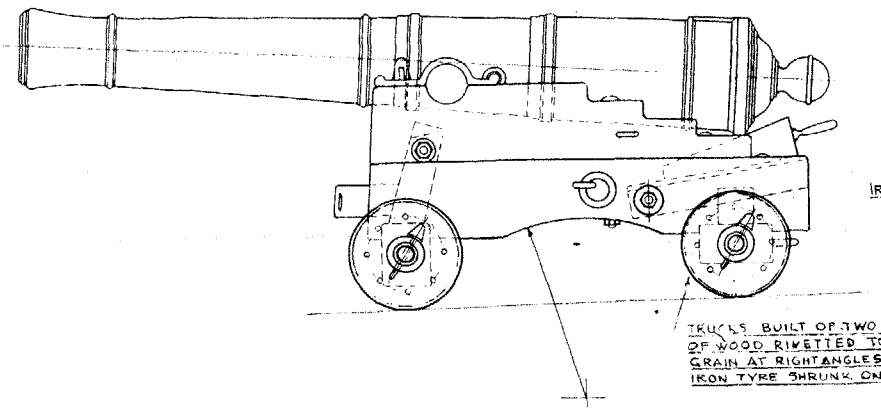
·ELEVATION· ·SECTION·

·3"·SCALE·DETAILS·OF·GUN·RACK·

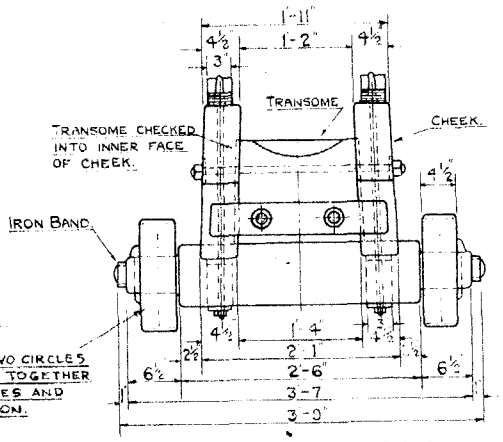
Plate XXIII. Working drawings for a 9-pounder gun and ship carriage, by Harold A. Underhill, Glasgow, Scotland.

Drawing No. 904, from Brown, Son & Ferguson Ltd., 52 Darnley Street, Glasgow G41 2SG, Scotland.

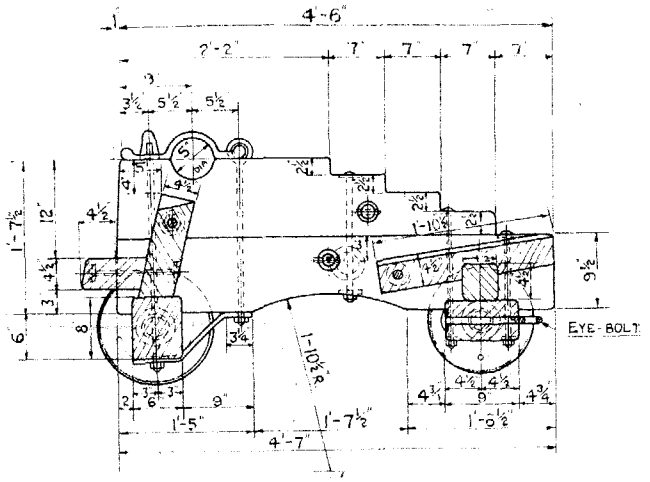
PRINTED & DISTRIBUTED BY BASSETT-LOWKE LTD.
NORTHAMPTON, ENGLAND.



SIDE ELEVATION.

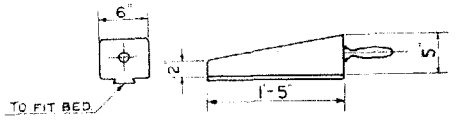


FRONT ELEVATION.

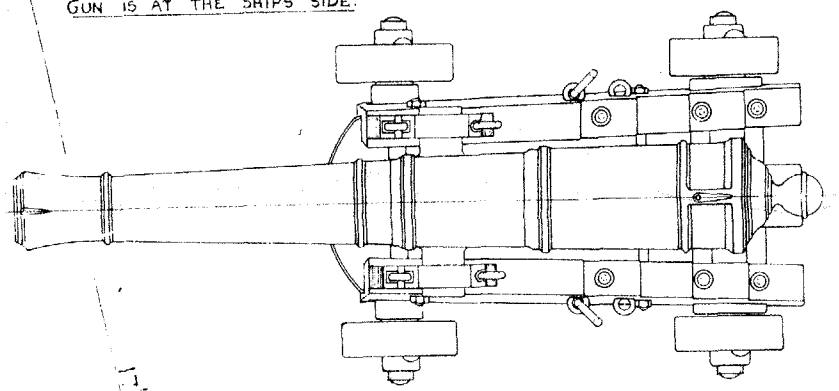


LONGITUDINAL SECTION.

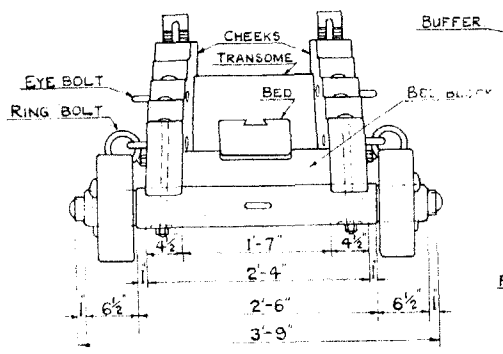
NOTE: THE HEIGHT OF GUN WILL VARY IN DIFFERENT SHIPS AND THE DEPTH OF THE CARRIAGE, AND DIAMETER OF THE TRUCKS MUST BE MADE TO BRING THE CENTRE OF THE GUN CENTRAL IN THE PORT THROUGH WHICH IT IS TO FIRE. THE RELATIVE DIAMETERS OF FRONT AND REAR TRUCKS MUST ALSO BE ARRANGED TO SUITE THE DECK CAMBER OF THE VESSEL. THE CARRIAGE MUST BE HORIZONTAL WHEN THE GUN IS AT THE SHIPS SIDE.



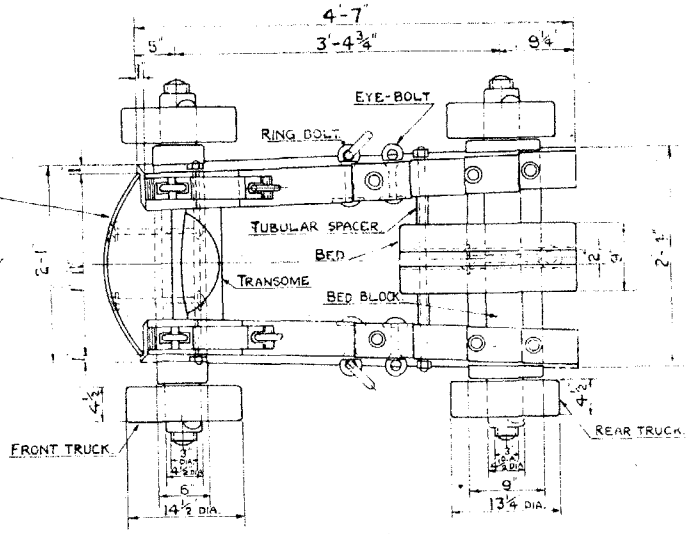
DETAIL OF QUOIN.



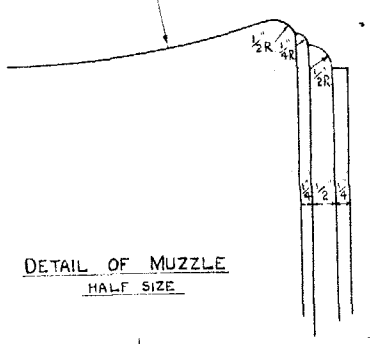
PLAN VIEW.



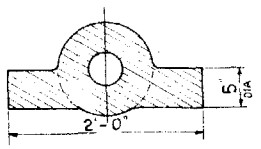
REAR ELEVATION.



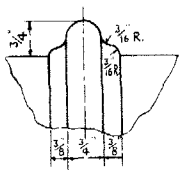
PLAN OF CARRIAGE.



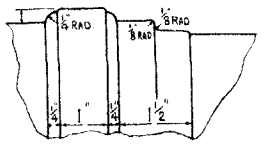
DETAIL OF MUZZLE
HALF SIZE



SECTION THROUGH TRUNNIONS.

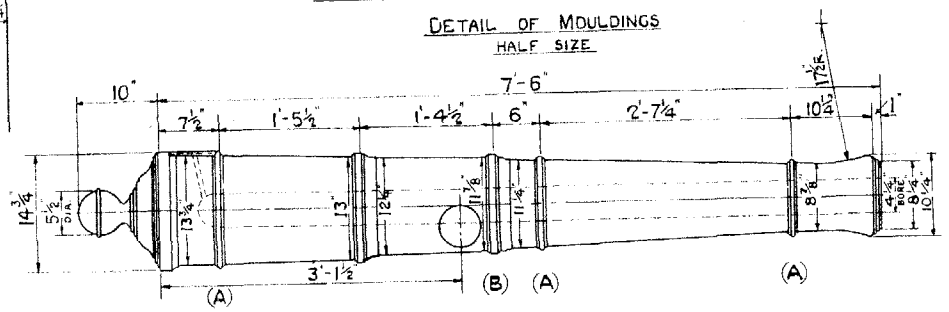


DETAIL AT (A).

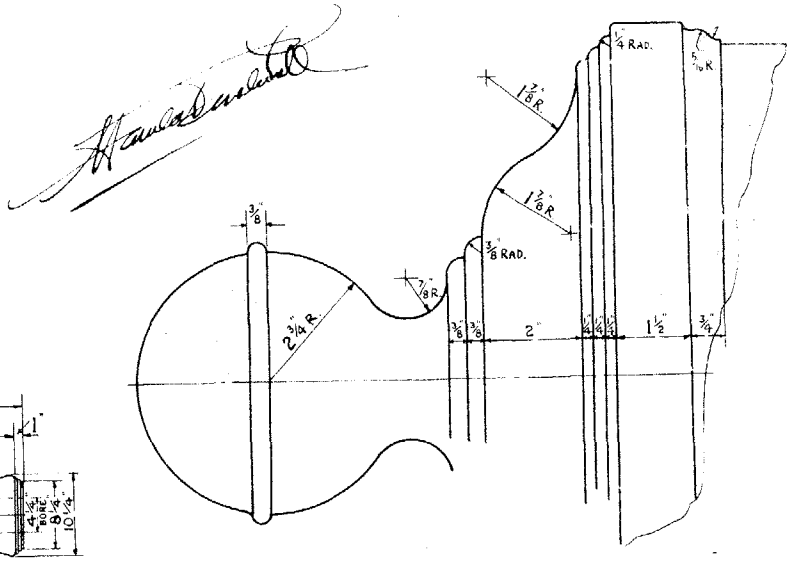


DETAIL (B).

DETAIL OF MOULDINGS
HALF SIZE



DETAIL OF GUN.



DETAIL OF BREECH
HALF SIZE

DRAWING Nº 904		
782.	32	POUNDER CARRONADE
783.	24	" GUN
784.	32	" " (UPPER DECK)
785.	32	" " (GUN DECK)
786.	32	" " (LOWER DECK)

7'-6" 9 POUNDER MUZZLE LOADING GUN.

Scale:-1"=1'-0" Moulding Details Drawn Half Size.

HAROLD A. UNDERHILL. A.M.I.E.S.
GLASGOW.