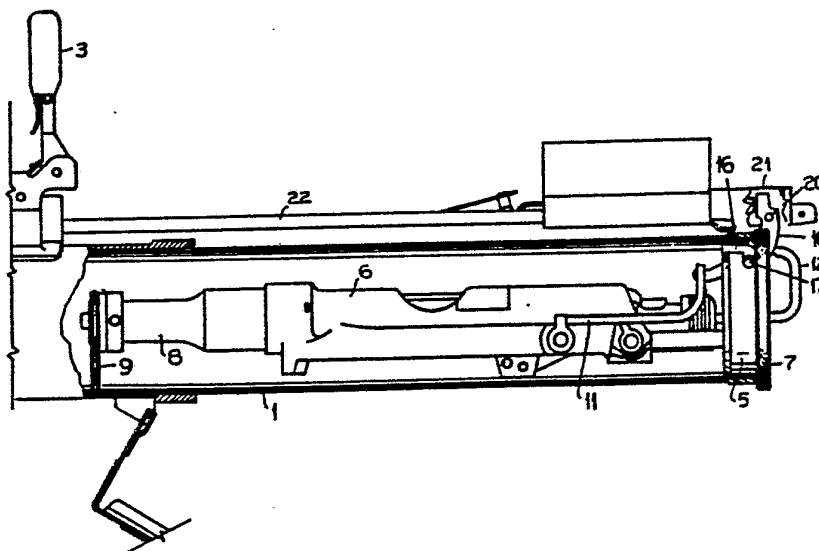




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<p>(51) International Patent Classification³ : F41F 27/00</p>	<p>A1</p>	<p>(11) International Publication Number: WO 85/ 01341 (43) International Publication Date: 28 March 1985 (28.03.85)</p>
<p>(21) International Application Number: PCT/AU84/00175 (22) International Filing Date: 10 September 1984 (10.09.84) (31) Priority Application Number: PG 1386 (32) Priority Date: 13 September 1983 (13.09.83) (33) Priority Country: AU</p> <p>(71) Applicant (for all designated States except US): THE COMMONWEALTH OF AUSTRALIA care of THE SECRETARY, DEPARTMENT OF DEFENCE SUPPORT [AU/AU]; Anzac Park West Building, Constitution Avenue, Canberra, ACT 2600 (AU).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only) : THOMPSON, Ian, Lister [AU/AU]; 10 Yorktown Road, Elizabeth East, S.A. 5112 (AU).</p>		<p>(74) Agent: COLLISON & CO.; 97 King William Street, Adelaide, S.A. 5000 (AU).</p> <p>(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent), US.</p> <p>Published <i>With international search report.</i> <i>With amended claims.</i></p>

(54) Title: SUB-CALIBRE TRAINING DEVICE



(57) Abstract

A sub-calibre training device for launchers and similar weapons comprising a gun (6) to be positioned in the barrel of the launcher (1) having coupling means between the trigger (4) of the launcher (1) and the trigger arm (11) of the gun (6) and including a safety lock (12) external of the launcher barrel, and an aligning and locking member (5, 7) on the gun to releasably engage the rear of the launcher (1).

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1.

"SUB-CALIBRE TRAINING DEVICE"

INTRODUCTION

It is known that for a given weapon system the highest level of training can be achieved by the repeated use of service weapons firing service ammunition in a field environment. Such ideal conditions can rarely be provided, largely due to the prohibitive costs involved. The direct cost of the weapon and ammunition can be readily appreciated, but there are also other less visible but very real costs such as those of transport to and from a suitable range, of supporting the trainees away from base, the cost of purchasing and maintaining the necessarily very large tract of land, the provision and maintenance of targets and so on.

One possible solution is the provision of a short range version of the original ammunition made by reducing the weight of the shot and the propellant. However for a given calibre of gun this implies a reduction in shot length which introduces problems in exterior ballistics and possibly in feed mechanisms etc. as well as an increase in chamber free-volume which is undesirable from a propellant combustion point of view. The cost of such ammunition is generally only a little less than that of the service round, hence it tends to be kept for specialised advanced training exercises.

The traditional and more attractive solution to this problem has been the use of sub-calibre ammunition fired either from sub-calibre barrels (either slipped inside or strapped outside the parent weapon) or less frequently from scaled down weapons designed around a cartridge of reduced dimensions. Stricly speaking only



2.

the former should be called sub-calibre but time has honoured the title for both systems.

DESIGN PHILOSOPHY

5. The designer of such training weapons must be reconciled to the fact that it will rarely if ever be possible to design a sub-calibre device to simulate the parent weapon in all respects; indeed the art of such design is to identify those aspects which are most relevant and to give them due priority. However the degree of

10. relevance may vary with the circumstances of use which themselves may impose restrictions, e.g. a trainer for use indoors should not generate sufficient noise to force the student and instructors to wear elaborate ear protection which will limit their ability to communi-

15. cate; neither should the resultant smoke be such as to require the use of large extractor fans which themselves tend to be noisy. Ammunition for use outdoors should not only match the trajectory of the service round over the range of interest but should also have

25. a similar time of flight and wind deflection.

Ideally each trainer should be tailor-made to a given weapon and given training philosophy but this approach contravenes one of the basic requirements - that of reducing costs. Compromises must therefore be

30. made which lead to the concept of a family of training devices each of which emphasises a particular range of related aspects of the parent weapon, with mastery of the first device leading logically to the second and so on. Ultimately such an arrangement should turn

25. out the required end product, i.e. proficient weapon operators, and ideally it should do so at reduced cost.



3.

HISTORY

5. The first general issue of such devices in the British Army occurred in 1883 when the "Tube, Aiming, Morris, Martini-Henry Rifle Mark 1" and its complementary "Cartridge, Aiming Tube, Morris" were approved for use. These, the forerunners of a family of Morris Tubes consisted of a complete chambered barrel of 0.230 inch bore which was slipped inside the service rifle barrel of 0.45 inch bore, held at the muzzle and breech and used the mechanism of the parent weapon to fire the much smaller cartridge. Auxiliary sights were provided to slip over the parent sight to give some harmonisation over a desired range band.

10. The basic requirement in this case was to allow training with the newly introduced Martini-Henry rifle to be carried out, other than on the few outdoor ranges considered safe for the full bore ammunition. The attendant advantages were of course a reduction in costs and the chance to accustom the trainees to firing the Martini-Henry rifle without experiencing its notorious recoil. Use of the more common 0.22 inch rimfire ammunition would have complicated the mechanisms by requiring either the bore or the firing pin to have been offset to suit the change from the centre fire to rimfire cartridge system.

15. Following the introduction of the 0.303 inch weapon and ammunition in 1888 the same principle was applied to the "Tube, Aiming, Lee-Metford Magazine Rifle 0.303 inch Morris" which came into service in 1891. Within a few years there was a family of similar devices to suit the range of rifles, carbines and proprietary machine guns in service; nine distinct patterns were listed in 1899.



4.

On the whole this system worked well with few mechanical problems until the reduction in calibre of the service small arms forced a corresponding reduction in the wall thickness of the tubes making them fragile and difficult to make.

A sudden massive increase in demand for training devices during World War I virtually sounded the death-knell of such tubes as it was found that less time and effort was involved in making one piece small-bore barrels which could be permanently attached to second grade service rifles, with the resultant weapon being designated for training use only. Where the weapon was thus permanently modified, it became relatively easy to offset the firing pin and hence to make use of the 0.22 inch rimfire ammunition. This design led to the Rifle No. 2 series of trainers which are still in limited use today.

One disadvantage of this system noted by many users over the years was that the small bore barrel, which contained more metal than its full bore counterpart, made such training weapons heavier overall, with the point of balance being moved perceptibly further from the shoulder.

For the larger naval and coastal defence guns a similar principle was employed using the obsolescent 1 inch Nordenfelt machine gun cartridge redesignated "Cartridge, Aiming Rifle, 1 inch", which was fired from sub-calibre barrels variously attached in or on the parent barrel, or took the form of a replacement breech block containing a firing mechanism and a short length of sub-calibre barrel. Patterns were available for both percussion and electric ignition as required.



5.

RECENT DEVELOPMENTS

Since World War II significant changes have been seen in the requirements for man-portable weapons which have caused changes in design, often even in the basic principle of operation. Small arms are now at least semi-automatic in operation if not fully automatic and the traditional closed breech gun has been augmented by rockets both in-tube burning and in-flight burning as well as by recoilless guns having the recoil balanced by either gas efflux or by ejected solids. The old principle of providing an expensive but almost everlasting gun from which to fire cheap expendable ammunition has been modified and in some cases even reversed, as now the launcher may well cost less than a single round of its ammunition.

Ideally, training for each of these types of weapons requires a training round operating on the same principle as the corresponding service round. Generally such rounds are available but they are often very expensive, particularly where a one-shot throw-away design has been used for the launcher. Much cheaper rounds should be available, at least for initial training.

Designers have approached this problem in a number of ways; the 66 mm HEAT LIA2 system, which consists of an in-tube burning rocket fired from a disposable launcher, has been provided with an ingenious sub-calibre rocket to be fired from a launcher modified to permit a degree of re-use. The 84 mm Carl Gustav recoilless gun has adaptors, each shaped as a round of ammunition, which permit the firing of conventional 6.5 mm or 7.62 mm small arm cartridges.



6.

In small arms, the changes have been more in detail than in principle, being mainly concerned with achieving an increase in the rate of fire. Such weapons are somewhat more complex than their predecessors and hence less amenable to the fitting of simple sub-calibre barrels. The Australian 7.62 mm SLR is, however, one such rifle which can readily be fitted with a sub-calibre adapter, in itself a complete gun, which, by replacing the original bolt, allows the firing of 0.22 inch rimfire ammunition in a realistic manner. The proposed reduction in calibre for small arms from 7.62 mm to 5.56 mm, i.e. a nominal 0.22 inch, should make the design of such adapters rather more simple although they will no longer be truly sub-calibre. The problem of offsetting the firing pin will still remain and perhaps be aggravated by the smaller volume in which to work.

Sophisticated indoor cine target ranges are now becoming available and have generated a demand for devices to allow the exercise on them of weapons other than the normal rifle either alone or as part of a team with other similarly adapted weapons. Training may thus be given not only in the weapons themselves but in the elementary tactics involved in the command of a mix of weapons in a range of simulated situations. The low powered 6.5 mm "gallery" load available for the Carl Gustav is well suited to such applications. No doubt the system could be further modified to fire the more or less standard 0.22 inch rimfire round which would further reduce the costs; however the distinctive 6.5 mm hole in the target could be of some help in assessing the results of fire from a mixed group of weapons.



7.

There are few if any suitable devices for light machine guns presumably due to problems associated with the belting of sub-calibre ammunition and with doubts on the ability of the target mechanism to resolve individual shots in a burst of fire.

5.

In the Patent Literature reference may be had to prior art as exemplified in United States Letters Patents Nos. 741,079 of 1903, TASKER, 2,541,025, BURFORD et al, 2,857,812, NICHOLS and the specification of Swedish Letters Patent No. 159,014 FRAUSSON.

10.

THE INVENTION

The sub-calibre rocket for the 66 mm Light Anti-Armour Weapon (LAW), while well suited to outdoor training is far too powerful and noisy for use on indoor

15. cine ranges. The present invention, developed by The Weapons Systems Research Laboratory of DSTO comprises a device, which is known for identification purposes as "SCATE" (Sub-Calibre Anti-Armour Training Equipment), which permits the firing of the 0.22 inch rimfire cartridge from LAW launchers in a representative manner.

20. This device consists of a sub-calibre single shot gun which fits inside a LAW launcher. The "feel" of the parent weapon is unchanged as the launcher retains its original sights, trigger etc. while the sub-calibre

25. gun closely simulates the weight of the normal rocket. Using a closed breech gun means that the system is not truly recoilless, as is the LAW, however, the use of standard velocity (sub-sonic) cartridges ensures that the recoil sensed by the firer is minimal, while the

30. noise level is sufficiently low to permit continued use indoors. High velocity rounds which closely match the trajectory of the LAW could be used outdoors with



8.

suitable ear protection. An additional safety catch is provided on the gun which is accessible whether in or out of the launcher. For exercising the complete firing cycle of the LAW, the device is loaded and mounted within the launcher which is then closed up, with the sling and end caps fitted in the normal manner. However since the LAW launcher was designed and manufactured as a one-shot disposable unit this process leads to rapid wear of the cocking mechanism as well as inducing damage to the somewhat fragile folding sights.

It is therefore intended that for the majority of training shots, the launcher will be left extended, with the sub-calibre gun being removed for reloading and replaced for firing; recocking of the launcher being done with a special tool. Under these conditions the launcher should remain serviceable for several hundred shots after which the modified components may be switched to another launcher.

The present design is the result of a perceived need to keep this device as simple as possible with minimal operating costs to suit its role as a high usage rate indoor trainer. Variations to the design are possible to suit other roles or to emphasise other features of the parent weapon. A two stage version has been demonstrated. It first fires a 7.62 mm blank cartridge, the gas from which is vented in such a way as to simulate the noise on firing of the LAW as well as the motion of the launcher during in-bore travel of the missile and finally to fire a sub-calibre round along the prevailing line of the bore. Tracer rounds of larger calibre could be used for longer ranges outdoors.



9.

The invention comprises a sub-calibre training device comprising in combination:

5. (a) a launcher for firing a missile such as a rocket along a selected trajectory comprising a barrel having sights and a trigger,
- (b) a gun capable of firing a projectile and including a trigger and selected to fit into the barrel of the launcher and having means to support it therein,
10. (c) means to align the gun with the launcher and to lock it therein, and
- (d) coupling means between the trigger of the launcher and the trigger of the gun including a safety lock to prevent accidental firing of the gun.

15. The means to support the gun in the launcher comprises a first aligning member forward on the gun engaging the bore of the barrel of the launcher and a second member at the rear of the gun releasably engaging the rear of the launcher.

20. To enable the nature of the invention to be fully understood, an embodiment thereof will now be described with reference to the accompanying drawings which are however merely illustrative and not to be taken as limiting the invention to the details shown.

DESCRIPTION OF THE DRAWINGS

25. FIG. 1 is a perspective side elevational view of the launcher and the gun with the gun removed from the launcher according to a preferred form of the invention,

30. FIG. 2 is a somewhat schematic longitudinal section of the rear section of the launcher with the gun in place therein,



10.

FIG. 3 is a rear end elevation of the launcher and gun showing the position of the mechanism when the gun is first inserted into the launcher,

5. FIG. 4 shows the locking ring turned together with the gun to engage the pins on the launcher in the bayonet slots of the ring, and

FIG. 5 shows the safety catch moved to the disengaged position to allow the gun to be fired.

DESCRIPTION OF THE PREFERRED EMBODIMENT

10. The launcher can be of usual approved construction as described herein and comprises a barrel 1 having sights 2 and 3 and a trigger 4 and the rear part of this barrel is adapted to have positioned in it by means of a main aligning and locking member 5 the gun 6 which
15. has its rear part locked in position and located by the aligning and locking member 5 which has a ring 7 forming part of it to allow the member 5 to be turned after it is engaged in the rear end of the barrel 1 of the launcher to lock the gun 6 in the barrel 1.

20. The forward end 8 of the gun has a forward aligning member 9 which engages the inside of the barrel 1 and together with the aligning member 5 accurately aligns the gun with the sights 2 and 3.

The trigger 4 is coupled to a pivoted arm 10 on the
25. member 5 and this is disposed to engage a trigger extension 11 of the gun. The aligning and locking member 5 also supports a suitable safety catch 12 for the gun, which is so arranged that whether the gun is in position in the barrel or is removed, the gun can be locked
30. against firing.



11.

5. The ring 7 which is part of the aligning and locking member 5 has in it bayonet slots 16 which are adapted to engage pins 17 projecting from the inner wall of the barrel 1 so that when the gun is pushed into position in the barrel as shown in Fig. 3 the gun is automatically aligned by the rear gun aligning and locking member 5 and the front gun aligning member 9 and is locked in position when the ring 7 is turned from the position shown in Fig. 3 to the position shown in Fig. 4.

10. The pins 17 can conveniently be equally spaced around the perimeter of the barrel 1, and the aligning and locking member 5 which includes the ring 7 is cut-away at 19 to give access to the gun, the cut-away portion 19 allowing the pivoted arm 10 to project into the path of the end of the trigger arm 11 so that when the ring 7 is turned from the position shown in Fig. 3 to the position shown in Fig. 4 the end of the trigger arm 11 engages above the end of the pivot arm 10 to allow the trigger 4 on the barrel 1 to actuate the trigger arm 11, the pivoted arm 10 being carried on a pivot pin 20 between guides 21 secured to the barrel 1.

The pivoted arm 10 projects above the pivot pin 20 and engages the end of the rod 22 which connects to the trigger 4 of the barrel 1.

25. The safety catch 12 when in its locked position as shown in Figs. 3 and 4 engages part of the firing mechanism to lock the firing pin against axial movement but when it is desired to fire the gun 6 the safety catch 12 is turned to the position shown in Fig. 5 where it disengages a detent 23 forming part of the safety catch 12 from the firing mechanism of the gun to leave it free to be fired.



12.

The detent 23 can engage any appropriate part of the firing mechanism of the gun such as the striker to prevent the gun from being fired until the safety catch 12 is turned to the position shown in Fig. 5 and the detent 23 is withdrawn from engagement with the firing mechanism.

The invention is not limited to use in the existing LAW as with suitable modifications to the mounting and trigger arrangements it could well be made to suit both contemporaries and successors to that weapon.



CLAIMS

1. A sub-calibre training device including sub-calibre means arranged in a barrel of a launcher for firing a missile such as a rocket along a selected trajectory, and comprising a barrel having sights and a trigger, characterised by
- 5.
- (a) a gun capable of firing a projectile and including a trigger and selected to fit into the barrel of the launcher and having means to support it therein and to align the gun with the launcher,
- 10.
- (b) means between the launcher and the gun to lock the gun in the launcher,
- (c) coupling means between the trigger of the launcher and the firing mechanism of the gun, and
- (d) a safety lock for the striker of the firing mechanism of the gun carried by the gun to be accessible when the gun is positioned in the barrel to prevent accidental firing of the gun,
- 15.
- whereby the said projectile can be fired along the normal trajectory of the missile from the launcher.

2. A sub-calibre training device according to claim 1 characterised in that the said means to align the gun within the launcher and to lock the gun in the launcher comprise a first aligning member forward on the gun engaging the bore of the barrel and a second aligning and locking member at the rear of the gun releasably engaging the rear of the bore of the launcher, the said rear aligning and locking member including bayonet joint means between it and the said barrel as the releasable locking means.
- 5.
- 10.



14.

3. A sub-calibre training device according to claim 1 characterised by rear aligning and locking means attached to the gun adapted to fit into the said barrel, bayonet slots on the rear aligning and locking member adapted to engage pins projecting inwardly on the barrel, a trigger arm projecting from the trigger of the gun into the path of a pivoted arm carried by the said barrel arranged so that when the gun is moved into the barrel the trigger arm is clear of the pivoted arm but when the gun is rotated about its axis to lock the pins in the bayonet slots the trigger arm is moved into the path of the pivoted arm to be actuated thereby when the pivoted arm is actuated by the trigger on the barrel of the launcher.

4. A sub-calibre training device according to claim 1 characterised in that the said safety catch is carried by the said gun to project from the rear of the means which support and lock the said gun in the barrel and is rotatable to engage or disengage a detent on the said safety catch on the firing mechanism of the said gun.

5. A sub-calibre training device according to claim 1 characterised in that means to lock the gun in the launcher comprise a forward gun alignment member on the said gun adapted to engage the bore of the said barrel, and a rear aligning and locking member secured to the said gun adapted to fit into and engage the bore in the rear part of the barrel, said barrel having means connecting the trigger on the barrel to a pivoted arm carried on a pivot pin on the said barrel to project into the rear of the said barrel on one side of the axis of the said barrel, a trigger arm projecting from the said gun into the path of the said pivoted arm to interengage when the rear aligning and locking member is rotated to lock the



15.

15. member in the barrel, and a safety lock carried by the said rear aligning member to have one part project beyond the rear of the aligning member and another part to project a detent into the path of the firing mechanism when it is desired to lock the said firing pin against a firing action.

5. 6. A sub-calibre training device according to claim 5 characterised in that the said rear aligning and locking member comprises a first aligning and locking portion adapted to engage in the bore at the rear of the said barrel, and a ring on the said first portion outside of the end of the said barrel, whereby the said gun can be inserted into the said barrel and turned to interengage locking means disposed in the bore of the said barrel and the said aligning and locking portion, and by a cut-away portion in the said aligning and locking member to give access to the said barrel, further characterised in that 10. the said pivoted arm on the said launcher is disposed to project through the said cut-away to project into the path of the said trigger extension of the said gun.

7. A sub-calibre training device constructed substantially as described and illustrated in the accompanying drawings.



AMENDED CLAIMS

[received by the International Bureau on 13 February 1985 (13.02.85);
original claim 2 cancelled; remaining claims amended and renumbered
1-6 (3 pages follow)]

1. A sub-calibre training device including sub-calibre means arranged in a barrel of a launcher for firing a missile such as a rocket along a selected trajectory, and comprising a barrel having sights and a trigger, characterised by

- (a) a gun capable of firing a projectile and including a trigger and selected to fit into the barrel of the launcher and having means to support it therein and to align the gun with the launcher,
- (b) means between the launcher and the gun to lock the gun in the launcher comprising a first aligning member forward on the gun engaging the bore of the barrel and a second aligning and locking member at the rear of the gun releasably engaging the rear of the bore of the launcher when the gun and aligning members are rotated,
- (c) coupling means between the trigger of the launcher and the firing mechanism of the gun engaged when the gun is rotated to lock it in position, and
- (d) a safety lock for the striker of the firing mechanism of the gun carried by the gun to be accessible when the gun is positioned in the barrel to prevent accidental firing of the gun,

whereby the said projectile can be fired along the normal trajectory of the missile from the launcher.

2. A sub-calibre training device according to claim 1 characterised in that the rear aligning and locking means are adapted to fit into the said barrel, bayonet slots on the rear aligning and locking member adapted to engage pins projecting inwardly on the barrel, a trigger arm projecting from the trigger of the gun into the path of a pivoted arm carried by the said barrel arranged so



that when the gun is moved into the barrel the trigger arm is clear of the pivoted arm but when the gun is rotated about its axis to lock the pins in the bayonet slots the trigger arm is moved into the path of the pivoted arm to be actuated thereby when the pivoted arm is actuated by the trigger on the barrel of the launcher.

3. A sub-calibre training device according to claim 1 characterised in that the said safety catch is carried by the said gun to project from the rear of the means which support and lock the said gun in the barrel and is rotatable to engage or disengage a detent on the said safety catch on the firing mechanism of the said gun.

4. A sub-calibre training device according to claim 1 characterised in that the means to lock the gun in the launcher characterised by means on said barrel connecting the trigger on the barrel to a pivoted arm carried on a pivot pin on the said barrel to project into the rear of the said barrel on one side of the axis of the said barrel, a trigger arm projecting from the said gun into the path of the said pivoted arm to interengage when the rear aligning and locking member is rotated to lock the member in the barrel, and a safety lock carried by the said rear aligning member to have one part project beyond the rear of the aligning member and another part to project a detent into the path of the firing mechanism when it is desired to lock the said firing pin against a firing action.

5. A sub-calibre training device according to claim 4 characterised in that the said rear aligning and locking member comprises a first aligning and locking portion adapted to engage in the bore at the rear of the said



barrel, and a ring on the said first portion outside of the end of the said barrel, whereby the said gun can be inserted into the said barrel and turned to interengage locking means disposed in the bore of the said barrel and the said aligning and locking portion, and by a cut-away portion in the said aligning and locking member to give access to the said barrel, further characterised in that the said pivoted arm on the said launcher is disposed to project through the said cut-away to project into the path of a trigger extension of the said gun.

6. A sub-calibre training device constructed substantially as described and illustrated in the accompanying drawings.



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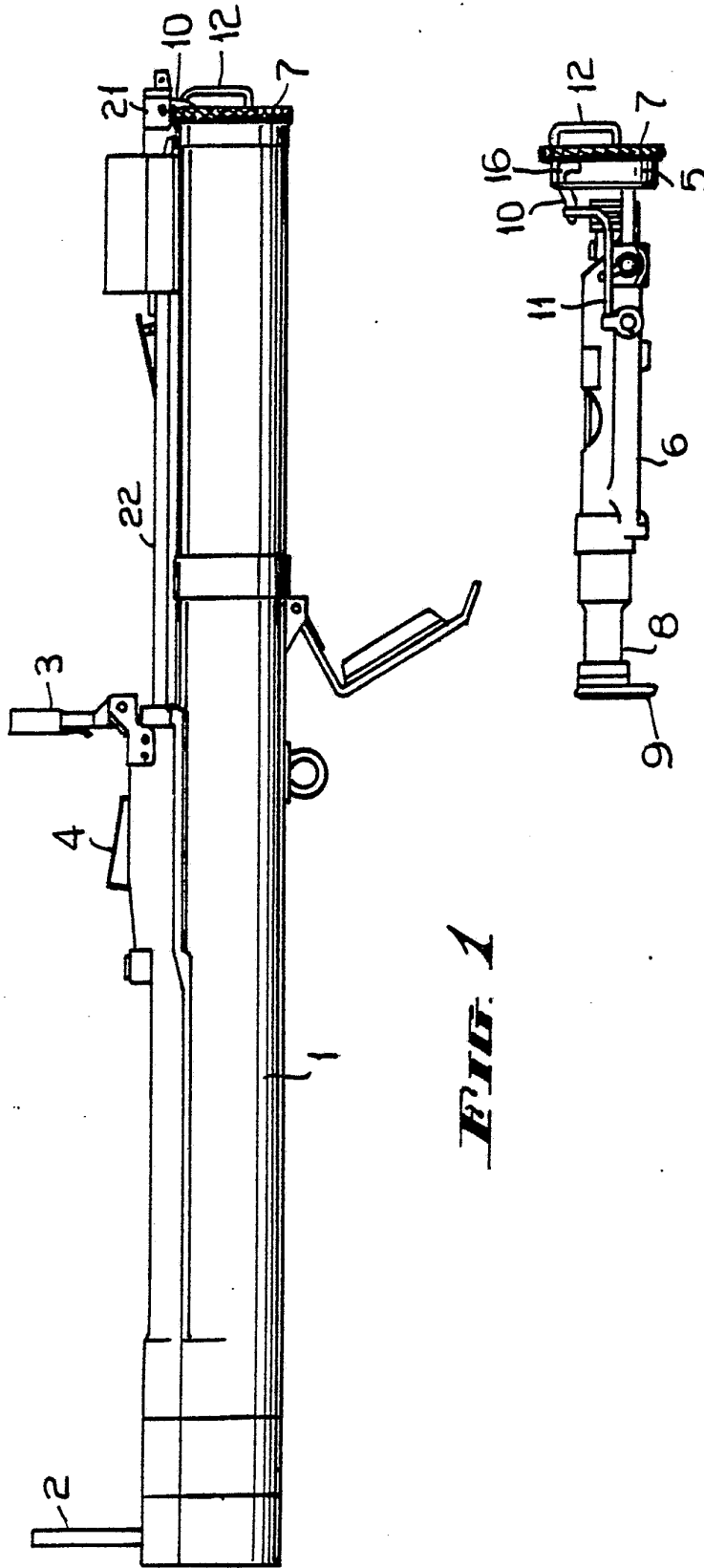


FIG. 1



2/3

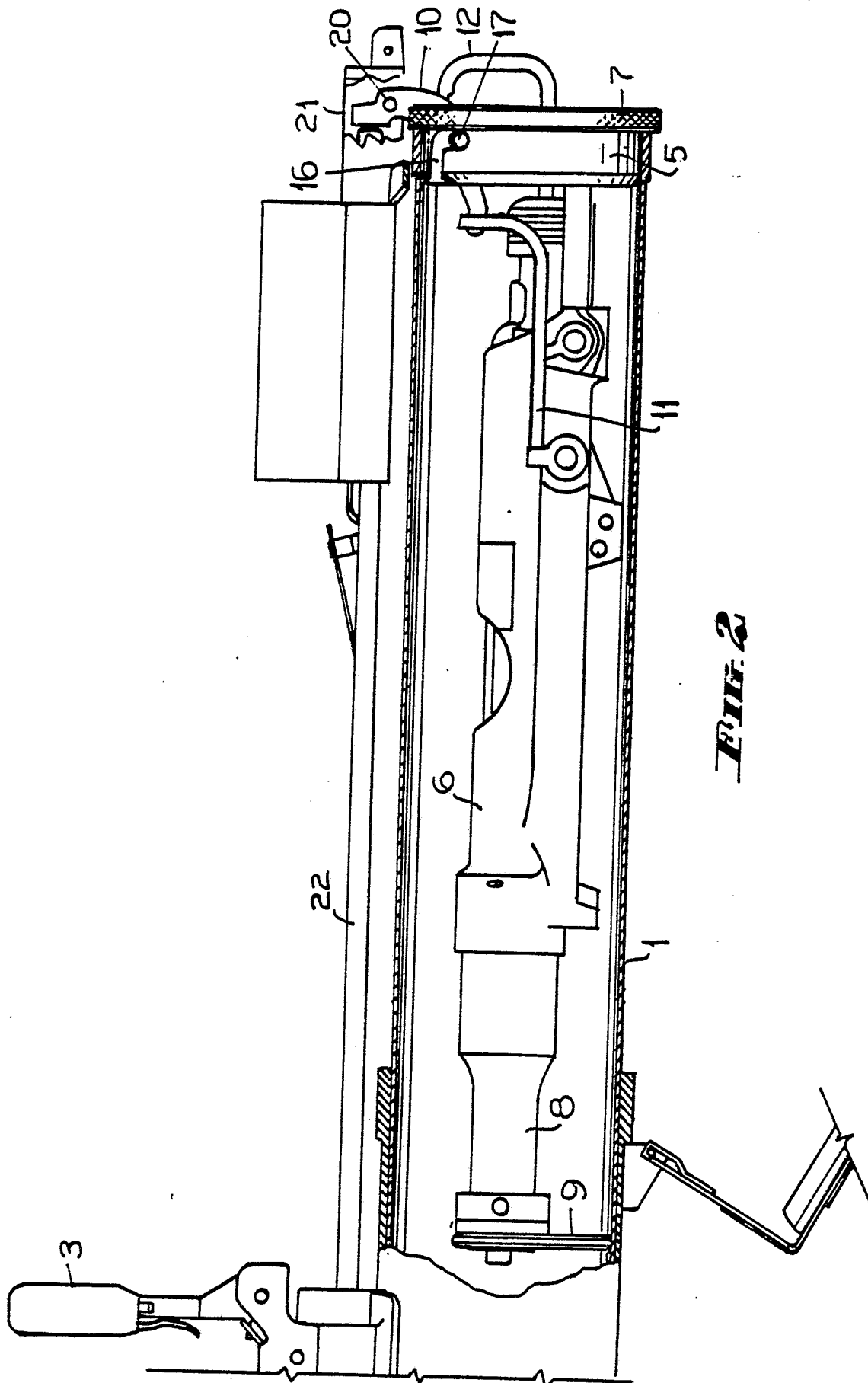


FIG. 2



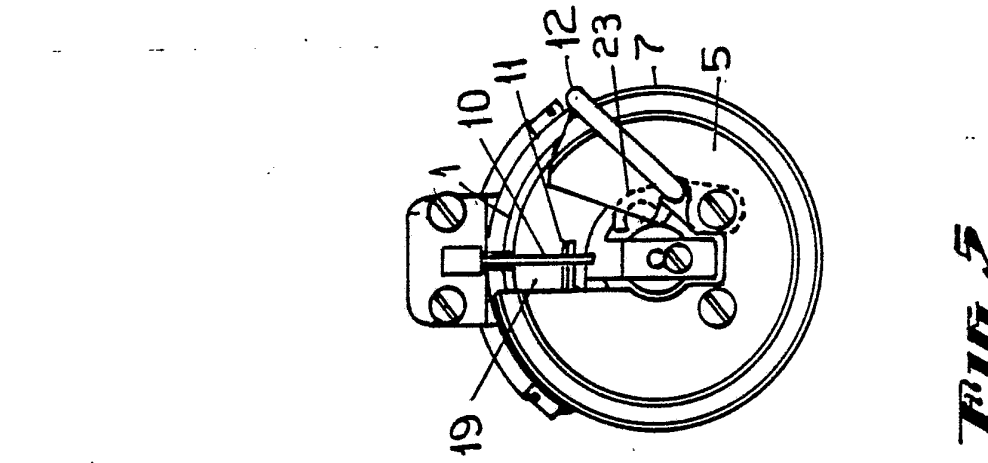


FIG. 5

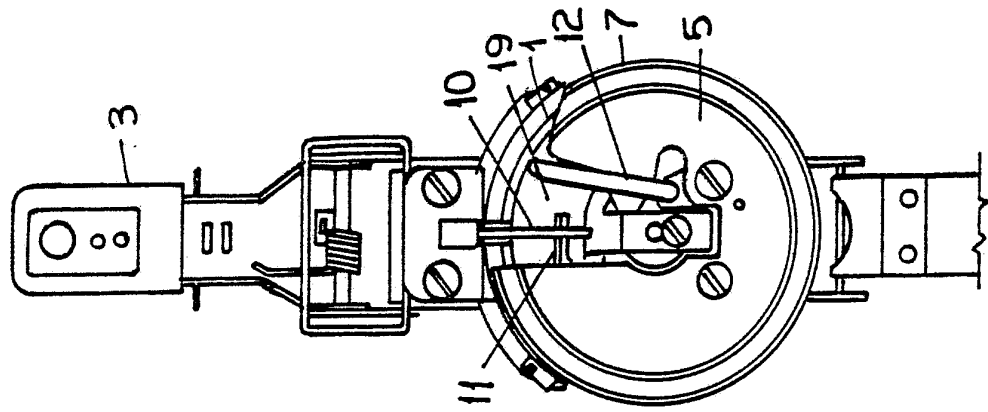


FIG. 4

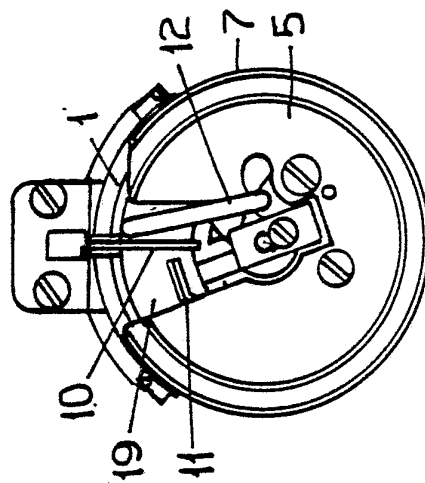


FIG. 3

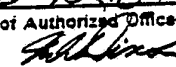
INTERNATIONAL SEARCH REPORT

International Application No. PCT/AU 84/00175

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ³	
According to International Patent Classification (IPC) or to both National Classification and IPC	
Int. Cl. ³ F41F 27/00	
II. FIELDS SEARCHED	
Minimum Documentation Searched ⁴	
Classification System	Classification Symbols
IPC	F41F 27/00, F42B 9/20, 13/16, 13/20
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵	
AU: IPC as above; Australian Classification 89.3	

III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴		
Category ⁶	Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
X	US,A,4362145 (STELCHER) 7 December 1982 (07-12-82)	(1)
A	US,A,4088056 (DALLAIRE) 9 May 1978 (09-05-78)	
A	US,A,3638571 (GAWLICK et al) 1 February 1972 (01-02-72)	
A	US,A,2857812 (NICHOLS) 28 October 1958 (28-10-58)	
A	US,A,2826145 (SANDBERG et al) 11 March 1958 (11-03-58)	
A	US,A,2541025 (BLUFORD et al) 13 February 1951 (13-02-51)	
A	FR,A,2350574 (ETAT FRANCAIS) 2 December 1977 (02-12-77)	
A	DE,A,3108988 (KRIEGHOFF) 23 September 1982 (23-09-82)	
A	DE,C,1036113 (GEIPEL) 15 January 1959 (15-01-59)	
A	AU,A,74763-81 (DYNAMIT NOBEL A.G.) 1 July 1982 (01-07-82)	
X	AU,A,36659-68 (WALLBERG et al) 23 October 1969 (23-10-69)	(1)
A	AU,B,16353-53 (157128) (FRANSSON) 30 April 1953 (13-04-53)	
A	AU,B,4251-51 (150503) (ANSTALT FUR DIE ENTWICKLUNG VON ERFINDUNGEN UND GEWERBLICHEN ANWENDUNGEN "ENERGA") 4 October 1951 (04-10-51)	

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| <p>* Special categories of cited documents: ¹⁵</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, i.e., exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> | <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Z" document member of the same patent family</p> |
|---|---|

IV. CERTIFICATION	
Date of the Actual Completion of the international Search: 5 December 1984 (05-12-84)	Date of Mailing of this International Search Report: 13 DECEMBER, 1984 (13.12.84)
International Searching Authority: Australian Patent Office	Signature of Authorized Officer:  M.E. DIXON

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

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SE, 172913 (MALMSTROM) 27 September 1960 (27-09-60)

V. OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹⁰

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. Claim numbers because they relate to subject matter ¹² not required to be searched by this Authority, namely:

2. Claim numbers because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out ¹³, specifically:

VI. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ¹¹

This International Searching Authority found multiple inventions in this international application as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

The additional search fees were accompanied by applicant's protest.

No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 84/00175

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document
Cited in Search
Report

Patent Family Members

US 4088056

CA 1044056

AU 74763/81

CA 1156871
ES 508232

DE 3048620
IL 64602

EP 56076
TR 21338

US 3638571

BE 720455
GB 1240881

DE 1578122
NL 6811787

FR 1585264

END OF ANNEX