

SHELL MAGAZINE

The technical field of the invention is that of the magazines for shells with automated handling.

5 In order to allow higher firing rates and reduce the physical efforts of the gun numbers of a large-caliber artillery, it is known to automatically supply an artillery weapon with ammunition and propellant charges.

10 Thus, patent FR2825144 describes a magazine for charges comprising compartments with walls substantially parallel to each other. Each compartment allows to arrange artillery propellant charges in a substantially horizontal manner into columns of charges, which are superimposed and parallel to each other.

15 Each propellant charge is supported by a supporting means, thereby preventing a higher charge from resting on a charge located below. The charges thus arranged allow an automated gripping means to grip the desired charges.

20 Such magazine with such supporting means is unsuitable to the support of shells which are extremely heavy in comparison to propellant charges. Furthermore, the device as described does not prevent the rebound of the charges stored in the magazine upon shocks and jerks which can occur during the firing and transport operations on board of all-
25 terrain vehicles, for example.

Patent FR2048095 describes a magazine for shells comprising vertical compartments in which the shells are arranged one above the other and gripped by a clamp. Such magazine cannot prevent the shocks and jerks experienced by
30 the shells.

The invention provides to solve the problem of holding shells in place in an automated magazine by preventing the vertical movements of the shells while allowing the passage of a gripping clamp.

Furthermore, the invention allows to adapt the magazine according to the length of the type of shells to be transported.

Thus, the invention relates to a magazine for shells
5 characterized in that it comprises at least one compartment defined by at least one pair of walls, the compartment being able to receive the shells arranged substantially horizontally and one above the other in a column, and a gripping means allowing to vertically extract the shells from their
10 compartment, the magazine comprising at least one supporting means arranged between each shell of a same column, the supporting means being mounted so as to be pivotable between a support position, in which it supports the shell located above the supporting means, and a retracted position allowing the
15 passage of the shell located below the supporting means, the magazine for shells comprising at least one holding means located above the longitudinal axis of each shell, the holding means being retractable by pivoting between a holding position, in which it limits the upward movements of the
20 shell, and a retracted position in which it allows the passage of a shell gripped by the gripping means, the transition from the holding position to the retracted position being caused by pressing the gripping means on the holding means when lowering the gripping means within the compartment, the holding means
25 having a length L such that the circle of radius L described by the end of the holding means is, at most, tangent with the shell when the latter is supported on the supporting means.

Advantageously, the holding means can be locked in the retracted position by a locking finger.

30 Advantageously, the magazine comprises a longitudinal blocking means for the shells, comprising, within each compartment, at least one pair of flaps pivoting around a substantially vertical pivot pin, the flaps being intended to be located on either side of the longitudinal axis of the

shell and at the warhead of the latter, so as to prevent the horizontal translation of the shell when they are in the closed position.

Advantageously, each flap comprises at least one fixed supporting means which is attached on one of the faces thereof, oriented toward the interior of the compartment in the open position, such that, when the flap is in the open position, the fixed supporting means contributes to support the shell when inserting the latter in the compartment.

Advantageously, the longitudinal position of the blocking means can be set by moving the pivot pin of the flaps along the walls so as to adapt the position of the blocking means to the length of the shells to be blocked.

Advantageously, the walls comprise two series of holes, each series of holes being located at a lower part and an upper part of the wall, the longitudinal setting of the blocking means being performed by positioning each end of the vertical pivot pin of each flap in one hole of each series of holes.

The invention will be better understood upon reading the following description, made with reference to the appended drawings in which:

FIG.1 shows a three-quarter view of a magazine for shells according to the invention.

FIG.2 shows a cross-sectional front partial view of a magazine for shells according to the invention.

FIG.3 shows a cross-sectional front partial view of a magazine for shells according to the invention, when gripping a shell.

FIG.4 shows a cross-sectional front partial view of a magazine for shells according to the invention, with the shell being extracted from the compartment.

FIG.5 shows a three-quarter partial view of a detail of a magazine for shells according to the invention, with the flaps thereof being closed.

FIG.6 shows a top partial view of a detail of a magazine for shells according to the invention, with the flaps thereof being open.

FIG.7 shows a top partial view of a detail of a magazine for shells according to the invention, with the flaps thereof being closed.

FIG.8 schematically shows an embodiment in which a compartment has more than two superimposed shells.

According to FIG.1, an automated shell magazine 1 is intended to be on board a vehicle in order to supply an artillery piece (vehicle and artillery not visible).

To this end, the magazine 1 comprises a series of compartments 2 intended to contain shells 100. Each compartment 2 is delimited by a pair of vertical lateral walls 5, and two compartments 2 adjacent to each other have a common wall 5.

The shell magazine 1 also comprises a gripping means 3 having a clamp 3a intended to grip the shells 100 individually in each compartment 2, according to the piece supply needs, in order to extract them via the top of the magazine 1.

This gripping means 3 is made movable along a horizontal rail 4 which extends along the rear face AR of the magazine 1, on the entire length of the magazine. The gripping means 3 moves along this rail 4 using a motorization (motorization not visible) of the gripping means 3 meshing on a rack 4a of the rail 4. The gripping means 3 is vertically movable so as to be able to enter and exit the clamp 3a in each compartment for gripping a shell 100 every time. This

vertical mobility is also obtained by moving along a vertical rack (vertical rack not visible).

Each compartment 2 is intended to receive shells 100 parallel to each other, in vertical columns where each shell 100 is substantially horizontally positioned with the warhead 100a thereof being oriented toward the front face AV of the magazine 1. The shells 100 are arranged in the magazine 1 via the front face AV when it is supplied with shells. This arrangement, with the fuze 100b at the front, allows to access the fuzes in order to adjust them.

According to FIGS.1 and 2, each wall 5 comprises at least one supporting means 6 vertically located between each shell 100. Each supporting means 6 is intended to support a shell and is in the form of a part which can pivot with respect to the wall 5 around a substantially horizontal axis 5a between a support position, which is substantially horizontal, in which it supports the shell by the lower part of the latter (lower part located below the longitudinal axis 20 of the shell), and a retracted position which is substantially parallel to the plane of the wall 5 so as to clear the passage to the top of the compartment 2 such that the shell 101 located below the supporting means 6 can exit once the shell 100 located above the supporting means 6 will have been extracted. Each supporting means 6 comprises a spring (spring not visible) whose action tends to hold the supporting means 6 in support position (supporting means 6 at the horizontal).

Raising the supporting means 6 along the wall 5 in the retracted position is performed by the passage of the shell 101 located below the supporting means 6.

In order to prevent the vertical movement of the shells 100 during transport or firing, each wall 5 also comprises at least one retractable holding means 7 located above the longitudinal axis 20 of each shell 100. Each

retractable holding means 7 is able to pivot between a holding position, in which it limits the upward movements of the shell 100, and a retracted position in which it allows the passage of the sell gripped by the clamp. The holding means 7 pivots with respect to a horizontal pivot pin 7a integral with the wall 5.

For the holding means 7 to be able to retract without interfering with the shell it aims to hold, a length L of the holding means 7 will be selected (FIG.2) such that the circle of radius L described by the end of the holding means 7 is, at most, tangent with the shell when the latter is supported on the supporting means 6.

Furthermore, in order to ensure that the shell is held, the holding means 7 will be provided with an inclination such that, in the holding position, it interferes with the shell moving with an upward movement. Thus, one could select an inclination of the holding means 7 ensuring a maximal range of movement of the shell that is of the order of a millimeter. It can be noted, in FIG.2, that the angle α between the holding means 7 and the vertical is about 75° . In this position, the shell is effectively held. If this angle is increased, the eventual range of movement for the shell would also be increased. If this angle is lower than 40° , the shell is no longer held (FIG.3).

Each holding means 7 comprises a spring (spring not visible) whose action tends to hold the holding means 7 in the holding position.

According to FIG.3, the transition from the holding position to the retracted position is caused by pressing the gripping means 3 on the holding means 7 when lowering the gripping means within the compartment. The holding means 7 is thus pivoted downwards. To this end, the gripping means 3 comprises a pressing surface 3b in the form of a sheet panel whose a substantially vertical portion is intended to

interfere with the holding means 7 in order to refold it downwards (also see FIG.1).

As visible in FIG.4, the holding means 7 could be blocked in a substantially vertical retracted position by a locking means 21 comprising a locking finger 21 engaging in a housing 21a of the holding means 7. The locking means 21 is pushed by a return spring (spring not visible) toward the housing 21a provided on the holding means, as shown in FIGS.4 and 8.

Thus, when the holding means 7 is pushed by the pressing surface 3b integral with the clamp 3a of the gripping means 3 which enters the compartment 2, the housing 21a thereof is facing the locking finger 21 which is pushed toward this housing 21a by its return spring. The holding means 7 is then automatically locked in the retracted position and will not hinder the raising of the clamp 3a carrying a shell.

It can be noted that such a locking means 21 is useless for the holding means 7 of the shell located at the lowest level in the compartment (see FIG.2). Indeed, during the gripping phase of this last shell and its raising initial phase, the holding means 7 is still maintained moved away by the pressing surface 3b. Then, it automatically returns to its holding position, pushed by its return spring, when the pressing surface 3a no longer maintains it moved away. During this raising movement of the clamp 3a carrying the shell, the locking means 21 still ensures the immobilization in the retracted position of the holding means 7 for the shell located at the highest level in the compartment 2. Therefore, this last holding means 7 does not hinder the raising and exit of the clamp 3a.

If the compartment 2 comprises more than two superimposed shells, it becomes necessary to provide a locking means 21 for all holding means 7 other than that of the shell located at the lowest level in the compartment.

FIG.8 provides an example of this embodiment in which the compartment 2 comprises more than two superimposed shells. The magazine comprises a locking means 21 allowing to block the holding means 7 in the retracted position for all shells of the compartment 2 except for the one located at the lowest level. The locking means 21 have the effect of clearing the passage to the top of the clamp 3a which, thanks to them, will not interfere with the holding means 7 when extracting the shells. The holding means 7 associated with the lowest shell is maintained retracted by the pressing surface 3b of the gripping means. It returns in the holding position, pushed by its return spring, when raising the clamp 3a, without hindering the movement of the latter.

Each locking means 21 comprises a handle 21b allowing to extract the locking finger 21 from its housing 21a in the associated holding means 7 so as to put the holding means 7 back in the holding position (returning to the holding position being ensured by the above-mentioned return spring). This operation is performed when supplying the magazine 1 with shells.

As visible in FIGS.1, 2, 3 and 4, in order to ensure a better support of the shell 100, as well as a better holding, several supporting means 6 and several holding means 7 are distributed into horizontal rows on the wall 5 according to the longitudinal direction of the shell. Each gap between a row of supporting means 6 and a row of holding means 7 defines a level intended to receive a shell.

Only the lowest level of the magazine does not have supporting means 6, this function being ensured by the bottom of the magazine 1.

According to FIGS.1, 5, 6 and 7, each shell compartment 2 has a longitudinal blocking means 8 for the shells 100. Each blocking means 8 comprises a pair of flaps 9

extending between the lowest level and the highest level of each compartment 2.

Each flap 9 is pivotally mounted with respect to a wall 5 around a substantially vertical axis 9b.

5 As visible in FIGS.5 and 7, each flap 9, when it is in a so-called closed position, is intended to place the free edge 9a thereof, opposed the vertical pivot pin 9b, against a part of the warhead 100a of the shell 100.

10 In this way, both flaps 9 arranged on either side of the warhead 100a counter the longitudinal translation of the shell. It can be noted that the flaps 9 are in contact with the warhead of the shell only at a horizontal plane including the longitudinal axis 20 of the shell. In this way, the flaps 9 do not counter the upward movement of the shell when it is
15 gripped by the gripping means 3. It can be noted that the flaps are advantageously located behind the fuzes so as to allow the access for adjusting or replacing the latter.

By opening the flaps 9 as shown in FIG.6, shells 100 can be inserted in the compartment through the front face AV
20 of the magazine 1 with a horizontal movement.

In front of each level except for the lowest one, the so-called outer face of each flap 9, which is oriented toward the shell 100 when the flap 9 is open, comprises a supporting means 6a, designated as fixed supporting means because it does
25 not pivot around a horizontal axis as the other supporting means 6.

When the flaps 9 are open, this fixed supporting means 6a contributes to support the shell 100 when it is arranged in a level of the compartment 2. To this end, it is
30 located at the same height as the other supporting means 6 of the level considered.

According to FIG.7, in order to make the magazine adaptable to shells of different length, each clamping means 8 is adjustable longitudinally by moving the flaps 9. To this

end, the pivot pin 9b of the flaps 9 can be arranged within holes 9c of a series of holes 9c located at the top and the bottom of each wall 5.

5 The invention thus allows to ensure a perfect blocking of the shells in the magazine so as to avoid the vertical rebounds of the shells. The invention also allows to longitudinally block the shells according to the length thereof.

CLAIMS

1 - A magazine (1) for shells (100) characterized in
5 that it comprises at least one compartment (2) defined by at
least one pair of walls (5), the compartment (2) being able to
receive the shells (100) arranged substantially horizontally
and one above the other in a column, and a gripping means (3)
allowing to vertically extract the shells (100) from their
10 compartment (2), the magazine (1) comprising at least one
supporting means (6) arranged between each shell (100) of a
same column, the supporting means (6) being mounted so as to
be pivotable between a support position, in which it supports
the shell (100) located above the supporting means (6), and a
15 retracted position allowing the passage of the shell (100)
located below the supporting means (6), the magazine (1) for
shells (100) comprising at least one holding means (7) located
above the longitudinal axis (20) of each shell (100), the
holding means (7) being retractable by pivoting between a
20 holding position, in which it limits the upward movements of
the shell (100), and a retracted position in which it allows
the passage of a shell (100) gripped by the gripping means
(3), the transition from the holding position to the retracted
position being caused by pressing the gripping means (3) on
25 the holding means (7) when lowering the gripping means (3)
within the compartment (2), the holding means (7) having a
length L such that the circle of radius L described by the end
of the holding means (7) is, at most, tangent with the shell
when the latter is supported on the supporting means (6).

30 2 - The magazine (1) for shells (100) according to
claim 1, characterized in that the holding means (7) can be
locked in the retracted position by a locking finger (21).

3 - The magazine (1) for shells (100) according to
one of claims 1 or 2, characterized in that it comprises a

longitudinal blocking means (8) for longitudinally blocking the shells (100), comprising, within each compartment (2), at least one pair of flaps (9) pivoting around a substantially vertical pivot pin (9b), the flaps (9) being intended to be located on either side of the longitudinal axis (20) of the shell (100) and at the warhead (100a) of the latter, so as to prevent the horizontal translation of the shell (100) when they are in the closed position.

4 - The magazine (1) for shells (100) according to claim 3, characterized in that each flap (9) comprises at least one fixed supporting means (6a) which is attached on one of the faces thereof, oriented toward the interior of the compartment (2) in the open position, such that, when the flap (9) is in the open position, the fixed supporting means (6a) contributes to support the shell (100) when inserting the latter in the compartment (2).

5 - The magazine (1) for shells (100) according to one of claims 3 or 4, characterized in that the longitudinal position of the blocking means (8) can be set by moving the pivot pin (9b) of the flaps (9) along the walls (5) so as to adapt the position of the blocking means (8) to the length of the shells (100) to be blocked.

6 - The magazine (1) for shells (100) according to claim 5, characterized in that the walls (5) comprise two series of holes (9c), each series of holes (9c) being located at a lower part and an upper part of the wall (5), the longitudinal setting of the blocking means being performed by positioning each end of the vertical pivot pin (9b) of each flap (9) in one hole (9c) of each series of holes.