United States Patent [19]

Lawrence

[11] **3,899,975**

[45] **Aug. 19, 1975**

[54] **DISPENSING APPARATUS**

[75] Inventor: **John Charles Lawrence,** London, England

[73] Assignee: **F. Bender Limited,** London, England

[22] Filed: **July 9, 1973**

[21] Appl. No.: **377,214**

[30] **Foreign Application Priority Data**

July 11, 1972 United Kingdom 32388/72

[52] **U.S. Cl.** ..... **102/63;** 102/61; 102/89; 343/18 E; 102/34.4

[51] **Int. Cl.** **F42b 13/50**

[58] **Field of Search** ..... 102/7.2, 34.4, 35.6, 37.6, 102/61, 63, 89; 343/18 E

[56] **References Cited**

UNITED STATES PATENTS

40,888	12/1863	Smith	102/61
1,241,095	9/1917	Courtesy	102/7.2
2,476,302	7/1949	Jeppson	102/34.4
3,626,415	12/1971	Montgomery	343/18 E
3,730,098	5/1973	Edwards	102/63

Primary Examiner—Verlin R. Pendegrass
Attorney, Agent, or Firm—Christensen, O'Connor, Garrison & Havelka

[57] **ABSTRACT**

A projectile contains an explosive charge and a fuse assembly which carries axially spaced groups of angularly spaced bundles of chaff and axially spaced explosive charges. Each bundle has an explosive charge. In order to form a cloud of chaff, the explosive charge in the projectile is detonated so that the fuse assembly and the bundles of chaff are ejected. The fuse is ignited by the detonation. The groups are ejected progressively from the fuse assembly, by detonation of the charges in the fuse assembly, the bundles of each group being blasted laterally from the fuse assembly, by the respective explosive charge. Each bundle is disintegrated after a predetermined time interval by its own explosive charge. All the charges and the fuse are set to detonate at predetermined time intervals so that the resultant cloud has a specific shape.

21 Claims, 2 Drawing Figures

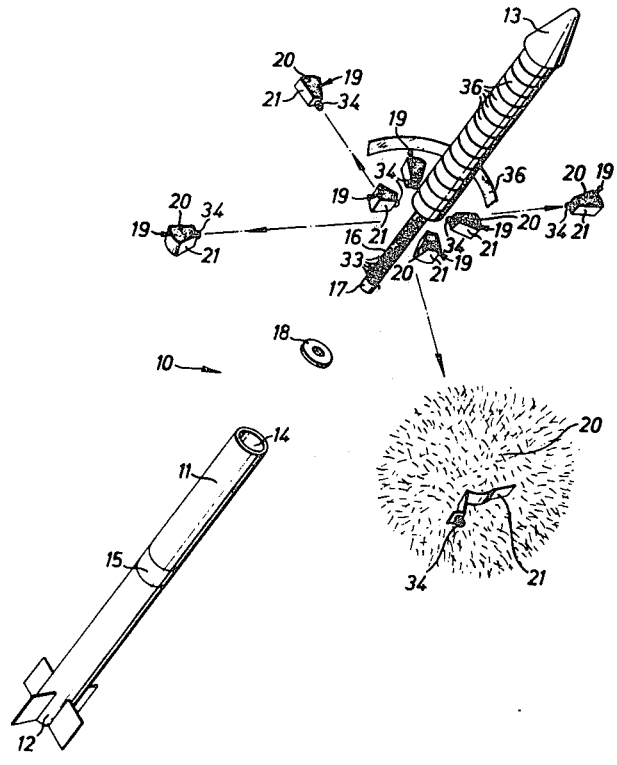


FIG. 1.

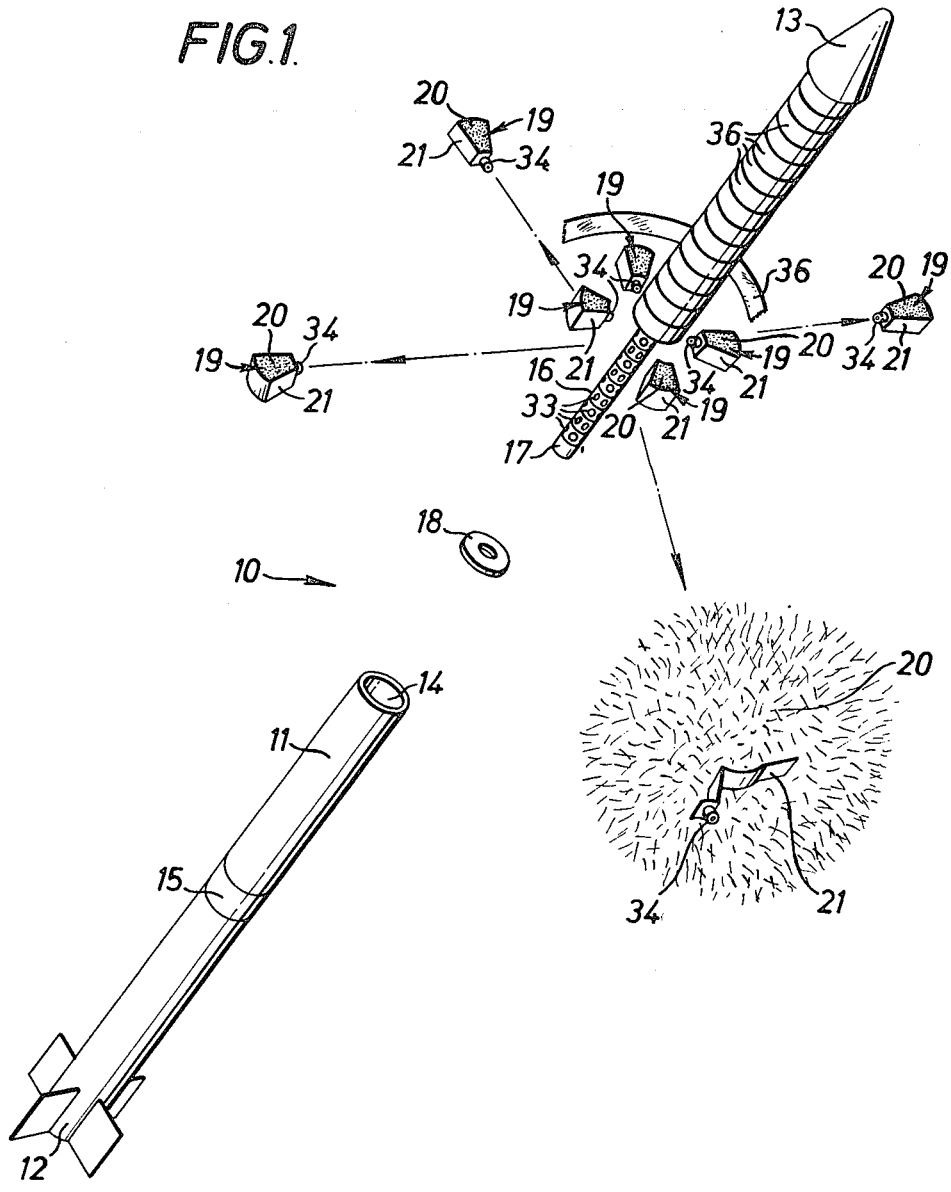
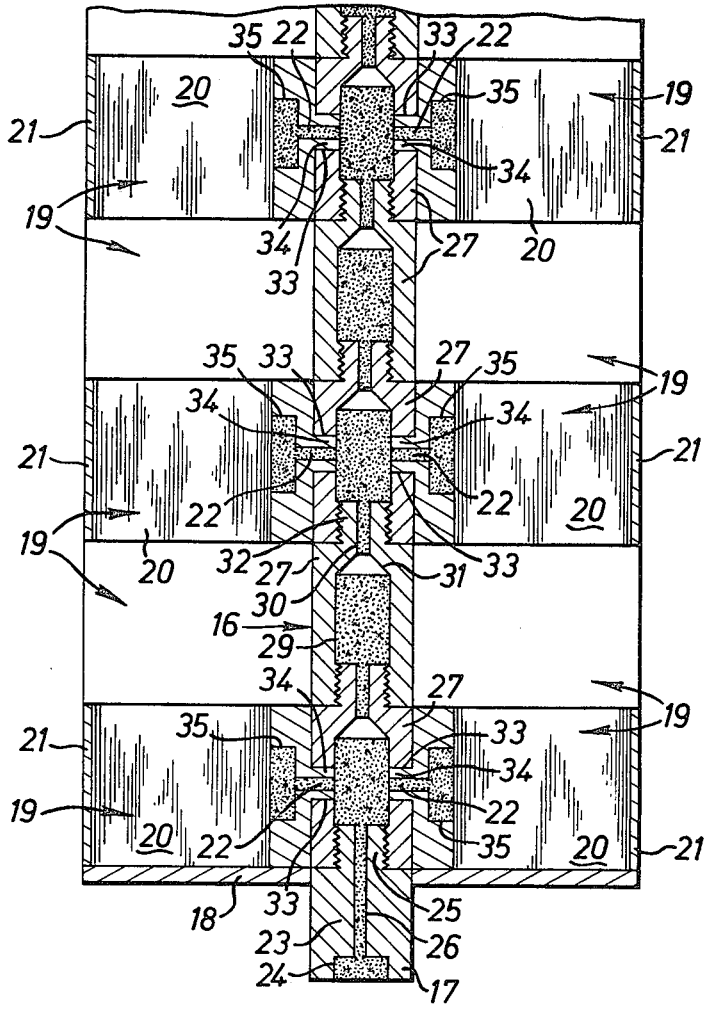

13
20
19
21
34
36
19
34
36
19
20 19
20
34
19
21
16
21
34
19
20
34 21
33
19
20
21
17
18
10
20
14
11
15
12
34
21

FIG. 2.


35
22
33
22
20
35
19
21
21
34
19
34
27
20
33
35
33
27
35
19
34
34
21
21
22
22
20
19
20
32
27
31
33
30
16
29
34
27
19
21
35
33
34
19
22
20
22
35
20
21
18
33
25
23
26
24
17

DISPENSING APPARATUS

This invention relates to the formation of a cloud of radar reflecting chaff within the atmosphere.

According to one aspect of this invention there is provided apparatus for forming a cloud of radar reflecting chaff comprising bundles of radar reflecting chaff and ejector means for ejecting the bundles from a projectile in flight, each bundle being arranged to disintegrate at the end of a predetermined time interval after ejection from the projectile so that, once all the bundles have been disintegrated the chaff is scattered within the atmosphere to form a cloud of a substantially predetermined form.

The ejector means may be arranged to eject groups of bundles of chaff laterally with respect to the flight path of the projectile at spaced intervals along the flight path so as to form a substantially spherical cloud. The ejector means may be arranged to eject each bundle of each group laterally along a respective path which extends radially from the flight path in a different direction to the paths of the other bundles of the group.

The ejector means may include an explosive charge, the arrangement being such that bundles of chaff are ejected from the projectile by explosion of the explosive charge. Conveniently the ejector means includes a number of explosive charges, the arrangement being such that each group of bundles is ejected by explosion of a respective explosive charge. Each bundle may include a further explosive charge and is arranged to be disintegrated by detonation of the further explosive charge. Furthermore each bundle may include a fuse which is arranged to be detonated by explosion of the respective explosive charge which is arranged to eject the bundle laterally with respect to the flight path, each fuse determining the time interval betwen lateral ejection and disintegration of the respective bundle.

The ejector means may comprise a tubular assembly, that part of each bundle which includes said fuse being spigotted into a radial aperture through the tubular wall of the tubular assembly, the respective explosive charge being housed within the portion of the bore of the tubular assembly with which the radial aperture communicates. Each bore portion which houses an explosive charge may be spaced from the juxtaposed bore portion or portions which also house an explosive charge by a bore portion of reduced diameter which delays ignition of the explosive charge which is further from the initially ignited explosive charge. Conveniently the tubular assembly comprises a number of tubular elements screwed together end to end. Each tubular element may comprise a bore portion which houses an explosive charge and a juxtaposed bore portion of reduced diameter. The tubular assembly may include an end tubular element which defines a said bore portion of reduced diameter which serves to delay ignition of the initially ignited explosive charge. Conveniently the spigot part of each bundle is tubular and said fuse is housed within the bore thereof.

According to another aspect of this invention there is provided a bundle of radar reflecting chaff for use in apparatus according to the preceding aspect, comprising chaff packed within a peripheral band and carrying a fuse which is adapted to be ignited by ejection of the bundle from a projectile in flight, the fuse being arranged so that the bundle disintegrates when the fuse has burnt through at the end of a predetermined period of time. The fuse may be arranged to burn through the peripheral band so that the bundle disintegrates, or to ignite an explosive charge in the bundle, the bundle being disintegrated by explosion of the explosive charge. The fuse may be housed within the bore of a tubular spigot which projects outwardly from the peripheral band.

In accordance with another aspect of this invention bundles of radar reflecting chaff are ejected from a projectile in flight and, at the end of a respective predetermined time interval, each bundle of chaff is disintegrated and the chaff scattered within the atmosphere so that, once all the bundles have been disintegrated and the chaff scattered, the scattered chaff forms a cloud of a substantially predetermined form.

Preferably groups of bundles of chaff are ejected laterally with respect to the flight path of the projectile at spaced intervals along the flight path to form a substantially spherical cloud. Conveniently each bundle of each group is ejected laterally along a respective path which extends radially from the flight path in a different direction to the paths of the other bundles of the group.

Bundles of chaff may be ejected from the projectile by the detonation of an explosive charge. Where groups of bundles are ejected laterally at spaced intervals along the flight path, each group may be ejected by the detonation of a respective explosive charge. Each bundle may be disintegrated by detonation of a further explosive charge. Conveniently the further explosive charge may be detonated by a fuse which was ignited by explosion of the respective explosive charge which ejected the bundle laterally with respect to the flight path, each fuse determining the predetermined time interval between lateral ejection and disintegration of the respective bundle.

One embodiment of this invention will be described now by way of example with reference to the accompanying drawings of which:

FIG. 1 is a perspective view of appartus according to the invention ejected from a projectile to form a cloud of radar reflecting chaff; and

FIG. 2 is a sectional view of part of the apparatus shown in FIG. 1.

Referring to FIG. 1 of the drawings, a projectile **10** has a tubular casing **11** which extends forwardly from an aft portion **12** in which is housed a power plant (not shown). A nose cone **13** is adapted to be fitted releasably to the front end of the tubular casing **11**, so as to close an opening **14**, defined by the front end of the tubular casing **11**. The interior of the tubular casing **11** between the aft portion **12** and the nose cone **13** comprises a load carrying space. The detailed construction and operation of the projectile forms no part of the present invention.

A first explosive charge **15** is mounted at the end of the load carrying space nearer the aft portion **12**. When the nose cone **13** is fitted to the front end of the tubular casing **11**, it retains an elongate fuse assembly **16** within the load carrying space. The elongate fuse assembly **16**, which will be described hereinafter in more detail with reference to FIG. **2**, has one end **17** in contact with an annular thrust disc **18** which, in turn, is in contact with the first explosive charge **15** and extends from the first explosive charge **15** to the nose cone **13** along the axis of the tubular casing **11**. The elongate fuse assembly **16** carries a number of axially spaced groups of explosive

charges within the load carrying space and supports a like number of axially spaced groups of bundles **19** of radar reflecting chaff (i.e. needles of aluminium foil) housed within the annular space defined between the elongate fuse assembly **16** and the inner wall of the tubular casing **11**, the bundles **19** of each group being arranged in a circumferential array. Each bundle **19** comprises chaff **20** packed within a peripheral band **21** of a suitable material, such as stiff paper, and extends radially from the respective annular explosive charge to the inner wall of the tubular casing **11**. The profile of each bundle **19**, when viewed along the axis of the tubular casing **11**, comprises inner and outer arcuate portions to one another at each circumferentially-spaced end by radial portions, both arcuate portions being concave to the centre of the tubular casing. The inner arcuate portion of each peripheral band **21** is formed of metal and carries a further fuse **22**. The further fuse **22** is arranged to ignite a further explosive charge carried by the bundle **19**. For reasons that will become more apparent from the description of the operation of the invention given below, the time taken for the further fuses **22** to burn through varies with the location of the respective bundle **19** along the axis of the tubular casing **11**. Those bundles **19** at each end of the tubular casing **11** burn for the shortest time and those at the centre of the tubular casing **11** burn for the longest time.

Referring now to FIG. **2**, the elongate fuse assembly **16** comprises a number of tubular elements screwed together end to end.

The end **17** is defined by an end tubular element **23** which has a counterbore **24** at the end **17** and an externally screw-threaded boss **25** at the other end. The main bore portion **26** and the larger diameter counterbore **24** are packed with explosive material. The boss **25** is screwed into a tapped hole in the juxtaposed end of another tubular element **27**.

The tubular element **27**, which is typical of all the tubular elements except the end tubular element **23**, which has a stepped through bore, the larger diameter bore portion **29** extending over a major part of the axial length of the tubular elements **27** and being tapped at its outer end to define the said tapped hole. The larger diameter bore portion **29** is separated from the smaller diameter bore portion **30** bya frusto-conical bore portion **31**. The smaller diameter bore portion **30** extends through an externally threaded boss **32** which is similar to the boss **25** and which is screwed into the tapped hole of the juxtaposed tubular element **27**. The larger diameter bore portion **29** and the smaller diameter bore portion **30** are packed with explosive material, the frusto-conical bore portion being empty.

Each tubular element **27** has four circumferentially spaced radial apertures **33** which communicate with the bore portion **29**. The aperture **33** of alternate tubular elements **27** are aligned axially and are displaced angularly with respect to the apertures **33** of the intervening tubular elements **27**. Thus a diametrically opposed pair of apertures **33** are shown in alternate elements **27** in FIG. **2**, none of the apertures **33** in the intervening elements **27** being visible in FIG. **2**.

The metal inner arcuate portion of each peripheral band **21** comprises a tubular projection **34** which is spigotted into the respective aperture **33** and which has a stepped bore **35**, the larger diameter portion of the stepped bore **35** being positioned radially outwardly with respect to the smaller diameter portion thereof. The stepped bore **35** is packed with explosive material which constitutes the further fuse **22**. FIG. **1** shows that each group of bundles **19** is surrounded by a paper band **36**.

In operation of the invention, when it is desired to form a cloud of radar reflecting chaff, the projectile **10** is launched. When the projectile **10** reaches the area in the atmosphere in which the cloud is to be formed, the first explosive charge **15** is detonated. The resultant explosion separtes the nose cone **13** from the tubular casing **11**, ignites the explosion material in the counterbore **24**, and forces the bundles **19** and the fuse assembly forwardly out of the open front end of the tubular casing **11** (as shown in FIG. **1**). The explosive material packed in the tubular elements **23** and **27** of the fuse assembly **16** is ignited progressively along the length of the fuse assembly **16**. Ignition of each explosive charge contained in the larger diameter bore portion **29** is delayed until after ignition of the explosive charge contained in the juxtaposed larger diameter bore portion **29** by the influence of the intervening smaller diameter bore portion **30**. Detonation of the explosive material packed in the larger diameter bore portion **29** of each tubular element **27** ignites the further fuse **22** of each bundle **19** of the surrounding group and blasts the bundles **19** of the surrounding group radially braking the surrounding band **36**. At the end of a predetermined time interval, determined by the burning time of each further fuse **22**, the further fuse **22** ignites the further explosive charge, the respective bundle **19** disintegrates and the chaff scatters within the atmosphere. It will be understood that the bundle **19** disintegrates at a radial distance from the fuse assembly **16** determined by the burning time of the respective further fuse **22**. The burning times of the further fuses **22** are selected so that once all the bundles **19** have disintegrated and the chaff scattered, the resultant cloud of chaff is substantially spherical.

Use of explosive charges instead of other means (such as springs), for ejecting chaff bundles laterally enables chaff to be ejected further to one side of the flight path and thus facilitates formation of a substantially spherical cloud which is more desirable than elongated or cigar-shaped clouds. Delay of the disintegration of the bundles of chaff **19** until the moment most suitable for formation of the desired cloud shape results in the majority of the chaff being scattered at the periphery of the cloud, where it is needed, leads to the formation of substantially hollow clouds, and thus results in better utilisation of the payload of the projectile. The further fuses **22** may be arranged to burn through the peripheral band **21** instead of igniting the further explosive charge as described above.

What we claim is:

1. Appartus for forming, from a projectile in flight, a radar reflecting chaff cloud having a predetermined form, said appartus comprising:

a plurality of bundles of radar reflecting chaff;

ejection means, suitable for being carried by a projectile in flight, for ejecting said plurality of bundles of radar reflecting chaff from said projectile when said projectile is in flight; and,

bundle disintegration means forming a portion of each bundle for disintegrating each bundle subsequent to its being ejected from said projectile and scattering the chaff forming the bundle, each of

said bundle disintegrating means including a timing mechanism for controlling the time interval between bundle ejection and bundle disintegration, said timing mechanisms controlling the bundle disintegration of their related bundles in a manner such that the time intervals between bundle ejection and bundle disintegration vary between selected ones of said bundles, said variations being controlled such that once all of the bundles have been disintegrated the scattered chaff forms a radar reflecting chaff cloud having a predetermined form, said form being determined by the controlled, variable time intervals occuring between bundle ejection and bundle disintegration.

2. Apparatus for forming a radar reflecting chaff cloud as claimed in claim 1 wherein said plurality of bundles are arranged in groups and wherein said ejection means selectively ejects said groups laterally with respect to the flight path of said projectile at spaced intervals along the flight path whereby the combination of the spaced intervals between the ejection of said groups and the time intervals between ejection and bundle disintegration cooperate so as to form a substantially spherical cloud.

3. Appartus for forming a radar reflecting chaff cloud as claimed in claim 2, wherein the ejection path of each bundle of a particular group of bundles is radial with respect to the flight path of said projectile, the ejection path of each bundle of a particular group of bundles being different than the ejection path of the other bundles of said particular group of bundles.

4. Apparatus for forming a radar reflecting chaff cloud as claimed in claim 1, wherein said ejection means includes an ejection explosive charge, the explosion of said ejection explosive charge ejecting said bundles of radar reflecting chaff from said projectile.

5. Apparatus for forming a radar reflecting chaff cloud as claimed in claim 2, wherein said ejection means includes a plurality of ejection explosive charges, one ejection explosive charge being associated with each of said group of bundles in a manner such that the explosion of an ejection explosive charge associated with a particular group of bundles ejects that group of bundles from said projectile.

6. Apparatus for forming a radar reflecting chaff cloud as claimed in claim 5, wherein said bundle disintegration means comprises a plurality of bundle explosive charges, one of said bundle explosive charges forming a portion of each bundle, the explosion of said bundles explosive charges causing the disintegration of the bundle associated therewith.

7. Apparatus for forming a radar reflecting chaff cloud as claimed in claim 6, wherein each timing mechanism includes a variable time fuse extending to the bundle explosive charge of the associated bundle which is ignited by the explosion of an associated ejection explosive charge, each individual fuse determining the time interval between lateral ejection and disintegration of the bundle to which the fuse relates.

8. Apparatus for forming a radar reflecting chaff cloud as claimed in claim 7, wherein said ejection means includes a tubular housing, said plurality of ejection explosive charges being longitudinally housed within said tubular housing at spaced intervals, said tubular housing including a plurality of radial apertures which selectively communicate with said plurality of ejection explosive charges, said fuses of said bundles being spigotted into said radial apertures so as to selectively contact said plurality of ejection explosive charges.

9. Apparatus for forming a radar reflecting chaff cloud as claimed in claim 8, wherein said tubular housing is formed such that the ejection explosive charges are spaced from their adjacent ejection explosive charges along the longitudinal length of said tubular housing by a bore portion of reduced diameter, said smaller bore portion containing an explosive material that provides a delay between the ignition of an immediately subsequent ejection explosive charge subsequent to the explosion of immediately precedent ejection explosive charge, running from one end of said tubular housing to the other thereof.

10. Apparatus for forming a radar reflecting chaff cloud as claimed in claim 8, wherein said tubular housing comprises a number of tubular elements screwed together end to end.

11. Apparatus for forming a radar reflecting chaff cloud as claimed in claim 10, wherein each tubular element comprises a bore portion adapted to house one of said plurality of ejection explosive charges and a juxtaposed bore portion of reduced diameter.

12. Apparatus for forming a radar reflecting chaff cloud as claimed in claim 11, wherein said tubular housing includes an end tubular element which defines a bore portion of reduced diameter, said end tubular element bore portion of reduced diameter acting to delay ignition of the ejection explosive charge nearest thereto.

13. Apparatus for forming a radar reflecting chaff cloud as claimed in claim 12, wherein said bundle includes a tubular part which is spigotted into one of said apertures in said tubular housing, said fuses associated with said bundles being housed within the bores of said tubular parts.

14. Apparatus for forming a radar reflecting chaff cloud as claimed in claim 13, wherein each of said plurality of bundles of radar reflecting chaff comprises radar reflecting chaff packed within a constrictive peripheral band, the bundle explosive charge associated with each of said bundles adapted to eliminate the constrictive effect of said peripheral band upon the explosion thereof and thereby release its associated chaff.

15. A method of forming a radar reflecting chaff cloud having a predetermined form comprising the steps of:

ejecting a plurality of bundles of radar reflecting chaff from a projectile in flight; and,

selectively disintegrating at predetermined time intervals the ejected bundles of radar reflecting chaff so as to scatter their radar reflecting chaff, the predetermined time intervals for certain of said bundles of radar reflecting chaff being different than the predetermined time intervals of others of said bundles of radar reflecting chaff, the differences in said time intervals being such that a time controlled selective scattering of the radar reflecting chaff occurs, said selective scattering causing the creation of a radar reflecting chaff cloud having a predetermined form, said predetermined form being related to the differences in said time intervals.

16. A method of forming a radar reflecting chaff cloud as claimed in claim 15, wherein groups of bundles of chaff are ejected laterally with respect to the flight path of said projectile at spaced intervals along

said flight path such that a substantially spherical cloud is formed when all of said bundles have been disintegrated.

17. A method of forming a radar reflecting chaff cloud as claimed in claim **16**, wherein each bundle of each group is ejected laterally along a respective path which extends radially from the flight path of said projectile in a different direction to the path of the other bundles of the same group.

18. A method of forming a radar reflecting chaff cloud as claimed in claim **17**, wherein the bundles of chaff are ejected from the projectile by the detonation of an ejection explosive charge.

19. A method of forming a radar reflecting chaff cloud as claimed in claim **17**, wherein each group of bundles is ejected by the detonation of a respective ejection explosive charge.

20. A method of forming a radar reflecting chaff cloud as claimed in claim **19**, wherein each bundle is disintegrated by the detonation of a bundle explosive charge.

21. A method of forming a radar reflecting chaff cloud as claimed in claim **20**, wherein the bundle explosive charges are detonated by a fuse which is ignited by the explosion of the ejection explosive charge which ejected the bundle laterally with respect to the flight path of said projectile, the nature of each fuse determining the time interval between lateral ejection and disintegration of the respective bundle.

* * * * *