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(71) Applicant
Schlumberger Electronics (U.K.) Limited

(Incorporated in United Kingdom)

124 Victoria Road, Farnborough, Hants GU14 7PW

(72) Inventors
Keith Barnes
Martin Pincock

(74) Agent and/or Address for Service
B. D. Stoole, M. Holt,
Schlumberger Electronics (U.K.) Limited, 124 Victoria Road, Farnborough, Hants GU14 7PW

(54) Training apparatus

(57) A simulated infra-red (ie thermal) target comprises a dummy target, such as a cloth-covered wooden frame in the shape of a tank, having patches of retroreflective material stuck to the regions which would be hot if the target were real. The target 18 is then irradiated with a low power infra-red laser source 26, typically a carbon dioxide laser, positioned behind and above the weapon system 12 whose thermal imaging is being aimed at the target, so that the thermal imaging sight "sees' the target by virtue of the infra-red radiation retroreflected from the patches.

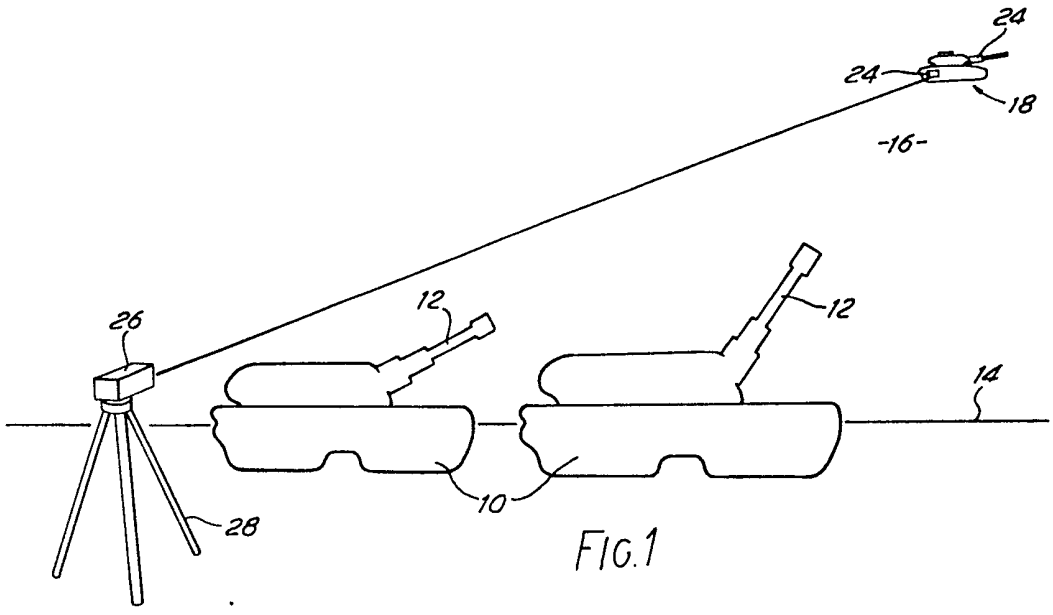

FIG.1

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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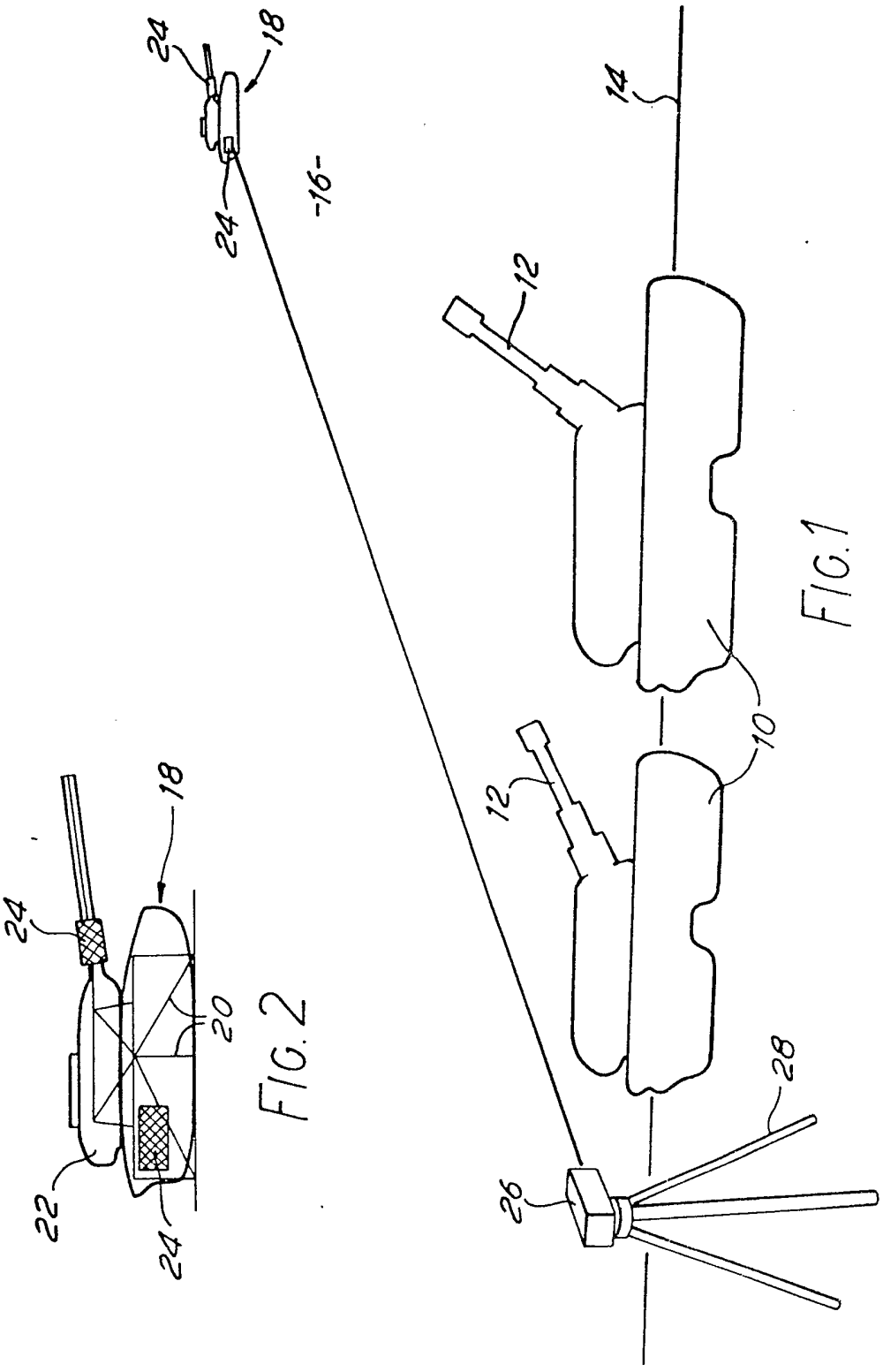

FIG.1

FIG.2

SPECIFICATION

Training apparatus

This invention relates to training apparatus, and is more particularly but not exclusively concerned with training apparatus for training tank and/or gun crews in the use of thermal observation systems and/or thermal imaging sights associated with their weapons.

Currently, one form of training apparatus for training tank and/or gun crews in the use of weapons having thermal imaging sights comprises a dummy target, typically a full size silhouette of a tank, which is positioned at a normal operational range with respect to the weapon and sight. This target is provided with local heating devices adjacent the parts thereof which would be likely to be hot if the target were real, eg in the case of a tank, the breech-end of the barrel of the main gun and the engine compartment, so that when the heating devices are energised, these parts will show up in the thermal imaging sight.

However, such an arrangement suffers from several drawbacks. Firstly, it is relatively complex and expensive, especially bearing in mind that the target is fired at, and therefore has to be expendable. Secondly, it requires the presence of a power source at the target or power cables extending from the weapon to the target, which is again expensive, indeed, in the latter case, it is inconvenient as well, and the cables themselves are vulnerable to damage from shell-fire.

It is therefore an object of the present invention to provide training apparatus in which the aforementioned drawbacks are alleviated.

According to one aspect of the present invention, there is provided training apparatus for training weapon crews in the use of thermal observation systems and weapons having thermal imaging sights against real targets having predetermined regions of likely elevated temperature, the apparatus comprising:

a dummy target representative of the real target, said dummy target being provided with at least one infra-red reflector means in a region thereof representative of a region of likely elevated temperature of the real target, and being positioned, in use, at a normal operating range of the weapon and sight; and

source means for producing a beam of infra-red light for illuminating the dummy target, the source means being positioned, in use, adjacent the sight.

According to another aspect of the invention, there is provided apparatus for simulating a real thermal target, the apparatus comprising a dummy target, at least one infra-red reflector means secured to the dummy target, and source means, remote from the dummy target, for producing a beam of infra-red radiation which is directed at and illuminates the dummy target.

In this specification, the term "real target" means any target at which a weapon would be fired in a real combat situation, whereas the term "dummy target" means a target which is used for training purposes and which merely represents such a real target, however inaccurately or incompletely.

Conveniently, the dummy target comprises a frame covered with cloth or other suitable material and shaped to represent a silhouette of the real target, and the reflector means preferably comprises one or more patches made from or coated with an infra-red reflecting material and stuck or otherwise secured to the dummy target.

In a preferred embodiment of the invention, the reflector means is retroreflective, that is, it reflects incident light mostly straight back along the line of incidence.

Preferably the source means comprises an infra-red laser, advantageously a low-power carbon dioxide laser

The invention will now be described, by way of example only, with reference to the accompanying drawings, of which:

Figure 1 is a schematic representation of training apparatus in accordance with the present invention; and

Figure 2 is an enlarged view of part of the apparatus of Fig. 1.

Fig. 1 shows two tanks 10 whose crews are to be trained in the use of thermal imaging sights (not shown) associated with the main guns 12 of the tanks. The tanks 10 are positioned at a firing point 14 on a firing range 16, and are firing at a dummy target 18 in the form of a silhouette of a tank. The target 18 is positioned within the operational range of the guns 12 and their sights, typically at say 1000 metres or 2000 metres from the firing point 14.

The dummy target 18 is shown on an enlarged scale in Fig. 2, and comprises a wooden or aluminium frame 20 covered with cloth or other suitable material 22. Secured to the portions of the target 18 approximately corresponding to the respective positions of the breech-end of the barrel of the gun and the engine compartment of the tank represented by the target are respective infra-red retroreflective patches 24. These patches 24 may each comprise, for example, a polymeric film moulded, pressed or rolled to form in its surface a multiplicity of small depressions covering the entire surface. Each depression has three mutually perpendicular intersecting walls, such that it effectively constitutes a retroreflector of the corner-cube type. The surface of the film, and thus the surfaces of the walls of each small depression, is then coated with indium oxide or tin-oxide, to enhance its infra-red reflecting capability.

Situated at the firing point 14, adjacent the tanks 10, is an infra-red laser projector 26 mounted on a tripod 28. The projector 26,

which comprises a relatively low-power (and therefore eye-safe) carbon dioxide laser, produces a beam of infra-red radiation which is directed towards and illuminates the target 18 throughout the duration of each training session. The beam is relected back along its line of incidence towards the tanks 10, thus enabling the target to be seen, and therefore aimed and fired at, using the aforementioned thermal imaging sight associated with each gun 12.

It will be appreciated that, by virtue of its construction, the target 18 is relatively inexpensive, which is a considerable advantage in view of its expendable nature. Also, it is light in weight, and therefore relatively easy to transport, and relatively quick and easy to set up. Further, the laser projector 26 is located at and controllable from the firing point 14, which is extremely convenient.

Many modifications can be made to the described embodiment of the invention. For example, the retroreflective patches 24 can be made from aluminium foil stuck to a substrate of polythene or other infra-red transparent material, or sandwiched between two such substrates, and then moulded, pressed or rolled to form retroreflectors in its surface, as described above in relation to the polymeric film patches 24. Also, the intensity of the radiation reflected from different parts of the target 18 can be varied by extending the coverage of the patches 24 and then applying an absorbing coating of paint or some other partially transmitting covering over selected parts of the patches, so as to simulate accurately the different levels of infra-red emission typically produced by real targets. In the limit, the patches 24 can be simply reflective rather than retroreflective, but that requires the use of a more powerful laser in the projector 26 and/or reduces the range over which the apparatus can be used.

In another possible modification, the laser projector 26 is more closely associated with the weapon with which it is being used as a training aid, for example by mounting it on or in the turret of the tank 10, in close proximity with the thermal imaging sight. Indeed the projector 26 can even form part of a more comprehensive training system, such as that manufactured by the Applicant under the trade mark SIMFIRE, mounted on each tank 10. Finally, the training apparatus of the invention can be used with weapons other than tank guns, for example with artillery and infra-red homing missiles.

CLAIMS

1. Training apparatus for for training weapon crews in the use of thermal observation systems and weapons having thermal imaging sights against real targets having predetermined regions of likely elevated temperature, the apparatus comprising:

a dummy target representative of the real target, said dummy target being provided with at least one infra-red reflector means in a region thereof representative of a region of likely elevated temperature of the real target, and being positioned, in use, at a normal operating range of the weapon and sight; and

source means for producing a beam of infra-red light for illuminating the dummy target, the source means being positioned, in use, adjacent the sight.

2. Apparatus for simulating a real thermal target, the apparatus comprising a dummy target, at least one infra-red reflector means secured to the dummy target, and source means, remote from the dummy target, for producing a beam of infra-red radiation which is directed at and illuminates the dummy target.

3. Apparatus as claimed in claim 1 or claim 2, wherein the dummy target comprises a frame covered with cloth or other suitable material and shaped to represent a silhouette of the real target.

4. Apparatus as claimed in any preceding claim, wherein the reflector means preferably comprises one or more patches made from or coated with an infra-red reflecting material and stuck or otherwise secured to the dummy target.

5. Apparatus as claimed in any preceding claim, wherein the reflector means is retroreflective.

6. Apparatus as claimed in claim 5, wherein the reflector means comprises a sheet of infra-red reflecting material having a multiplicity of recesses, each shaped to serve as a retroreflector of the corner-cube type, provided in the surface thereof.

7. Apparatus as claimed in any preceding claim, wherein the source means comprises an infra-red laser.

8. Apparatus as claimed in claim 7, wherein said laser is a carbon dioxide laser.

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