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54 **Camouflage and a method of obtaining such camouflage.**

57 A camouflage having attenuating properties within the infrared and microwave ranges consists of a water-based foam having an expansion ratio greater than or equal to 1 000, and/or a plastic-based foam having an expansion ratio greater than or equal to 100. The camouflage is particularly, but not exclusively, useful to conceal vehicles, antitank mines, airfields and stationary objects, such as coast artillery pieces and trench shelters.

In generating such camouflage, vehicle engine cooling air may be utilized to blow the foam.

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Camouflage and a method of obtaining such camouflage

The present invention relates to a camouflage having attenuating properties within the infrared and the micro-wave range in order to mask primarily military objects.

By the term object, as used herein, is meant installations, 5 e.g. airfields, as well as equipment and personnel. The invention is also concerned with a method at the generation of such a camouflage.

In order to camouflage an object, it is usually painted, 10 covered with nets and the like or placed towards a suitable background. Characteristic of such camouflage is that it is effective mainly within the visible wave-length ranges. Within the infrared range and the microwave range, where a lot of search equipment and homing active parts are 15 working, there have up to now been found no good camouflage methods.

Thus the object of the present invention is to suggest a camouflage giving protection from search equipment provided 20 with homing devices working within the infrared and micro-wave ranges.

Said object is achieved by giving the camouflage of the invention the characteristics stated in claim 1.

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This is because it has been found that a water-based foam having an expansion ratio greater than or equal to 1 000 and that a plastic-based foam having an expansion ratio

greater than or equal to 100 give considerable absorption of IR-radiation and microwaves.

The camouflage of the present invention may primarily,
5 but not exclusively, be used for the following applications:

- camouflage of vehicles and antitank mines
- camouflage of airfields
- 10 - camouflage of stationary objects, such as coast artillery pieces and trench shelters

The water-based foam may be an ordinary fire extinguishing foam, which is obtained in a way known per se by mixing
15 water with a foaming agent which when being sprayed is added air with a foam production as the result. Moreover, the foam may comprise stabilizers and corrosion inhibitants. Suitably the foam also comprises colouring agents usual for masking purposes.

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As examples of foaming agents known for foam extinguishing purposes may be mentioned ammoniumlauryl ethersulfate, diethylglykol monobutylether and lauryl alcohol. As stabilizers there may be used in a conventional way
25 gelatine, sodium carboxymethyl cellulose, polyethylene imine, starch phosphate, glycerol, sorbitol, fatty acid monoethanol amides, fatty acid amides, N-alkylimino diacetates or sulfobetaine.

30 Examples of corrosion inhibitants are carbamates, tetrasodium pyrophosphate and sodium benzoate.

Even other water-based foams may be used than those known for fire extinguishing purposes, based on synthetic as
35 well as naturally occurring foaming agents.

The plastic-based foam consists of a cellular plastic, e.g.

cellular urethane plastic, cellular phenol plastic or cellular carbamide plastic, produced in the conventional way. After mixing the components together and spreading of the foam obtained, the curing action may be performed 5 in place. The cellular plastic structure is obtained by vaporization of the blowing (expanding) agent being part of the reaction mixture or by air being blown into the reaction mixture.

10 Example 1. Camouflage of vehicles

Vehicles, primarily combat vehicles, are usually pattern painted for masking purposes in order to be protected from direct view. The pattern painting may be completed with 15 bunches of twigs and the like being fixed to the vehicle. When the vehicle is deemed to be stationary in a place for a longer period of time (for instance at quartering), the camouflage is completed with camouflage nets being tightened across and around the vehicle.

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Modern aids for reconnaissance and firing activities are, however, being introduced. Reconnaissance and attack aviation is today provided with an equipment admitting discovery and combating of objects under camouflage. A 25 corresponding equipment is being introduced into modern combat vehicles. With the camouflage according to the invention protection is also given from reconnaissance equipment and armament being effective within the infra-red or the microwave range. Protection is obtained from 30 reconnaissance and combating from the air as well as from other combat vehicles.

In order to camouflage a combat vehicle from the air or in order to protect it from view from the ground the 35 horizon around, it is necessary that the foam is put around the whole vehicle. Vertically the foam should cover the sides of the chassis and the upper parts of the front ar-

mour and the back armour. The barrel and prisms and sight equipment should be free from foam.

On those occasions when the vehicle does only have to be masked for protection from view from the ground, the foam could be put in a sector in front of the vehicle.

With a foam height of about 2 metres and for a camouflage all around there is required about 100 m^3 foam and for a front camouflage about 25 m^3 foam. As the camouflage only needs to be of a relatively short duration, a water-based foam can be used. With an expansion ratio of about 1 000, it is required about 100 litres of water, 100 m^3 air and about 1 litre of foaming agent in order to achieve a camouflage all around the vehicle.

In order to cool the engines of a combat vehicle a large quantity of cooling air is required. Altogether there is required about $10\text{-}20 \text{ m}^3/\text{sec}$ of air to cool a tank. It is possible to utilize the cooling air for blowing the foam.

To produce the foam there may be used a conventional foam blowing device having a number of muzzles. The number is adapted in order that the foam will be produced as quickly as possible and that an acceptable continuous camouflage will be obtained.

It must be possible to vary the colouring of the foam depending on the background. If possible, one should be able to choose the colour from the inside of the vehicle at the time of spreading the camouflage.

The foam must be non-toxic as there is a risk of getting foam inside the vehicle.

Example 2. Camouflage of mines

The camouflage of the invention is particularly suitable for masking antitank mines, something that has been
5 difficult up to now and has required large resources.

In meadow-land and the corresponding, the mines are buried by hand or are put into the ground by means of minelayers. Then the mines are being camouflaged by putting back on
10 top of the mines, those pieces of turf that were loosened at the minelaying.

In wooded ground the mines are buried by hand or, the terrain being favourable, by means of minelayers. The
15 locations of the mines are then being camouflaged by scattering needles, smaller twigs and grass on top of them.

In a gravel road the mines are buried into the roadway by hand, and then the entire roadway is covered with a thin
20 (about 5 cm) layer of gravel, twigs or straw and in the winter with snow.

In hardened roadways, the mines are buried into the roadway by digging (boring, pinchbarring, blasting). A camouflage
25 flage is obtained by spreading a thin layer of gravel on the roadway, which layer is joined together using a slurry of asphalt or cement.

If there is only a short time at disposal for the minelay-
30 ing and in winter-time when the frost has gone into the ground, the mines are usually laid out without being buried into the ground. Such an action puts greater demands on the camouflage. Irrespective of the ground and weather conditions it will as a rule be difficult to conceal the
35 fact that mining has been done if the laying has been carried out by means of a minelayer (track formation and such like). The same goes for minelaying by hand in the winter-time.

The clearance of mines is carried out by hand, by blasting or shooting or by means of a mine roller. Mine clearance by blasting or shooting must most often be completed with a removal of mines by hand. Removal by hand and even
5 blasting does require that the individual mine is first being located.

The camouflage of antitank mines requires that a plastic-based foam is being used because of the long time such a
10 camouflage must be able to stay. The height should be about 0.5 cm in order to cover the mines and to make the mine clearance more difficult. A mining that is laid on a road or buried into the roadway will have to be covered with foam over the entire width of the roadway.

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From the above is evident that the camouflage according to the invention can be favourably used:

- in order to conceal the exact location of buried mines
20 in those cases when masking in another way is not possible (the locating of the individual mine can also be made more difficult if the foam is made gluey).
- in order to quickly conceal not buried mines, particularly at conditions of bare ground when there is a hurry and
25 in winter-time when the frost has gone into the ground
- at all conditions to replace the camouflage methods being used up to now. Making use of the present invention, the
30 mines can be laid out directly on the ground. The mining should then be completed with a feigned mining in the form of foam layers laid in connection to the actual mining. Said method must, however, be estimated with consideration taken to the risk of mine clearance by means of mine
35 rollers.

Example 3. Camouflage of airfields

Airfields, military as well as civil fields, are important objects in case of war. The aggressor wishes to get hold
5 of them undamaged in order to quickly supply troops and necessities. Airfields that are not used are consequently barred (and defended) while airfields that are used by our air force, are being defended. Airfields that an aggressor does not intend to use will be combated
10 by him in order to obstruct our air force. Said fields may be barred or used by our air force.

When laying a foam over runways, some important advantages can be gained. Combating of fields is made more diffi-
15 cult if the foam is laid in such a way that the direction and extension of the runway is concealed. Undesirable landing is also prevented. One's own aircraft may land/ take off from a runway covered with foam if directions are given from the ground.

Claims:

1. Camouflage having attenuating properties within the infrared and the microwave range in order to mask
5 primarily military objects, characterized in that the camouflage consists of a water-based foam having an expansion ratio greater than or equal to 1 000 and/or a plastic-based foam having an expansion ratio greater than or equal to 100.
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2. A camouflage as claimed in claim 1, characterized in that the foam comprises one or several predetermined masking colouring agents.
- 15 3. Method at the generation of a camouflage as claimed in any of the preceding claims, characterized in that the generation is carried out in a vehicle and that the vehicle engine cooling air is utilized to blow the foam.



European Patent
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EUROPEAN SEARCH REPORT

0018956

Application number

EP 80 85 0057

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ¹)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	US - A - 4 142 015 (BIENZ) * Figures; abstract; column 2, lines 52-55; column 4, lines 5-7 *	1,2	F 41 H 3/00
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X	DE - A - 2 345 607 (RADEMACHER et al.) * Claims 1,17; page 12, paragraph 2 *	1	
	--		TECHNICAL FIELDS SEARCHED (Int.Cl. ³)
	DE - A 2 252 431 (PUSCH) * Claim 3; page 1, paragraphs 1,2; page 2, line 6 *	1	F 41 H A 62 C H 01 Q
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	FR - A - 1 131 158 (THE PYRENE COMP. LTD.) * Page 2, left-hand column, lines 1-9 *	3	
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A	US - A - 3 733 606 (JOHANSSON) * Abstract *		CATEGORY OF CITED DOCUMENTS
	--		X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
A	GB - A - 565 238 (STERNSON LABORATORIES LTD.)		
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PA	FR - A - 2 421 363 (MAGNUSSON) * Claim 1 * & DE - A - 2 912 751		& member of the same patent family, corresponding document

☒ The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 07-07-1980	Examiner FISCHER