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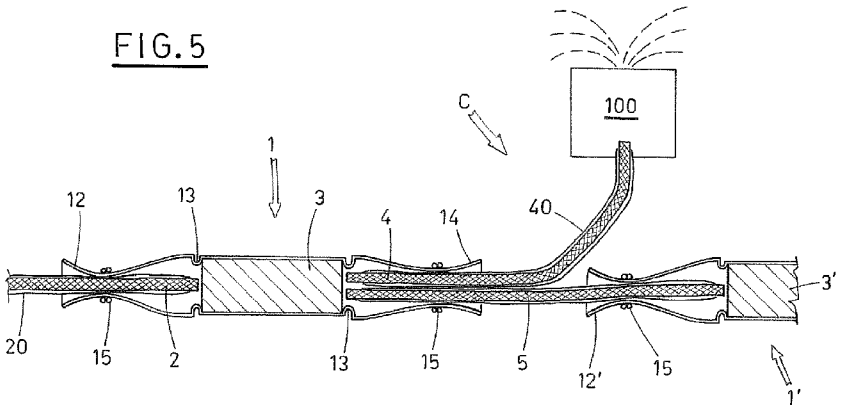
(54) **Title**: A DEVICE FOR IGNITING FIREWORKS

FIG.5




(57) **Abstract**: A device for igniting fireworks comprises, in a known way, a first length of wick (2), which is inserted in a respective fire-passing sheath (20), the device being designed to ignite a timed fuse (3), which in turn is able to ignite at least a second fuse (4), which is connected downstream with an exploding pack (100) of said fireworks or with other wicks and fuses of a pyrotechnical chain (C). The device (1) of the invention comprises: a tubular element (10) made of a flexible heat-shrinking material in which a central portion (11) is defined, destined, due to the heat treatment, to receive and snugly adheringly key to the fuse (3); two side portions (12, 14), provided in the tubular element (10), which are designed to accommodate at least a portion of said lengths of wick (2, 4); retaining means (15) designed at least locally to retain the side portions (12, 14) such that said lengths of wick (2, 4) are blocked with respect to the same device (1).

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# A Device for Igniting Fireworks.

## Technical Field

The invention relates to the technical sector of pyrotechnic devices, also known as fireworks.

## Background Art

As is known, the packing of the particular firework known as an aerial shell is projected upwards by a mortar-type launcher via a firing charge, the mortar being lit by a blasting wick which ignites at least a timed primer associated to the shell itself.

When the shell reaches the opening height, the fuse, which in the meantime has reached the end thereof, transmits the flame to the shell, which is activated to burst open.

The transmission of the flame downstream of the fuse is normally done via a length of wick which inserts in the charge of the firework.

In the case of complex fireworks, several of these wicks are equipped in a same shell, and are set off by wicks with a possible interposing of further lengths of retard fuses, such that a desired sequence of firework ignition is obtained.

Most of the time, a battery of shells is used, which are activated in a predetermined sequence which operates by means of an appropriate connecting-up of various wicks and fuses which all connect back to the original primer wick.

The arrangement of primers and fuses is termed a pyrotechnical chain.

The wicks are made using tressed strings impregnated with a solution containing gunpowder and are wound about by a fire-passing sheath.

The fuses are generally made by winding one or more sheets of paper or cardboard about a gunpowder capsule which has been moist-compacted, such as to obtain a tube. The length or shortness of the capsule leads to an increase or reduction of the ignition delay the fuse produces.

The paper or cardboard tube extends bilaterally with respect to the gunpowder capsule, such as to define empty portions in which the heads of the wicks are inserted in the sheaths. The portions are then tied and constrained such as to block them to the sheaths.

A problem which can obtain due to a faulty preparation of the tube relates to the imperfect adherence of the tube to the gunpowder capsule of the fuse. When this fault obtains, the flame transmission from upstream to downstream of the fuse can occur at the side of the fuse, through the slits, and thus the delay in ignition which results from the complete combustion of the fuse is not correct.

If the defect is localised in an intermediate point of the ignition sequence, there will be erroneous ignition sequences, but if unfortunately the device is at the start of a pyrotechnical chain internally of a shell, there could be an explosion of the shell at a low height or even in the launcher itself, which might have very dangerous consequences.

A further possible drawback can derive from the violent mechanical traction stress the tube is subjected to during wick combustion, which is liable to tear the tube with a consequent interruption in the flame propagation. In ground-laid pyrotechnical chains, recourse is made to re-ignition, which is very dangerous as can easily be imagined.

A further negative aspect of this solution derives from the fact that when the set-up of the launchers is complete it is not possible to verify whether the head of the wick internally of the tube is correctly positioned with regard to the capsule of the fuse, or whether by mistake it has shifted too far away, with an ensuing risk of interruption of the pyrotechnical chain.

The tube of paper or cardboard is further quite liable to becoming damp, which might lead to malfunctioning of the fuses.

US patent US 7 100 512 B2 describes a fuse-holder, obtained by moulding, which comprises a tubular inlet manifold and two outlet connections, of which one is coaxial to the inlet manifold and the other is angled thereto by 90°.

The fuse is friction-inserted in the inlet manifold and a head of a wick is then blocked with respect to the fuse holder by a small match-stopper, also obtained by moulding, which fastens the wick and snap-fits in the manifold.

Further wicks can be inserted in both connections, blocked by relative match-stoppers, while the coaxial connection is destined to couple with the inlet manifold of a further device which is thus connected in series.

By appropriately combining the various elements, a predetermined pyrotechnical chain is defined.

The reported drawbacks of this solution relate to an aspect which has already been mentioned with regard to the solution with the cardboard tube, i.e. the risk that there might be splits around the fuse, due to the fact that the inlet manifold exhibits a conical hole, which facilitates the introduction manoeuvre of the fuse but reduces the zone of contact between the fuse and the manifold.

A further drawback deriving from the foregoing is that the axial position of the fuse along the inlet manifold is not entirely certainly stabilised - this is also true of the fastening thereof.

The fuse holder device, being made of a rigid material, necessarily requires use of the special match-stoppers for blocking the wicks; if the wicks, together with the relative sheaths, exhibit dimensions that are not comprised in the accepted range, there can be difficulties of insertion of the match-stoppers, in one case, or poor blocking in the other case.

**Summary of the Invention**

The aim of the present invention is therefore to provide an igniting device for fireworks which is able to obviate the above-mentioned drawbacks, in particular in order to increase the safety of persons laying the fireworks or whoever else is in the vicinity of the point of launch.

A further aim of the invention consists in providing a device suitable for obtaining pyrotechnical chains which might even be complex, with the certainty that the ignition timings given by the capsules of the various fuses is respected.

A further aim of the invention relates to the fact of providing a device of simple conception, which is perfectly compatible with the traditional methods for preparing fireworks.

**Brief description of the Drawings.**

The characteristics of the invention will be set out in the following description of a preferred embodiment of the igniting device of the invention, according to what is set out in the claims and with the aid of the accompanying figures of the drawings, in which:

figure 1 is a longitudinal section of the device during a stage of preparation thereof;

figure 2 illustrates, in a similar view to that of figure 1, the device ready to be applied to a firework;

figure 3 is a lateral view of figure 2;

figure 4 is a perspective view of the device of figure 2;

figure 5 is an example of a pyrotechnical chain obtained with the device of the invention.

**Best Mode for Carrying Out the Invention.**

With reference to the figures of the drawings, 1 denotes the ignition device of the invention in its entirety.

The device 1 is associated to fireworks and comprises, in a known way, a first length of wick 2, inserted in a relative fire-passing sheath 20, destined to ignite a timed ignition fuse 3, in turn able to ignite at least a second length of wick 4 inserted in a respective fire-passing sheath 40.

The second length of wick 4 can be connected downstream with an exploding pack 100 of the fireworks or with further wicks and fuses of a pyrotechnical chain C, as will be specified herein below.

The device 1 of the invention comprises a tubular element 10 made of a heat-shrinking flexible material, which is prepared with variable lengths according to the length of the fuse 3; the material is advantageously transparent.

The internal diameter of the tubular element 10 is originally slightly greater than the external diameter of the fuse 3, such as to enable easy insertion thereof up until it is located in a more-or-less central position (figure 1).

The central portion 11 of the tubular element 10 is of a corresponding length to the length of the fuse 3, following a special heat treatment which causes it to shrink and its diameter to reduce such as to key on the fuse 3 tightly (figure 2).

Two lateral portions are in this way defined in the tubular element 10, respectively a first lateral portion 12 and a second lateral portion 14, adjacent to the central portion 11 (figures 2, 4) and destined to house the corresponding heads of the lengths of wick 2, 4 with the relative fire-passing sheaths 20, 40.

In a preferred embodiment, two annular gullies 13 are comprised at the edges of the central portion 11, which annular gullies 13 are destined to axially block the fuse 3 and to close any residual split existing between the fuse 3 and the central portion 11 (figures 2, 4).

The annular gullies 13 are obtained, for example, by moulding during the heat-treatment stage.

The device 1 finally comprises retaining means 15 for tightening, at least locally, the lateral portions 12, 14 such as to block the lengths of wick 2, 4 to the device 1 (figure 5).

The retaining means 15 can be constituted by tabs or strips, and can be for example made of metal, in any case be such as to guarantee a stable blocking.

Figure 5 illustrates, by way of example, a part of a possible pyrotechnical chain C comprising the above-described device 1.

The configuration of the pyrotechnical chain C is such that in the second lateral portion 14 of the device 1, apart from the head of the second length of wick 4, a head of a third length of wick 5 is also inserted, and both are blocked using the retaining means 15.

The second length of wick 4 runs directly into an exploding pack 100, which the third length of wick 5 enters the first lateral portion 12' of another device 1', arranged in series, for setting off the relatively fuse 3'.

Obviously the pyrotechnical chain C can be extended and branched, downstream of the first device 1, with further wicks and devices with fuses, according to the requirements of the particular firework display to be set up.

The device is thus destined to obtain both ground pyrotechnical chains by times setting-off of the launching charges of a battery of launchers, or, and furthermore, for pyrotechnical chains associated to each shell.

In a first variant of the device, not illustrated, the tubular element 10 is made of an elastic material; in this case, the internal diameter is at first slightly smaller than the diameter of the fuse 3.

A suitable tool for dilating the tubular element during the stage of introduction of the capsule in the wick is used for inserting the fuse 3.

Ain a further variant of the device, also not illustrated, the tubular element 10 is internally clad, at least in the central zone, by a layer of heat-activatable glue, which blocks the fuse 3 following its introduction, and seals the contact surface between the two.

From the above, the positive characteristics of the device of the invention clearly emerge, in particular its ability to guarantee that the flame applied to the first wick faithfully follows the trajectory established by the pyrotechnical chain, respecting the times given by the various fuses as thus causing the exploding packs to be set off at the pre-determined times, while at the same time guaranteeing the safety of the persons operating or nearby and the pyrotechnic result.

A further important advantage derives from the greater mechanical resistance offered by the tubular element made of synthetic material, with respect to elements made of paper or cardboard in the known devices. The greater mechanical resistance means the element of the invention can withstand the violent traction stresses that obtain during combustion of the wicks, without tearing and without interrupting the propagation of the flame.

In pyrotechnical chains on the ground, this means that risky manual interventions for re-igniting, mentioned herein above, are thus avoided.

The synthetic material of the tubular element is waterproof and therefore protects the capsule of the fuse and the wicks much better, and guarantees correct functioning of the device.

The greater resistance to fire of the synthetic material of the tubular element, with respect to paper, gives the device a greater degree of safety against undesired ignition caused by sparks or incandescent particles which, for whatever reason, can come into contact with the device.

The choice of a transparent material for the tubular element is extremely advantageous as it enables controlling, even when the work is complete, the correct positioning of the wicks with respect to the fuses, in order to guarantee that the pyrotechnical chain that has been set up will not be subject to halts.

The foregoing is presented by way of non-limiting example, and any modifications to details thereof which might be introduced for technical or functional reasons, are considered to fall within the ambit of protection defined by the following claims.

**Claims.**

1. Device for igniting fireworks, of the kind provided with a first length of wick (2), which is inserted in a respective fire-passing sheath (20), the device being designed to ignite a timed fuse (3), which in turn is able to ignite at least a second fuse (4), which is inserted in a respective fire-passing sheath (40) and which is connected downstream with an exploding pack (100) of said fireworks or with other wicks and fuses of a pyrotechnical chain (C), said device (1) being characterized in that it comprises: a tubular element (10), in which a central portion (11) is defined, intended to receive and adheringly key to the fuse (3); two side portions, respectively a first portion (12) and a second portion (14), provided in the tubular element (10), which are adjacent to the central portion (11) and designed to accommodate at least a portion of said lengths of wick (2, 4) with the respective fire-passing sheaths (20, 40); retaining means (15) designed at least locally to retain the side portions (12, 14) such that said lengths of wick (2, 4) are blocked with respect to the same device (1).

2. Igniting device according to claim 1, characterized in that said tubular element (10) is made up of heat-shrinking material, with initially an inner diameter which is slightly greater then an outer diameter of the fuse (3), and in that the central portion (11) is made to adhere thereto by thermal treatment.

3. Igniting device according to claim 1 or 2, characterized in that two annular grooves (13) are provided at the edges of the central portion (11), which are designed to axially block the fuse (3) and to close any residual slit between the fuse (3) and the central portion (11).

4. Igniting device according to claim 1 or 2, characterized in that said tubular element (10) is made up of flexible material.

5. Igniting device according to claim 1 or 2 or 4, characterized in that said

tubular element (10) is made up of transparent material.

6. Igniting device according to claim 1, characterized in that said retaining means (15) are strings.

7. Igniting device according to claim 1, characterized in that said retaining means (15) are clamps.

8. Igniting device according to claim 7, characterized in that said clamps (15) are made of metal.

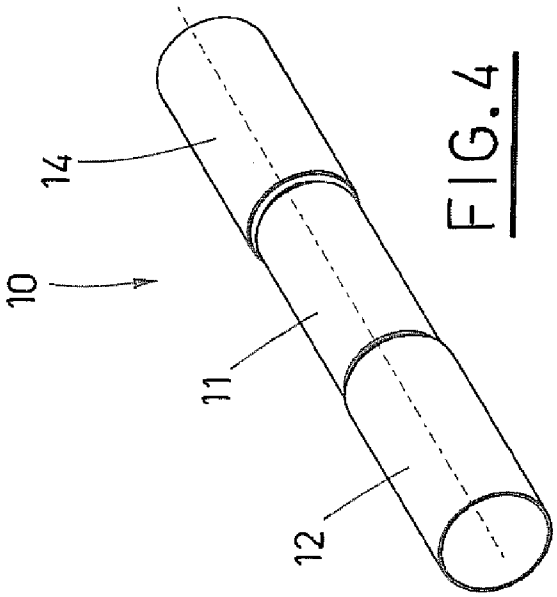


FIG. 4

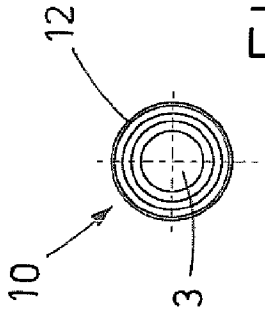


FIG. 3

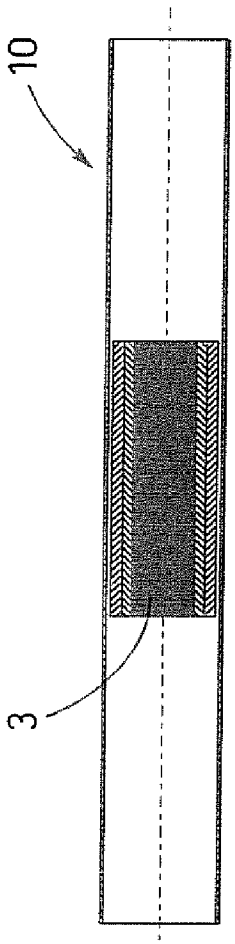


FIG. 1

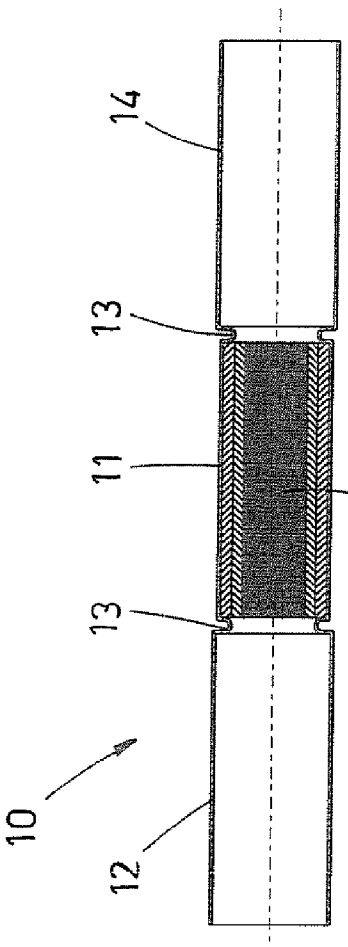


FIG. 2

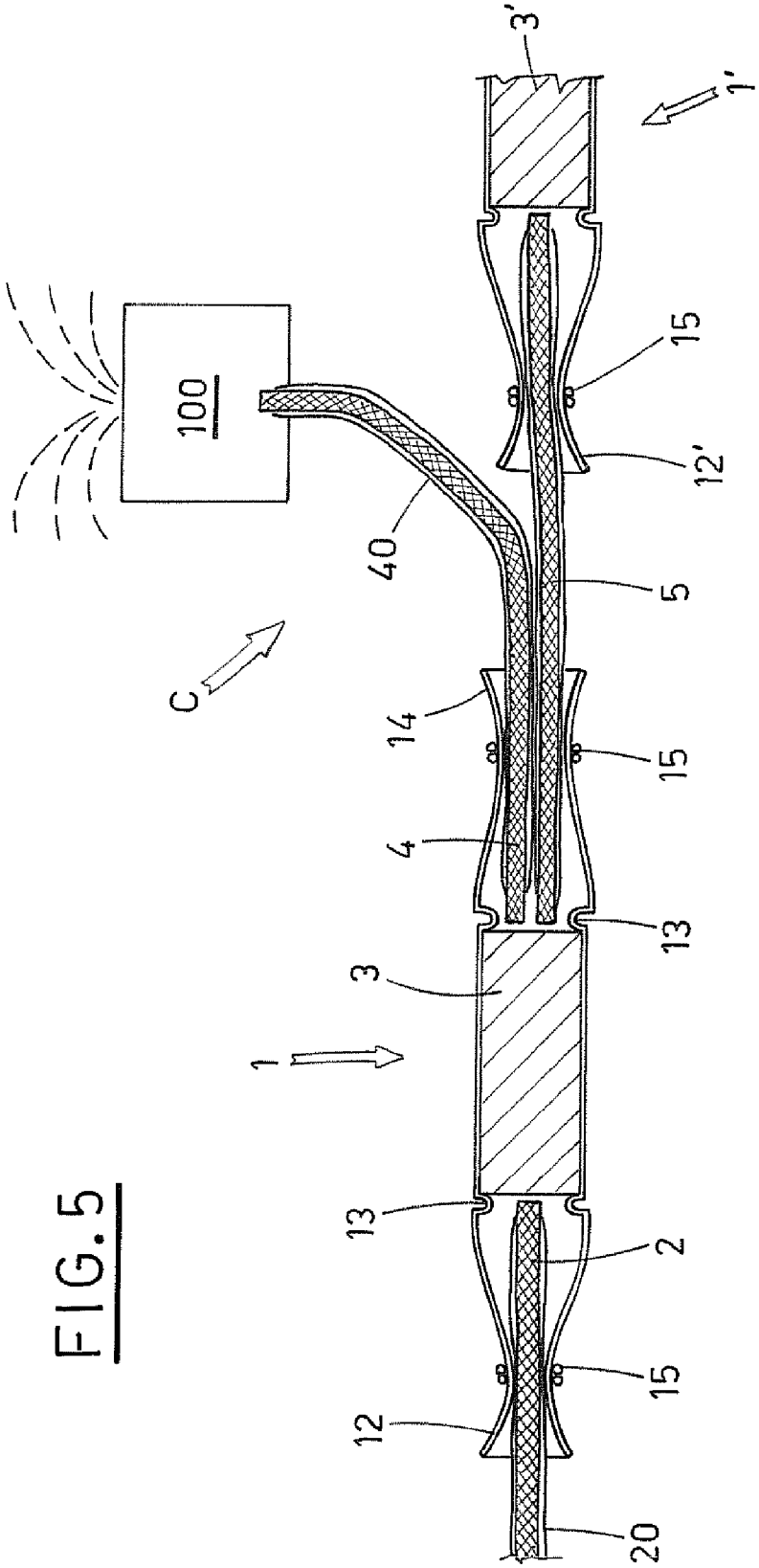


FIG.5

# INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2010/052800

A. CLASSIFICATION OF SUBJECT MATTER
INV. F42B4/00 F42D1/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F42B F42D C06C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 24 August 2010 | 01/09/2010 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Schwingel, Dirk |

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International application No
PCT/IB2010/052800

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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