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(54) Title: RACK FOR HOLDING AND GUIDING FIREWORK-MORTAR TUBES

(57) Abstract: Invention relates to a rack (1) for holding and guiding firework-mortar tubes (2). It comprises a pair of end supports and between the pair of end supports crosswise to said end supports at least one support frame (3) for the mortar tubes (2), said support frame (3) comprising at least one support lattice (4) for holding mortar tubes (2). End supports are formed by multiple elongated support elements (6), wherein at least one first support element (6, 6a) forms a base for corresponding end support, resting on the support surface. Onto both ends of the support frame (3) at least one second support element (6, 6b) is fixed, forming corresponding end bars of the support frame (3), and at least one third elongated support element (6, 6c) is used for fixing inclination of the support frame (3) in relation to the base (6, 6a) such that one end of at least one such third elongated support element (6, 6c) is fixed to at least one first support element (6, 6a) forming a base. Said third support element (6, 6c) is fixed at least at one point to at least one second elongated support element (6, 6b) forming an end bar of the support frame (3).
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Description

RACK FOR HOLDING AND GUIDING FIREWORK-MORTAR TUBES

Technical Field

[0001] Present invention relates to a rack used for holding firework-mortar tubes in their firing position and for guiding firework-mortar tubes. More specifically the present invention relates to a rack used for holding mortar tubes to launch fireworks mortar shells and for guiding said tubes.

Background Art

[0002] From the background art individual racks for holding and guiding firework-mortar tubes are known.

[0003] At present most commonly used technology is based on using racks having a flat bottom, a frame at the top and at the bottom of the rack, made of wood or preferably of plywood, and having wooden side walls. The firework-mortar tubes, generally 3-10 mortar tubes, are placed into the holes in the frame. Those racks are installed at the launching site of the firework in the desired position and braced with wooden planks, fastened to the side walls of the rack by screws or nails.

[0004] The disadvantage of this technology is that installing a rack on the fireworks launching site and later dismantling the rack exerts a great strain to the side walls of the rack, because increasingly great number of holes and cracks caused by the nails and screws are left in the side walls. Also generally the wood used in the racks is not weatherproof.

[0005] For the sake of a wider effect in the sky, the fireworks mortar bombs are let off at the firework display. For guiding mortar bombs, the racks with mortar tubes are inclined according to the desired spread of the launched fireworks mortar bombs. The guiding of the commonly used racks is complicated, because the wooden or plywood board is used as the base of the rack. If the rack is inclined most of the bottom of the rack is hanging in the air without support surface and only the edge of the bottom of the rack is supported on the ground. If in all mortar tubes of the rack all charges are ignited simultaneously, the pressure exerted to the base plate could break it.

[0006] When the fireworks are let off in rainy weather, the mortar tubes in rack
are covered by the packaging membrane to protect mortar shells from moisture. Moreover the mortar tubes are covered by the aluminium foil to protect mortar shells from the sparks falling down during the fireworks display. The disadvantage involves also a need for many additional accessories (screws, battery-powered drill, wooden planks, etc.). As a result such a solution is laborious and the material consumption is relatively high.

[0007] One known rack solution comprises two end supports made of aluminium, which are formed by two parallel support elements, upper and lower ones correspondingly, which are rigidly connected to two transverse elements, and whereas one support element a base, lying on the support surface is used. The parallel support elements comprise fixing holes along their entire length. In use an aluminium end bar is fixed onto both ends of the wooden support frame of the mortar tubes. The lower end of the end bar is fixed to fixing hole of the corresponding lower support element of the end support and the inclination of the support frame is fixed by connecting the end bar to the fixing hole of the upper support element.

[0008] One disadvantage of this solution being that the configuration of the end supports is not variable and they take up a lot of space during transportation, because they are not demountable. They cannot be combined either to extend the end supports by connecting them consecutively to each other without special additional details.


[0010] The rack is made of aluminium or of some other lightweight material. The rack comprises support lattices for holding mortar tubes and sides for holding support lattices. The sides of the rack comprise openings, wherein support beams, poles or customized support bars especially to be used in that rack can be inserted. The rack can also be supported in an inclined position for guiding fireworks mortar shells by placing a wooden support beam through the openings on the sides of the rack and by attaching said beam by nails or screws. This rack lacks bottom and mortar tubes rest on the ground or on some other material. The disadvantage of this rack is the
complexity of the design. But at the same time aforesaid rack can be installed at different inclination angles. Additional accessories (beams or special support bars, screws or nails, hammer, etc.) are also needed for installation of said rack.

Disclosure of Invention

[0011] The object of the present invention is to provide a rack for holding and guiding firework-mortar tubes, which enables simple installation on site and also a support frame or frames of the mortar tubes to be inclined as desired and which includes as few different elements as possible.

[0012] The present invention provides a rack for holding and guiding firework-mortar tubes, comprising a pair of end supports and, between the pair of end supports crosswise to end supports, at least one support frame for the mortar tubes, said support frame comprising at least one support lattice for holding firework-mortar tubes.

[0013] The invention is characterized by that both end supports are formed by multiple elongated support elements, where by in both end supports at least one first support element forms a base for corresponding end support, resting on the support surface.

[0014] Onto both ends of the support frame of the mortar tubes at least one second support element is fixed, forming a corresponding end bar of the support frame of the mortar tubes.

[0015] In both end supports at least one third elongated support element is used for fixing inclination of at least one support frame of the mortar tubes in relation to the base of the corresponding end support such that one end of at least one such third elongated support element is fixed to at least one first support element forming a base of end support and that third support element is fixed at the remaining part of said third support element in at least one point to at least one second elongated support element forming an end bar of the support frame of the mortar tubes.

[0016] In the preferred embodiment of the present invention said third elongated support element is used for fixing an inclination of at least one support frame of the mortar tubes in relation to the corresponding base of the end support such that at least one third elongated support element is fixed at
one end to the first support element forming a base of the end support and said third support element is fixed at the remaining part of said third support element in at least one point to the second elongated support element forming an end bar of at least one support frame of the mortar tubes such that triangle is formed between the fixing points of said three support elements.

[0017] In another preferred embodiment of the present invention the support frame for the mortar tubes comprises between end bars at least two support lattices for holding mortar tubes near their upper and lower ends so that lower ends of the mortar tubes are supported on the elongated bottom bar between the lower ends of the end bars.

[0018] In the preferred embodiment the bottom bar of the support frame of the mortar tubes has a circular cross-section, the diameter of which corresponds to the width of the support elements forming a base of the end supports such that in a working situation both bases of the end supports and the bottom bar of the support frame of the mortar tubes are supported onto the support surface.

[0019] In another preferred embodiment of the present invention the bottom bar comprises intermediate holders between the lower ends of the mortar tubes.

[0020] In another preferred embodiment of the present invention at each support point of the ends of the mortar tubes a planar base is fixed to the bottom bar for supporting the end of the corresponding mortar tube.

[0021] In another preferred embodiment of the present invention a single elongated planar base is fixed to the bottom bar in the direction of the bottom bar for supporting the ends of the mortar tubes.

[0022] In another preferred embodiment of the present invention, in which rack comprises multiple support frames for the mortar tubes, the end bars of support frames for the mortar tubes are connected at their distal parts in relation to the corresponding base of the end bar with at least one other longitudinal third support element to the end bar of the support frame for the mortar tubes having its inclination fixed in relation to the corresponding base of the end support.
Preferably according to the present invention the elongated support elements comprise along the support elements multiple fixing holes for joining support elements.

According to the most preferable embodiment of the invention all elongated support elements, i.e. support elements used as a base of the end support, as an end bar of the support frame and as a support element fixing the inclination of the support frame in relation to the base, are identical.

The connections for the support elements of the rack are made such that on the holding ground of the fireworks display there is no need for additional accessories and the rack can easily be installed also onto the uneven surface.

The rack according to the invention can be placed in the ignition position as a single rack or set comprising multiple racks; it is also possible to install the rack in different inclination positions with the help of the support elements provided according to the desired launching direction of the fireworks mortar shells.

After the fireworks display, the support elements can be left attached to the rack in the position facilitating their transportation such that no additional space is needed.

Preferably the support elements of the rack, support frame of the mortar tubes and support lattices are made of glass fibre material, plastic material or some other suitable material. The design of the support lattices of the mortar tubes reduces a risk of spreading sharp fragments in case fireworks mortar shell explodes within the tube and the support lattice provides better protection for other shells in other tubes of the rack avoiding them being crushed and being mass exploded. Loops can also be attached to the support lattice for fusecords and for ignition wires in case of electronically controlled fireworks, for the delay charges, etc.

Brief Description of Drawings

The present invention is hereinafter described in detail with references to the accompanying drawings, wherein:

Figure 1 shows schematically a frontal view of a rack according to the
embodiment of the present invention comprising one support frame for mortar tubes;

Figure 2 shows schematically an elongated support element used in the rack according to the invention;

Figure 3 shows schematically a frontal view of a rack according to the embodiment of the present invention comprising three support frames for the mortar tubes, wherein outermost support frames are flaring out from the support frame in the centre;

Figure 4 shows schematically a frontal view of a rack according to the embodiment of the present invention comprising four support frames for the mortar tubes, wherein all support frames are inclined at the same angle and in the same direction;

Figure 5 shows schematically a frontal view of an embodiment of the support frame of the mortar tubes;

Figure 6 shows schematically a side view of a support frame according to Figure 5;

Figure 7 shows schematically a top view of a support frame according to Figures 5 and 6 as viewed from the side of the openings of the mortar tubes; and

Figure 8 shows schematically a side view of the second embodiment of the support frame of the mortar tubes.

Mode(s) for Carrying Out the Invention

[0030] Figure 1 shows a frontal view of one end support of a rack 1 according to the present invention for holding and guiding mortar tubes 2. It goes without saying that at the other end of the rack there is a similar end support. This applies also for the embodiments in Figures 3 and 4.

Between said end supports a support frame 3 of the mortar tubes 2 is fixed, and the embodiment as shown in Figures 3 and 4 is described in greater detail with the help of Figures 5, 6 and 7.

[0031] In the accompanying drawings there is shown an embodiment of the rack, whose end supports are formed by identical elongated support elements 6 comprising fixing holes along their entire length.

[0032] In drawings the support element 6 is identified according to its function and
reference number 6a indicates a first support element functioning as a
base for the end support, reference number 6b indicates a second support
element functioning as an end bar for the support frame of the mortar
tubes and reference number 6c indicates a third support element used for
fixing inclination of the end bar (support element 6b) in relation to the base
(support element 6a). For the person skilled in the art it is obvious that
support elements of different length can be used for the base as an end
bar and for fixing the inclination.

[0033] When forming end supports according to the embodiment as shown in
Figure 1, i.e. corresponding base, or in other words the first support
element 6a in the corresponding end support, is connected to the end bar
of the support frame 3 of the mortar tubes 2, or in other words it is
connected to the second support element 6b at its lower end with the pin 5
in connection 9. Then the third support element 6c is connected to the
base with the help of connection 11 and the other part of the third support
element 6c is connected with the connection 10 to the support element 6b
acting in its role as an end bar. Since said support element 6b is also an
end bar of the support frame 3 of the mortar tubes 2, it fixes inclination of
the support frame 3 of the mortar tubes 2 in relation to the base, or i.e. in
relation to the first support element 6a.

[0034] Connections 8, 9, 10 and 11 as shown in the drawings are preferably
formed as mechanical quick connections. But also threaded connections
(screws, bolts, wing nuts), pin joints, wedge joints, eccentric joints, etc. can
be used.

[0035] In the embodiment of the rack 1 in Figure 3 the end supports are used for
fixing inclination of three support frames. Figure only shows the end
support at one end.

[0036] Similarly to the rack as shown in Figure 1, at first one support frame (in
present case the one in the middle in Figure 3) is fixed by means of the
second support element 6b functioning as an end bar using the third
support element 6c in relation to the first support element 6a functioning as
a base. Then another third support element 6c is used for fixing two other
support frames 3 (on drawing one in the left and one in the right) in relation
to the base. For that purpose the second third support element 6c is used, which in its middle part is attached to the end bar of that support frame, the inclination of which in relation to the base is already fixed by the first third support element 6c.

[0037] In this embodiment all three support frames of the mortar tubes are pointed towards the sky at different inclination angles.

[0038] In Figure 4 rack 1 according to the invention is used to point four support frames of the mortar tubes towards the sky at the same inclination angle.

[0039] Further it can be seen in the drawing that in this embodiment the base is formed using two first support elements 6a, which are rigidly fixed together.

[0040] Also in this embodiment at first one support frame is fixed with the help of its end bar in relation to the base, i.e. is the second support element 6b functioning as an end bar of the support frame is attached to the first support element 6a and the inclination angle is fixed in relation to the first support element 6a with the help of the third support element 6c. Thereupon another third support element 6c is fixed at the upper part to the end bar of the support frame having its inclination fixed, and this third support element 6c being used to fix the inclination angle of the remaining three support frames with the second support elements 6b functioning as end bars in relation to the first support elements 6a functioning as a base.

[0041] As it is apparent from the above description, the use of identical support elements 6, 6a, 6b, 6c enables them to be interchanged or mutually prolonged. An user does not have to carry along several different support elements, but he must have at least two support elements per one support frame of the mortar tubes to be used as end bars for that support frame, at least two support elements to be used as a base (one for each end support at both ends) and at least two support elements for fixing inclination (one for each end support at both ends).

[0042] The use of identical support elements enables significant reduction of their manufacturing costs.

[0043] In the embodiment as shown in Figures 5, 6 and 7 the support frame 3 comprises two support lattices 4 including series of openings for capturing
mortar tubes 2. In the shown embodiment support lattices 4 have at their ends attached with the help of connections 8, support elements 6b functioning as end bars of the support frame 2. In this embodiment support lattices 4 are formed from two halves, each of which comprises semi-circular recesses, which form openings for the mortar tubes 2, when two halves are put together. In the embodiment as shown in Figures 6 and 7 the two halves of the support lattice are joined with the bolted joint - the hexagonal bolt heads and nuts of the bolted joints can be seen in the drawing between parts of the support lattice 4 comprising mortar tubes 2.

[0044] The lower ends of the mortar tubes 2 are supported onto the bottom bar 7 of the support frame 2, where the pins 5 at the ends of the bottom bar are located at the lower ends of the ends bars (support element 6b).

[0045] In the most simple embodiment the bottom bar 7 consists of a tube having circular cross-section, the diameter of which corresponds to the width of the support element 6a used as a base. This ensures that when changing inclination of the support frame 3 of the mortar tubes 2 in relation to the base, the bottom bar of the support frame is always supported on the support surface, onto which the bases of the end supports are also supported.

[0046] But the bottom bar can also have a semi-circular cross-section, where the ends of the mortar tubes 2 are supported onto the planar part of that cross-section. The semi-circular cross-section ensures that irrespective of the inclination of the support frame, the bottom bar 7 rests on the support surface.

[0047] In Figure 8 is shown a second embodiment of the support frame 3 of the mortar tubes 2. This differs from the embodiment of the Figures 5 to 7 in that the bottom bar 7 has intermediate holders 12 attached to the bottom bar 7 between the ends of the mortar tubes 2 - in Figure 8 one of the intermediate holders 12 can be better seen between two lower ends of the mortar tubes 2 in the left, where said support lattice 4 is shown in partial cut for better clarity.

[0048] Intermediate holders 12 comprise a groove 13 for connecting two halves of the support lattice 4 with the help of the bolt joint. Grooves 13 in the
intermediate holders 12 enable the support lattice 4 to be moved closer to or away from the bottom bar 7. This can be used to move support lattice 4 to the height of the mortar shell in the mortar tube 2 such that the mortar tube 2 is surrounded in the explosion area of the mortar shell by the semi-circular parts of the support lattice 4. This reduces the risk of fragments to be blown around in case the mortar tube 2 bursts in explosion. This also reduces the risk of the mass explosion, when the broken mortar tube initiates explosion within the adjacent tubes. The intermediate holders 12 between mortar tubes 2 have the same purpose.

In another embodiment, not shown in the drawings, onto the bottom bar there is fixed a planar base at the toehold of each mortar tube to support the end of the mortar tube. This can be necessary when mortar tubes with a larger diameter are used.

This base can also be implemented as a single elongated base in the direction of the bottom bar to for support the ends of the mortar tubes.

It should also be mentioned, that in the support frame of the mortar tubes of the rack according to the invention readymade mortar tube boxes can be used, which are formed as a wooden frame or a case, comprising usually compartments for each mortar tube (mortar tubes can be housed also in the common compartment). This box when used is supported on the bottom bar of the support frame between two support elements functioning as end bars, which in turn are fixed to the ends of the box.

For the person skilled in the art it is obvious, that the invention is not limited to the embodiments described above and depicted in accompanying drawings, but within the scope of the claims other embodiments are conceivable.

LIST OF REFERENCE NUMBERS
1 - rack for holding and guiding firework-mortar tubes
2 - mortar tube
3 - support frame
4 - support lattice
5 - pin
6 - support element (generally)
6a - support element used as a base for the end support
6b - support element used as an end bar for the end support for the support frame of the mortar tubes
6c - support element used for fixing an inclination of a support frame of the mortar tubes in relation to the base of the end support
7 - bottom bar of the support frame of the mortar tubes
8 - connection between end bar and support frame
9 - lower connection between end bar and base
10 - upper connection between end bar and support element used for fixing an inclination
11 - connection between base and support element used for fixing an inclination
12 - intermediate holder
13 - groove
Claims

1. Rack (1) for holding and guiding firework-mortar tubes (2), comprising a pair of end supports and between the pair of the end supports crosswise to said end supports at least one support frame (3) for the mortar tubes (2), said support frame (3) comprising at least one support lattice (4) for holding firework-mortar tubes (2), characterized in that each end support is made up of multiple elongated support elements (6), wherein at least one first support elements (6, 6a) forms a base for the corresponding end support, resting on the support surface, wherein at least one second support element (6, 6b) is fixed in onto both ends of the support frame (3) of the mortar tubes (2) to form a corresponding end bar of the support frame (3) of the mortar tubes (2), and at least one third elongated support element (6, 6c) is used to fix inclination of the support frame (3) of the mortar tubes (2) in relation to the base of the corresponding end support (6, 6a) such that one end of at least one third elongated support element (6, 6c) is fixed to at least one first support element (6, 6a) forming a base, and that third support element (6, 6c) is fixed at the remaining part of said third support element (6, 6c) in at least one point to at least one second elongated support element (6, 6b) forming an end bar of the support frame (3) of the mortar tubes (2).

2. Rack according to the preceding claim, characterized in that third elongated support element (6, 6c) is used to fix an inclination of at least one support frame (3) of the mortar tubes (2) in relation to the corresponding base (6, 6a) of the end support such, that at least one third elongated support element (6, 6c) is fixed at one end to the first support element (6, 6a) forming a base of the end support and said third support element (6, 6c) is fixed at the remaining part of said third support element (6, 6c) in at least one point to the second elongated support element (6, 6b) forming an end bar of at least one support frame (3) of the mortar tubes (2) such that a triangle is formed between the fixing points of said three support elements (6, 6a, 6b, 6c).

3. Rack according to claim 1 or 2, characterized in that rack (1) comprises
multiple support frames (3) for the mortar tubes (2), the end bars (6, 6b) of
support frames (3) for the mortar tubes (2) being connected at their distal parts
in relation to the corresponding base (6, 6a) of the end bar with at least one
other third support element (6, 6c) to the end bar (6, 6b) of the support frame
(3) for the mortar tubes (2) having its inclination fixed in relation to the
corresponding base (6, 6b) of the end support.

4. Rack according to anyone of the preceding claims, characterized\(^A\) that
elongated support elements (6, 6a, 6b, 6c) comprise along the support
elements multiple fixing holes for fixing the support elements.

5. Rack according to anyone of the preceding claims, characterized\(^A\) that all
elongated support elements (6, 6a, 6b, 6c) are identical.

6. Rack according to anyone of the preceding claims, characterized\(^A\) that, the
support frame (3) for the mortar tubes (2) comprises between end bars (6, 6c)
at least two support lattices (4) for holding mortar tubes (2) near their upper
and lower ends so that lower ends of the mortar tubes (2) are supported onto
the elongated bottom bar (7) between the lower ends of the end bars (6, 6c).

7. Rack according to claim 6, characterized\(^A\) that the bottom bar (7) comprises
intermediate holders (12) between lower ends of the mortar tubes (2).

8. Rack according to claim 6 or 7, characterized\(^A\) that the bottom bar (7) of the
support frame (3) of the mortar tubes (2) has a circular cross-section, the
diameter of which corresponds to the width of the support elements (6a)
forming a base of the end supports such that in a working situation both bases
of the end supports and the bottom bar (7) of the support frame (3) of the
mortar tubes (2) are supported onto the support surface.

9. Rack according to anyone of the claims 6 to 8, characterized\(^A\) that at each
support point of the ends of the mortar tubes a planar base is fixed to the
bottom bar for supporting the end of the corresponding mortar tube.

10. Rack according to anyone of the claims 6 to 8, characterized\(^A\) that to the
bottom bar a single elongated planar base is fixed in the longitudinal direction
of the bottom bar for supporting the ends of the mortar tubes.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. F42B4/20 F41A23/02 F42B4/24 F41F1/06 F41F1/08

ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F42B F41A F41F

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 practicable, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>wo 97/48959 AI (DYNAMIT NOBEL GRAZ GES MBH [AT]; WINTER UDO [AT]; MARTIN WERNER [AT]); 24 December 1997 (1997-12-24) page 8, line 30 - page 10, line 13 figures 1-7</td>
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[X] Further documents are listed in the continuation of Box C.  
[ ] See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search: 27 September 2012

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Name and mailing address of the ISA:
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Authorized officer: Gex-Collet, A

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