

**COX SUBMARINE
BOLT DRIVING & PUNCHING GUN
FOR SHIP'S PLATE, ETC.**

For use Above and Below Water

Instructions

COX SUBMARINE AIR-BOLT EQUIPMENT

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The following observations have been approved by the Head of the Admiralty Salvage Department

In the light of recent experience on Salvage work, the Cox Bolt Driving and Punching Gun has proved itself to be not only an asset, but an indispensable piece of modern salvage equipment, which has enabled salvage divers and officers to carry out in a few hours that work which hitherto occupied days and weeks.

The importance of this time-saving is paramount.

- (1) The values of the ship and cargo are not allowed to deteriorate.
- (2) The vessel being in a temporary repair haven is removed from enemy exposure in an expeditious manner.
- (3) The effects of the arch enemies of the Salvor, weather and tide, with their devastating toll on the ship, are reduced to a minimum.

Although precision on the part of the operator is an asset, it is by no means essential. For small patching, such as water inlet connection blown from ship's side, or large splinter damage, four or more bolts may be shot fair to fair around the damage, and extension bolts fitted. A wooden patch is made to fit between the bolts, and is padded by a pillow or other suitable padding. The patch is set up by two or more strong-backs using butterfly nuts.

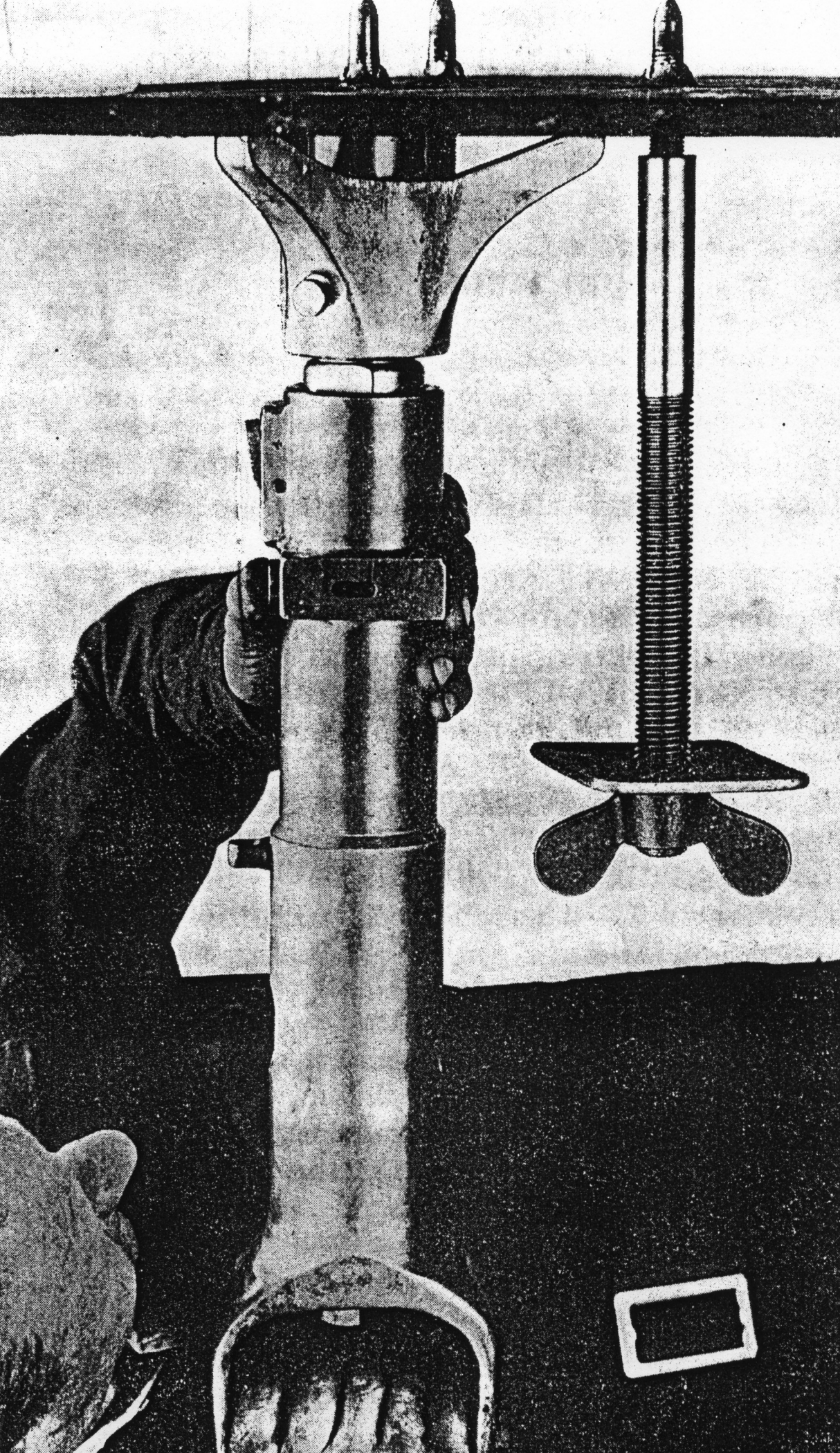
Three inlet valves were recently sealed in a vessel by this method, enabling the salvors to carry out immediate internal cementing. In the dry-dock the work effected by the divers was so rigid that the cementing effected as a precautionary measure could have been dispensed with in an emergency.

Outside patching over large areas has been accomplished very successfully, and even patching on tank tops against pressure has been carried out.

In the hands of resourceful operators fresh uses are being found for this equipment. Rivets have been tightened by shooting a bolt through them, seams have been tightened by shooting bolts between riveting. Shoring and stiffening has been pinned to 'tween decks. Brackets have been shot on to tank tops, to form steps for the heel of shores. Eye-plates for slinging and securing pumps in difficult localities may be secured by employing the gun, and loose, leaking or staggered rivets may be punched out using punch ammunition, and then plugged by wooden rivet plugs.

FOR COFFERDAM WORK THE OLD PROCESS IS REVOLUTIONISED.

WEEKS AND MONTHS OF SETTING UP DRILLING STANDS AND DRILLING HOLES FOR UPRIGHTS MAY NOW BE AVOIDED. The bolts may be shot through a template as fast as the gun is loaded, and the staging moved, with a result that the securing bolts are at a standard pitch, and in consequence the timber work can be drilled in readiness and secured without delay by the diver.



COX SUBMARINE BOLT DRIVING AND PUNCHING GUN

DESCRIPTION

This is an explosively actuated gun which instantaneously drives solid or hollow screwed bolts, and punches holes in steel plate, above or below water, WITHOUT RECOIL, FLASH or REPORT.

Invaluable for rapid attachment of steel plate patches, splinter boxes, etc., the construction of cofferdams, and the attachment of eye-plates and other fixtures for lifting and salvage purposes.

The hollow bolt instantly produces a means of supplying air or oxygen for breathing, compressed air for lifting, liquids or gases for fire fighting, the introduction of small wires for electrical circuits, etc., to otherwise enclosed spaces. This process is independent of any access to the inner side of the plate, the whole operation of inserting the hollow bolt, the unsealing of it, and the coupling up of the supply, being performed from the operating side of the plate. The lengthy and costly process of drilling, threading and bolting by submerged gear during salvage and repair operations, is eliminated, and a diver can carry the gun and operate it at any depth to which he can descend. Where operating time is short due to tide and weather conditions, the apparatus is of the greatest value, because the bolts are inserted and holes punched instantaneously.

The loading of the barrels with ammunition is performed above water, and the loaded sealed barrels may be carried by the diver, or the diver may remain submerged with the gun, and have the loaded barrels lowered to him. These he inserts into the gun, discharges them, and returns them to the surface for re-loading, in the meantime carrying on with a fresh supply. Speed of operation thus depends on a sufficient number of barrels to keep the diver constantly supplied.

The Cox Submarine Gun has been perfected over the course of many years by experiments, trials and actual use on the job, and is in use by many Government Departments. As part of a ship's or dockyard equipment for emergency work, it is invaluable.

PARTICULARS OF EQUIPMENT

The following comprise the various items of Cox Submarine Gun and equipment:—

- (1) **No. 2 Size Gun.** Operating weight 36 lbs. The gun is complete with one barrel for bolting, one barrel for punching, and is packed in a loading box with tools as listed under "Tool Equipment."
- (2) **7" Bolting and 7" Punching Barrels.** A sufficient number of these are supplied to enable the diver to be constantly supplied with loaded barrels. They are packed in a rope-handled containing box.
- (3) **Bolt Ammunition.** This bolt is $\frac{5}{8}$ " diameter, $4\frac{1}{2}$ " long, threaded B.S.F., and is available loaded to suit steel plate from $\frac{1}{4}$ " to 1" thick inclusive. It is of heat-treated alloy steel, and of a tensile strength of 90 tons per square inch, and will take a 15° bend before yielding. A pressure of 12 tons is required to force the bolt out of $\frac{3}{4}$ " plate. It will be seen that bolting strengths are considerably in excess of those obtained with the usual mild steel bolts.
Bolt ammunition is supplied in a box which contains a suitable supply of sealing washers, locating registers, and nuts to suit the bolt.
- (4) **Punch Ammunition.** The punch is $\frac{11}{16}$ " diameter and produces a hole of a size to suit the bolt. It is available loaded to suit steel plate from $\frac{1}{4}$ " to $\frac{3}{4}$ " thick inclusive. This ammunition is supplied in a box containing a suitable supply of sealing washers. For special requirements punch ammunition can be produced to punch holes of any diameter within the capability of the apparatus.

(5) **Extension Bolts.** These provide a means of extending the standard $\frac{5}{8}$ " bolt, after insertion in plating, for cofferdam construction and wooden patches. They are 1" diameter, internally threaded at one end to screw on the fired bolt, and are screwed 1' Whit. for 8" at the other, and are supplied with washer plates and nuts. Standard lengths are 12", 18" and 24".

(6) **15" Timbering Barrels for Cofferdamming and Timber Patching.** A new development provides for the perfect spacing and alignment of fired-in bolts and extension bolts with the bolt holes drilled in the timber. The usual procedure is to construct and employ templates as between the timber to be drilled and the steel plate to which the timber is to be attached. Notwithstanding great care variations in spacing occur and alignment is not provided for, due to variations in angularity of drilled holes and bolts. Specially long barrels can now be supplied which permit the timber to be drilled first at the approximate spacings required. The timbering is then placed in position and the special barrel passes through the drilled hole. The bolt is then fired into the steel plating, thus giving perfect spacing and angle of stand. The extension bolt is then passed through the drilled hole in the timber and screwed on to the fired-in bolt. A wooden ferrule is placed over the extension bolt into the drilled hole in the timber and the whole secured with washer plate and wing nut, thus making the bolt hole watertight at the same time.

These specially long barrels are being supplied for

Admiralty requirements, and permit the shooting of screwed bolts through a maximum thickness of 12" of timber.

Standard ammunition is used as in the short barrels.

Wooden ferrules are supplied to fit $2\frac{3}{8}$ " diameter holes in the timber.

(7) **Wooden Ferrules.** For use with timbering barrels. They are tapered to fit $2\frac{3}{8}$ " diameter holes in timber, and are bored to slide over the extension bolts.

(8) **Slinging Cord.** Each gun-holder is now fitted with two slinging eyes to which an elastic slinging cord can be attached by means of an attaching chain. This consists of a six-foot length of cotton covered stranded elastic cord, with a safety hook at each end, complete with a chain for attachment to the slinging eyes, by means of the safety hooks fitted. The strength of the cord is such that when the gun is attached, it will stretch two feet, and can be stretched a further two feet with little effort on the part of the operator. In effect, this gives a gun of very little weight which can be operated easily over a distance of four feet, without adjusting the length of the line to which the slinging cord is coupled. The attaching chain itself is made up of open links, and thus it is possible to adjust the position of the cord, according to the angle at which the gun is to be used.

All metal parts are cadmium plated.

COX SUBMARINE GUN AND EQUIPMENT

(Size No. 2)

Indication of Quantities of the Various Items Frequently Comprising One Set

Cox Submarine Gun , complete with one Bolting barrel, one Punching barrel, tools, and re-loading box	
Elastic Slinging Cord	
Steel Plate Bolting Equipment	
Extra Bolting barrels. (This number is recommended as sufficient to keep diver supplied with loaded barrels)	8
Bolt Ammunition for thickness of plate from $\frac{1}{4}$ " to 1" inclusive. Total, 350 rounds, or according to requirements, i.e. 50 rounds for each plate thickness	350
Steel Plate Punching Equipment	
Extra Punching barrels	2
Punch Ammunition for thickness of plate from $\frac{1}{4}$ " to $\frac{3}{4}$ " inclusive. Total, 125 rounds, or according to requirements, i.e. 25 rounds for each plate thickness	125
Wooden Patch and Timber Construction Equipment	
12" Extension Bolts with Nuts and Washer plates	60
18" Extension Bolts with Nuts and Washer plates	24
24" Extension Bolts with Nuts and Washer plates	24

15" Timbering Barrels	3
Wooden ferrules	100

Air-Bolt Equipment

Air-Bolt barrels (12")	4
Air-Bolt adaptors complete with blanking nuts, screwdrivers and spanner	12
Air-Bolt Ammunition for thickness of plate from $\frac{1}{4}$ " to 1" inclusive. Total, 84 rounds, or according to requirements, i.e. 12 rounds for each plate thickness	84

(All the above equipment is packed in strong wooden containing boxes with rope handles.)

TOOL BOX EQUIPMENT

Loading and unloading equipment is comprised as follows:—

- 1 Containing and loading-box with cross position seat lid.
- 1 Vice with ring nut.
- 1 Dismantling anvil.
- 1 Spanner for breech nut.
- 1 Spanner for barrel ($1\frac{1}{8}$ " Whit.).
- 1 Spanner for screwed bolt nuts ($\frac{5}{8}$ " B.S.F.).
- 1 Spanner for handle nuts ($\frac{3}{8}$ " B.S.F.).
- 1 Spanner for holder rear end nut ($\frac{7}{8}$ " B.S.F. Box Spanner).
- 1 Set of loading and ejecting drifts and one vice tommy bar.
- 1 Screwdriver.
- 1 Copper hammer.
- 1 Oil feeder.
- 1 Barrel-cleaning rod.
- 1 Three-legged stabiliser.

BARRELS

Barrels for use with the gun are as follows, and it is of the utmost importance that the correct barrel is used for the ammunition to be loaded.

(1) 7" Barrel fitted with Bolt Nose or Punch Nose.

For use only with Bolt or Punch Ammunition with *short* piston.

(2) 15" Timbering Barrel fitted with Bolt Nose only.

For use only with Bolt Ammunition with *short* piston.

(3) 12" Air Bolt Barrel fitted with Bolt Nose only.

For use only with Bolt Ammunition with *long* piston.

Long piston ammunition is oversize, and no attempt must be made to load this ammunition in either the 7" or 15" barrel. Use 12" barrel only.

Short piston ammunition must on no account be loaded into the 12" barrel. Use 7" and 15" barrel only.

AMMUNITION

All ammunition is stamped upon the firing block with a number which indicates the thickness of ships black mild steel plate for which it is intended, as follows:—

No. 2 indicates $\frac{1}{4}$ " Plate

No. 3 " $\frac{3}{8}$ " "

No. 4 " $\frac{1}{2}$ " "

No. 5 " $\frac{5}{8}$ " "

No. 6 " $\frac{3}{4}$ " "

No. 7 " $\frac{7}{8}$ " " (Except No. 7 Punch.

See note below)

No. 8 " 1" "

(AMENDMENT. PAGE 13)

PARAGRAPH (2). 15" BARREL FITTED WITH BOLT NOSE FOR USE WITH BOLT AMMUNITION WITH SHORT PISTONS.

15" BARREL FITTED WITH PUNCH NOSE FOR USE WITH PUNCH AMMUNITION INDEX NO. 6 OR INDEX NO. 7. THESE HAVE LONG PUNCHES AND ARE FOR USE ON $\frac{3}{4}$ " THICK PLATE.

Ammunition having an extra long piston and marked " A " upon the firing block is a hollow bolt for air supply, and is for use only in the 12" air bolting barrel. One round of Bolt Ammunition is comprised as follows:—

- 1 Loaded screwed bolt unit. Bolt is $4\frac{1}{2}$ " long threaded $\frac{5}{8}$ " B.S.F.
- 1 Nut to fit screwed bolt.
- 1 Fibre sealing washer for nose.
- 1 Fibre sealing washer for arresting block.
- 1 Register for locating on punched or drilled holes.

The above items are all packed in the same containing box.

One round of Punch Ammunition is comprised as follows:—

- 1 Loaded punch unit (For Index Nos. 2 to 5 inclusive the punch is $\frac{11}{16}$ " diameter \times $1\frac{3}{4}$ " long. For index Nos. 6 and 7 the punch is $\frac{11}{16}$ " diameter \times $2\frac{3}{4}$ " long.)
- 1 Fibre sealing washer.

Packed in the same containing box.

Note: Index No. 7 Punch is of higher power for use on $\frac{3}{4}$ " thick plate of higher tensile strength.

Ammunition selected by the correct index number and fired into ships black mild steel plate will give an average stand of $2\frac{3}{8}$ " above the entry side of the plate. For intermediate thicknesses of plating, or high-tensile plating, reference to the Ammunition Selection Chart will enable satisfactory results to be obtained, although a certain amount of variation of the bolt stand from the plate may be experienced. Variations occur in plate

thickness and qualities and also from thickness loss due to rust or corrosion. Thus it may be necessary after a trial shot using the standard index number of ammunition as shown in the Selection chart, to select an index number above or below to give the required penetration in the particular plate being operated upon.

Bolt Ammunition fired in 7" Barrels:—

Index Nos. 2, 3, 4, 5 and 6. Bolt should fix into its appropriate thickness of plate with not less than $1\frac{1}{2}$ " and not more than $2\frac{3}{4}$ " of the bolt standing above the entry side of the plate.

Index No. 7 and 8. Bolt should fix into its appropriate thickness of plate with not less than $2\frac{1}{4}$ " and not more than 3" of the bolt standing above the entry side of the plate.

Bolt Ammunition fired in 15" Barrels:—

Any index number of Bolt ammunition fired in a 15" Barrel will penetrate on average $\frac{3}{8}$ " to $\frac{1}{2}$ " deeper than the same index number fired in a 7" Barrel. The Bolt should fix into its appropriate thickness of plate with not less than 1" and not more than $2\frac{1}{2}$ " of the bolt standing above the entry side of the plate.

Air Bolt Ammunition fired in 12" Air Bolt Barrels:—

Air Bolt should fix into its appropriate thickness of plate with not less than the threaded portion of the air bolt (i.e. 1") standing above the entry side of the plate, and not less than $\frac{1}{2}$ " of the shank excluding nose-piece projecting from the rear side of the plate (i.e. the detachable nose-piece should project clear of the plate).

Punch Ammunition fired in 7" Punch Barrels:

Each punch should give complete perforation of its appropriate thickness of plate resulting in a clear hole.

COX SUBMARINE GUN AMMUNITION SELECTION CHART

Thickness of Plating to be pierced		Index Number of Ammunition for use on Mild Steel			Index Number of Ammunition for use on H.T. or D. quality Steel				
		Bolting	Punching	Air Bolting	Bolting	Punching	Air Bolting		
lb. per sq. ft.	in.	mm.							
10	$\frac{1}{4}$ "	6.3	2	2	2A	2	2	2A	2A
12½	$\frac{5}{16}$ "	8	2	3	2A	3	3	3A	3A
15	$\frac{3}{8}$ "	9.5	3	3	3A	4	4	3A	3A
17½	$\frac{7}{16}$ "	11	3 or 4	4	3A	4	4	4A	4A
20	$\frac{1}{2}$ "	12.5	4	4	4A	5	5	4A	4A
22½	$\frac{9}{16}$ "	14	4 or 5	5	4A	6	6	5A	5A
25	$\frac{5}{8}$ "	16	5	5	5A	6	6	5A	5A
27½	$\frac{11}{16}$ "	17.5	5 or 6	6	5A	7	7	6A	6A
30	$\frac{3}{4}$ "	19	6	6	6A	8	8	6A	6A
32½	$\frac{13}{16}$ "	20.5	6 or 7	—	6A	—	—	7A	7A
35	$\frac{7}{8}$ "	22	7	—	7A	—	—	7A	7A
37½	$\frac{15}{16}$ "	24	7 or 8	—	7A	—	—	8A	8A
40	1"	25.5	8	—	8A	—	—	8A	8A

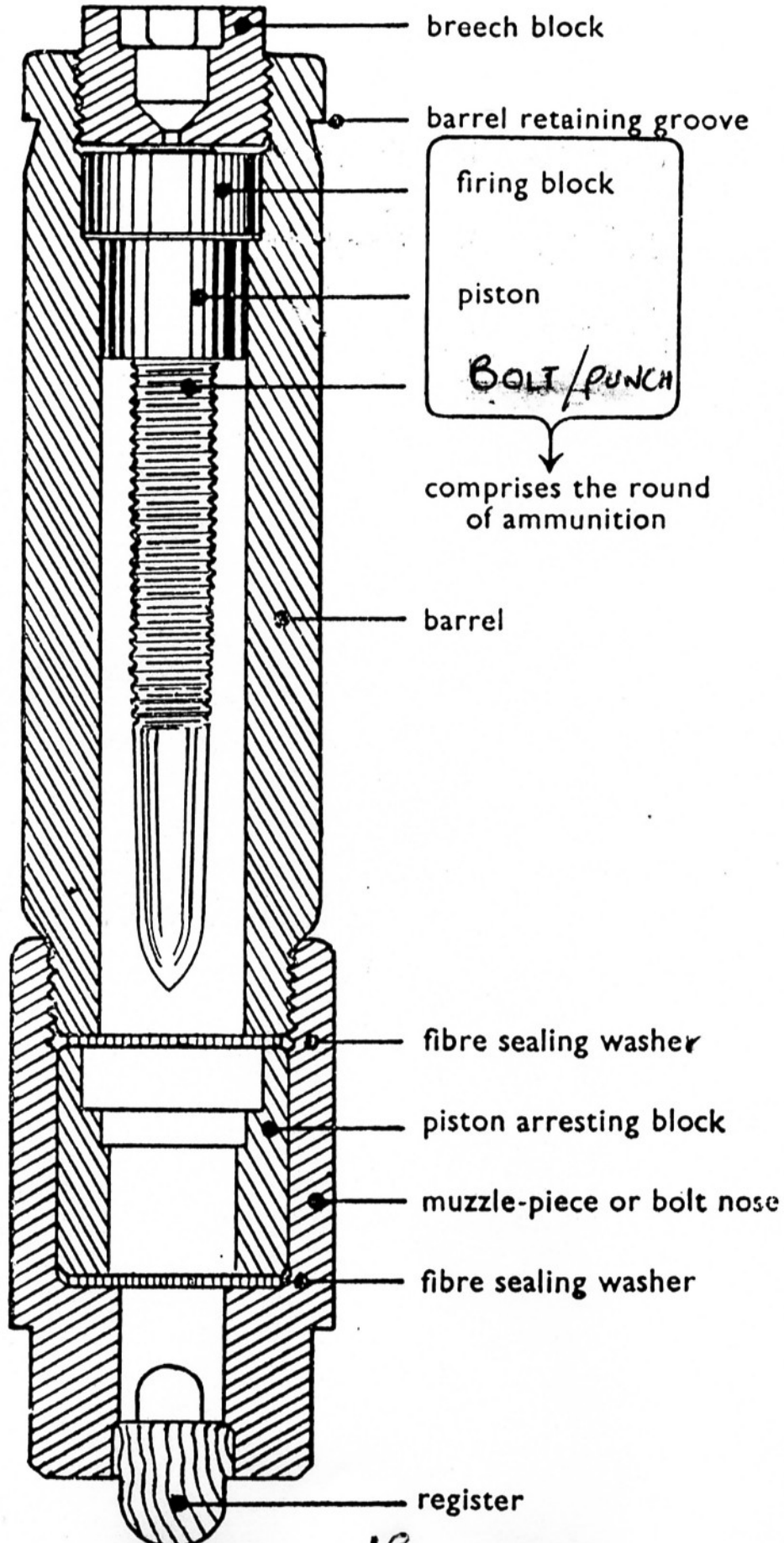
X. 15" BARREL FITTED WITH PUNCH NOSE TO BE USED FOR INDEX NOS. 6 & 7 PUNCH.

LOADING SOLID BOLT AMMUNITION

- (1) Place lid of loading box crosswise on the loading box, forming a seat.
- (2) Insert muzzle-piece marked " Bolt Nose " in the vice, and secure with hand-nut.
- (3) Insert one fibre sealing washer in nose.
- (4) Insert selected arresting block with end marked " TOP " uppermost. (See note on selection of arresting blocks.)
- (5) Insert another fibre washer on top of arresting block.
- (6) Screw 7" or 15" barrel into nosepiece and make watertight joints by screwing down barrel with the $1\frac{1}{8}$ " spanner provided.
- (7) Select desired round of Bolt ammunition and insert in breech of barrel.
- (8) Screw down breech nut and wring up as tightly as possible with cross-key spanner, making a watertight joint.

N.B.—It is of the utmost importance that sealing washers are not omitted, and that all joints are pulled down firmly.

SECTION OF LOADED BARREL ASSEMBLY



USE OF ARRESTING BLOCKS

Four arresting blocks are available for each solid bolt-driving barrel, and are marked as follows:—

“ C,” “ $\frac{1}{2}$ ” Patch,” “ $\frac{3}{4}$ ” Patch,” and “ 1” Patch.”

The block marked “ C ” is to be used in all cases where the nose of the gun is in actual contact with the plate to be penetrated.

$\frac{1}{2}$ ”, $\frac{3}{4}$ ”, and 1” blocks are for use when bolts are fired through a previously drilled or punched patching plate, and thus the muzzle of the gun is separated from the plate to be penetrated by the thickness of the patch, e.g., if the total thickness of the patch is $\frac{3}{4}$ ”, use the arresting block marked “ $\frac{3}{4}$ ” Patch.” If jointing rubber is used, or if the patch is sprung away from the shell to be penetrated, the total thickness of patch plate, rubber and space, must be counted as patch thickness.

LOADING PUNCH AMMUNITION

- (1) Insert $\frac{1}{2}$ ” tommy bar through body of vice for the purpose of engaging the slot in the muzzle-piece.
- (2) Insert muzzle-piece marked “ Punch Nose ” in the vice and secure with hand-nut.
- (3) Insert one fibre washer only.
- (4) Screw down 7” barrel as before.
- (5) Select desired round of Punch Ammunition and proceed as before.

N.B.—There is no separate arresting block for use with the Punch Nose.

(AMENDMENT. PAGE 19)
PARAGRAPH (4).
SCREW DOWN 7” BARREL AS BEFORE IF USING
PUNCH AMMUNITION INDEX NOS. 2–5. FOR INDEX
NOS. 6 & 7 SCREW DOWN 15” BARREL

FIRING

- (1) To ensure a squarely standing bolt, slide the three-legged stabiliser right home on bolt nose and tighten grub screw.
- (2) Insert breech end of barrel into Gun Holder until the securing catch clicks.
- (3) Place the nose of the barrel squarely in contact with the steel plate, the thickness of which is suited to the ammunition.
- (4) Depress rearmost firing catch with the thumb, and *whilst depressed*, give the holder a **vigorous thrust forward**, thus firing the charge.
- (5) To fire the screwed bolts through a patch plate with previously drilled or punched clearing holes, insert the small registers in the front of the bolt nose, and drift home for the purpose of locating the barrel to the clearing hole. (See " Patching.")
- (6) When using punch ammunition, it is advisable to support the plate to be punched on sand, earth or bridged over timber with sacking underneath, as the punch passes right through the plate, preceded by a punching of metal, and both have a certain velocity which may cause them to ricochet and cause damage.
- (7) **When firing a strong and rapid thrust forward of the gun holder is essential.** It is possible to indent the detonators with a slow crushing push, and yet not fire the detonator. This gives the appearance of a misfire and may erroneously be attributed to a faulty detonator or to a faulty round of ammunition. It is recommended that the firing stroke be practised with an unloaded barrel (see " Misfires ").

UNLOADING

- (1) Depress rearmost firing catch, allowing the barrel to move forward in the holder to the releasing catch.
- (2) Press the releasing catch and remove barrel.
- (3) Place barrel in vice as before and unscrew breech nut.
- (4) Unscrew barrel from nose-piece.
- (5) Remove indented copper washer if this is attached to the breech nut.
- (6) Insert drift provided in the front end of barrel, and remove firing block.
- (7) Remove arresting block with drift if necessary, and also remains of fibre washers from nose-piece.
- (8) Place anvil provided on the vice and remove piston from arresting block or punch nose, by means of drift and hammer.
- (9) Ensure all broken pieces of sealing washers are removed, wipe all parts clean with an oily swab and clean out barrel with the cleaning rod and oil.

PATCHING (Steel Plate)

When preparing a patch plate, it is important to select the correct charge to punch the clearing holes, e.g., No. 6 Punch Ammunition must be used for $\frac{3}{4}$ " plate. Do not use ammunition upon thinner plate than it is designated for, otherwise too heavy a load is imposed upon the gun muzzle and damage will result. If ammunition is used upon a heavier plate than designated, it will fail to punch right through. Plates may be punched supported on sand, earth, or bridged over timber with sacking underneath to prevent ricochet of the punch or punching.

When the patching plate is prepared, proceed as follows :-

- (1) Load a bolt barrel using the arresting block marked " C " (contact), and fire this bolt adjacent to the damage.
- (2) Secure jointing and patching plate to this bolt, or more if required. Nuts on these tack bolts must be made **finger-tight** only, until firing is completed. Tightening up of nuts on adjacent bolts while firing is still proceeding may result in broken bolts or the withdrawal of bolts from the plate.
- (3) Load bolt barrels to shoot through the clearing holes in the patching plate. For this purpose arresting blocks must be used which correspond as nearly as possible to the total thickness of the combined jointing and patching plate, e.g., a damaged $\frac{3}{4}$ " shell patched with a $\frac{1}{4}$ " patch and $\frac{1}{4}$ " patching rubber would require a No. 6 charge and a $\frac{1}{2}$ " arresting block.





- (4) Location of the bolt barrel to the clearing hole in the patching plate is obtained by inserting the small register in the front of the bolt nose.
- (5) Where thin jointing is used, it is necessary to countersink the holes on the joint side to receive the swell set up by the insertion of the bolt in the shell.

EXTENSION BOLTS

For cofferdam construction and wooden patches, extension bolts are supplied for screwing on to the fired bolts. These are 1" diameter bolts threaded at one end to screw on the fired bolt and are screwed 1" Whit. for 8" at the other end, and are supplied with washer plates and nuts. Standard lengths are 12", 18", and 24". These provide a means of rapidly patching shell holes or splinter damage. Bolts may be shot around the damage, extension bolts fitted, and a wooden patch or splinter box fitted between, padded with a pillow. The patch is then set up by strong-backs and finally secured, using the nuts.

For more extensive damage, extension bolts are more conveniently used with timbering barrels.

TIMBERING BARRELS

Use of long timbering barrels and extension bolts without templating.

These barrels provide dead location and alignment of the fired-in bolts and the fitted extension bolts with the bored holes in the patching timber.

- (1) Bore holes $2\frac{3}{8}$ " diameter in patching construction at points required. These holes must be accurate in diameter to ensure easy insertion of barrel and the correct fitting of the wooden ferrules.
- (2) Load barrel identically as short barrel, using arresting block marked " C."
- (3) Insert barrel through bored hole in timber and fire the screwed bolt into plate.
- (4) Fit extension bolt to suit thickness of timber, and screw it through the bore on to the fired-in bolt.
- (5) Slide wooden ferrule over head of extension bolt, and pull flush into timber bore with the washer plate and nut.

NOTE.—Timbers can be tacked into position desired by means of two or more bolts, and further bolts driven where the timber is bored.

An Auger of correct size ($2\frac{3}{8}$ " diameter) can be supplied.

(ADDITION. PAGE 25.)

15" TIMBERING BARRELS FITTED WITH PUNCH NOSES ARE ALSO FOR USE WITH PUNCH AMMUNITION INDEX NOS. 6 & 7. THESE TWO INDEX NUMBERS OF PUNCH AMMUNITION HAVE LONG PUNCHES AND ARE FOR USE ON $\frac{3}{4}$ " THICK PLATE.

COX AIR BOLT EQUIPMENT FOR USE WITH STANDARD COX No. 2 SUBMARINE BOLT DRIVING AND PUNCHING GUN

This apparatus utilises a hollow bolt with a detachable solid nose, and is designed for the supply of air or oxygen for breathing, for the supply of compressed air for lifting and exhausting operations, for the supply of liquids or gases for fire fighting purposes, or for the introduction of small wires for electrical circuits to otherwise enclosed spaces. Suitable adaptors are provided to enable standard supply lines to be coupled to the hollow bolt after insertion in the plating. The process is independent of any access to the inner side of the plate, the whole operation of inserting the bolt, the unsealing of it and the coupling up of the supply line, being performed from the accessible side of the plate. A series of bolts may be inserted and the adaptors fitted. A water-tight joint is maintained and the unsealing may be performed when convenient. This is done by inserting a special screwdriver through the adaptor and bolt and engaging a slot in the detachable nose, allowing it to fall away, thus giving access within.

The equipment consists of the following :—

- (1) Special 12" air-bolting barrels.
- (2) Air-bolt ammunition suitable for thicknesses of plate from $\frac{1}{4}$ " to 1" inclusive, each charge being suitable for both mild steel and " D " quality high-tensile plate.

The bolt is threaded externally $\frac{3}{4}$ " Whit., and has a bore of $\frac{17}{64}$ " with a threaded detachable nose,

which can be removed with a special screwdriver after the bolt has been inserted in the plate.

(3) Air-bolt adaptors. These are T-shaped bronze and of two types.

The "D" type is provided with $\frac{3}{4}$ " B.S.P. compressor line thread and $1\frac{1}{8}$ " Siebe Gorman diving line thread and $\frac{3}{4}$ " Whit. thread to suit the air-bolt.

The "O" type is provided with $\frac{3}{4}$ " B.S.P. thread and $1\frac{1}{8}$ " U.N.F. thread and $\frac{3}{4}$ " Whit. thread.

Complete with chain attached blanking nuts and blanking nut for the air-bolt.

(4) Special screwdriver to engage slot in detachable nose-piece, and $\frac{3}{4}$ " Whit. spanner for adaptor.

LOADING

- (1) Place muzzle-piece marked bolt nose in vice and secure with hand nut.
- (2) Insert one fibre sealing washer in nose.
- (3) Insert " C " arresting block, with end marked " Top " uppermost.
- (4) Insert another fibre washer on top of arresting block.
- (5) Screw special 12" air-bolt barrel into nose-piece and make water-tight joints by screwing down barrel with $1\frac{1}{8}$ " spanner provided.
- (6) Select desired round of air-bolt ammunition, and insert in breech of barrel.
(*N.B.*—This ammunition has a specially long piston and cannot be inserted in the standard 7" barrel or the 15" long timber shooting barrel.)
- (7) Screw down breech nut and wring up tightly, using cross key spanner making watertight joints.

IT IS OF THE UTMOST IMPORTANCE THAT SEALING WASHERS ARE NOT OMITTED AND THAT ALL JOINTS ARE PULLED DOWN FIRMLY.

FIRING

Proceed as for solid bolt driving.

COUPLING

- (1) When the air-bolt has been inserted in the plate, screw on T-shaped adaptor and pull up with $\frac{3}{4}$ " Whit. spanner.
 - (2) Remove $\frac{3}{4}$ " B.S.P. thread blanking nut and pass screwdriver through adaptor and air-bolt, and engage slot in detachable nose-piece. A clockwise movement of the screwdriver will remove nose-piece and allow it to fall away.
 - (3) Remove screwdriver and replace blanking nut, until ready to couple up selected pipe line.
 - (4) When work has been completed on one particular bolt, the adaptor may be removed, and the bolt sealed by means of the $\frac{3}{4}$ " Whit. blanking nut provided.
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All air-bolt ammunition is marked as for solid bolt, but followed by the letter A, e.g., No. 6A being air-bolt ammunition for $\frac{3}{4}$ " thick plate, and is suitable for both mild steel and " D " quality high-tensile plate.

CAUTION.—On no account must the 12" air-bolt barrel be used for Solid Bolt or Punch Ammunition.

MARKING OF ADAPTORS

The adaptors are T-shaped and the positions of the various threads are maintained as follows:—

“ D ” Type. One end of the stroke of the “ T ” has a female $\frac{3}{4}$ ” Whit. thread marked “ A B ” to suit the air-bolt. The other end of the stroke of the “ T ” is threaded $\frac{3}{4}$ ” B.S.P. and is marked “ C ” and has a chain attached blanking nut. The stem of the “ T ” is threaded $1\frac{1}{16}$ ” Siebe Gorman and is marked “ D ” and also has a chain attached blanking nut. Each thread can thus be distinguished by its position.

“ O ” Type. This adaptor is similar to the “ D ” type but the $1\frac{1}{16}$ ” is replaced with $1\frac{1}{8}$ ” U.N.F. thread to suit latest type divers hoses, and is marked “ O ”. A larger size chain attached blanking nut is fitted ($\frac{7}{8}$ ” Whit. spanner size).

PRECAUTIONS

It is of the utmost importance for operators and loaders of this apparatus to realise that this gun, although simple and easy to operate, can with careless handling, cause serious personal injury or death. Thus the same precautions must be taken as when handling any other type of firearm.

- (1) Never pass a loaded barrel with the muzzle aimed at any part of your own body, or in line with any other person.
- (2) Never place the hand over the muzzle when inserting a loaded barrel into the gun-holder.
- (3) Never depress the firing catch until ready to fire.
- (4) Never attempt to use the gun with either the firing catch or retaining catch removed.
- (5) Never use a charge which is obviously much too strong for the plate being operated upon—the projectile may pass right through.
- (6) When punching, always ensure that no damage will be caused by the punching of metal or the punch itself. Both of these pass completely through the plate, and may still possess considerable velocity.
- (7) When shooting into plate, the thickness of which is doubtful, always ensure that no persons will be endangered on the other side, should the charge prove too strong and pass through the plate at velocity.
- (8) Always ensure that the firing catch is free and not jammed down, through particles of sand or other foreign matter in the mechanism. This firing catch is a safety device, and a firing stroke is quite impossible unless the catch is depressed.

MISFIRES

(1) The firing operation of the gun is very simple, but it is necessary to emphasise that a sharp and vigorous blow of the holder is essential to obtain a satisfactory detonation of the charge. A slow push will generally cause a misfire, and may be wrongly attributed to a faulty detonator or round of ammunition. The effect of a slow push is as follows : The firing-pin will strike the detonator without firing it, and may break down the fulminate and prevent detonation, even when the correct sharp blow is given subsequently. Also, the detonator may be pierced, allowing entry of water and again preventing detonation.

A slow-firing stroke may be due to one of the following causes.

- (2) Operator unacquainted with the blow necessary to obtain detonation of the charge. We recommend that all operators should practise the firing stroke, using an unloaded barrel.
- (3) Awkward position of the diver, or an insecure staging, which swings away upon making a firing stroke.
- (4) Sand, seaweed, or other obstruction of the free movement of the barrel in the holder. This might also be caused by burrs upon the barrel itself.
- (5) The firing catch must be kept depressed until the firing stroke is completed.
- (6) It is essential that all barrels are made watertight by means of the sealing washers provided, and that all joints are pulled up firmly.

MAINTENANCE

The Cox Submarine Gun and equipment requires little attention, apart from thorough cleaning and oiling after use.

GUN HOLDER. After use, the retaining catch and firing catch screws should be removed, and the catches and springs wiped and oiled and replaced. This is a straightforward operation, as these catches can only be reassembled in their correct functioning position. A quantity of oil should be poured into the mouth of the gun-holder, and allowed to flush out through the port holes at the rear. This can then be distributed over the walls of the gun by inserting an **UNLOADED** barrel, and working backwards and forwards. This will loosen any deposit which may have collected on the walls. For the purpose of cleaning and oiling, it is not necessary to remove the buffer with its spring and firing pin, the above procedure should be sufficient. If attention is required to the firing pin or buffer, necessitating removal of the buffer, proceed as follows:—

- (1) Remove handle nuts and bolt, and remove handle.
- (2) Remove buffer nut and spring washer.
- (3) The buffer, together with its spring, can then be driven out by the means of a drift and a hammer. For this purpose, the drift should be $1\frac{1}{8}$ " diameter, recessed with a $\frac{7}{8}$ " diameter hole to prevent damage to the thread. Drive from the handle end of the gun with the mouth of the gun supported on a block of wood.

(4) If removal of the firing pin for replacement is required, this is secured by one of two means. On early guns, the firing pin is a taper fit, and is driven in. To remove, grip firing pin tightly in a vice and rotate buffer by means of a Stilson wrench. This will free the firing pin and allow its removal. On later models the firing pin is parallel and is pressed home in the buffer, and secured by a 3/16" diameter pin or by a taper pin driven radially through the buffer and firing pin, and then riveted. This must be located and removed before attempting to remove the firing pin. When fitting the new firing pin, this hole must be drilled through the firing pin when it is in position, and the securing pin re-fitted.

ON ALL MODELS THE FIRING PIN MUST BE INSERTED IN THE BUFFER SO THAT THE DISTANCE FROM BUFFER FACE TO TIP OF FIRING PIN IS 1 1/32" EXACTLY.

(5) When replacing the buffer in the holder it is important that the firing pin does not receive damage. Support the handle end of holder on a block of wood, and slide the buffer down the mouth of holder, and drive home with a hammer and drift. This drift should be a strong tube or recessed to clear the firing pin.

(6) Replace washer, nuts and handle.

BARRELS. During operations it is advisable, as far as possible, to keep barrels, noses and breech nuts together as originally assembled. During use, stresses which are set up may cause distortions, which, while not affecting individual assemblies, may prevent the interchange with parts from other assemblies. Certain

barrel units have assembly numbers stamped upon them, and these should be kept together, *i.e.* No. 1 barrel should be assembled with No. 1 nose, and No. 1 breech nut, and so on.

CLEANING. When operations are finished for the day barrels, noses and breech nuts should be thoroughly wiped dry and clean with an oily rag, and the cleaning rod used inside the barrel. Finally, leave a surplus of oil on all parts. If operations are concluded and the apparatus is to be stored, barrels, noses and breech nuts can be protected from rust and corrosion by thoroughly cleaning with boiling water, wiping dry and liberally greasing with petroleum jelly or grease, and wrapping in greased paper or oily rag.

All equipment is well greased and protected when despatched, and, provided storage is reasonably dry, should remain in good condition.

Ammunition is greased and protected, and must be kept dry.

PARTICULAR ATTENTION IS DIRECTED TO THE REMARKS UNDER "MISFIRES."

TRACING OF FAULTS

(1) **Ammunition Fails to Detonate.**—See “Misfires.” Also see that firing pin is undamaged and is indenting detonator.

(2) **Insufficient Penetration of Bolt.**—Use next higher numbered round of ammunition.

(3) **Excess Penetration of Bolt.**—Use next lower numbered round of ammunition.

(4) **Failure of Punch to Penetrate.**—Use next higher numbered round of ammunition.

(5) **Bolts Break or Pull Out.**—It is of great importance when attaching steel patching plates that tightening up of nuts is not carried out until firing is completed. The pressure of a bolt entering the plate may exceed the strength or hold of an adjacent bolt which has been nutted-up and may result in fracture or withdrawal of this adjacent bolt.

(6) **Ammunition Detonates but Fails to Penetrate Plate.**—Assuming ammunition has been selected correctly, failure due to entry of water into barrel owing to omission of sealing washers or insufficient tightening of joints.

(7) **Noisy Firing and Recoil.**—Due to omission of arresting block when assembling barrel, assuming that ammunition has been selected correctly to suit plate.

N.B.—Punch ammunition detonates with a considerably louder report than bolt ammunition.

SPARE PARTS LIST

Part No.	Number used per Assembly	Description
GUN HOLDER		
1	1	Gun holder.
2	1	Buffer.
3	1	„ nut.
4	1	„ washer.
5	1	„ spring.
6/T	1	Firing pin (Taper type on early models).
6/P	1	„ „ (Parallel type).
7	1	„ „ fixing pin (for parallel type only).
8	1	Barrel retaining catch.
9	1	„ „ „ screw.
10	1	„ „ „ spring.
11	1	Firing catch.
12	1	„ „ screw.
13	1	„ „ spring.
14	2	Slinging eye.
15	1	Rubber grip.
16	1	„ „ tube.
17	1	„ „ bolt.
18	2	„ „ nuts.
TOOL BOX EQUIPMENT		
19	1	Containing and Loading box with lid.
20	1	Vice.
21	1	„ ring nut.
22	4	„ coach screws.
23	1	Dismantling anvil.
24	1	Breech nut spanner.
25	1	Barrel spanner (1 $\frac{1}{8}$ " Whit.).
26	1	Spanner ($\frac{5}{8}$ " B.S.F.).
27	1	„ ($\frac{3}{8}$ " B.S.F.).
28	1	„ ($\frac{7}{8}$ " B.S.F. Box).
29	1	Screwdriver.

Part No.	Number used per Assembly	Description
TOOL BOX EQUIPMENT		
30	1	Copper hammer.
31	1	Oil feeder.
32	1	Barrel-cleaning rod.
33	1	Three-legged stabilizer.
34	1	" " screw.
36	1	Dismantling drift (13/16" dia.).
37	1	" " (1/2" dia.).
38	1	Tommy bar (5/16" dia.).
1/38/C	—	Complete Gun Set.
BARRELS		
39	1	7" Bolt barrel.
40	1	" " nose.
41	1	" " breech nut.
42	1	Arresting block "C."
43	1	" " " 1/2" Patch."
44	1	" " " 3/4" Patch."
45	1	" " " 1" Patch."
46	—	Containing Box.
39/46C	—	Complete 7" Bolt Barrel Assembly.
47	1	7" Punch barrel.
48	1	" " nose.
41	1	" " breech nut.
46	—	Containing box.
47/46/C	—	Complete 7" Punch Barrel Assembly.
49	1	15" Timbering barrel.
40	1	" " nose.
41	1	" " breech nut.
42	1	Arresting block "C."
50	—	Containing box.
49/50/C	—	Complete 15" Timbering Barrel Assembly.
51	1	12" Air-Bolt Barrel.
40/A	1	" " nose.
41	1	" " breech nut.
42	1	Arresting block "C."
52	—	Containing box.
51/52/C	—	Complete 12" Air-Bolt Barrel Assembly.

Part No.	Number used per Assembly	Description
AMMUNITION		
53/2	1	Loaded round of Bolt Ammunition for $\frac{1}{4}$ " plate.
53/3	1	" " " " $\frac{3}{8}$ " "
53/4	1	" " " " $\frac{1}{2}$ " "
53/5	1	" " " " $\frac{5}{8}$ " "
53/6	1	" " " " $\frac{3}{4}$ " "
53/7	1	" " " " $\frac{7}{8}$ " "
53/8	1	" " " " 1" "
(One round of Bolt Ammunition includes 2 sealing washers, 1 nut and 1 register).		
54	2	Additional fibre sealing washers.
55	1	" nuts ($\frac{5}{8}$ " B.S.F.).
56	1	" registers.
57	—	Box for 150 rounds bolt ammunition.
58	—	" 100 " " "
59	—	" 50 " " "
60/2	1	Loaded round of Punch Ammunition for $\frac{1}{4}$ " Plate.
60/3	1	" " " " $\frac{3}{8}$ " "
60/4	1	" " " " $\frac{1}{2}$ " "
60/5	1	" " " " $\frac{5}{8}$ " "
60/6	1	" " " " $\frac{3}{4}$ " "
60/7	1	" " " " $\frac{3}{4}$ " "D" Plate.
(One round of Punch Ammunition includes 1 fibre sealing washer).		
54	1	Additional fibre sealing washers.
61	—	Box for 150 rounds punch ammunition.
62	—	" 125 " " "
63	—	" 100 " " "
64	—	" 75 " " "
65	—	" 50 " " "
66/2A	1	Loaded round Air-Bolt Ammunition for $\frac{1}{4}$ " Plate.
66/3A	1	" " " " $\frac{3}{8}$ " "
66/4A	1	" " " " $\frac{1}{2}$ " "
66/5A	1	" " " " $\frac{5}{8}$ " "
66/6A	1	" " " " $\frac{3}{4}$ " "
66/7A	1	" " " " $\frac{7}{8}$ " "
66/8A	1	" " " " 1" "
(One round of Air-Bolt Ammunition includes 2 fibre sealing washers).		
54	2	Additional fibre sealing washers.
67	—	Box for 84 rounds Air-Bolt Ammunition.

Part No.	Number used per Assembly	Description
EXTENSION BOLTS		
68/C	1	12" Extension bolt with Nut and Washer Plate.
68	1	12" " " only.
69/C	1	18" " " with Nut and Washer Plate.
69	1	18" " " only.
70/C	1	24" " " with Nut and Washer Plate.
70	1	24" " " only.
71	1	Nut.
72	1	Washer plate.
73	—	Box for 30 12" Extension bolts complete.
74	—	" 12 18" and 12 24" Extension bolts complete.
WOODEN FERRULE		
75	1	Wooden ferrule.
76	—	Box for 100 Wooden ferrules.
AIR-BOLT ADAPTOR TYPE " D "		
7/85/C	1	Complete Air-Bolt Adaptor Assembly.
77	1	Adaptor body.
78	1	Blanking nut " C " ($\frac{3}{4}$ " B.S.P. thread).
79	1	" " " D " (1 $\frac{1}{16}$ " Siebe Gorman thread).
80	1	" " " AB " ($\frac{3}{4}$ " Whit. for Air-Bolt).
81	4	Split rings.
82	2	Brass chain.
83	1	Spanner ($\frac{3}{4}$ " Whit.).
84	2	Special screwdriver.
85	—	Box for 12 complete adaptors.
SLINGING CORD		
86	1	Elastic cord with safety catches.
87	1	Attaching chain with safety catches.
AIR-BOLT ADAPTOR " O " TYPE		
88	1	Adaptor body.
89	1	Blanking nut " O " (1 $\frac{1}{8}$ " U.N.F. thread).
90/C	1	Complete Air-Bolt Adaptor assembly, $\frac{3}{4}$ " Whit., $\frac{3}{4}$ " B.S.P. and 1 $\frac{1}{8}$ " U.N.F. threads, with blanking nuts. (Part Nos. 78, 80, 81, 82, 83, 84 and 85 are common to " D " Type and " O " Type Adaptors.)
91	1	2 $\frac{3}{8}$ " diameter Auger with handle.