

FLEXIBLE CHUTE IN PARTICULAR FOR AMMUNITION

The invention relates in particular to the field of feeding ammunition to a firearm and particularly to a flexible chute to guide a flexible ammunition belt from an ammunition box to a firearm.

This chute is intended to be attached on the one hand near a cartridge box and on the other hand at the inlet of the feeding chute of the weapon; by design, it has the necessary and sufficient flexibility in bending and in torsion to allow the movements of the weapon without imparting more deformations to the belt than those required for its proper operation.

In many cases, the gun numbers of small-caliber machine-guns, up to 12.7 mm, feed their weapon with an ammunition box, or even without ammunition box, they then have at their disposal only 100 or 200 shots available that they must watch over during the shot so as to avoid any inopportune hooking before inserting the ammunition, which could block the weapon or damage its proper operation.

Today, in particular for new weapons or new weapon systems, there are flexible and metal ammunition chutes. These chutes are constituted by a series of component assemblies mounted one behind the other, so as to form successive joints and constitute a chute with a length sufficient to link an ammunition box and a weapon to thereby ensure the ammunition feeding of the weapon. These devices have many disadvantages such as their complexity of production, the need for a significant maintenance to maintain the joints in a proper state.

To overcome these disadvantages, US patent 3,435,937 discloses a chute with a partially rectangular cross-section comprising a large longitudinal groove on one of

its long sides and formed by a succession of identical sections, two successive sections being linked by lateral wall portions on each of the lateral faces of the short sides thereof. Thus, two half-blind grooves arranged in a same plane divide two successive sections and the chute comprises n assemblies of two half-blind grooves arranged in parallel planes and allow some flexibility of the chute, the longitudinal groove also participating in the flexibility of the chute, as indicated in the description relating to FIG.2 of said patent.

"Lateral wall portion" is intended to mean that these lateral wall portions do not link the small lateral sides on their entire length, but only on a portion of the latter.

However, such a chute shows a flexibility only in a plane, which significantly restricts its use.

An object of the invention is to provide a flexible chute allowing to overcome all disadvantages of the state of the art, and particularly to provide a light ammunition chute which is flexible in at least two planes, does not need any maintenance, has a very low cost, is easy to implement and to repair on the field.

The solution is a flexible chute for ammunition, comprising successive sections linked by wall portions on the transverse faces thereof and comprising at least one tubular section of axis G, with a first wall portion integral with one of its two transverse faces and a second wall portion integral with the other transverse face, characterized in that the projections of these wall portions, perpendicularly to a transverse plane of the section, are at least partly distinct.

"Distinct" is intended to mean that the projections, in a same transverse plane, for example one of the transverse faces, are entirely distinct; they thus have no common point.

5 According to another feature, said projections are radially offset by an angle between $\pi/9$ and $8\pi/9$, and preferably between $\pi/3$ and $2\pi/3$, the origin of the radius being the center G.

10 According to a particular feature, a flexible chute for ammunition according to the invention comprises successive sections linked by wall portions on the transverse faces thereof, characterized in that it comprises at least one tubular section comprising at least an upper long side, a lower long side and two smaller
15 lateral sides, and in that this section comprises, on a first transverse face, at least one wall portion only on at least one of said lateral sides and, on its second transverse face, at least one or more wall portions only on one of the upper and lower long sides or both.

20 According to an additional feature, the solution is a flexible chute for ammunition comprising successive sections linked by wall portions on the transverse faces thereof, characterized in that it comprises at least first, second and third successive tubular sections comprising at
25 least an upper long side, a lower long side and two smaller lateral sides, and such that the first section is linked to the second section only by one or several axial wall portions on each of the transverse faces of their lower and/or upper long sides facing each other, while the second
30 section is linked to the third section only by one or more lateral wall portions on each of the transverse faces of their smaller lateral sides facing each other.

Thus, the first and second sections are partially separated by a first and a second groove arranged in a first plane and facing each other, while the second and third sections are partially separated by a third and a fourth groove arranged in a second plane and facing each other, the first and second grooves being radially offset with respect to the third and fourth grooves. This radial offset allows to obtain a flexibility of the first section with respect to the second section along a first direction, and a flexibility of the second section with respect to the third section along a second direction different from the first direction.

In this patent application, the term "axial" does not have a geometrical meaning, but is used to distinguish the wall portions linked to the long sides from the wall portions, called lateral wall portions, linked to the smaller lateral sides.

According to a particular feature, a chute according to the invention is characterized in that it comprises at least first and second successive assemblies, each having first and second tubular successive sections comprising at least an upper long side and a lower long side and two smaller lateral sides, and such that the first section is united to the second section only by one or more axial wall portions on each of the transverse faces of their lower and upper long sides, and in that the first assembly is united to the second assembly only by one or more lateral wall portions on each of the transverse faces of their smaller lateral sides.

According to a particular feature, said section(s) is/are tubular with a rectangular transverse outer shape, with two long sides having the same length and being linked to two other smaller sides, also having the same length.

According to another particular feature favoring the flexibility of the chute, each of the sections has a thickness, measured lengthwise, lower than 2 cm and preferably between 0.3 and 1 cm.

5 According to another feature, the lateral wall portions are concentrated in the middle part of the transverse faces of said small sides.

According to another additional feature, the axial wall portions are concentrated in the middle part of the
10 transverse faces of said long sides.

According to another feature facilitating its production, the chute is monobloc, preferably made of plastic or elastomer, thus allowing the production thereof by molding.

15 According to another feature allowing to unite the chute to a weapon or an ammunition box, a flexible chute according to the invention comprises, at least at one of its ends, an adaptation tip comprising a first part having mainly an inner diameter slightly greater than the outer
20 diameter of the flexible chute and a second part with an inner diameter equal to that of the chute.

According to another feature allowing to unite to each other two non-linked chute parts, a chute according to the invention comprises at least a device, this device
25 comprising a U-shaped plate, the size between the branches of which is equal or slightly greater than the thickness of the chute, and the width of the plate is substantially equal to that of two sections arranged side-by-side, and which comprises lateral edges so as to form a component to
30 be clipped on two sections arranged side-by-side.

Other advantages and features will become more apparent from the description of a particular embodiment of the invention, in reference with the appended drawings:

- 5 - FIG.1 shows an example embodiment of a flexible chute for ammunition made of plastic by molding,
- FIGS.2a and 2b show the global shape of a section used in FIG.1,
- FIG.2c shows a diagram of the projection of the axial and lateral wall portions of a section in a transverse
10 plane of this section,
- FIG.3a shows a top view of an assembly of said chute, whereas FIG.3b shows a cross-sectional view thereof according to the plane AA' in FIG.3a,
- FIG.4 shows a diagram of a side view of the first five
15 assemblies of said chute,
- FIG.5a shows a diagram of a top view of an example of deformation of the sections of an assembly,
- FIG.5b shows a diagram of a side view of an example of deformation of two successive assemblies,
- 20 - FIG.6 shows a diagram of a perspective view of an adaptation tip 30 intended to unite the chute 1 to certain types of weapons or ammunition boxes,
- FIG.7 shows a diagram of a first part, namely a front part, of a tip according to FIG.6,
- 25 - FIG.8 shows a diagram of a second part, namely a rear part, of a tip 30 according to FIG.6,
- FIG.9 shows a partially exploded view of a chute comprising an adaptation tip at each of its free ends, a cartridge belt being inserted within the chute and
30 the tips,

- FIGS.10a and 10b show an example of device 49 intended to repair a flexible chute according to the invention by uniting to each other two non-linked chute parts.

5 FIG.1 shows an example embodiment of a flexible chute for ammunition made of plastic by molding.

 This chute 1 has a general tubular shape with a rectangular cross-section having outer dimensions of 25 mm x 86 mm, and a wall thickness of 5 mm, thus having a cavity
10 with a rectangular cross-section having dimensions of 15 mm x 76 mm intended to allow the passage of 7.62 link-mounted ammunition to form a belt.

 This flexible chute 1 is mainly constituted of successive sections 2 linked by wall portions 11, 13 on
15 their transverse faces. FIGS.2a and 2b show the general shape of a section used in this example embodiment of the invention, and more particularly, respectively, a diagram of a perspective view of one of the transverse faces of a section 2 used in the frame of the chute 1, and a diagram
20 of a perspective view of the other transverse face. This section 2 has a rectangular tubular shape of axis G, with first and second parallel small sides 8, 18 linked to first and second parallel long sides 9, 19, and first and second parallel transverse faces 10, 20 intended to face different
25 sections. The outer dimensions of this section are 25 mm x 86 mm, and the section of the walls is of about 5 mm x 5 mm.

 FIG.2c shows a projection of the section 2 and of the wall portions associated therewith in the transverse plane
30 P_T containing its transverse face 10, the center of which is G, G also being on the axis of the tubular-shaped section and on the axis of the chute when it is

rectilinear. It can be noted that the projections 26_1 , 26_2 perpendicular to Pt of the axial wall portions 11_1 and 11_2 are entirely distinct from those 26_3 , 26_4 of the lateral wall portions 13_1 and 13_2 , and all projections of these
 5 wall portions are distinct. Furthermore, G being the origin, the projections 26_3 , 26_4 of the lateral wall portions 13_1 and 13_2 are respectively offset with respect to those of the axial wall portions 11_1 and 11_2 by an angle α equal to $\pi/2$.

10 The chute 1 according to this embodiment is constituted of a succession of identical assemblies, such as the assembly shown in the top view of FIG.3a and FIG.3b, with a cross-sectional view according to the plane AA' in FIG.3a.

15 Each assembly 12 is constituted of a first section 2_1 and a second section 2_2 arranged in parallel and side-by-side, such that the transverse surface 10_1 of the first section 2_1 faces the transverse surface 20_2 of the second section 2_2 . These first and second sections 2_1 , 2_2 are
 20 united, on the one hand, to a first axial wall portion 11_1 linking the first long side 9_1 of the first section 2_1 to the first long side 9 of the second section 2_2 , and, on the other hand, to a second wall portion 11_2 linking the second long side 19_1 of the first section 2_1 to the second long
 25 side 19_2 of the second section 2_2 . These first and second axial wall portions 11_1 and 11_2 have a transverse section of about 5 mm x 5 mm and, longitudinally, a thickness of about 3 mm.

FIG.4 shows a diagram of a side view of the first five
 30 assemblies 12_1 , 12_2 , 12_3 , 12_4 , 12_5 of the chute 1. The first assembly 12_1 is united to the second assembly 12_2 , on the one hand, by a first lateral wall portion 13_1 linking the

first small side 8_2 of the second section 2_2 of the first assembly 12_1 to the first small side 8_1 of the first section 2_1 of the second assembly 12_2 , and, on the other hand, by a second lateral wall portion 13_2 linking the
 5 second small side 18_2 of the second section 2_2 of the first assembly 12_1 to the second small side 18_1 of the first section 12_1 of the second assembly 12_2 .

Thus, except for the first and last sections, each section is linked, on the one hand, to the preceding one by
 10 first and second axial wall portions 11_1 and 11_2 respectively linking their first and second long sides, and, on the other hand, to the following section by first and second lateral wall portions 13_1 and 13_2 respectively linking their first and second small lateral sides.

15 As can be seen in FIGS.3a and 4, said first and second axial wall portions 11_1 and 11_2 link the long sides at the middle part thereof, and said first and second lateral wall portions 13_1 and 13_2 also link the small sides at the middle part thereof.

20 The first and second upper and lower wall portions 11_1 and 11_2 provide the chute with a flexibility in the width direction of the chute, while said first and second lateral wall portions 13_1 and 13_2 provide the chute with a flexibility in the thickness direction of the chute.

25 Thus, as shown in FIG.3, within the same assembly, the sections 2_1 and 2_2 are separated by first grooves 14_1 and 14_2 facing each other and having a C-shape with respect to the material forming the assembly, while two successive assemblies are separated by second grooves 15_1 and 15_2
 30 facing each other and having a U-shape with respect to the material forming the assembly. These first and second grooves each have a symmetry plane, and the symmetry plane

of the first grooves 14_1 and 14_2 is perpendicular to that of the second grooves 15_1 and 15_2 .

FIG.5a shows a diagram of a top view of an example of deformation of the sections 2_1 , 2_2 of an assembly 12_3 . It can be noted that due to:

- small dimensions of the axial wall portions 11_1 and 11_2 linking the long wall sides generating the first grooves 14_1 and 14_2 with a C-shape,
- some elasticity of the material constituting the chute,

the position of the first section 2_1 can vary with respect to that of the second section 2_2 , and more particularly symmetrically with respect to the longitudinal neutral axis passing through said axial wall portions 11_1 and 11_2 . Thus, the end 16_1 of the long side 9_1 of the first section 2_1 abuts against the end 16_2 of the second section 2_2 , while the end 17_1 of the long side 9_1 of the first section 2_1 is at a longer distance from the end 17_2 of the second section 2_2 , thus generating a bending of this assembly in the plane formed by the first long sides 9 .

FIG.5b shows a diagram of a side view of an example of deformation of two successive assemblies 12_4 , 12_5 . It can be noted that due to:

- small dimensions of the lateral wall portions 13_1 and 13_2 linking the long wall sides generating the second grooves 15_1 and 15_2 with a U-shape,
- some elasticity of the material constituting the chute,

the position of the assembly 12_4 can vary with respect to that of the assembly 12_5 , and more particularly symmetrically with respect to the transverse neutral axis passing through the center of said lateral wall portions

13₁ and 13₂. Thus, the end 21₄ of the small lateral side 18₄ of the assembly 12₄ abuts against the end 21₅ of the small lateral side 8₅ of the assembly 12₅, while the end 22₄ of the small lateral side 18₄ of the assembly 12₄ is at a longer distance from the end 22₅ of the small lateral side 8₅ of the assembly 12₅, thus generating a bending of these assemblies in a plane perpendicular to that formed by the first long sides 9.

When the chute is bent, particularly lengthwise, the ends 16, 21 are in contact with each other, while the other ends 17, 22 show an increased gap. When a belt is towed, it tends to adopt the shortest path, the ammunition belt will thus tend to bear on the side where the sections are in contact with each other. Accordingly, the likelihood that the most sensitive part of the ammunition belt, namely the tip side of the cartridges, is blocked in the grooves between the sections is practically zero.

With this geometry, a bending radius of 110 mm was obtained in the thickness direction of the chute and a bending radius of 300 mm was obtained in the width direction of the chute.

However, the bending radii depend on the width of the grooves between each section of the flexible chute.

Obviously, the existing weapons and ammunition boxes do not have an interface allowing to unite the chute 1 to them. Accordingly, an adaptation interface, called a tip, is described below with respect to FIGS.6-8.

FIG.6 shows a diagram of a perspective view of an adaptation tip 30 which can be used to unite the chute 1 to certain types of weapons or ammunition boxes.

This adaptation tip 30 for flexible chute 1 has a rectangular tubular shape having:

- a first part 31 having, mainly, an inner diameter slightly greater than the outer diameter of the flexible chute,
- a second part 32 having an inner diameter equal to
5 that of the chute,
- a shoulder 33 ensuring the interface between first and second parts 31, 32.

FIG.7 shows a diagram of a first part, namely a front part, of a tip 30 according to FIG.6. This first part is
10 constituted of a steel plate with a thickness of 0.8 to 1.2 mm, with a length greater than that of an assembly 12 of the chute and with the same peripheral shape as that of a section 2, but with an inner diameter at least equal to the outer diameter of a section such that the latter can
15 enter inside.

This steel plate comprises, on each of its long sides 34, four longitudinal notches with two notches 35 on a side of the long side and two notches 36 on the other side of the long side, so as to form two plates 37 of about 10 mm x
20 10 mm, the free end of which is inwardly bended so as to form claws 38, and such that the distance between the shoulder and the claw is slightly greater than that of an assembly. These claws 38 are chamfered on their outer lower part. The length of the notches is sufficient to provide
25 said plates 37 with a certain elasticity.

Thus, to unite the chute 1 to this tip, an end of the flexible chute 1 is inserted within the first part 31 of the tip such that its free transverse face is in contact with the shoulder 33. In this position, the claws 38 each
30 are in a groove, namely the grooves 15, and the absence of chamfer on the inner part of the claws allows to block the chute in this position.

It can be noted that, because of said chamfers on the lower part of the claws 38, these slide on the corresponding lower or upper parts of the chute when the chute is inserted in the tip. To remove the chute from the tip, it is only required to pull the free ends 37 of the four plates 36, 37 towards the outside so as to simultaneously remove the claws 38 from the grooves 15 and remove the chute from the tip.

FIG.8 shows a diagram of a second part, namely a rear part, of a tip 30 according to FIG.6. This second part 32 of the tip, shown in FIG.8, has an inner diameter substantially equal to that of the chute 1 and further comprises means for locking this tip on a weapon or an ammunition box, constituted of a lower transverse protruding plate 40 disposed on its lower long side 41 and of a tube 42 disposed on its upper long side and having slits 43 in which flat bolt components 44 are inserted, as shown in FIG.9. These locking means are intended to cooperate with complementary means which are not shown, and arranged on the weapon or the ammunition box.

FIGS.10a and 10b show an example of a device 49 intended to repair a flexible chute according to the invention by uniting to each other two non-linked chute parts. It is constituted of a U-shape plate 50, the size between the branches of which is equal or slightly greater than the thickness of the chute, and the length of the branches is slightly lower than half the width of the chute minus the half-width of an axial wall portion 11. The width of the plate is substantially identical to that of two sections arranged side-by-side.

This plate 50 comprises lateral edges 53, 54 so as to form a component intended to be clipped on two sections arranged side-by-side.

In case of damage to the flexible chute, accident, projectile or spall, it can be repaired within a very short period of time.

The operation mode for the repair is the following:
5 cutting the damaged sections and the corresponding lateral wall portions 13 so as to contiguously arrange two assemblies 12. A first device 49 is arranged so as to clasp a first part of the sections facing the two contiguous assemblies, and then a second device 49 is arranged so as
10 to clasp a second part of the sections facing the two contiguous assemblies, the first and second devices 49 facing each other.

The feeding of an ammunition belt within the chute can be performed manually or using a device such as the device
15 described in the French patent application 1200275 filled in the name of the applicant.

Obviously, many modifications can be made to the example embodiment without departing from the scope of the invention. Thus, the dimensions of the flexible chute can
20 be adapted to those of the ammunition used, and this invention can be adapted to all small calibers link-mounted up to 12.7 mm, or even medium calibers as well as cartridge grenades.

Moreover, a chute according to the invention can have
25 a different shape, for example a trapezoidal or elliptical shape. If the required bending and the direction(s) thereof are known, the wall portions cannot be arranged in the middle part of the long sides and/or the middle part of the small sides so as to promote the flexibility in this/these
30 direction(s) and this bending, and radial offsets of the wall portions along the chute can also be contemplated.

Furthermore, the sections can be gathered together by more than one wall portion on the small and/or long side.

Furthermore, on all or part of the chute, said projections of the wall portions of a section can be radially offset with respect to those of the preceding or following section, the offset being regular or not along the chute.

5 Finally, a flexible chute according to the invention can have applications other than the feeding of a weapon with ammunition. Indeed, such a chute can be used with an endless and flexible drive chain and one or more recipients, for example a cup, for the regular feeding of a
10 machine with objects. The chain can be, for example, a flexible belt as described in the patent application PCT/FR2013/00027, on which cups are attached, preferably in a regular manner. Such a device can be used, for example, to feed a robot with rivets, one of the ends thereof being
15 linked to a rivet feeder and the other to a 3D robotic arm for assembling mechanical parts.

CLAIMS

1 - A flexible chute (1) comprising successive sections (2) linked by wall portions (11, 13) on the transverse faces thereof and comprising at least one tubular section (2) of axis G, with a first wall portion (11₁, 11₂) integral with one of its two transverse faces and a second wall portion (13₁, 13₂) integral with the other transverse face, characterized in that the projections (26₁, 26₂, 26₃, 26₄) of these wall portions, perpendicularly to a transverse plane of the section, are at least partly distinct.

2 - The flexible chute according to claim 1, characterized in that said projections (26₁, 26₂, 26₃, 26₄) are entirely distinct.

3 - The flexible chute according to claim 2, characterized in that said projections (26₁, 26₂, 26₃, 26₄) are radially offset by an angle between $\pi/9$ and $8\pi/9$, and preferably between $\pi/3$ and $2\pi/3$, the origin of the radius being the center G.

4 - The flexible chute according to claim 1, comprising successive sections (2) linked by wall portions (11₁, 11₂, 13₁, 13₂) on their transverse faces (10, 20), characterized in that it comprises at least one tubular section (2) comprising at least an upper long side (9), a lower long side (19) and two smaller lateral sides (8, 18), and in that this section (2) comprises, on a first transverse face (20), at least one wall portion (13₁, 13₂) only on at least one of said lateral sides and, on its second transverse face (10), at least one or more wall portions (11₁, 11₂) only on one of the upper and lower long sides (9, 19) or both.

5 - The flexible chute according to claim 1, comprising successive sections linked by wall portions on their transverse faces (10, 20), characterized in that it comprises at least first, second and third successive tubular sections (2) comprising at least an upper long side (9), a lower long side (19) and two smaller lateral sides (8, 18), and such that the first section is linked to the second section only by one or several axial wall portions (11₁) on each of the transverse faces of their lower and/or upper long sides facing each other, while the second section is linked to the third section only by one or more lateral wall portions (13₁) on each of the transverse faces of their smaller lateral sides facing each other.

6 - The flexible chute according to any of claims 1-5, characterized in that it comprises at least first and second successive assemblies (12₁, 12₂) each having first and second tubular successive sections (2₁, 2₂) comprising at least an upper long side (9₁, 9₂) and a lower long side (19₁, 19₂) and two smaller lateral sides (8₁, 8₂, 18₁, 18₂), and such that the first section (2₁) is united to the second section (2₂) only by one or more axial wall portions (11₁, 11₂) on each of the transverse faces (10₁, 20₂) of their lower and upper long sides, and in that the first assembly (12₁) is united to the second assembly (12₂) only by one or more lateral wall portions (13₁, 13₂) on each of the transverse faces (10₂, 20₁) of their smaller lateral sides.

7 - The flexible chute according to any of claims 1-6, characterized in that each of the sections (2) has a thickness, measured lengthwise, lower than 2 cm and preferably between 0.3 and 1 cm.

8 - The flexible chute according to any of claims 1-7, characterized in that the lateral wall portions (13₁,

13₂) are concentrated in the middle part of the transverse faces (10₂, 20₁) of said small sides (8₁, 8₂, 18₁, 18₂) and/or the axial wall portions (11₁, 11₂) are concentrated in the middle part of the transverse faces (10₁, 20₂) of
5 said long sides (9₁, 9₂, 19₁, 19₂).

9 - The flexible chute according to any of claims 1-8, characterized in that it is monobloc, for example, made of plastic or elastomer.

10 10 - The flexible chute according to any of claims 1-9, characterized in that it comprises, at least at one of its ends, an adaptation tip (30) comprising a first part (31), having mainly an inner diameter slightly greater than the outer diameter of the flexible chute and a second part (32) with an inner diameter equal to that of the
15 chute.

11 - The flexible chute according to any of claims 1-9, characterized in that it comprises at least one device (49) able to unite to each other two non-linked chute parts, this device comprising a U-shaped plate (50),
20 the size between the branches (51) of which is equal or slightly greater than the thickness of the chute, and the width the plate is substantially equal to that of two sections arranged side-by-side, and which comprises lateral edges (53, 54) so as to form a component to be clipped on
25 two sections arranged side-by-side.

12 - Application of a flexible chute according to any of claims 1-11 to the supply of ammunition of a weapon.