

COMMANDER MARSHALL'S NEW PATENT SHIPS GUN CARRIAGE.

Fig. 1.

Gun run in.

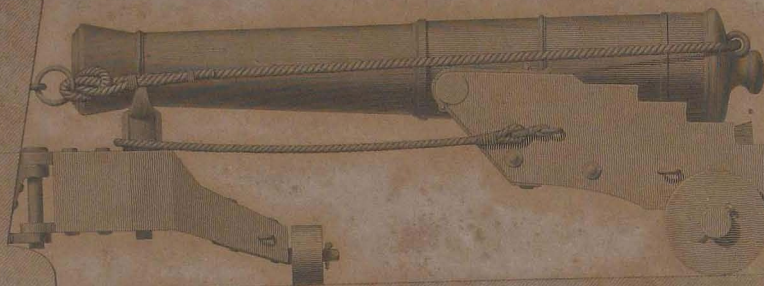
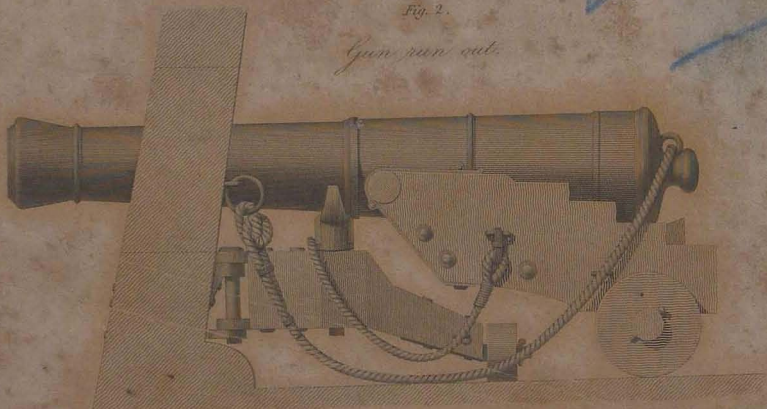


Fig. 2.

Gun run out.



Senfaja Rajah 1830

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DESCRIPTION

OF

COMMANDER MARSHALL'S

NEW MODE OF

MOUNTING AND WORKING SHIPS' GUNS;

WHEREIN

THE NATURE AND ADVANTAGES OF ITS PROPERTIES ARE SHOWN
AND ILLUSTRATED BY THE RESULTS OF

OFFICIAL EXPERIMENTS.

LONDON :

JOHN MURRAY, ALBEMARLE STREET.

1829.

100/100 1830

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TO
THE RIGHT HONOURABLE LORD VISCOUNT MELVILLE,

THIS ATTEMPT
MATERIALLY TO IMPROVE THE GUNNERY

OF THE
BRITISH FLEET,

IS,
BY PERMISSION OF HIS LORDSHIP,

RESPECTFULLY DEDICATED
BY HIS LORDSHIP'S MOST OBEDIENT HUMBLE SERVANT,

JAMES MARSHALL,
COMMANDER.

P R E F A C E.

A considerable time has now elapsed since my new mode of mounting ships' guns was first submitted to the attention of the Honourable Board of Ordnance; since which period my Lords Commissioners of the Admiralty have been continuing that investigation of my suggestions, which His Royal Highness the Lord High Admiral, was pleased most promptly to institute. From time to time their Lordships have done me the honour to transmit copies of reports on my gun carriages, received from the different officers appointed to try them; and, having also been favoured by the Directors of the Honourable East India Company with the result of a trial which has been made of my mode of mounting the guns in their naval service, I feel the period to have arrived, when, upon the authority of official documents the most conclusive and satisfactory, rather than upon my own views and assertions, I may call the attention of the profession, to which I have the honour of being attached, to the most important subject, perhaps, that can occupy their investigation,

viz. an enquiry into a method by which the guns of the British Fleet may be worked with greater rapidity—more extensive powers of operation—less labour—and more certain effect, than has ever before been practicable.

For an individual of but moderate rank and less distinguished influence to attempt effecting an entire change in that system of ships' gunnery which for some centuries has been exclusively practised by all the Navies of the civilized world, is an undertaking in which few would presume to engage. As, however, the direction of a powerful stream, that for ages has been confined to its prescribed limits, may ultimately be diverted by the smallest brook that may first trace out a simpler course, so the most important improvements will sometimes establish themselves, though the humblest individuals may have been the first to promote them. It has therefore been, from the novelty and simplicity of my system, combined with its real utility, rather than through any means of influence, or efforts of patronage, that I have derived encouragement to proceed in my great object; till at length, a powerful collection of important facts having been developed, I now venture on the publication of a detailed description of my system, for the investigation of all who may feel themselves interested in the subject.

I avail myself of this opportunity to express my lively sense of obligation to a nobleman who has long been distinguished

for his hearty attachment to every thing connected with the Wooden Walls of his country. The first experiments which were made with my gun carriages on board H. M. S. Prince Regent, immediately led to the long guns of the Falcon being mounted on my principle, by which the noble possessor of that celebrated yacht, in his desire to advance improvement, has been enabled to afford me much satisfactory and valuable information, connected with the mounting of *brass* guns upon my carriages.

It will appear that my present object is simply to make known the properties and advantages of my new mode of mounting guns. To show the exercise applicable to it, and to point out a system of tactics arising from its use, which must necessarily present some new features in the art of naval warfare, will be more immediately connected with the objects of a future publication.

SECTION I.

INTRODUCTORY REMARKS.

Ever since England became the first maritime power in the world, her elevated position has required a continual application of talent and exertion, and the expenditure of large annual sums to render the British Navy as efficient as possible; for however varied the policy of different administrations may have appeared on other questions of expediency, and however strenuously economy may have been advocated, the maintenance of a powerful navy has at all times been one of the most decided measures of Government, and one of the most popular appropriations of no inconsiderable portion of the national resources.

Considering the efforts which have been made to perfect the construction and the fitting of ships of war, by the adoption of many valuable improvements in ship-building, and by the introduction of those suggestions in their equipment which mechanical ingenuity or professional experience has been able to supply; it appears singular that no alteration has yet taken place in the mode of mounting ships' guns, though the existing inconveniences of their carriages have never ceased to present themselves to practical men, and to call forth numerous attempts to improve their construction.

That the art of naval gunnery in point of national importance is deserving attention, equally with that of constructing ships of war, cannot be doubted; since to neglect any means of improving the one, whilst every effort is exercised to advance the other, would be to construct, at vast expense, numerous powerful engines to effect certain purposes, and to be regardless of the means whereby their operations may be rendered useful in the most extensive manner. Indeed so fully have the Lords Commissioners of the Admiralty considered the importance of acquiring celerity and precision in the exercise of ships' guns, that they have most strictly and earnestly commanded that the greatest exertions should be made for the attainment of these objects.

Hence, the singular fact of a ship's gun carriage remaining the same unwieldy machine, which it has ever been since its first introduction on ship board* is far from being a proof that its construction has not occupied the consideration of His Majesty's Government, or the attention of many naval officers and scientific characters, who have effected improvements in other branches of ordnance equipment; but the inference rather is, that either the established carriages answer in the most effective manner all the purposes required of them, or that, from the principle upon which guns are mounted, they are incapable of improvement.

How far the present gun carriage is calculated for sea service will appear by adverting to some of the duties it is required to perform; when, to the unprejudiced at least, it will be evident that there scarcely exists a machine or instrument, by which important objects are to be effected, more devoid of mechanical contrivance or less calculated to facilitate the efforts required in its application.

In the first place, a ship's gun requires to be moved quickly in different directions, and is subject to be checked very suddenly in its

* Guns in Henry VIII.'s reign were mounted on the present principle.

motions : It is nevertheless placed upon a carriage, whose axletrees are immoveably bolted parallel to each other, and upon which its weight is so disposed that nearly the whole of it rests upon one extremity of the carriage. When a gun is so improperly placed, upon a carriage so imperfectly constructed, the inconveniences in working it, as regards the violence with which it tilts up, and the difficulty which exists in laterally moving the fore part of the carriage, are consequences which naturally follow.

When a gun is much heated by continued firing, the recoil becomes more and more irregular ; and it consequently requires to be replaced more frequently in its proper position in the port. This should be effected by as little labour as possible ; for the prolonged continuance of the action, which occasions a more frequent occurrence of the operation, produces a reduction in the means whereby it is to be accomplished ; the strength and numbers of the crew decreasing as the engagement advances. Yet, to square a gun, or laterally move it, in its port upon the old carriage, is attended with more difficulty and labour than any other part of the exercise.

Not only much labour is occasioned, but also much time is lost, by the irregular motions of a heated gun. In forging an anchor, to save a few moments during the heat of the metal, such mechanical expedients are resorted to as render it practicable to place, with the utmost ease and expedition a mass of iron, equal in weight to a thirty-two pounder, in any required position. To give facility to the movements of guns in action must, however, seem equally desirable ; since upon the celerity with which they are worked, depends in general those results, for the attainment of which, all the resources of discipline have been employed and millions expended.

It is evident, that the further guns can be pointed towards the bow or quarter, the more powerfully will they defend the ship and

assail the enemy. It will consequently be supposed that the size of a port will form the limit to the angle at which a gun can be trained or pointed across it; but this is not the case: for the form of the old carriage generally prevents the guns traversing through an arc so great as might otherwise be obtained, by from eighteen to twenty-four degrees: and thus, as it were, the application of the instrument is limited by the clumsiness of its handle.

Again, as ships are frequently required to engage under sail, when their decks are more or less inclined to the horizon, means should be afforded by which their guns may be so elevated or depressed as to counteract the inclination of their platform, and to fire horizontally: so limited, however, is the angle at which it is possible to depress them, on the old carriages, that a moderate press of canvass in some ships, will prevent weather guns being levelled.

One further remark may be made on the peculiar difficulties which seamen have to contend with in the use of their guns, and which the defective principle of their carriages affords no means of removing. In order to discharge a correct shot from a ship in motion, the elevation of the gun, and the line of its direction, must both be accurately adjusted at the instant the gun is fired. The former, however, by the rolling of the ship, is undergoing constant change, whilst the latter is receiving continual alteration, from the motion of the ship's head: two causes over which the marksman has no control.

Now, since it is absurd, as a principle, to calculate that the rolling of a vessel shall produce a proper elevation, at the same instant that the motion of its head is not interfering with the true line of the gun's direction; it is necessary that, whilst taking aim, the marksman should have the power of changing either the elevation, or the line, of his gun, at the same instant that the motion of the ship may be producing the other required movement; and also, that he should be able to fire at the

moment these joint operations have produced their desired effect. It happens, however, that since neither the elevation of the gun nor the direction of its line can be altered by the crew, so as to admit of its being fired, till they have retired clear of its recoil, an interval of time must elapse, after the aim has been adjusted, before the gun can be discharged; during which interval the ceaseless motion of the ship will, in all probability, have again deranged the accuracy of the aim; and thus not only is time lost, but the firing of a true shot rendered very doubtful.

Contrary to all other artillery exercises, it hence appears that the practice of naval gunnery requires an art similar to that of firing at moving objects; for, whether the object aimed at, or the platform of the gun be in motion, the same effects have to be counteracted; and, consequently, before any general system of correct firing can be hoped for in cases of this nature, seamen must be provided with a gun carriage better calculated than the old one to meet the peculiar circumstances in which they are so frequently placed.

On hereafter comparing the properties of the new with those of the old carriages, other defects in the latter will be adverted to; enough will have been advanced to show that, whatever is the cause which prevents their improvement, it is not that they have been found fully calculated to perform all the duties required.

It now remains to state briefly a few reasons why it seems impracticable to remove the objections which are attached to the old carriages, so long as the ancient practice of mounting ships' guns by their trunnions is continued.

First, since the width of the fore axle prevents a gun's training to the greatest angle across its port, this must be contracted to remove the objection; as, however, nearly the whole weight of the gun rests upon

the *fore* axle, its stability, as regards any tendency to upset, would be decreased by thus narrowing its bearings; nor would any extension that could be given to the width of the hind axle always restore that safety to the gun which a contraction of the fore trucks would endanger; because the violent twisting check, which the irregular action of the breeching sometimes occasions, at the same instant tilts up the gun and throws its whole bearing upon the fore axle, which has alone to resist any tendency the gun may then have to upset.

Again, were it attempted to render a gun less liable to tilt up, either an unnecessary weight of metal must be added to the breech, or the trunnions be placed nearer to the muzzle; already, however, ship's guns are inconveniently heavy; and already the space from the trunnion to the muzzle is not sufficient to allow the muzzle always to clear the side, when trained to the greatest angle.

To facilitate the lateral movements of a gun, castors, or what are termed German trucks, naturally suggest themselves; the great weight however which would rest upon them, when placed under the fore part of the carriage (where alone they would be useful), would be liable to disorder their action and injure the decks; whilst the gun, when re-coiling upon wheels at liberty to move in any direction, would become less steady and more liable to twist round than it is at present.

For the purpose of traversing with expedition, &c., it was proposed by Sir William Congreve to mount ships' guns upon moveable platforms or traversing beds. However valuable this plan may have been found in land service, it is greatly opposed to a sailor's conceptions of what is safe in action and snug in a gale. Those who are best acquainted with the propensities of thirty-two pounders, in either of these situations, will be anxious to see them lodged upon their own foundations, with a broad bearing under them of the simplest construction.

From what has been remarked, the conclusion may be drawn, that so long as a square four-wheeled carriage is required for mounting ships' guns, little improvement can be made upon those in use; but they are nevertheless inconvenient and inefficient for the purposes of naval warfare, however well adapted they may be for land service (for which they were first invented), where narrow embrasures require no lateral moving of the gun in training it—where its platform is never in motion—and where no tilting of the gun takes place, because breechings are not used to check its recoil.

With the truth of these observations will appear the necessity of resorting to new principles in the construction of gun carriages, in order to obtain those material improvements in naval gunnery which it is my object to effect. In therefore submitting to investigation a mode of mounting ships' guns, which, I believe, has never on any former occasion been tried or proposed; my suggestions will, I trust, appear to have arisen, less from a desire to display novelty of contrivance, than from a practical knowledge of the difficulties to be encountered, and a professional acquaintance with the defects to be remedied.

SECTION II.

*Construction, Strength, Durability, Stability, Surface, Securing,
Transporting, Dismounting.*

CONSTRUCTION.

The new gun carriage consists of two distinct parts, whose movements are independent of each other; and which, though jointly supporting the gun, have separate duties to perform: one is termed the breech carriage, the other the breast carriage.

The breast carriage A, Plate II. Fig. 1, consists of a block of elm, in which two plates of nearly similar form are let in flush upon the top and bottom surfaces, and secured in their places by the clinched bolts, 1, 2, 3, 4. The upper plate is made much thicker than the lower one, and the bolt 1 stouter than the others. By means of these plates, termed eye plates, the breast carriage is attached to the centre of the port by the breast bolt G passing through the holes E, E, and through the gudgeons C, D, which are fixed to the ship's side. In the eye plates, the holes X, X, form a socket in which the spindle of the crutch works; a hole having been made through the breast block sufficiently large to

prevent the spindle of the crutch from ever becoming tight in it.* Bolted to the under part of the breast block, is an iron axle, *d*, upon which a bushed wooden truck works, and the end of the breast carriage traverses. The upper gudgeon *C* is fixed to the ship's side, by bolts passing through the timbers, and the top eye plate rests upon it. The lower gudgeon, or a socket placed upon the waterway, as most convenient, is only required to steady the heel of the breast bolt, and does not support any of the weight of the gun.

The crutch *H*, shown also in Fig. 3, is formed of wrought iron, and receives within the lower part of it a small block of wood, upon which the gun rests and works. The block is made a little concave to receive the gun; and, in the other direction of its upper surface, is so cut away, or made convex, as not to interfere with the gun's lodging on nearly the centre of the block, when it is elevated or depressed.

The breech carriage, *B*, Fig. 1, is formed similarly to the old gun carriage, with the fore part of it cut away; *p, p*, are iron clamps with a hinge at *o*; the lower part is secured to the front of the breech carriage by a bolt, and by the eye pin *g*, which is clinched at *v*. The upper, or moveable part, spans round the trunnion; and, being fore-locked down to the eye pin, suspends or attaches the front of the breech carriage to the gun. The breech of the gun is supported upon a bed and coin, and is elevated and depressed by them in the usual way.

Fig. 1 Plate I., represents a twenty-four pounder in the port of a frigate, mounted upon the new carriage: at the breech it is supported upon the two-wheeled breech carriage, which, being attached to the trunnions, moves with the gun in every direction; at the fore part of the

* The spindle hole through the breast block should be made before the eye plates are put on, that it may be larger than the holes *X, X*, and prevent the possibility of the wood swelling to such an extent as to confine the action of the crutch.

gun upon the breast carriage, which, being bolted to the ship's side, remains stationary, whilst the gun runs in and out over the block in the crutch.

The circumstance which renders practicable this mode of mounting long guns, in ships of war, is, that contrary to land service, the gun is stopped in its recoil by a strong rope or breeching as soon as the muzzle arrives sufficiently within the port to allow of its being conveniently loaded; for since it happens that the proper and usual space over which a gun is allowed to run in (all unnecessary recoil increasing the delay and labour of running the gun out) is, on an average of cases, about equal to the distance of the gun's trunnion rim from its muzzle rim, it follows that all the action which it is expedient a gun should have, in and out of its port, is obtained by its being made to slide backwards and forwards from its trunnion to its muzzle upon the stationary rest or crutch of the breast carriage. In Fig. 2, Plate I., the gun is prevented from running out any further by the trunnions, or trunnion rim, coming in contact with the crutch; and in Fig. 1, where the gun is run in, the approach of the muzzle any nearer to the crutch, or the danger of its recoiling too far through it, is not only prevented by a stout breeching, but doubly guarded against by a strong breast rope, fixed to the breech carriage, and passed round the crutch, as shown in the figure. Thus are the two parts of the carriage prevented from approaching into contact, or of receding too far from each other, whilst the gun itself preserves the communication between the two parts of its carriage. The chief novelty of this principle of mounting, consists in having removed the bearing of the gun upon its carriage, from the trunnions (which have now nothing to do with supporting the gun) to a fixed point at the breech, and a moveable point somewhere between the muzzle and the trunnion.

The axis of motion, upon which the gun is now elevated and depressed, is therefore no longer at the trunnions, but at the point where the fore part of the gun rests upon the crutch block; and in each change

which this axis undergoes, a support will be afforded to the gun exactly in the place where it is wanted ; for when it is run out, as in Fig. 2 (the only situation in which the elevation is adjusted), the axis of motion is nearly in the centre of the gun, to facilitate the operation ; and when the gun is run in Fig. 1, and stopped by the breeching (the only case in which it has any tendency to tilt up), the axis becomes a prop at the muzzle to prevent it.

With regard to the motion of the gun upon its crutch block, it may be remarked, that the quantity of friction produced, depends in a great measure upon the hardness and extent of surface of the block. Upon a metal block, a gun may be found to work too lively: on a broad elm block, not sufficiently so. *Lignum vitæ* appears the most suitable for heavy guns, and Elm for light ones.

The breast carriage not only supports the fore part of the gun, but affords the means of traversing it from one side of its port to the other. Thus, in Fig. 5, Plate II., the weight of the gun, resting on the crutch at the point *x*, may be drawn over to the position *xa*, with the greatest facility, by the small breast tackles D, D; when, by traversing the breech round at the same time, the gun is at once placed in any position across its port. The gun being at liberty to move round upon the crutch pin at *x*, as an axis of traversing motion, it is not necessary, in training round, to move both the breech and the breast carriage at the same moment; nor are both these parts of the carriage required to be in the same line when the gun is fired. By moving either the breast or the breech of the gun, the aim may therefore be altered, and the breech carriage may recoil in any direction, without producing any twisting strain upon the crutch or breast carriage.*

* In mounting guns for experiments on board His Majesty's ships Prince Regent, Galatea, and Isis, the ends of their breast carriages were supported upon two traversing trucks instead of one; subsequently they have been fitted with one in the Hon. East India Company's service.

In the construction of the new carriage, attention has been paid to economy. The guns in use require no alteration, and the present carriages may be converted into breech carriages by removing the fore axle, &c., to the left of the dotted line in Fig. 7, Plate II. The gunners' stores in use are also applicable to the new system.

With regard to the weight of the respective carriages, an old one of seven cwt. is replaced by a breech carriage of five cwt. and a breast carriage of three cwt. ; thus the total weight of the new exceeds that of the old, in a twenty-four pounder, about one cwt. The moveable part of the carriage, however, or that which the crew has to put in motion in running out the gun, is less by two cwt. than the old carriage.*

STRENGTH.

The strength of the new carriage will appear, by considering the manner in which the force of explosion, and the weight of the gun act upon it.

The most violent shock to its structure will be communicated at the instant the gun is fired ; the carriage being then at rest, and the effort to put it in motion being then applied with the greatest force : also the strain will be the greatest at that part of the carriage which opposes the greatest resistance to the gun's recoil ; and the extent of this strain will greatly depend upon the length of the lever, at which the moving force acts upon the point of resistance. Now, since nearly the whole weight of the gun, at the time it is fired, rests upon the crutch block, the resistance to motion will principally be there, and, the gun being in immediate contact with it, the moving force of the recoil will be in a

* No experiments have yet been made to show the strength which is necessary in the parts of the new carriage ; they have probably been made much heavier than experience may show to be requisite.

line with the resistance opposed to it, and the least possible strain will be brought upon the carriage.

Referring to the old carriage, the fore trucks principally support the weight of the gun, and the resistance to its motion takes place chiefly there; so that the strain of the recoil acts upon the carriage at a lever equal to the distance of the trunnion from the fore axle, or about two-thirds the whole height of the carriage.

Again, as regards the capability of the new carriage to sustain the weight of the gun when secured at sea. In Fig. 1, Plate V., a lower deck gun, housed and secured, is represented. The chief weight of the gun being there made to rest upon the breech carriage, and the bed and coin being removed as usual, it is secured within twelve inches of the deck upon the axletree, and without resting upon the sides of the carriage.

When a gun is secured on the old carriage, as in Fig. 3, Plate V., though the breech is lowered upon the hind axle, the muzzle is in the same proportion raised; whilst nearly all the weight of the gun still rests, at its trunnions, upon the side of the carriage, and so considerably above the fore axle, as to bring a severe twisting strain upon the carriage when the ship is heavily labouring. So great a top weight of course causes much of the creaking noise which the carriage makes in a gale of wind.

DURABILITY.

It appears that, whether a gun be in action, or secured at sea, it produces less strain upon the new, than upon the old carriage; and as all the parts of the former, when acted upon, have movements independent of each other, and may be renewed with facility: there is reason to infer that one carriage will last at least as long as the other. In their

capabilities to continue serviceable in an action, the new carriage possesses great advantages, from the ease with which any disabled parts may be restored, or the gun be remounted by its own crew.

When the old one is disabled, the whole weight of the gun must be lifted, before another can be placed under it. Two causes prevent this being attempted in an engagement: the difficulty of the operation, and the inability of the gun's own crew to accomplish it without such assistance as would, for a considerable length of time, deprive other guns of their men. On the new carriage, the gun has two distinct supporters; upon either of which the greater part of its weight may be thrown; from three to six men are therefore sufficient to remove either the breech or the breast carriage, by a very simple process hereafter described: so simple indeed is this operation, that, on board His Majesty's ship *Isis*, the breech carriage of a twenty-four pounder was removed by seven men in twenty seconds, and the gun again mounted in an equally short space of time.

STABILITY.

With respect to the stability of the new carriage, or its power to prevent the upsetting of the gun, and other unsteady tendencies, it is evident that, when in the securing position which has been alluded to, the gun will be rendered much less liable to upset, from its being made to rest so much lower upon its carriage, and so much nearer the deck. On making experiments, with accurate models, a gun in this position was found not to upset, till its platform inclined fifty-one degrees; but when placed on the old carriage, with its breech on the hind axle, thirty-four degrees of declivity caused it to turn over. It further appeared that the gun, when levelled, required thirty-five degrees of inclination when run in, and forty-one degrees when run out, to throw it over; though thirty-two degrees produced this effect when the gun was levelled on the old carriage. These facts may be thus accounted for:—

A gun upon the old carriage, of course upsets when its centre of gravity overhangs the trucks of its carriage; on the new carriage, however, that part of its weight which rests upon the crutch block never overhangs its point of support, and the gun can only upset when the overhanging weight upon the hind axle attains sufficient power to twist it round within its crutch. The greater therefore the weight is on the breech carriage, the sooner will its overhanging position attain this power, and *vice versâ*; so that the stability of the gun will be the greatest, when run out; and, when run in, the nearer will the stability of the old carriage approach it.

Allusion has been made to a novel property of the new principle, by which a gun is prevented tilting, or jumping up, when stopped at the extent of its recoil; it also renders the gun perfectly steady, when run out upon a lee deck. Where a ship is greatly heeling over, the weight of a gun on the old carriage, is so made to overhang the fore axletree, as occasionally to tilt up; more particularly, when suddenly stopped, after acquiring momentum down the inclined deck: on the new carriage this is prevented; for the fore part of the gun being in contact with a fixed point of support, instead of resting eighteen inches above an axis of tilting motion, preserves its balance under all circumstances.

SURFACE.

On the surface which the carriage exposes, depends in a great measure the chances of a gun's becoming disabled by the enemy's shot, the commodious arrangement of a ship's decks, the comfort of the crew, and the free circulation of air between decks.

On measuring the areas which the respective carriages present to a raking shot, little or no difference will be found; when a shot however enters from the direction in which the guns are pointed, the fore axle,

from being considerably wider than the breast carriage, will be more liable to be hit, and to sustain injury which cannot be repaired.

The space which a spare carriage occupies, is much decreased by the new method; since the breech carriage will contain the breast carriage within it, and not require more than half the stowage of the old one, Figs. 6 and 7, Plate II.; and, though no spare carriages are supplied to ships of war, yet, if a disabled gun can now be remounted in action, it is important that they may be packed ready for use in a very small compass.

Where guns are secured on the lower deck, as in Fig. 1, Plate V., their trunnions and muzzle are lowered more than one-fourth of their usual distance from the deck; additional room, over the gun, is thus afforded for the hammocks; and the breast carriage, being so much narrower than a fore axle and trucks, gives more room round the mess tables.

Again:—the elevated guns, as secured on the old carriages, cross the whole aperture of their ports from top to bottom, and check the admission of air, and its fore and aft circulation; whilst much injurious vapour is confined under the broad bases of these carriages. By lowering a gun below the top of the port, more air will be admitted, and, the new carriage, having no fore trucks, a more free circulation will take place under the carriage; whilst no wet can be detained, or dirt be concealed, under the breast of the gun.

Under its proper head will be considered the expediency of securing main deck guns fore and aft; should this mode be found in some cases to be the most convenient, the space of deck occupied will be nearly triangular, and the breech axle, forming the base, will project in eighteen pounders, about one foot less from the ship's side, than the end of the old carriage when secured with the gun run out.

SECURING.

From the limited opportunity I as yet have had of witnessing the application of my carriages in ships of war, I do not feel prepared to decide upon the best method of performing such manual operations connected with them, as experience at sea can alone determine. In the present Section I would, therefore, be considered as suggesting modes, rather than as laying down rules, by which to accomplish the ends required.

To secure a lower deck gun, it is proposed that a ring bolt A, Fig. 1, Plate V. be placed in the deck, beyond the utmost traversing sweep of the hind trucks; and that the breech axletree be secured down to it. Instead of the usual tompions, let one like B be introduced, by which the muzzle may be lashed back to the crutch, so as to form an additional security against the gun's running out. To prevent the breast carriage from moving sideways, the breast tackles C may be hooked to the breeching ring bolts, and tightened by a cross frapping over the breast carriage, in front of the crutch. By making fast the side tackles, and breeching in the usual way, the securing of the gun will be completed.

By this mode the weight of the gun is brought nine inches nearer the deck, and prevented from pressing outwards against the ship's side, when rolling; a circumstance attending the old method of housing which is very objectionable.

To secure main deck guns run out square, the usual means may be applied; and, if a small block of wood be placed in the space between the front of the breech carriage and the breast carriage, all the strain will be taken off the horns of the crutch, which might arise were the gun to rest against them in a lee lurch. From the great strength of the crutch, this precaution may however prove unnecessary.

Should it be more convenient to stow main deck guns fore and aft, they would appear as in Fig. 2, the breech lowered upon the axletree, lashed to the ring bolt of the next port, and the muzzle secured also to the side. By passing the tompon lashing round the crutch as before described, and by frapping to the breast rope, the gun will be prevented from moving upon its crutch block, and may be further secured by the breeching and side tackles.

It appears, from experiments with a model, that the centre of gravity of an eighteen pounder, on a frigate's main deck stowed in this manner, is not further moved from the fore and aft axis of the ship, than when secured in the usual way; and as the difficulty of quickly preparing a gun for action on a square carriage, when in a fore and aft position, does not in this case exist, there seems not any objection to this mode of securing, by which the gun would be again considerably lowered, and more room be afforded, together with the means of altering the trim of a ship with her guns, without casting them adrift; for the tompon lashing and the breast rope being kept fast, and the breeching being allowed to render or slip through the cascabel, the gun might be traversed round from its position in the figure to a similar one on the opposite side of its port, without being able to move in any other than a direction which a fixed radius would describe.

TRANSPORTING.

A gun on the new carriage may be transported along the deck, by two or three methods. A concave block of wood upon two trucks has hitherto been used, which on being placed under the breast of the gun when run in forms a square carriage, the weight resting on the crutch block being thrown upon the transporter by simply taking out the quoin. Though this method has been found to answer the purpose perfectly well, the following appears more simple :—

An axletree, Fig. 6, Plate IV. having been formed of wood, with two iron arms and nine inch trucks (spare ones for breast carriages), it may be placed under the fore part of the breast carriage, in the position (*m*) by taking off the trucks, the projecting bolts *a, a*, fitting into holes in the bottom eye plate, in which they are confined when the trucks are put on. On drawing out the breast bolt, and disengaging the breast carriage from the ship's side, by a pull at the train tackle, the gun will be then upon a four-wheeled carriage, Fig. 8, the fore part of which, like a waggon, is free to lock round upon the spindle of the crutch; the muzzle, when necessary, being kept in the position shown by a lashing. In moving a gun by this means, all the labour and difficulty which arise in giving a particular direction to the old carriage are avoided. To mount the gun again in its port, place a handspike under the transporting axle, and lift the lip of the top eye plate into its place, the trucks will then come off and the axletree be disengaged.

The expediency of preventing, as much as possible, the transporting of guns in action from one port to another, will hereafter be adverted to; should however the stern require still to be defended by guns borrowed from the broadside, they may no doubt be moved with more ease, and equal celerity, by the method suggested, when a little practice has been attained.

The new carriage is also capable of being quickly and most effectively converted into a square one for land service, by attaching very portable iron side pieces, cross bolted to one of the spare axletrees, which all ships carry; by this means a sort of cradle is formed to receive and support the front of the breech carriage; and since six pairs of these side pieces may be contained within one spare breech carriage, together with all the bolts, &c. necessary to convert six of these carriages into square ones; no difficulty or inconvenience will arise, should guns mounted on the new carriages be required to be landed for temporary service on shore.

MOUNTING.

An eye bolt being placed in the beam over each gun above the breech, when run out, and another over the centre of the port, as is now provided for the muzzle lashing of the old guns ; the geer necessary to remount on the new carriage will simply be one hook block, with a runner rove in it like A, Fig. 1, Plate IV.

To dismount from the breast carriage, run the gun in, and secure the train tackle and one side tackle ; hook the block A, Fig. 1, and pass the bight of the runner under the tompion, or the muzzle ; hook a side tackle to the end of the runner, and the muzzle may thus be lifted off the crutch, and the breast carriage be unbolted, removed, and replaced. In this way the muzzle may be lowered to the deck, as at Fig. 2, a position in which guns may be stowed very snugly and securely, when required to be moved from their ports.

To change the breech carriage, Fig. 3, run the gun out, secure the falls of the breast tackles, pass a lashing under the cascabel and through the eye bolt in the beam above ; unhook the side tackles from the carriage, and hook them to the breech lashing, making them fast ; the breast rope and breeching having in the mean time been cast off, and the trunnions unclamped, by taking out the quoin the carriage will be disengaged from the gun.

To remount the breech, throw back the trunnion clamps, as at D, Fig. 4, and, by a cross lift with two handspikes under the fore part of the carriage, raise it to its place and fasten the clamps ; put the quoin tight under the breech, and cast off the lashing, &c.

SECTION III.

Training, Elevating, Recoiling.

TRAINING.

This may be considered under two heads: the mode by which the training or traversing of a gun is effected, and the extent to which this effect can be produced. The former connects itself with the labour of the seaman, the latter with the science of the tactician.

In order to point a gun mounted in the old way, so that its direction shall form a considerable angle across its port, the breast or fore part of it must be in a certain position, with reference to the centre of its platform. If, for instance, a gun square in its port, as at Fig. 2, Plate III. were required to be pointed in the direction Fig. 4, the fore truck at *a*, must be moved to the point *b*; for, if traversed round without moving the centre of the gun or point *x*, the muzzle would be trained to its greatest extent when in the position *x*, *e*, or ten degrees from that of Fig. 4.

Trained as in Fig. 4, a gun may be pointed to an angle of 34° on each side of what is termed the beam of the port; but only to 23° when

trained as x, e , Fig. 2. When therefore a gun is on the middle of its port, only two-thirds of its training capacity can be exercised; and when the point x has been moved to one side of the port, as at Fig. 4, the muzzle can then only pass over a much smaller range before it woods or binds against the port. From these facts, it appears, that when the powers of the gun to point towards the bow, or quarter, are called into action, the operation of moving the breast, or nearly its whole weight, across the platform, at right angles to the direction in which the trucks act, is of frequent occurrence. In running a gun out, if the direction in which it will be wanted is known, a bias may be given to its motion, so as to place the breast a little on one side of the port. The effect of manning the foremost or aftermost tackles best, is however much less than is generally supposed, and is often attended with delay; as, from the difficulty of controlling a carriage with wheels all fixed parallel to each other, the muzzle occasionally strikes the ship's side.

To show, however, that any particular mode of running the gun out does not prevent the necessity of laterally moving it, let the gun A. Fig. 4, Plate II. be required to be pointed in the direction a, a . For the muzzle to keep clear of the side of the port, it must be run out in the direction e, e , by which means the point x will be brought to the position C; before, however, the gun can be trained to a, a , x must be moved to D.

When it is required to point a gun upon the new carriage, the greater part of its weight, or that which in the other case rests upon the fore axle, is placed upon the breast carriage; one end of which is supported upon an axis of motion, and the other upon a traversing wheel moving concentrically round it; the centre of the gun, or point x , round which the breech traverses, may therefore, as upon a crane, be placed on either side of the port by the most simple effort. In this way a long twelve-pounder, on board the Prince Regent, worked by only three men, was traversed from an angle of 54° before the beam of its port,

to 54° abaft; or through an arc of 108° , in the short space of twenty five seconds.

In performing what has hitherto proved the most difficult movement in the great gun exercise, and which is not always understood and practised, since men in the common routine of exercise will, if possible, evade the great labour which it occasions, it appears that upon the new carriage two or three men are enabled instantly to place the breast of the heaviest gun in any position required; but that upon the old carriage the strength of ten or twelve must be applied to tackles requiring to be fixed for the purpose, and a weight of nearly three tons must be moved in such a direction that its carriage only acts as a sledge.*

In working the old carriage it may also here be remarked, that, in a continued cannonading, its breast is liable to be moved from its required position in the port, in running in and out, over decks which spring or rise towards the stem or stern, or incline forward or aft from the trim of the vessel. When a gun is engaging, under these circumstances, upon the new carriage, by making fast the breast-tackle, when properly placed, however heavily the ship may be pitching, or however frequently the gun may be fired, its axis of traversing motion will always continue in the same position with reference to the port. In firing a number of rounds, at a great angle of training, this advantage is particularly valuable.

In pointing a gun to form its greatest angle with a line perpendicular to the longitudinal direction of its port, it is limited to a position

* When His Royal Highness the Lord High Admiral inspected the new carriages on board the *Isis*, the old carriage, worked by ten men, was ordered to be traversed from 34° on one side of its port to a similar position on the opposite side. To accomplish this operation, the aid of a capstan bar was resorted to; notwithstanding which, however, the crew (seven men) at the new carriage traversed their gun over nearly one-third greater space in fifty seconds less time.

that just places the muzzle outside of the port, and throws the fire clear of the ship. An eighteen pounder in the port of a frigate, appears in Plate III. Fig. 4, trained according to this general rule, and forms an angle of 34° ; this angle about three points before or abaft the beam is, with little variation, the training capacity of ships' guns; though there is sufficient room in the port to exceed this angle, did not the truck at A prevent it.

On training a gun to its greatest angle by the new carriage (Plate III. Fig. 5), the breast carriage may be drawn round till the horns of the crutch are at *c, c*, and the trunnion T, in a wider port, is made to touch the ship's side; by this means, the gun diagonally crosses its port at a maximum of training (in this instance 45°), whilst the greatest possible extent may be obtained, to which the trunnion will allow the muzzle to project beyond the side.

Referring to Figs. 2, and 4, Plate III. it appears that the point *x*, or centre of the gun at the fore axle, is much further within the ship's side when at a great angle of training, than when run out square; and, since the more diagonally a gun lies across its port the greater space its muzzle has to pass over before it reaches the outside, two causes in training the old carriage combine to bring the muzzle inboard; when, however, the point *x*, rests upon the breast carriage, Fig. 5, Plate II. the more it is traversed round, the nearer the breast of the gun approaches the port; and consequently the more the muzzle can be run out to counteract the shortening effects of its diagonal position.

These causes produce the uniform positions which the muzzle of a gun on the new carriage assumes outside its port; when trained to 1, 2, 3, and 4 points, as in Fig. 3; and its receding appearance, when pointed at similar angles, 1, 2, and 3, on the old carriage, as in Fig. 1.

In the former case, it is important to observe that the extent of

recoil which the breeching allows, will be nearly the same, at whatever angle the gun is trained; and the strain on the breeching will be consequently always uniform. In the latter case, the gun being so much further inboard at the position 3 than at *a*, its recoil will be shortened nearly one-third, and the action on the breeching be increased in a very objectionable degree.

In the capabilities which the new carriages possess of enabling guns to bear on objects in a much more angular direction, a very important advantage is afforded in naval tactics; for if the ship A, Fig. 1, Plate VII. could train her guns to 45° , whilst the ship B could only bring hers to bear at an angle of 34° , the former might take up a position on the quarter of the latter within a range of 300 yards, when all her broadside would bear upon her enemy, without B being able to return the fire; and if B were the sternmost ship of a retreating fleet, and A an advanced frigate hanging upon her quarter, a destructive position of comparative impunity might steadily be maintained; since A could fire her broadside guns, without having occasion to luff up or alter her course from that of B.

To the above, many other striking cases might be added; and in looking over the records of our naval actions, many speculations might be indulged in, as to the different aspects which unfavourable incidents in those conflicts might have assumed, had our ships' guns possessed greater training powers.* Aware, however, that all which might be

* In the account of the action of the Java with the Constitution, Captain Chads says, "from half-past three we could not fire more than two or three guns till a quarter past four, when our mizen mast was shot away; the ship then fell off a little, and brought many of our starboard guns to bear." This *little* in the ship's falling off, for the want of which the Java for three quarters of an hour received a dreadful cannonading, which she could only return with a few guns, would in all probability not have been required, could her guns have been trained as much further towards her enemy as the new carriages will admit.

advanced will not escape the consideration of the intelligent officer, I proceed to notice the effect, which my system of gunnery is calculated to produce, upon the defence of a ship's quarter.

The great interest which has been taken by His Majesty's Government, and by naval officers, in the introduction of round sterns into the British fleet, cannot but convey some idea of the importance which is attached to the power of bringing two or three more guns on the quarter to bear upon the enemy. Cases indeed exist, as in the instance of His Majesty's Ship Cambridge, wherein the customary form of a line of battle ship's broadside has been changed, in order to admit a few of the after guns to be pointed more towards the quarter; and if an advantage of this nature, which can only be attained by decreasing the number of broadside guns that will bear before the ship's beam, has been considered worthy of attention; how much more so must any system of gunnery appear, which, without any sacrifice to the general efficiency of the ship, extends the power of action; not only of two or three guns in one particular direction, but of *each* gun on board in *every* direction.

The capabilities which two faces of a battery possess of defending their connecting angle, depend not only upon the extent to which the guns will traverse, but also upon the angle at which those faces incline to each other; as therefore the direction which the after broadside ports of ships of war make with those of the stern occasionally varies, the breadth of some ships being much more contracted at the stern than others, whilst the ports in the rounding of the stern frame are more or less inclined; a general view of the defence of the quarter, or junction of the stern and broadside batteries, may be best taken by placing them as in Fig. 2, Plate VII. at right angles to each other. Let the guns in Fig. 2 be trained in defence of the quarter, so as to make an angle of 34° with the beam of their ports; in this case the stern and broadside fire will diverge from each other at an angle of 22° , and a space of im-

punity on the connecting angle of the stern and broadside will be left, varying in extent with its distance from the quarter. If, however, the guns could be trained to 45° , as in Fig. 3, the stern and broadside guns would train towards the quarter, in a parallel direction to each other, and thus they would powerfully defend what has been termed the point of impunity; and with equal effect, however close, or however far off the enemy might be situated. The ship C, therefore, that in Fig. 2 might so place herself on the quarter of B, as to be clear of the diverging fire of the stern and broadside guns, would, when similarly situated as at D, Fig. 3, on the quarter of A, receive the fire of all the stern guns, and of eleven broadside guns from each deck.*

It would not be understood to assert that the Fig. B exactly represents the state of helplessness in which a ship of war would find herself with an enemy on the quarter as at C. The introduction of round sterns furnishes a valuable port in the angle on each deck. One or two of the after ports, by departing from the line of broadside, might be found to face towards the quarter so as to allow their guns to bear; or the expedient which has been before resorted to, of firing through the stern frame, might be practised by an intrepid commander in the heat of action.

The few guns, however, which a round stern or these irregular practices would afford, could form but a very small portion of the efficiency which the ship A possesses, and by which she is made capable, in an orderly systematic way of defending her quarter when thus attacked, with a fire very little inferior to that of her broadside.

* With the training of some of this number of upper deck guns to the quarter, the rigging will of course interfere; this is, however, not the fault of the gun carriage, nor can it reasonably be urged against the principle of an improvement, that owing to circumstances with which it is unconnected, its benefits cannot in every particular case be applied.

Fig. 2 also shows the force with which the ship C, with guns on the new carriages, may attack or chase the ship B upon the old point of impunity.

Fig. 3 represents the effect with which A can defend her quarter with the new, and the very limited powers of attack which D possesses with the old mode of mounting.

In the defence of the quarter it is very important to remember, that each gun (except that in the quarter port of a round-sterned ship) must be pointed at its greatest angle of training; and as difficulty, labour, and delay, must attend this operation by the old carriage, it follows that a very slow fire will be kept up, from even the two or three guns employed. Since, however, a gun worked on the new carriage can be fired any number of rounds in succession, with very nearly the same rapidity when trained to 45° as when pointed on the beam, this system will defend the quarter, not only with a most powerful increase of guns, but with an equally formidable accession of effect, from the rapidity with which they can be fired.

In arming the stern of a ship, it is important that the guns should not require to be moved from one port to the other; since the operation causes confusion and delay, by which a valuable opportunity may escape of firing upon the enemy. As this part of the ship has been so much strengthened, by the improvements which have been introduced in its construction, it is probable that ere long it will be found expedient for ships to carry regular guns for their stern ports, instead of their being furnished from other situations, where their services may be equally required.* This provision for the more efficient defence of the stern and

* Some ships in the French navy have lately been constructed to carry regular guns in their stern ports.

quarters will appear the more necessary, when it is considered that in future wars our line of battle ships will be occasionally assailed by powerful steam vessels, which, taking the opportunity of light winds, or a disabled state of the rigging, will harass, by rapid movements, the weak points of their unwieldy enemies, on which occasions a gun "all ready" will be wanted in every direction. To avoid however the serious objections which would arise in carrying guns regularly mounted in the stern, they might be stowed and secured in some convenient part of the deck in the position Fig. 2, Plate IV. and, on preparing for action, be mounted on the breast carriages by the simple process before described.

In applying the new carriages to bow guns, it will be found that, contrary to the old one, it will train to as great an angle in a circular breast work as in a straight one; and since the shape of every ship's bow lies between that of a circle and a triangle, in either of which cases the gun will train to at least 45° , it follows that there is a situation in each ship's bow wherein, if a common sized port were placed, the new carriage would train either right ahead or upon the ship's beam.

On the advantage of being able in a few seconds to traverse a gun, from a broadside to a fore and aft position, no comment need be made, with reference to its general application in ships of war; but, as the chase guns, which are furnished to our cruisers, are very little available for the purposes intended (though, if more conveniently mounted, they might frequently be useful, even on the peace establishment, when chasing pirates, slave ships, or smugglers), a case or two may be more particularly adverted to.

In Fig. 1, Plate VIII. A, B, C, D, represent the bow ports of an eighteen-gun sloop; at the port A it appears that a six-pounder, on the new carriage, will train from the position 1, or right a-head, to the position 2, abaft the beam; whilst in the corresponding port, B, the old

carriage will only train from 4 to 5, by which the gun does not approach a fore and aft position by about two points, and would consequently require the ship's course to be altered materially before it could be fired on an object a-head.

Again:—since the position 2 is nearly parallel to 3 (the old carriage, at port C), and gun 1, is trained considerably further to the bow than 5 in port B, a gun upon the new carriage, placed in port A, has much more training capacity than the old carriage in both the ports B or A and C together; and if, to avoid bringing the weight of the gun too far forward for the trim of the ship, it were desirable to fire from the after bow-port, it would train as far forward, on the new carriage, in the port D, as if, in the other case, it were impeding the ship's sailing in the foremost port, B.

In training the old carriages, 3, 4, and 5, a few degrees more might be obtained by bringing the muzzle within the port; and, in action, these guns would no doubt be thus fired. As the bow guns of a cruiser are, however, often wanted, under circumstances in which a commander would not feel disposed to risk an injury to the bulwarks of his vessel, the respective muzzles in the plate have been placed so as to clear them.

Should it be wished to obtain on the gun decks a greater angle of training than 45° , in after or bow ports, this may be effected by making them a few inches wider, or by rounding their inside edges. A twelve pounder, mounted in a port adapted for an eighteen pounder, or an eighteen pounder in that now allowed for a twenty-four pounder, will train to about 50° on the new carriage, and still have its muzzle outside the port. A twelve pounder, in its fore-castle port, on board the Prince Regent, trained to 54° before and abaft the beam of its port.

RECOILING

To those who may not have witnessed a naval action, it would be difficult to describe the degree in which the decks of a ship are shaken by the jumping or tilting of the guns, when their recoil has become violent by double shooting or continued cannonading.

This effect appears to be caused by the sudden manner in which the gun is stopped by its breeching; for when thus acted upon, as in Fig. 9, Plate IV, a power in the direction A, a , is exercised by the re-action which takes place, which applied at the lever A, b , tilts the gun over the axis b , or point of resistance.

In the new carriage, Fig. 10, the effect of re-action is communicated in the direction M, m , or about in a line with the point of resistance, O ; so that, independently of the gun's inability to tilt up, in consequence of its muzzle being propped at O , the breeching has little or no tendency to produce this motion.

By the straight direction in which the breeching of the new carriage acts, a fair strain is brought upon all its parts or strands: the breeching of the old carriage, Fig. 9, however, being made to pass through the ringbolt A , receives there a very severe nip, and generally gives way first at that part.

In working a gun, great delay also arises from this tilting motion, occasioned by the bed and quoin being thereby allowed to move out of their proper position. In the old carriage the bed and quoin are alone kept in their places by the pressure of the breech upon them; when, however, from the sudden stopping of the gun, the quoin possesses a tendency to slip from under the breech, the weight of the breech at the same moment is removed from it by tilting up. On the new carriage,

however, the greatest weight is on the hind axle, when the breeching stops the recoil, so that the greatest effort is made to keep the quoin in its place at the only time when a cause exists to move it.

The advantages which arise in retaining the quoin firmly in its place, during a continued cannonading, refer not only to the saving of much time, but ensure a continuance of any particular accuracy, with which the guns, under the superintendence of their officers, may have been levelled on preparing for action. In an engagement in the night, or when the smoke prevents a sight of the enemy, these advantages will be more particularly obvious.*

Before a gun upon the old carriage is fired, it is necessary that the breeching be middled, or so pulled through the cascabel and side rings, as to provide an equal length of slack breeching on each side of the carriage; for if, as in Fig. 1, Plate VI., part 1, should become tight before part 2, the friction with which the breeching would pass through the cascabel and side rings before the gun was stopped, would exercise a power to twist round the muzzle in the direction P. This power would be alone opposed by the resistance of the hind trucks to move sideways, the fore trucks on each side of X, the axis of motion, being free to move, the one forward the other backward round it; and, as a small portion only of the gun's weight rests upon the hind axle, its momentum would have little effect in preventing this change in the gun's direction. By a

* It has frequently been suggested to elevate ship's guns by screws, instead of quoins; how far, however, any contrivance of this kind would stand the violent jumping of a thirty-two-pounder, and be a sufficiently steady supporter for the breech when greatly elevated, can be alone determined by experiments. To change the elevation of a heavy gun, by means of a screw, is a much more slow operation than by handspikes; and the strength and simplicity of the bed and quoin are advantages of the highest moment in sea service. The same property, however, in the new carriage which, by preventing any tilting motion, renders the bed and quoin unobjectionable, would make the successful application of the screw less doubtful.

gun's thus twisting round, delay is occasioned, since when the muzzle is at P it cannot be loaded.

When an imperfectly middled breeching acts upon the recoil of the new carriage, it has simply to pass through the cascabel (no rings, A, Fig. 9, Plate IV. being attached to the carriage), and the chief weight of the gun being now upon the hind trucks, a very much greater resistance to their being laterally moved opposes itself to a smaller twisting power. Should however the muzzle of the gun assume the position P, Fig. 1, Plate VI. little weight being then on the breast carriage, the most trifling effort will instantly place the muzzle in any direction the man about to load may require. By this means he may be kept from the danger of grape or musketry by moving the muzzle close to the side of the port; or in loading with the ports down, if the scuttle be on a level with the crutch block, the muzzle may, on all occasions, be drawn opposite to it, and the regular sponge or rammer be used by putting its end through the scuttle.

In working the old gun, the vigilance of the crew is also exercised in keeping the slack part of the breeching, when the gun is run out, drawn through the side rings, to prevent its getting under either of the arms of the fore axle; and also in coiling down the side tackle falls, so that the fore trucks may not run over them; for if, in the first case, the breeching, from hanging loose under the breast of the gun, should get placed as at *t*, Fig. 2, Plate VI. not only a strong bias to the motion of the gun would be given, but an effort to upset it would be exerted, varying with the violence of the recoil. In the other case, should the side tackle fall, *r*, get into the position *f*, and the fore truck run upon it, the tackle being thus jammed would (if not carried away) prevent the recoil of one side of the carriage, and turn the gun round.

On these occasions, wherein delay, confusion, and danger to the men are so evidently involved, the new carriage, having no fore axle, cannot become entangled with the breeching; and the front supporter to the

gun, not being moveable upon the deck during the act of recoil, cannot come in contact with the side tackle falls.

ELEVATING.

In elevating and depressing a ship's gun upon its carriage, the object is not only to fire a high or a low shot, but to counteract the inclination of its platform; now as ships seldom engage at a distance much beyond point blank range, but very often when heeling over under canvass, in naval warfare a gun is more frequently depressed and elevated on its carriage under the latter than under the former circumstances, and it is therefore expedient that it should be capable of receiving as much depression as elevation; for it is as frequently required to act as a lee gun, as it is a weather one. Notwithstanding, however, that weather guns might be engaged when the ship is heeling over to an extent that would prevent lee ports being opened or lee guns worked; the capability of depressing them, so as to fire horizontally to windward, is little more than one half of that by which when to leeward they can be elevated to a level position. Inconsistent and inexpedient as this arrangement may appear, it cannot be obviated by the old mode of mounting, without raising the guns much higher upon their carriages, and increasing the size of the ports considerably, inconveniences which would counterbalance any benefit to be derived.

By a very peculiar property, which is exclusively attached to the new carriage, the whole angle through which a gun can be elevated and depressed in its port is very greatly increased without requiring the port to be enlarged; and though the gun is so mounted that its powers of depression equal those of its elevation on the old carriage, yet when engaging, the gun is very little higher from the deck, and when secured considerably lower than its accustomed position.

The limit to be observed in depressing or elevating upon the old carriage is that the muzzle shall not be lower or higher, when run out, than the plane of the top or bottom of the port; for if the muzzle of the gun Fig. 3, Plate VI. be depressed below the line *a, b*, it will strike the port on recoiling and cannot run in.

When a gun however upon the new principle recoils, its muzzle always arrives at the same stationary point (the crutch block), and this being higher than the bottom and lower than the top of the port, the muzzle must rise or fall in receding from either of those directions; and thus the muzzle *m*, Fig. 4, Plate VI. though depressed below the line *a, b*, will gradually rise in its approach to *G*, the crutch, so as to pass clear of the port sill; the curve which the muzzle thus describes on running in and out may be delineated by the diagram Fig. 5, Plate VI.

Let *a, a*, be the port sill; *E, D*, the direction of a gun depressed below it, over the axis *C*, or crutch block; and *D* the breech of the gun, which on recoiling upon its breech carriage, in a direction parallel with the deck, will arrive at the points 1, 2, 3, 4, &c., and the corresponding positions of the gun will be *D C E*, 1 *C F*, 2 *C G*, 3 *C H*, &c., by which the muzzle will have been moved, so as to describe the curve *E, F, G*, &c. over the port sill.

In experiments with a twelve-pounder, on board the Prince Regent, the angle of elevation that the port would admit of was $14^{\circ} 45'$, and of depression $13^{\circ} 30'$. On the old carriage, however, a similar sized port only allowed the gun to be elevated to $12^{\circ} 15'$, and to be depressed $7^{\circ} 15'$; so that, in this instance, the new principle of mounting increased the whole range, from $19^{\circ} 30'$, to $28^{\circ} 15'$.*

* I have been informed that on the arrival of His Majesty Ship *Isis*, off Caraboosa, Sir Thomas Staines, in the execution of the particular service on which he was sent, was desirous of firing a shot on shore. Finding, however, that none of the regular guns of his ship could be sufficiently elevated, the trucks were taken off one of the new carriages, when it was fired at so great an elevation as to produce the desired effect.

The advantage which the new carriage in this respect affords to ships engaging under sail is not confined to the increased angle of heeling at which weather guns may be levelled ; it renders their action upon inclined decks much more easy, safe, and uniform.

When guns are worked in the old way, in a ship heeling over, the recoil of a weather gun, Fig. 8, Plate VI. acquires such momentum as to bring a very severe strain upon the breeching and ring bolts ; whilst that of a lee gun, Fig. 6, is seldom sufficient to force it in-board for loading. The labour also required in one case to run the gun out, and in the other to run it in, is frequently more than the regular crew can supply.

The recoiling motion of a gun, upon the new carriage, has been shown to raise its muzzle when depressed below, and to lower it when elevated above the level of the crutch block, which in one case must accelerate, and in the other retard the recoil ; that is to say, the depressed gun, Fig. 9, Plate VI. will require much greater effort to run it in, than the depressed gun, Fig. 8, and will run out again with much greater facility ; also the elevated muzzle, Fig. 7, will come in more freely and run out with more difficulty, than on the old carriage, Fig. 6. Now as a *depressed* muzzle is applied to level a *weather* gun, and an *elevated* muzzle to level a *lee* gun ; the weather gun 9 will recoil with much less violence than the weather gun 8, and run out again with greater ease ; and the lee gun 7 will recoil up the inclined deck more freely, and run out more steadily, than No. 6 on the old carriage.

The facilities which the new carriage thus affords in the difficult, slow, and often dangerous process of working guns under a heavy press of sail, can alone be estimated at sea. The Figs. 6, 7, 8, 9, however, show, that when lee or weather guns are levelled on the old carriages, the *whole* of their weight must move up and down the inclined deck ; but that when levelled upon the new carriages, all the weight resting upon the crutch block will move horizontally over it in all cases ; the action

of the breech carriage, or a *part* only of the gun's weight, being influenced in its movements, by the inclination of the deck.

When run out to windward, the tendency which the old carriage has to move in again is greatly prevented by the new properties described; for when a gun is run out, as in Fig. 9, nearly its whole weight rests upon the crutch, and, before it can stir, must be drawn horizontally over it. This effect, the disposition of the breech carriage to move down the deck will not always be able to produce, since only an inconsiderable portion of the gun's weight then rests upon it.

It is here proper to remark, that when a gun on the new carriage is elevated to a very great extent above the horizon (from 9° to 12°), it will show the same tendency to run in a certain distance by the effect of its own weight, if not guarded against by the usual methods, as the old gun does to descend an inclined deck when run out to windward. As regards this particular circumstance, the old mode of mounting will therefore have the advantage. Since, however, ships' guns are much more frequently required to fire horizontally from inclined decks, than to direct their shot greatly above the horizon, the inconvenience which, in the less frequent case, arises to the disadvantage of the new system, will meet with ample compensation in the valuable aid which is afforded to steady and equalize the action of the gun, in the more frequent situations of being worked on inclined decks.*

* Considering that by the use of a new principle of producing elevation and depression, every important advantage, in the most complete manner, is afforded to extend under all circumstances the application of ships' guns to their utmost limit, and to facilitate the working of them in a remarkable degree; it appears singular, that in only one case the old carriage should show superiority, and that it should be one which of all others at sea is perhaps the least frequently brought into action, when of course any inconvenience attending it would be removed by those precautions to which seamen in the use of the old carriage are so frequently required to resort.

The position which the muzzle of a greatly elevated or depressed gun assumes, when run in for loading, deserves also to be noticed. When placed upon the old carriage, the sponge sometimes cannot be introduced without altering the elevation. On the new carriage, whatever be the position of the gun when fired, the muzzle on arriving at the crutch block is always in a proper position for loading.

SECTION IV.

Pointing, Working.

POINTING.

Since the efficiency of a ship in action depends upon the number of accurate shot that can be fired in a given time, the ease and expedition with which her guns may be pointed are deserving the most serious consideration.

That a gun upon the new carriage can be brought to bear much more quickly, in any direction which might require the breast of the old carriage to be moved, has already been shown; and it will be equally apparent, that in all other cases a much greater facility of procuring a correct aim is attainable.

When the breast of the old carriage is in its proper place, the gun is pointed, by moving the breech with handspikes, or with the side tackles. By the former process a jerking, unsteady motion is communicated backwards and forwards too much or too little; so that when any very great accuracy is required much time is often expended in

attaining it; or should the side tackles be used, they require to be hooked to the training bolts, and the violent pull that is necessary to move the gun generally produces too great and too sudden an effect: as the falls also require to be carefully coiled down before the gun can be fired, time is again lost by this process.

When a gun upon the new carriage has been trained to something like a required position, the aim is adjusted by moving the breast-carriage instead of the breech, by which means a man at each breast-tackle is enabled to draw the muzzle horizontally to one side or the other, with a motion so smooth and gentle, that the eye of the marksman is never thrown off the apertures of the sights till he perceives his aim to be true, when he is enabled instantly to fire; since the men, whilst in the act of moving the gun, are perfectly clear of the recoil. By this method of pointing much time is saved, and the eye and attention of the gunner not requiring to be diverted from his object from the time he begins to take aim to the time he pulls the trigger, many causes of impatient and inaccurate firing are removed.

In consequence of the difficulties which exist in quickly taking an accurate aim with the old carriage, it is a practice, when the enemy is expected to pass across the direction of the gun, or when the ship's motion is likely to correct the aim, to *wait* for that event, as being the best calculated to produce an accurate shot; though it not unfrequently happens that at the moment waited for a sight of the enemy may be intercepted by smoke, &c. The marksman, however, by the use of the breast carriage, being able to move his gun as steadily, and to fire as instantaneously, as if the ship were producing this effect, will obtain these advantages without waiting for them, and fire upon his enemy whenever visible, and within range.

In a former section, the cause has been assigned which renders it so difficult to fire a true shot from the old carriage, when the rolling of the

ship, and the motion of its head, are continually changing the elevation, and varying the line of the gun. On the new carriage, should the line require altering, when the rolling motion has produced the necessary elevation, this may instantly be done and the gun fired.

It has generally been found that seamen, when firing leisurely for practice, are excellent marksmen, but that in action their shots often do less execution than might be calculated upon, from the weight of metal discharged; it may therefore be inferred that this ineffectual firing has not so much proceeded from the inability of the men to point more accurately, as from their not being sufficiently patient, under the excitement of their situation, to devote the time and trouble which is required to point the old carriage with sufficient precision, when the enemy is not immediately under the muzzles of their guns. Should this view of a most important consideration be a correct one, to facilitate the operation of pointing will not only save time, but promote that accuracy in the direction of the fire, upon which victory depends.

From the ease and expedition with which guns on the new carriages can be traversed through a range of 90 or 100°, a system of what may be termed *focal* firing is attainable, by which a broadside, or a division of guns, might be concentrated upon any part of the enemy. The difficulties which arise in pointing the old carriages sharply to the bow or quarter may hitherto have prevented the practice of so destructive a manœuvre; for the time that would be lost in working the guns, at the extreme ends of the battery, would greatly counteract the advantages to be derived: indeed, so great is the desire of seamen to fire their guns the moment they appear likely to hit *any part* of their opponent, that it would always be difficult, and sometimes impracticable, to controul their movements in the heat of action by any orders of this nature, which so materially would retard their operations in vieing with each other at their guns.

Why however a ship's battery should in action be a scene wherein a crowd of men are firing their respective guns without controul, as to connected effect, whilst the movements of a battery on shore are so accurately guided, as to throw the whole fire to any given point; or why a party of marines, by a simple order, may be made to fire into an enemy's main top, when it would require the greatest exertion of every officer in the ship to cause all the guns to be pointed to her foremast, can only be accounted for, by the difficulties which always arise in training the guns. And as it is frequently essential to success that the efforts of artillery men should be directed to one point, rather than to the whole face of the works assailed; surely most important advantages might in like manner be obtained in naval warfare.

Let, for instance, five well directed broadsides double shotted be all concentrated into any part of the enemy, which may be effected in five minutes by the new system; and there can be little doubt but that much more decisive effects would be thus produced on the fate of an action than the customary results of a first onset.

These principles of combined and controlled effort might also be applied with advantage, when closely engaged abreast; by the bow division firing on the quarter, and the stern division on the bow of the enemy: by this means her decks would be crossed by the shot diagonally, and their effect be encreased in the proportion of an hypotenuse to a perpendicular, or of radius to the cosine of the angle of inclination.

The mode of conducting a general system of practice connected with the principle of concentrated firing, will more properly be shewn in the details of the gun exercise connected with my carriages. I would here only remark, that where commanding officers have paid particular attention to the pointing of their guns; and by any contrivances of their own in marking degrees on the port sill, deck, &c., have prepared their men to produce the effect of a few connected and well-aimed

broad-sides, results of the most brilliant nature have rewarded their exertions.

WORKING.

From what has appeared, it is evident, that a gun may be worked with more expedition upon the new carriage than upon the old one; and as the more laborious parts of the exercise are rendered easy and simple, and the danger of accidents in a great measure removed, it may also be inferred, that a brisk fire may longer be kept up, and the physical strength of the men be longer preserved from exhaustion.

The experiments which have been made in His Majesty's service, not only prove these conclusions to be correct, but also that a less number of men are necessary to work the new carriage. In the Prince Regent, three men worked a long twelve-pounder quicker than six by the old method; on board the Galatea, six men an eighteen-pounder with greater facility than ten, whilst a number of experiments made in the Isis at sea have established the fact, that seven men are able to fire a much greater number of shot from a twenty-four-pounder in a given time, than can be accomplished by ten men in the usual way*.

There are few scenes which display greater bustle and apparent confusion than the decks of a ship of war when exercising the guns: between each carriage there is scarcely a clear space of seven feet, to contain two rows of men (working different guns), with their rammers, handspikes, tackles, &c. In materially reducing, therefore, the number

* I have reason to infer from some facts before me, that with twenty-four-pounders seven men at the new carriage in a continued cannonading, are able to fire one third more shot than can be discharged in the same time by the old method with ten men, or that an eighty gun ship with 100 men less than her established complement, could by the new system of gunnery fire forty rounds accurately pointed in the same time that a three decked ship of the first rate could discharge an equal number of shot by the old carriages worked by 250 more men.

of men required to perform a variety of laborious duties where so little room is afforded, order and convenience must evidently be promoted, and the loss of many lives be prevented by distributing the men more thinly on the decks.

Fig. 2, Plate VIII. represents the quarters of eighteen-pounders on the gun deck of a frigate, and Fig. 3, the number of men required to work similar guns upon the new carriages. By these drawings the commodious arrangement of one battery compared with the other is very obvious, and if a few pencil marks be dashed promiscuously across the respective figures to represent shot entering amongst the men, some idea may be formed of the ratio, in which the chances of hitting them are decreased by reducing their number in similar spaces.

To suggest how any men might be best disposed of, whose services were no longer required to work the guns, is not connected with my present object. As regards the extension of means to fit out ships, the saving of expense in their crews, and of human life in action, some remarks may be made.

To a nation like England, whose facilities in constructing ships of war are so extensive that her naval power may be said only to be limited by the means she possesses of obtaining seamen, it must be of the greatest importance that ships' guns should be worked with as little labour as possible; or, at all events, that it should not be necessary for a greater number of men to be embarked for this purpose than would otherwise be required. That the guns employ more men to work them than are wanted for all the purposes of navigation, &c., may be inferred from the reduction which is made in ship's crews when put upon the peace establishment, or when sent on service unconnected with naval armament. Supposing then that 500 men were able to work the guns of a seventy-four more effectually than is now practicable by her full complement of 600, and that the former number were fully capable of

handling the ship; on any scarcity of men or sudden emergency, one sixth more ships might be put to sea, with stowage for one-sixth more provisions for their crews.*

With respect to economy, a reduction of men on this scale would, in our late wars, have occasioned an annual saving of much more than half a million; and were only one man disembarked from each long gun now in commission, a saving of at least £50,000 per annum would be made. Should it however not be deemed expedient to make any further reduction in ships' crews now on the peace establishment, their guns, by the new method, might be better worked than by any augmentation of men to the war establishment; whilst in ships carrying their full complement, one-third would be relieved from the guns to work the ship in action, to recruit the quarters, or to make up any deficiencies which sickness, men absent in prizes, and other casualties generally occasion.

In military warfare, victory often depends upon the numbers which in one army can be destroyed by the other, and the importance of a conquest frequently rests upon the destruction of life which it has occasioned. In this respect, however, naval warfare wears a different aspect—the destruction of ships being its object rather than the death of their crews, and the disabling of the vessel being more frequently the cause of terminating an action than the carnage which may have been produced. Assuming that the objects of a naval action may be attained without (as a necessary measure) sacrificing the lives of either friends or foes, it will, I trust, be found that my system of ships' gunnery, whilst it affords the means of more quickly disabling an enemy, is nevertheless calculated, in the day of battle, to save the lives of many brave seamen.

* When the Gloucester 74, in the winter of 1826, was sent from England to St. Petersburg, the crew appointed to navigate her was considerably less than 500.

It must be highly important that the movements of a ship's gun, and the work to be performed in every day exercise, should assimilate as much as possible with that which takes place in action. The soldier in the use of his musket handles it with the same ease in an engagement as on parade, and the field artilleryman goes through a course of exercise resembling every case in which he may be required to act. The sailor, however, in learning the art of sponging, loading, and running out his gun, practices upon a quiet controllable body, which in action, when greatly heated, becomes violent in its movements, appears under totally new circumstances, presents new difficulties, and requires increased caution; whilst to keep up a brisk fire, and to counteract the irregular positions which the gun, confined to no particular part of its platform, assumes, call forth such a degree of increased exertion, as can alone be supplied by the excitement of an engagement. In proportion then as the continuance of peace shall remove from our naval service the experience of seamen acquainted with war, it is expedient that either the exercise of ships' guns should resemble warlike operations, or that their action in battle should be made to resemble the quiet movements of simple exercise. As it would require, however, a very expensive supply of powder and shot to produce the effects of half an hour's continued cannonading, and as this would so shake the decks as to render in all probability a caulking necessary, it does not seem likely that so costly a mode of drill will be resorted to. The more simple alternative of rendering the movements and propensities of a heated gun similar to those of a cold one, will consequently be deemed the most expedient, and this alternative the new carriage is completely calculated to effect.

To those who may associate the nature of a naval action with the manner in which some of our most important victories have been obtained; i. e. where each ship placed her broadside opposite to an enemy and continued an uninterrupted fire, from a position so close as almost to prevent the possibility of missing, I may have appeared to attach too

much importance to a facility of working ships' guns through great angles of training, and to have described the old carriage as more unwieldly than it may have proved. The proficiency however in naval gunnery, to which foreign powers had arrived towards the close of the war, assures us that the dauntless energy of our seamen will be met by every aid which gunnery, tactics, and the improvements of the day can supply; so that, however anxious, as heretofore, British officers may be to close with their enemy as the most certain means of victory, this may not always be found practicable, when opposed by steady gunnery, good sailing, and able manœuvring.

Again, the introduction of steam ships of war seems to be rapidly advancing, and as it does not appear probable that their use can ever supersede the services of those fleets and vessels which England has always found necessary to equip, our cruisers more particularly, in any future hostilities, will occasionally be encountered by enemies possessing properties so formidable and novel as to require that the former should have improved means of defence. These means the new carriages will supply, by greatly extending the defence of those weak points which a steam ship, enabled to choose her position, would seek to assail; and, by simplifying the training of the guns so as to correspond with the rapid movements of the enemy, thus insure her being assailed from any direction, with a quick succession of well directed shot.*

In conclusion, it may be observed, that it is highly important a uniform proficiency in the exercise of ship's guns should prevail throughout His Majesty's service. The greater celerity with which

* Experiments having been made on board His Majesty's Ship *Galatea*, on the capability which a ship's crew possesses of propelling their vessel by working paddle wheels; some contrivance of this nature, may hereafter be found necessary, when a ship is becalmed; to counteract the manœuvres of a steam ship; in which case, the crew would be sufficient to work their guns in the new way, and to propel their vessel at the same time.

some ships work their guns than others, shows however that the attainment of this object is attended with difficulties of no ordinary character. So great is the labour required to put guns (on the old carriages) through all their motions, that without some particular object to excite the energies of their crews, or a very vigilant superintendence in their officers, those parts of the exercise which are the most difficult to perform will be evaded—hence, to sponge, run out, and traverse the breech of the gun are constantly practised, whilst the moving of the breast to attain the greatest angle of training is seldom attempted. In the exercise however with the new carriage, so simple and little laborious are all the operations, that they will be as easily understood as they can be readily practised; and from the shortness of time which will be found necessary to render newly raised crews perfectly acquainted with the use of their guns, a general system of expert and accurate gunnery may thus be more easily established throughout the British fleet.

SECTION V.

RESULTS OF EXPERIMENTS.

His Royal Highness the Lord High Admiral having been pleased to direct that one of the Prince Regent's guns should be mounted upon the carriage of my invention, and that Vice-Admiral Sir Robert Moorsom should order the three senior captains, under his command, to inspect it, and make their report,—on the 15th of June, 1827, Captain Maling, of H. M. S. Cambridge, Captain Moorsom, H. M. S. Prince Regent, and Captain Patton, H. M. S. Isis, assembled on board the Prince Regent, when the following experiments were made:—

No. 1. The respective guns, one a twelve-pounder mounted upon the established carriage, the other a twelve-pounder upon the new carriage, were trained to the greatest angle before and abaft the beam of their ports, which their carriages would allow: their muzzles being each placed outside of their ports.

Angle of the new gun 54° .

Angle of the old gun 39° .

No. 2. The new gun, worked by three men, was trained from an angle of 54° on one side of the beam of its port to 54° on the opposite

side ; and the old gun, worked by six men, was trained from an angle of 39° to 39° in the opposite direction.

Time in which new gun was trained	- - -	25"
Do. - - - old gun, do.	- - -	29"

No. 3. The guns were each fired eight rounds, and pointed alternately at objects on the beam, three points before the beam, and three points abaft the beam.

Time in which eight rounds were fired in the above order, by	
new gun, worked by three men	- - - - - 7' 44"
Time in which the same was performed with the old gun,	
worked by six men	- - - - - 9' 9"

No. 4. The guns were each fired eight rounds, double shotted. The old gun kicked up, shook the deck, and displaced its quoin. The new gun did not kick up, nor shake the deck, nor displace its quoin.

No. 5. The new gun was pointed steadily to its object by moving the breast block, and was fired whilst in the act of being pointed.

This was done most satisfactorily; the men, when traversing the gun, being perfectly clear of the recoil.

No. 6. The guns were pointed at the greatest angle of elevation and depression which their ports (of similar height) would admit of.

New gun	{ Angle of elevation	14° 45'
	{ Angle of depression	13° 30'
Old gun	{ Angle of elevation	12° 15'
	{ Angle of depression	7° 15'

No. 7. The new gun, by its crew (three men) was placed upon its transporting truck in 57", and remounted upon the breast block in 40".

No. 8. The breech carriage was taken away by three men in 43", and replaced by the same in 24".

No. 9. The breast block was removed from the gun in 1' 2", and replaced by three men in 1' 10".

To the following Questions the inspecting Officers were pleased to attach the accompanying answers :—

QUESTION 1.

GENTLEMEN,

Do you consider the gun carriage, invented by me, to be constructed upon such principles of strength, durability, and simplicity, as to render it calculated for the purposes required of it?

ANSWER.

It combines strength with simplicity of construction ; and, as far as the experiments have gone, seems well calculated for sea service.

QUESTION 2.

Considering the superficial surface of my gun carriage, and the means it possesses of admitting any of its parts to be replaced in action by the crew of the gun, would it be more liable to be disabled in action than the established one?

ANSWER.

If either of the two parts of this carriage were disabled, it might be more easily replaced by a spare one, than any similar injury done to the old carriages could be remedied.

QUESTION 3.

Do you consider that the broadside of a ship, whose guns are mounted on the proposed plan, could be brought to bear on an enemy, under circumstances that would not admit of it, were her guns mounted on the old carriages?

ANSWER.

It could, on account of the guns training more fore and aft.

QUESTION 4.

The gun mounted upon my carriage has been worked by half the number of men usually stationed to a long twelve-pounder; in addition to this advantage, do you consider the operation of working a gun upon my principle to be more simple, to be attended with less bustle, and in training much forward or aft to require less art and experience?

ANSWER.

Fewer men make less bustle, the operation of training this carriage is more simple and uniform than the other, and would need less practised seamen.

QUESTION 5.

From the old carriage being subject to kick up, it displaces its quoin, muzzle, &c.; when, under similar circumstances, these effects are

prevented by the new carriage; would not much delay in action be avoided, by the use of a carriage that binds the quoin firmly in its place, and keeps the muzzle of the gun always in the necessary position for loading?

ANSWER.

Certainly; and it is of importance to preserve the elevation, when engaging in the night, or when the smoke prevents a sight of the enemy.

QUESTION 6.

If a gun, as upon the new carriage, can be steadily directed to its object, by moving the breast block instead of the breech, and thus admit of the gun's being fired whilst in the act of being moved, may not a correct aim be more quickly attained, and may not the precision of a seaman's fire in the heat of action be more calculated upon, when, by rendering the task of pointing a gun more simple and less tedious, his patience will be less exercised?

ANSWER.

Quickness and precision of pointing may be more easily attained with this carriage, as was proved in the experiments we witnessed.

QUESTION 7.

Do you consider that guns mounted upon my carriages may be fired at objects, when they cannot be sufficiently elevated or depressed for that purpose on the old carriage?

ANSWER.

The difference of elevation is not very great, but that of depression is such as to give great advantage to this carriage.

QUESTION 8.

Does it appear that if the guns of a ship of war were mounted on the proposed carriages they might prove as efficient in action as those of a similar ship worked by more men on the old plan?

ANSWER.

This question requires further trial of the carriage, but apparently much more so.

QUESTION 9.

Do you consider that guns, when housed, may be as safely secured by my method as by the existing mode, and with less strain to the ship's side when rolling?

ANSWER.

Yes; and with less strain, as the guns are much lower in the carriage when secured.

QUESTION 10.

Is the new gun carriage, on recoiling, so liable to get foul of the breeching or side tackle as the old one?

ANSWER.

It is less liable to get foul.

QUESTION 11.

In making the experiment No. 3, do you consider that the men who were stationed at the old gun are a fair average of British seamen, have been well trained at the great gun exercise, and that they worked their gun with all the skill, zeal, and exertion in their power?

ANSWER.

They were all this, and appeared to be more active men than the crew of the new gun, and it would appear that every possible advantage was taken in working the old gun, even to soaping the deck and trucks.

(Signed)

J. T. MALING, Capt. H. M. S. Cambridge.

C. R. MOORSOM, Capt. H. M. S. Prince Regent.

H. PATTON, Capt. H. M. S. Isis.

A report of the foregoing experiments was forwarded with the following letter to the Commander in Chief at Chatham, Vice Admiral Sir Robert Moorsom.

H. M. S. Cambridge,

Chatham, June 15, 1827.

SIR,

In pursuance of your order of yesterday, we this morning assembled on board H. M. S. Prince Regent, to examine into the merits of a new gun carriage invented by Lieutenant Marshall, and we have the honor to refer you to our answers, given against each experiment in the enclosed document ; and we beg further to add, we found it so unob-

jectionable, that we venture to recommend your moving His Royal Highness, the Lord High Admiral, to allow of its having a more extended trial in a sea-going ship.

We have the honor to be, &c.

(Signed)

T. J. MALING, Capt. H. M. S. Cambridge.

C. R. MOORSOM, Capt. H. M. S. Prince Regent.

H. PATTON, Capt. H. M. S. Isis.

To Vice Admiral Sir Robert Moorsom, K. C. B.

Commander in Chief in the River Medway.

On receipt of the above report, two eighteen-pounders were immediately ordered to be fitted with the new carriages on board H. M. S. Galatea, bearing the flag of Rear Admiral Sir T. Hardy, and two twenty-four-pounders on board H. M. S. Isis, Captain Sir T. Staines.

The following reports have been made by those distinguished officers :—

*Galatea, off Scilly,
July 11, 1827.*

SIR,

I request you will be pleased to report to His Royal Highness, the Lord High Admiral, that in obedience to the directions signified in your letter of 4th ultimo, I have made trial of the eighteen-pounder gun [only one was fitted], on board the Galatea, on a carriage according to a plan suggested by Lieutenant Marshall, Flag Lieutenant of the Prince Regent; and having caused the gun to be repeatedly fired with single and double shot, I beg to report that the carriage appeared to

stand perfectly well, and is worked with much more facility by six men than the other carriages are by ten men. It combines the power of being pointed eleven degrees further before or abaft the beam than the guns now in use, and I think it particularly well adapted for a bow or stern chase gun ; but, if used on the broadside, some remedy is required to allow the gun to recoil more within the port, in order that the men loading it might not unnecessarily be exposed, as they now must be from the present construction of the carriage, in close action with the enemy.*

I have the honor, &c.

(Signed)

T. M. HARDY, Rear Admiral.

To J. W. Croker, Esq.

§c. §c. §c.

After a trial of nearly two years with the twenty-four-pounders on board the *Isis*, the following report has been transmitted from Commodore Sir T. Staines :—

Isis at Malta, March 23rd, 1829.

SIR,

In compliance with your excellency's Memorandum of the 30th of January (not received until the end of February), I have the honor to inform you that since my first report to the Admiralty Board,

* The gun of the *Galatea* would have come in six or eight inches more if the ornamental rim near the muzzle had not prevented it. The Board of Ordnance having allowed the bottom part of this rim to be filed off, in the guns of the *Isis*, they have been found to recoil sufficiently within the port to remove any possible objection of this nature.

on the advantages or disadvantages of Marshall's gun carriage, I have had several additional comparative trials with that and the common carriage, successively firing, with cartridge only, with single shot, and with double shot. The result has been invariably favorable to Marshall's invention; for although on one occasion, only, of firing direct a-beam, the common carriage was worked with as much celerity, and the gun fired, single shotted, twelve rounds equally quick, yet the fact of Marshall's gun being worked with three men less in number gives it great advantage (viz. common gun ten men one boy, Marshall's gun seven men one boy); but, when training is necessary to point to the object, the advantage increases with Marshall's in proportion to the increased angle in training. I must say, however, that except on the one occasion Marshall's gun has invariably had the advantage. On this one occasion, perhaps, the excessive activity of the crew belonging to the common gun may account for it. The fact of Marshall's gun being capable of training to one point further aft and one point further forward, together with the greatly increased elevation and depression, are advantages also of the highest moment, and give it the superiority over every other gun I have seen. The breast training process is admirable; performed with the greatest ease and with the utmost celerity; enabling the captain of the gun to fire the instant it bears on the object, without the necessity of cautioning or giving the crew time to stand clear of the training tackle falls (which must be done with the common carriage), the breast training stool of Marshall's carriage not recoiling with the gun. If an injury happens to the crutch, the gun is easily and speedily lifted to shift it (spare ones would of course be supplied). The one we found broke,* mentioned in my former report to the Admiralty, has been repaired at Malta, and now perfect. The lifting of the breech of the gun to shift the carriage is likewise an easy and quick operation. The recoil is nearly equal with both carriages, whether fired with powder only, with single or with double shot. The exception to the general adoption of Marshall's carriage is, in my opinion, that

* From imperfect workmanship, as reported by Sir T. Staines.

the ship supplied with them should have at least the two after and the two foremost guns on the old carriages, to shift for bow or stern chasers or back to their ports as occasion should require.* With this exception, or perhaps an additional one on each side for shifting from one side to the other, a ship might, in my opinion, be furnished with Marshall's gun carriages advantageously to the service.

I have the honor, &c.

(Signed)

T. STAINES, Captain,

To His Excellency Vice Admiral

Sir P. Malcolm, K. C. B.

In 1827, four eighteen-pounder Congreve's guns were fitted with the new carriages on board the Honourable East India Company's ship the Earl Balcarras, Captain Broughton; on the return of that officer from China, he made the following report for the information of the Committee of Shipping.

SIR,

June 13, 1829,

In obedience to your orders to report upon Captain Marshall's gun carriages fitted on board the Honourable Company's ship, Earl Balcarras, under my command, I beg to state that upon repeated trials

* This remark arises no doubt from Sir T. Staines considering the new carriage incapable of being moved from one port to another as quickly as the old one. By the new process described in Transporting, with which Sir T. S. is unacquainted, equal celerity in shifting the guns will, I doubt not, be found attainable.

working the patent guns against the common mounted guns, I find that four men can work the former gun easier and faster than seven can work the latter gun, and, upon firing them double shotted, the patent gun kicks less than the common mounted gun does single shotted; from the construction of the gun carriage on Captain Marshall's principle, the gun recoils much quicker than the other gun, consequently must have very good breechings.

I am &c.

(Signed) B. BROUGHTON.

To John Morice, Esq.
&c. &c. &c.

It enables a ship powerfully to defend her quarters by the fire of her guns and broadside guns, and thus to command every point of attack from the stern to the bow.

A great portion of the broadside guns may be brought to bear on what is termed the point of impunity, and a vessel in chase may so place herself, that the point of her enemy within point blank range as to fire all her broadside guns without those of the enemy on the side being able to return the fire, the ships containing no parallel lines of

From the foregoing official reports of all the trials which have been instituted with my gun carriages, the statements made, and the inferences drawn, in my description of them, receive, I trust, the most satisfactory confirmation.

In conclusion, the following summary of the leading properties of the respective modes of mounting may be collected from what has appeared:—

PROPERTIES OF THE NEW CARRIAGE.

It allows the gun to be pointed at the greatest angle across its port which the width of the port or the length of the gun will admit, that is, through an arc of from 90 to 100 degrees; upright sides, with broad waterways, &c., present no obstacles to the training of the gun.

It enables a ship powerfully to defend her quarters by the fire of her stern and broadside guns, and thus to command every point of attack from the stern to the bow.

A great portion of the broadside guns may be brought to bear on what is termed the point of impunity, and a vessel in chase may so place herself on the quarter of her enemy within point blank range as to get all her broadside guns to bear, without those of the enemy on the old carriages being able to return the fire, the ships continuing on parallel lines of sailing.

PROPERTIES OF THE OLD CARRIAGE.

Prevents its gun training through a greater arc than about 60 degrees under general circumstances; in upright sides with broad waterways a smaller angle of training can only be obtained.

Does not enable a ship to defend her quarters by the fire of her stern or broadside, an arc of about 20 degrees on the quarter being left unprotected by their faces.

PROPERTIES OF THE NEW CARRIAGE.

A gun trained to its greatest angle may be fired repeatedly in that direction with the same expedition as in any other.

A greater number of accurate shot in a given time can be fired.

3 men			are sufficient to work a long 12 pr.
4 men	Do.	Do.	a Congreve's 18 pr.
5 men	Do.	Do.	a long 18 pr.
7 men	Do.	Do.	a long 24 pr.

Exclusive of powder boy.

Hence the reduced crews of ships of war on the peace establishment are more than sufficient to work their guns.

The services of about fifty men from each deck of long guns being dispensed with, much less confusion and carnage at quarters will prevail; by requiring fewer men, economy may be promoted, more ships may be equipped, or the present crews be made more efficient.

When disabled in action it may have its parts quickly renewed.

PROPERTIES OF THE OLD CARRIAGE.

The continued fire of a gun is very much retarded by the difficulties which attend its being trained when engaged much before or abaft the beam of its port; these difficulties the irregular direction of the gun's recoil frequently occasions.

6 men			are required to work a long 12 pr.
7 men	Do.	Do.	a Congreve's 18 pr.
9 men	Do.	Do.	a long 18 pr.
10 men	Do.	Do.	a long 24 pr.

Exclusive of powder boy.

Hence the full war complement of men are required to work a ship's guns.

In the confined space between the guns so many men are stationed to work them, that the decks are inconveniently crowded, and the enemy's shot amongst them very destructive.

If disabled cannot be replaced in action without such difficulty as to prevent its being attempted.

PROPERTIES OF THE NEW CARRIAGE.

The breeching of the gun can never get foul of the carriage, and little or no caution is necessary to keep the side tackle falls clear of the recoil.

A gun engaged at a great angle of elevation or depression, does not require its quoin to be moved in order to load it.

Guns in the regular sized ports may be elevated and depressed through an angle of at least 28 degrees.

A ship heeling over 10 or 12 degrees, may lay point blank her weather guns.

Weather, and lee guns, may be worked more easily, a part of their weight only requiring to be moved up and down the inclined plane of the deck.

However heated or heavily shotted the gun may be, it never jumps up at the breech.

When the guns are all laid at their proper level on going into action, they will continue in this position.

PROPERTIES OF THE OLD CARRIAGE.

Serious inconveniences may arise when the ropes attached to the carriage get under the fore trucks, and to keep them clear requires much attention.

When working a gun much elevated or depressed upon its carriage, the muzzle often requires to be levelled each time it is loaded.

Guns in their ports can only be elevated and depressed through an arc of about 18 degrees.

A ship laying over above 6 or 7 degrees cannot point her weather guns horizontally.

When the decks are inclined the whole weight of the gun is moved up and down them.

The gun after a few rounds kicks or tilts up, by which means the bed or quoin is moved, and the decks violently shaken.

However carefully the elevation of the guns may have been inspected and adjusted, two or three rounds will move the quoins.

PROPERTIES OF THE NEW CARRIAGE.

By a new mode of altering the line of the gun, by moving the breast block instead of the breech, the gun is steadily drawn in a line with its object, and may be fired at the same instant, the men whilst in the act of moving the gun being clear of the recoil.

Guns when secured are much nearer the deck, and lower in the ship.

Very little practice is required to work the gun with the greatest celerity in all cases; a uniform proficiency in naval gunnery may therefore throughout His Majesty's service be more easily attained.

PROPERTIES OF THE OLD CARRIAGE.

The rough motion of a handspike applied to the breech occasions delay in accurate pointing, and the men being required to stand clear before the gun can be fired, an interval of time elapses in which the motion of the ship may alter the direction of the gun.

To work a gun smartly in different directions requires very great practice and skill, and to keep up a brisk fire for any length of time, very exhausting efforts.

Since the foregoing sheets have been printed, His Majesty's Steam Ship Columbia, has been ordered to be fitted with guns upon my pivot carriages; my Lords Commissioners of the Admiralty have also done me the honour to transmit the following copy of a further trial made on board the Isis, of my gun carriages; and to inform me, that as the report appears so favourable, their Lordships have recommended to the Board of Ordnance that one side of the upper deck guns of the Donegal at Sheerness, should be fitted with these carriages.

COPY.

Results of several trials made of Commander J. Marshall's gun carriage, with a long twenty-four pounder gun upon it, in the presence of Vice Admiral Sir P. Malcolm, and the Captains of the Ocean, Revenge, Wellesley, and Windsor Castle.

TRAINING.

Marshall's carriage,—Forward $4\frac{1}{4}$ points,—Aft $4\frac{1}{2}$ or a little more
 Old - - - - - $3\frac{1}{2}$ - - - * $4\frac{1}{4}$

ELEVATING (the trucks on both carriages).

Marshall's $13^{\circ}\frac{3}{4}$, and came in clear of the lintel.

Old 14° extreme; and
 7° to come in clear of the lintel.

ELEVATING (the trucks taken off both carriages).

Marshall's $15^{\circ}\frac{1}{4}$ and came in clear of the lintel.

Old $15^{\circ}\frac{1}{4}$ extreme, and
 $8^{\circ}\frac{1}{4}$ to come in clear of the lintel.

* This figure is evidently an error of the writer of the report, and should be 3, not 4.

DEPRESSING. (as shown in the previous page) It can be elevated and depressed considerably more than the old carriage. Marshall's 15°, and came in clear of the port. Old 11° extreme, and 6½° to come in clear of the sill.

The carriage recoils steadily, and does not jump from the deck; and during the whole of the firing the duoin never started.

FIRING.

Elevated (trucks on) with 8 lbs. powder	single	shot	3
do.	double		2
(trucks off)	single		3
do.	double		2
Depressed	single		3
do.	double		2

15 times.

Point blank	single	7
do.	double	5

12 rounds in 11' 45"

The gun was also fired with eight pounds of powder, and a single shot, upon a transporting truck, and recoiled easy, without displacing the truck.

REMARKS.

The gun mounted on this carriage can be pointed nearly a point further forward and aft than upon the old one.

It can be pointed at an object with perfect ease and precision by the mere moving of the breast carriage; and can be fired, whilst it is being so pointed, without any risk of endangering the men from recoil.

It can be elevated and depressed (as shown in the preceding page) considerably more than upon the old carriage, and it recoils clear of the port.

The carriage recoils steadily, and does not jump from the deck : and during the whole of the firing the quoin never started.

It cannot be transported with as much facility as the old carriage,* nor is it so well adapted for the lower deck : the crutch not admitting of its being run in quite far enough to load with ease, when it is necessary to lower the ports.†

The crutch must be much stronger (and there is no reason why it should not be so), and several spare crutches should be allowed, with a few spare breast carriages also, in case of accident ; they would not require much space for stowage.

It is worked with greater facility by eight men than the old carriage can be with ten ; and the training of it, by the breast tackle, is done with remarkable ease.

We consider this carriage, for the reasons above stated, to have considerable advantage over the old gun carriage, and to be well adapted

REMARKS

* It has been before remarked that the quick and simple mode of transporting, now suggested, was not attached to the guns of the Isis.

† No trials with lower deck guns have yet been made. Since, however, the muzzle of a gun on the new carriage is always, when run in, the same height from the deck, its bore will be always about on a level with the scuttles now fixed in the ports ; by drawing the muzzle, therefore, opposite to this small hole, when the ports are down (and which can instantly be done by one man), the rammer, or sponge may be worked with the usual celerity, by putting the end of it through the scuttle, (see page 33.) From this circumstance, it is presumed, that guns may be loaded with the ports down, with much greater expedition by the new than by the old method.

for the upper decks of ships; but we recommend, at the same time, that if it should be brought into use, a ship should always have some of her guns mounted upon the common carriage, for transportation when necessary.

*On Board H. M. S. Isis, off Vourla,
5th of August, 1829.*

(Signed)

P. MALCOLM, Vice Admiral.
P. CAMPBELL, Ocean.
N. THOMPSON, Revenge.
F. MAITLAND, Wellesley, H.
D. P. BOUVERIE, Windsor Castle.

SECTION VI.

Having illustrated the various properties of my new system of naval gunnery, as connected with the mounting of long guns now established in His Majesty's service, a few observations may be made on its application to the arming of steam ships, gun boats, and merchant vessels; to the mounting of Congreve's guns, and on the peculiar advantages it affords to the ships of the Honorable East India Company.

In whatever way steam ships of war may be constructed, it will no doubt be found expedient to arm them with long guns, that they may be enabled to avoid close action and keep their machinery from danger. To move heavy guns, therefore, with a celerity that may correspond with the quickness of manœuvring by steam, and to be enabled to fire with accuracy and rapidity, will be important advantages; whilst in cases where the stowage of engines and fuel leaves so small a space for provisions and accommodations, it will be of great consequence that the reduced numbers of men which are sufficient to navigate steam vessels, should also be able to work the guns which they may be required to carry.

To arm a moderate sized steam ship, a traversing long gun in the bow, and another in the stern, to fire over a bulwark made low, or partly

to let down, will perhaps be found the most effective and convenient mode; and for guns of this description, the new principle affords the means of constructing a pivot carriage the most simple that can be imagined:—for, by fixing the crutch into the top of a short, strong post, Fig. 1, Plate IX. secured in the middle of the deck, or centre of the gun's sweep, no traversing platform is necessary; the gun when run out resting nearly all its weight upon the head of the post, (round which axis it traverses), the breech carriage recoiling along the deck as usual.

The spindle of the crutch fixes into an iron socket in the top of the post, which is well hooped. The breeching is placed round the base of the crutch, and being kept in this position by an eye on each side of it, moves with the crutch, when the gun is traversed round the post. The side tackles may be hooked to eye bolts in the post, and under the carriage to the axletree.

This mode of mounting traversing guns is equally applicable for gun boats. To work a long eighteen-pounder five men are sufficient. The gun should be run out before loading commences, by which means the operations of sponging, coiling down the side tackles, preparing to point, &c. may all be in progress at the same time. On service with gun boats, or where a steam vessel may be required to advance up a river and dislodge an enemy on its banks, &c. &c. the rapidity with which a long gun may be thus worked will be of the utmost importance.

In vessels of light construction, and more particularly steam ships, this method of mounting guns will be found valuable in preventing all jumping and unsteady motion in their recoil; which, with powerful guns, might so shake the vessel as to be injurious to the machinery. It may therefore be found that on the pivot carriages heavier guns can be carried. Their low position when secured will be found also an advantage by no means inconsiderable.

In the arming of merchant ships, it must be unnecessary to point out the benefits which would be derived from the use of the Patent carriages. The very small number of men they require to work them, and the little practice or knowledge of the gun exercise that is necessary to direct them with the greatest rapidity, would enable a crew of fifteen or twenty men to render themselves very formidable opponents against pirates, privateers, &c. three men having been found all that are necessary to work even a long twelve-pounder. The low and snug manner in which guns on these carriages stow fore and aft, close into the ship's side; or in which they may be lashed down to the deck when removed from the port, are objects of consideration which will not escape attention.

It is no doubt in consequence of the unsteady action of brass guns when heated, that they are now so rarely used on board ship; though, from their lightness, they might in many cases be useful on the slight upper works of small vessels.

From the repeated trials which Lord Yarborough made at sea with the brass guns of the Falcon, they were found in all cases on the new carriages to be perfectly steady, and from their being much smaller in diameter than iron guns of similar bore, the new mode of mounting them enabled that circumstance to be made available, in producing a very extraordinary degree of training towards a fore and aft direction.

Some years ago, a new description of cannon, something between a carronade and a long gun, was introduced, by Sir W. Congreve, into His Majesty's naval service, and also into that of the East India Company. From the Congreve guns being about one-fifth lighter, and much shorter than the regular guns of similar calibre, whilst their point blank range

was found to be more extensive,* they seemed calculated to be importantly useful, more particularly in the upper tiers of three decked ships, and in the service of the East India Company. From the unsteady and unsafe action of these guns upon their carriages, their use has however lately been discontinued in His Majesty's service, though they still form the entire gun deck armament of the fleets of the India Company.

By mounting these guns on the new method, Fig. 2, Plate IX. it appears, from the experiments of Captain Broughton, that they are rendered steady and secure though fired double shotted; and that with three men less, or with only four-sevenths of the old crew, they may be worked more easily and quickly than before: thus all the benefits which were expected to arise from the use of Congreve's guns, may be now realised, their general efficiency be greatly increased, and a considerable number of guns at present considered useless, be again restored to His Majesty's service.

By mounting Congreve's guns on board ships of the line and Indiamen, short guns were introduced on board thick sided vessels; by which the greatest angle of training towards the bow and quarter, already too limited was made still less than before. On the new carriage, however, Congreve's guns train to about 45° ; and as they may be worked by nearly the same number of men as carronades of similar calibre, line of battle ships carrying even fewer men, may now change their main deck guns for Congreve's thirty-two-pounders, by which means all the guns and carronades of the whole broadside will fire the same sized shot.

* The weight of a long twenty-four-pounder is about $49\frac{1}{2}$ cwt. that of a Congreve's twenty-four-pounder 41 cwt. According to the result of experiments published by Sir W. Congreve, the point blank range of the former to the first graze is 368 yards, whilst that of the Congreve gun is 505 yards.

There is also in His Majesty's service a class of small frigates, on board of which Congreve's guns might be used with apparent advantage, in exchange for the carronades which form their gun deck armament.

Without enquiring into the comparative merits of long guns and carronades, it must be considered an unfortunate circumstance that so many of the twenty-eight gun frigates, in which it has been found expedient to mount nothing but carronades, should rank amongst the worst sailing ships of His Majesty's fleet; for being unable to advance within carronade range upon a quicker sailing enemy manœuvring with long guns, or to retreat from a superior force, they are incapable of returning the distant fire of the one, or of crippling the advance of the other. Now, since eighteen-pounder Congreve's may be worked on the new carriages by very few men, and will stow fore and aft, nearly as conveniently as carronades, twenty-eight gun frigates, without any augmentation to their crews or inconvenience to their narrow decks, may be rendered equally efficient with ships of a larger class, and may be made capable of acting at distant ranges with eighteen-pounders either at sea or in shore service, where there may not be water for larger vessels.

When it is considered that nearly the whole armament which defends the valuable cargoes of the Honorable East India Company consists of Congreve's guns, the means which the new carriages afford of rendering them perfectly serviceable cannot but appear in a very favorable point of view, for the same policy which requires the application of a collection of long guns nearly equal in number to all that are now employed in the British navy, must also suggest the expediency of making them equally effective.

In arming Indiamen with Congreve's guns on the old carriages, other objections present themselves which the new carriages also remove.

First, being all square sterned vessels, and having in general very thick sides, a considerable space for attack is left undefended on their quarters, the broadside and stern guns not being able to train beyond twenty-eight or thirty degrees towards that direction before their muzzles are brought so far in board as to endanger blowing off the ports. Of this circumstance a chasing ship having long guns, training to a greater angle, would of course take advantage, her approach not being checked by any loss of spars or rigging, which a powerful fire from the quarter might successfully assail. Fig. 3, Plate IX. shows the respective angles of training, by the old and new method of a Congreve's eighteen-pounder in a port twenty-two inches thick.

To afford strength to the East India Company's ships, large iron knees are made to project along the gun deck. These knees (one of which is generally found between each port, see A, A, Fig. 3, Plate IX.) in many cases form a serious obstruction to the working of the guns, for if trained towards the bow or quarter, the fore trucks must frequently come in contact with them, and thus endanger the gun's upsetting in the recoil; they likewise produce delay and difficulty in running them out. In consequence however of the breast carriage traversing *within* the knees, as shown in Fig. 3, Plate IX. a gun worked on the new carriage will not meet with these obstructions.

That Sir Robert Seppings' valuable mode of strengthening ships on the gun deck, by filling up the angle which connects the deck with the side, cannot be adopted in Indiamen is evident, from the very little distance the muzzles of their guns can already be made to project outside the port. A piece of timber nine inches square in the waterway, would however not interfere with the working of guns on the new carriages.

From the great height above the water to which the gun decks of Indiamen are sometimes raised, low vessels, boats, &c., attacking,

might so place themselves alongside, as to avoid the possibility of being fired into. The great angle of depression, however, which is attainable by the new system would more effectually counteract any manœuvres of this nature.

On inspecting the spacious quarters on the gun decks of these powerful ships, with all their appointments complete, an adequate supply of British sailors seems alone necessary to render them most formidable ships of war. The necessities, however, in war of His Majesty's service, so limit their complement of English seamen, and in peace economy suggests such retrenchment in their crews, that they rarely, if ever, are able to work all the guns they carry to the best advantage. If however four men are now found to be sufficient to work their present guns with increased facility, by an alteration in their carriages, sixty or seventy men are all that will be required on the war establishment, to render the effect and efficiency of their gun deck fully equal to that of a forty-six gun frigate; whilst their present reduced crews may be fully prepared to guard the valuable cargoes entrusted to them, against any sudden commencement of unforeseen hostilities.

In concluding my illustration of what I trust will be considered a successful attempt to effect important improvements in ships' gunnery, I would remark, that however exclusively adapted for war my suggestions may appear, there are many considerations which will prevent my present efforts being deemed unseasonable, or their application unprofitable to His Majesty's service. For, in proportion as the enlightened state of the world shall advance, and with it, more correct views as to the general interests of society, the safety and influence of a nation will depend more upon the means it possesses of resenting aggression, than upon the positive exercise of its hostile powers.

Whilst, therefore, the naval officer who is diligently preparing himself to serve his country on some future day, may favourably view

my endeavours to add efficiency to the armament by which his object is to be attained; the prudent statesman will also, I trust, in peace, be led to estimate the value of an invention, which affords the means of rendering more complete those preparations for war, by which he seeks to secure the continuance of his country's tranquillity.

FINIS.

Fig. 1.

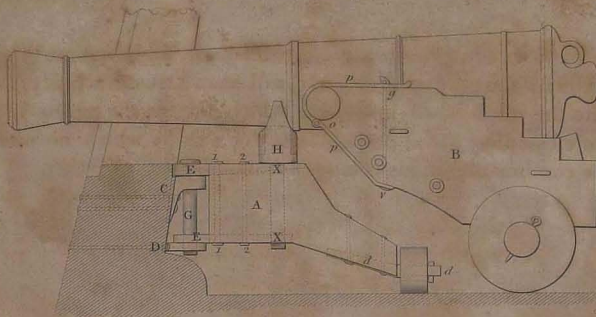


Fig. 3.



Fig. 2.



Fig. 4.

Fig. 5.

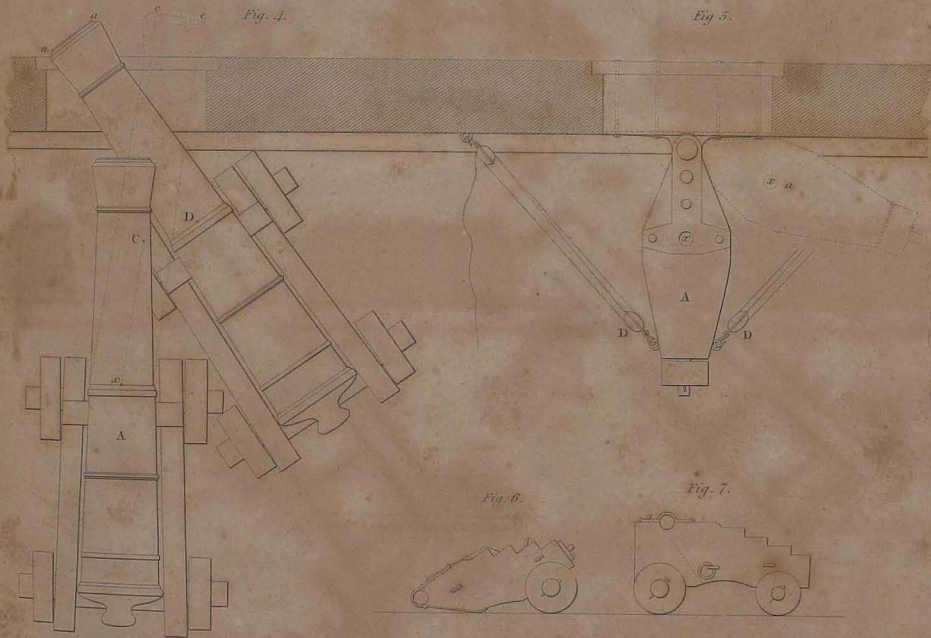


Fig. 6.

Fig. 7.

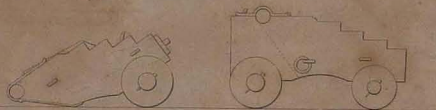


Fig. 1.

Trained on old carriage.

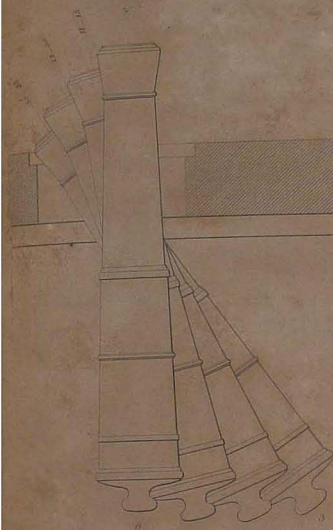


Fig. 2.

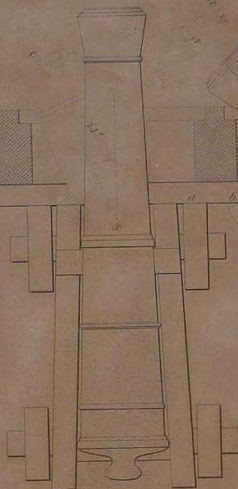


Fig. 3.

Trained on new carriage.

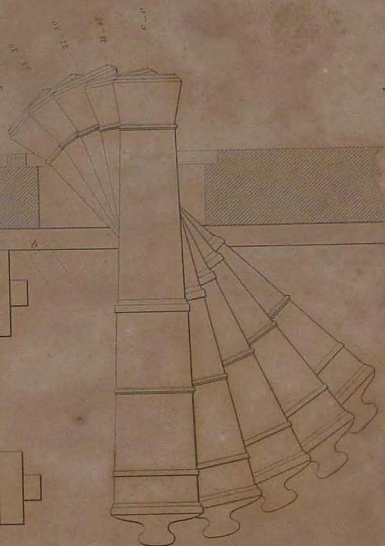


Fig. 4.

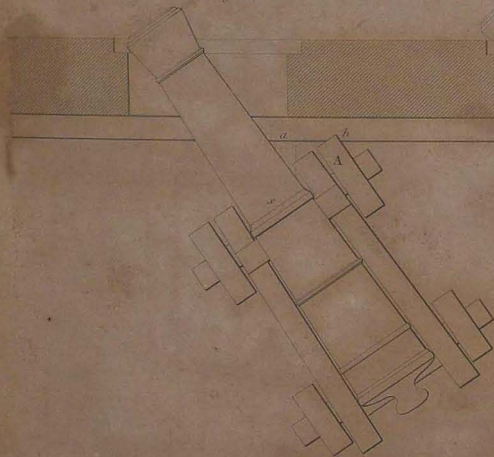
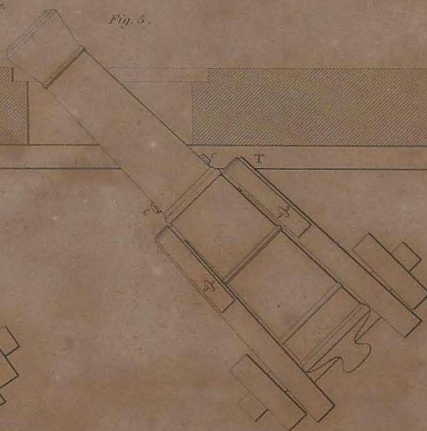


Fig. 5.



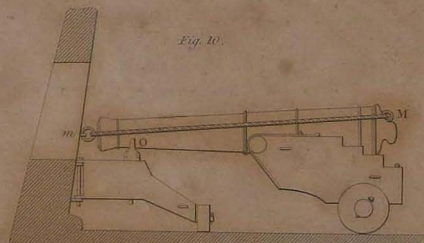
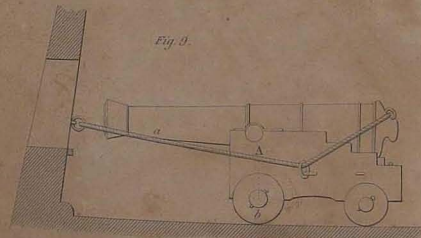
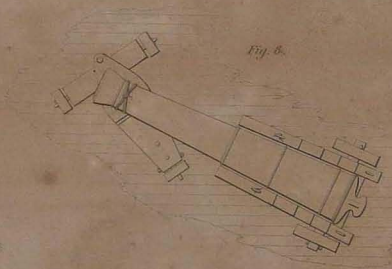
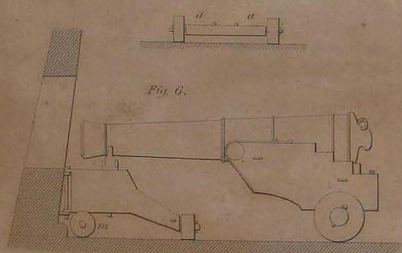
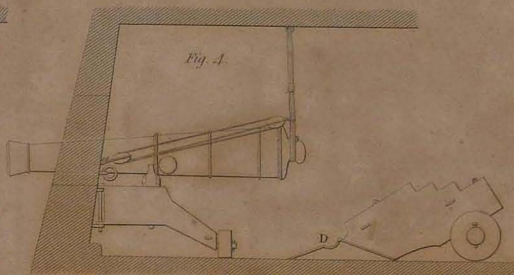
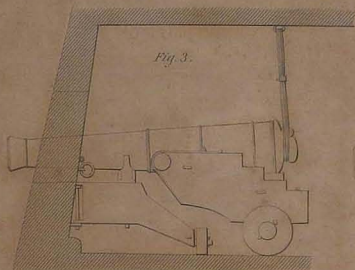
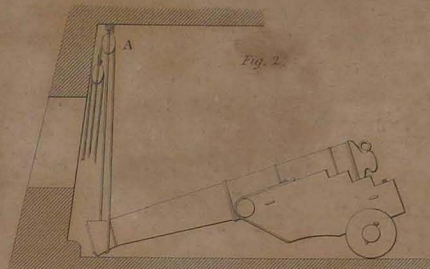
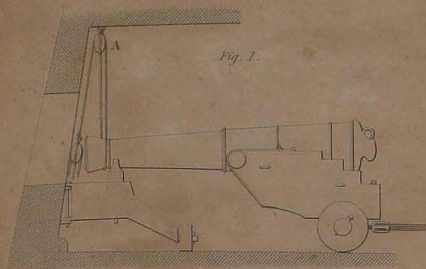


Fig. 1.

A Soutard's Gun Secured

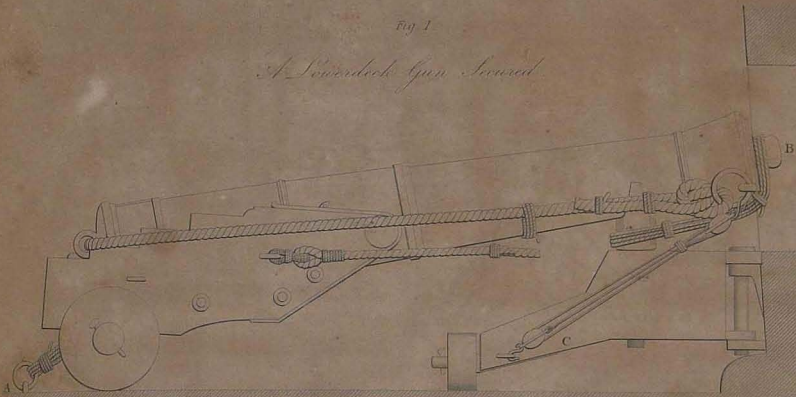


Fig. 2.

A Gun secured fore and aft.

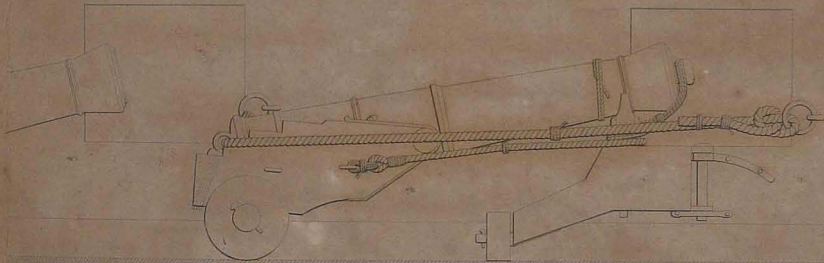


Fig. 3.

Height of New Gun secured.

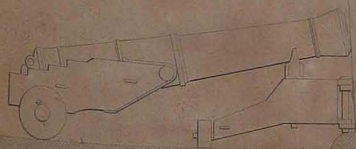
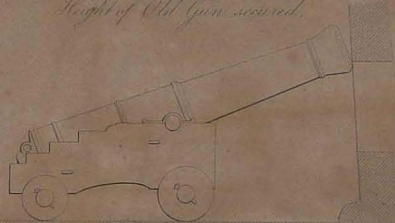


Fig. 3.

Height of Old Gun secured.



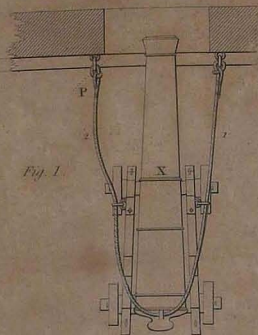


Fig. 1.

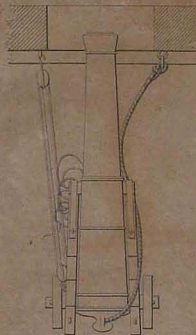


Fig. 2.

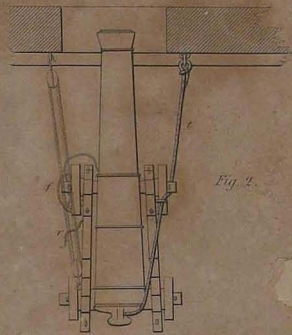


Fig. 3.

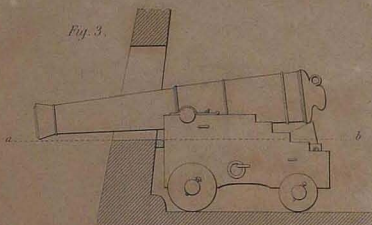


Fig. 4.

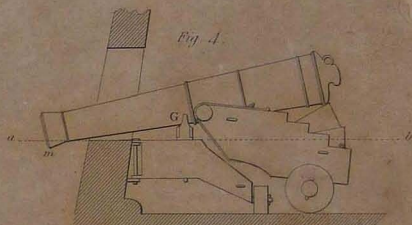


Fig. 5.

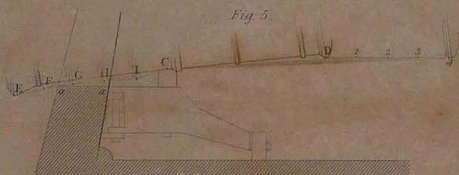


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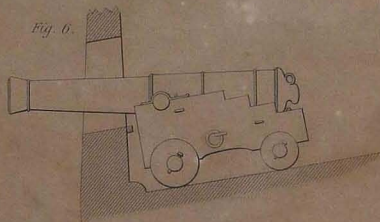


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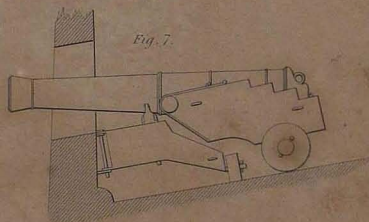


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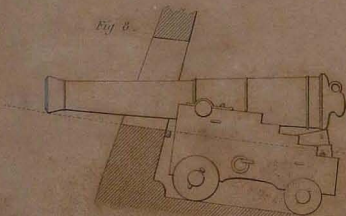


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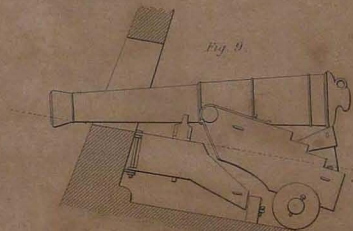


Fig. 1.



Fig. 2.

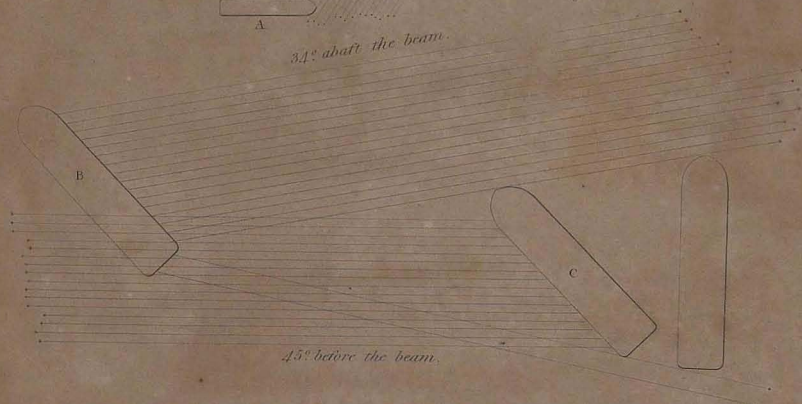


Fig. 3.

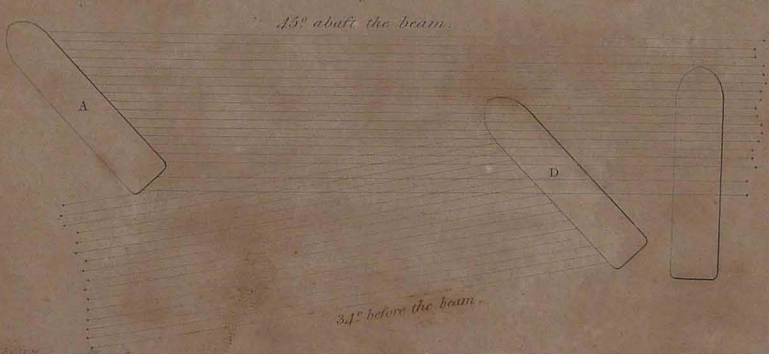
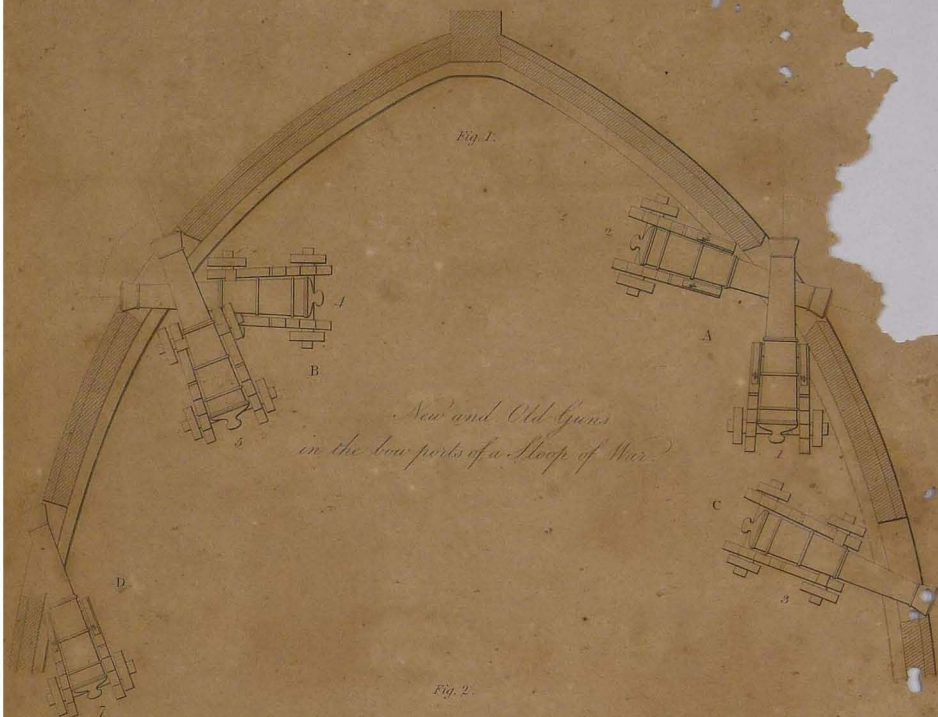


Fig. 1.



*New and Old Guns
in the bow ports of a Ship of War.*

Fig. 2.

Appearance of Men (○) at quarters with 18 p. on Old Carriages.

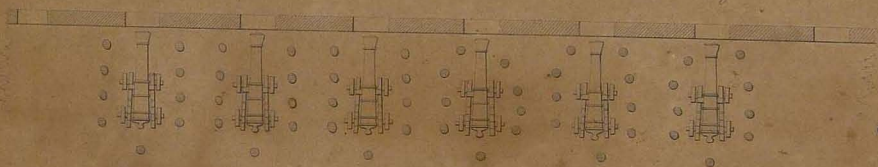


Fig. 3.

Appearance of Men (○) at quarters with 18 p. on New Carriages.

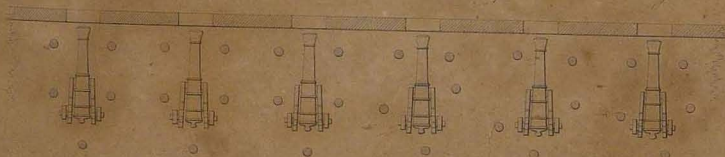


Fig. 1.

18 Pth. Pivot Guns.

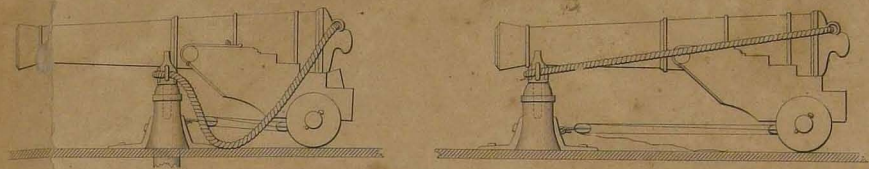


Fig. 2.

Congress Gun on the New Carriage.

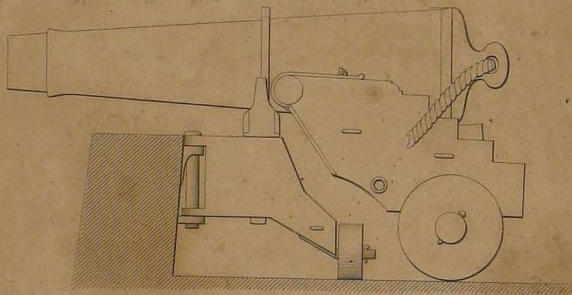
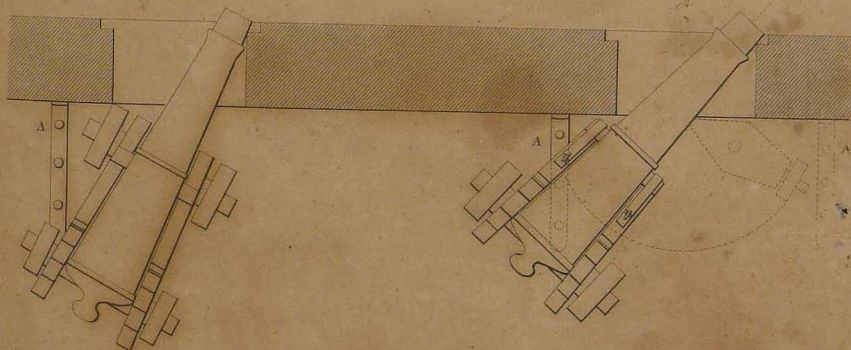


Fig. 3.

Guns of an East Indianman, trained on the Old and New Carriages.



Drawn by J. H.

Engraved by G. R. H. & Co.