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#### (54) Benevnelse PORTABLE MACHINE FOR CONNECTING LINKS AND AMMUNITION

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### PORTABLE MACHINE FOR CONNECTING LINKS AND AMMUNITION

#### Subject matter of the invention

The present invention relates to the field of portable machines or tools, automatic or not, allowing to easily and quickly hook ammunition together by means of links

to realize a flexible belt or chain of ammunition connected to each other, in order to allow the automatic firing of a weapon such as a gun. The invention can be applied to all types of chained ammunition, preferably but not exclusively medium-caliber ammunition, i.e. typically between 15 and 50 mm.

### State of the art

10 At present, the use of dummy ammunition, for example in the case of testing automatic firing devices such as armored vehicle gun-loading robots, requires the rapid and manual assembly of a number of ammunition rounds in the form of belts.

The ammunition belts considered in the present invention typically consist of cartridges inserted or clipped into a flexible belt or chain by means of metal links.

- 15 Figures 1 and 2 show detailed views of typical links, respectively alone and in combination with a cartridge. The actual link 10 consists of a first part 11 attached to a second part 12, whereby the two parts 11, 12 can be hinged to each other, but not necessarily. The second part 12 comprises a loop 13, which is central relative to the height of the connector 10, defining an approximately semi-cylindrical
- opening, sized to be fitted onto the shell 21 of a cartridge 20 of a given caliber. The first part 11 comprises two loops 14, 15 of this type but located, vertically, respectively on either side of the central loop 13. Each of these loops 13, 14, 15 generally has at its free ends a small loop 16 oriented in the opposite direction, so as to define a flared shape allowing an easier insertion or removal of the cartridge
- (this small loop does provide a certain elasticity to the corresponding handle). The upper loop 14 of the first part 11 may be extended by an essentially flat rectangular part 17 extending upward, and the lower loop 15 of the first part 11 may also be extended downward by an essentially flat part 18, which terminates in a finger 19 that advantageously fits into the extraction groove 22 of the cartridge

30 20 in order to ensure the proper alignment of the cartridge within the chain.

Usually, the ammunition is inserted in an individual link, either by threading or clipping, into the loops 14, 15 of the first part 11 (Figure 3) and then the created link-cartridge assembly 10, 20 is hooked to the already-made chain 23 by attaching the free central loop 13 at the end of the chain 23 to the new cartridge

5 20 between the loops 14, 15 of its link (Figure 4).

However, it is known that the (re)loading of a mesh chain of medium- or largecaliber ammunition is often impossible to carry out with bare hands because of the effort required or because of the specific dimensions of an armored vehicle turret, for example.

10 Currently, this need for ammunition fastening is often met in an unorthodox manner through the use of an additional tool such as a hammer or mallet. In this case, the penetration of the cartridge in the handle (or handles) of a free link can be achieved by a hammer blow, or even by using one's foot.

It is easy to understand that this manual process is very imprecise and that the

15 final relative position of the ammunition in relation to the link can be haphazard and variable from one ammunition to another, which can block the equipment for which the ammunition chain is intended.

In the field of automatic belting, currently known machines are large, complex and non-portable, or for small calibers such as 7,62 or 9 mm, are portable

20 machines that push or clip the ammunition into the links.

US 2,460,096 discloses a powered machine for making 20 mm ammunition chains, having a cartridge loading wheel, cartridge feed means to direct cartridges into said loading wheel, a link assembly wheel formed with link holding pockets around its periphery and having a step-by step rotating movement, link feed

- 25 means to direct links into said assembly wheel, a reciprocating plunger carriage having a fixed stroke, a pair of plungers mounted in said carriage in spaced circumferential positions with respect to the axis of said link assembly wheel, one of said plungers being longer than the other and said two plungers having their reciprocatory paths respectively in line with successive pockets on the periphery of
- 30 said link assembly wheel. The plungers of the plunger carriage push the cartridges

into the links in the assembly wheel to create a chain of ammunition, in two successive stages during the step by step rotation of the assembly wheel.

US 2,480,834 discloses a motorized mechanism wherein a ramming slide which is made to reciprocate on a base beneath the discharge spout of an upright

<sup>5</sup> ammunition hopper, whence successive rounds are thrust into the interfitted knuckles of belt links arriving from a slide onto a conveyor belt, with a rotating star wheel providing continuous operation of the machine.

US 2,344,443 discloses a machine comprising a continuous flexible sheet metal conveyor belt having a plurality of open troughs into which a plurality of cartridges

are inserted, means for feeding links for holding such cartridges into the troughs, a rotatable drum having a plurality of alternating grooves and projections in its periphery conforming to the contour of the conveyor belt for engaging and driving same, and cam means for pushing the cartridges to a predetermined position into the links as the cartridges are carried along by the conveyor belt.

## 15 Purposes of the invention

20

The present invention is intended to provide a solution for the easy, safe and reproducible production of belts of ammunition hooked together, such as, for example, medium-caliber ammunition.

In particular, the invention aims to reproduce in an automated manner the manual technique of loading an ammunition belt, in order to save time for gun operators.

In particular, the invention is intended to provide a compact and efficient device designed to fit easily into an enclosed environment such as the interior of an armored vehicle turret.

The invention also aims to quickly produce ammunition belts, typically a belt of
15 cartridges in less than 5 minutes, without mechanical cranking effort greater
than 130N, by manual operation of the machine.

## Principal features of the invention

The present invention relates to an ammunition fastening machine for forming an ammunition or cartridge link chain or belt, comprising a substantially cylindrical warhead, case and base, attached end-to-end by links hinged together, each link consisting of a first part attached to a second part, the two parts being offset from

- 5 each other the second part comprising a loop which is central with respect to the height of the link, defining an approximately semi-cylindrical opening, sized to be fitted on the casing of a cartridge of a given caliber, the first part comprising two loops also of that type but situated, in height, respectively on either side of the central loop, said machine comprising:
- a first slide, intended to successively introduce the links detached from each other and to guide them under the effect of gravity, and a second slide, intended to successively introduce the cartridges and to guide them under the effect of gravity;
  - a moving mechanism provided with a first shaft, a second shaft and a third shaft, said shafts being mounted parallel to each other and connected by gears,
- the moving mechanism being set in motion by the rotation of the third shaft, which drives, in a continuous movement, the counter-clockwise rotation of the first shaft and the clockwise rotation of the second shaft, or vice versa, the first shaft comprising at least two gripping wheels each having regularly spaced grooves of circular shape that make it possible to drive the cases of the
- 20 cartridges, the second shaft comprising at least two gripping wheels having regularly spaced grooves for driving the base or the rear part of the links, so that, when the moving mechanism is set in motion, each cartridge is presented by the rotation of the first shaft synchronously with the link presented by the rotation of the second shaft and is clipped transversely into said link (10);
- 25 an electric motor or a manual crank for rotating the third shaft.

According to preferred embodiments of the invention, the ammunition fastening machine further comprises at least one of the following features or an appropriate combination thereof:

- the gripping wheels of the respective cartridges and links are removable 30 and fitted, in the shape of the grooves, to the caliber or size of the respective

cartridges and links, the assembly being easily adaptable to other calibers or sizes by replacing the gripping wheels;

to allow the passage from the 40 mm caliber to the 30 mm caliber, the first shaft comprises a gripping wheel distal from the position in use of the cartridge
 warhead and two twin gripping wheels proximal to the position in use of the

cartridge warhead, the two twin wheels having grooves respectively adapted to the 30 mm caliber and the 40 mm caliber, the return to the 40 mm caliber being ensured by the removal of the wheel provided for the 30 mm caliber;

- the two aforementioned twin wheels are connected by at least one 10 cylinder using a ball pin;

- the machine comprises a reciprocating mechanism with a finger which serves as a stop blocking the first link of the column located in the bottom of the first slide, the finger unlocking and retracting sequentially upon rotation of the moving mechanism, so as to ensure the passage and gripping of the links one after the other;

 the first slide is profiled so that the links are presented with the openings of their loops towards the front of the machine.

The ammunition fastening machine according to the invention is suitable, for example, for producing ammunition belts with links having at least the central loop comprising at its free ends a small loop oriented in the opposite direction to

20 that of the main loop, so as to define a flared shape for easier transverse insertion or removal of the cartridge, the upper loop of the first part being extended by an essentially flat and rectangular part extending upwards and the lower loop of the first part being extended downwards by an essentially flat part, terminated by a finger which is inserted in the extraction groove of the cartridge.

#### 25 Brief description of the figures

Figure 1, previously mentioned, shows a top view and an elevation view, respectively, of an example of a medium-caliber ammunition belt link.

Figure 2, already mentioned, shows respective elevation views of the link alone and the cartridge inserted into the link.

Figure 3, already mentioned, represents the two usual modes of belting.

Figure 4, already mentioned, represents the formation of an ammunition belt by belting cartridges close to one another.

Figure 5 represents a first perspective view, from the front, of a belting machine

5 according to the present invention, also showing the general principle of operation.

Figure 6 shows a second front perspective view of the belting machine according to the present invention, where the front cover has been removed to show the detail of the moving mechanism.

Figure 7 shows yet another perspective view of the belting machine according to the present invention, also showing detail of the moving mechanism.

Figure 8 shows an internal plan view of the belting machine according to the present invention, also showing detail of the moving mechanism.

# Description of preferred embodiments of the invention

According to a preferred embodiment of the invention shown in Figures 5 to 8, the

- belting machine 30 comprises a first slide 31, intended to successively introduce the links 10 detached from each other and a second slide 32, intended to successively introduce the ammunition or cartridges 20 which are for example medium-caliber cartridges (30 and 40 mm in the example considered). The number of links 10 and the number of rounds 20 fed into the machine is preferably the same.
- The machine 30 can either be operated manually, by means of a crank 33, or electrically, by means of an electric motor replacing the crank 33 (not shown).

Typically, a moving mechanism 34 comprises a set of wheels 35 located on a shaft 36, said wheels 35 being intended to grip a cartridge 20. As the shaft 36 rotates, the cartridge 20 is inserted into a link 10, which is synchronously presented by a link 10

shaft 37 10 when the main shaft 38 is operated by the motor or crank 33.

When the machine 30 is activated, the first cartridge 20 available in the bottom of the second slide 32 is thus taken by the moving mechanism 34, brought into

contact with the first link 10 available in the bottom of the first slide 31, and the cartridge is clipped transversely into the link 10.

The machine 30 has an outlet opening 39, for example with a ramp leading into a collection box (not shown), through which the belt of linked ammunition 22 is

5 expelled by gravity.

The moving mechanism 34 thus has a first shaft 36 with a plurality of wheels 35 that serve to grip the cartridges 20. A second shaft 37 allows the advancement of the links 10. For example, the first shaft 36 rotates counterclockwise while the second shaft 37 rotates clockwise. The two shafts 36, 37 are set in motion by a third shaft

38 which is connected to a manually operated crank 33 or to an electric motor. The three shafts 36, 37, 38 are parallel to each other and connected by gears 40.

Advantageously, the first shaft 36 has at least two wheels 35 with regularly spaced grooves 41 of circular shape making it possible to grip the casings 21 of the cartridges 20. The second shaft 37 also has at least two wheels 42 with grooves

43 for gripping the base of the links 10. During the rotation of the movingmechanism 34 the cartridge 20 is clipped longitudinally into the link 10.

Even more advantageously, the slides 31, 32 and the gripping wheels 35, 42 are adapted to the size of the ammunition and the links. They are removable and interchangeable, making the set easily adaptable to other sizes or calibers. For

example, the grooves of the wheels of cartridges 41 can be adapted to 30 and 40 mm caliber ammunition (the links are identical for these two calibers). Switching from 40 mm to 30 mm on the grooves can be advantageously carried out by means of an actuator using a ball pin 44 acting by connecting two twin wheels 41.

Advantageously, the belting machine according to the invention 30 comprises a mechanism having a finger 45 which serves as a stop blocking the first link 10 and consequently the whole column of links located in the bottom of the first slide 31. The finger 45 then unlocks sequentially as the moving mechanism 34 rotates.

It is also advantageous that the machine is equipped with carrying handles and preferably weighs no more than 40 kg.

30 The device according to the present invention has the following advantages:

- EP3 715 775
- ability to assemble a belt of dummy or real ammunition;
- portability by two people;
- reducing the assembly time of an ammunition belt;
- adaptation to different calibers of ammunition, for example from 20 to 40 mm;
- 5 reconstituting an ammunition belt with links already in use;
  - manual or electrical operation.

### List of reference symbols

- 10 link
- 11 first link part
- 10 12 second link part
  - 13 second part loop
  - 14 first part loop
  - 15 first part loop
  - 16 small external loop
- 15 **17** flat rectangular part
  - 18 downward extension
  - 19 finger
  - 20 cartridge
  - 21 case
- 20 22 extraction groove
  - ammunition chain

- 30 belting machine
- 31 link-feeding rail
- 32 cartridge-feeding chute
- 33 crank
- 5 34 moving mechanism
  - 35 cartridge gripping wheel
  - 36 first shaft
  - 37 second shaft
  - 38 third shaft
- 10 **39** outlet from the ammunition chain
  - 40 gears
  - 41 cartridge gripping grooves
  - 42 link-gripping wheel
  - 43 link-gripping grooves
- 15 44 ball pin
  - 45 link stop finger

NO/EP3715775

## PATENTKRAV

1. Ammunisjonsfestemaskin (30) for å danne en ammunisjons- eller patronkjede eller -belte (20), omfattende et i det vesentlige sylindrisk stridshode, hylster og basisdel, festet ende-til-ende med ledd (10) hengslet

- sammen, idet hvert ledd (10) består av en første del (11) festet til en andre del (12), idet de to delene (11, 12) er forskjøvet fra hverandre, den andre delen (12) omfatter en løkke (13) som er sentral med hensyn til høyden på leddet (10), noe som definerer en tilnærmet halvsylindrisk åpning, dimensjonert for å monteres på hylsen (21) til en patron (20) av et gitt kaliber, idet den første
- delen (11) omfatter to løkker (14, 15) også av den typen, men plassert i høyden, henholdsvis på hver side av den sentrale løkken (13), idet maskinen omfatter:

en første sleide (31), beregnet på suksessivt å innføre leddene (10)
 frakoblet fra hverandre og å føre dem under påvirkning av tyngdekraften, og
 en andre sleide (32), beregnet til suksessivt å innføre patronene (20) og å føre
 dem under påvirkning av tyngdekraften;

- en bevegelig mekanisme (34) utstyrt med en første aksel (36), en andre aksel (37) og en tredje aksel (38), idet akslene (36, 37, 38) er montert parallelt med hverandre og forbundet med tannhjul (40), idet den bevegelige

- 20 mekanismen (34) settes i bevegelse ved rotasjon av den tredje akselen (38), som driver, i en kontinuerlig bevegelse, rotasjonen av den første akselen (36) mot klokken og rotasjon av den andre akselen (37) med klokken, eller omvendt, idet den første akselen (36) omfatter minst to gripehjul (35) som hver har jevnt adskilte spor (41) med sirkulær form som gjør det mulig å drive hylsene (21) til
- 25 patronene (20), idet den andre akselen (37) omfatter minst to gripehjul (42) som har har jevnt adskilte spor (43) for å drive basisdelen eller den bakre delen av leddene (10), slik at når den bevegelige mekanismen (34) settes i bevegelse, fremkommer hver patron (20) ved rotasjon av den første akselen (36) synkront med leddet (10) fremkommet ved rotasjon av den andre akselen (37) og klipses
- 30 på tvers inn i leddet (10);

NO/EP3715775

- en elektrisk motor eller en manuell sveiv (33) for å dreie på den tredje akselen (38).

 Ammunisjonsfestemaskin (30) ifølge krav 1, karakterisert ved at gripehjulene (35, 42) til de respektive patronene (20) og leddene (10) er
 avtagbare og montert, i form av sporene (41, 43), til kaliberet eller størrelsen til de respektive patronene (20) og leddene (10), idet sammenstillingen lett kan tilpasses til andre kalibre eller størrelser ved at gripehjulene (35, 42) byttes ut.

3. Ammunisjonsfestemaskinen (30) ifølge krav 2, **karakterisert ved at** for å tillate passasjen fra 40 mm kaliber til 30 mm kaliber så omfatter den

10 første akselen (36) et gripehjul (35) distalt fra posisjonen ved bruk av patronstridshodet (20) og to doble gripehjul (35) proksimalt til posisjonen ved bruk av patronstridshodet (20), idet de to tvillinghjulene (35) har spor (41) tilpasset henholdsvis 30 mm kaliber og 40 mm kaliber, idet tilbakeføringen til 40 mm kaliber sikres ved å fjerne hjulet (35) som er tilveiebrakt for 30 mm

15 kaliber.

4. Ammunisjonsfestemaskinen (30) ifølge krav 3, **karakterisert ved at** de to tvillinghjulene er forbundet med minst én sylinder ved hjelp av en kulebolt (44).

 Ammunisjonsfestemaskinen (30) ifølge krav 1, karakterisert ved at den omfatter en frem- og tilbakegående mekanisme med en finger (45) som
 tjener som en stopper som blokkerer det første leddet (10) av søylen plassert i bunnen av den første sleiden (31), idet fingeren (45) låses opp og trekkes tilbake sekvensielt ved rotasjon av den bevegelige mekanismen (34), for å sikre passasje og griping av leddene (10) etter hverandre.

Ammunisjonsfestemaskinen (30) ifølge krav 1, karakterisert ved at
 den første sleiden (31) er profilert slik at leddene (10) fremkommer med
 åpningene til sine løkker (13, 14, 15) mot fronten av maskinen.





<u>FIG. 1</u>





![](_page_14_Figure_4.jpeg)

![](_page_15_Picture_2.jpeg)

FIG. 3

![](_page_15_Figure_4.jpeg)

4 / 8

![](_page_16_Figure_1.jpeg)

<u>FIG. 4</u>

EP3 715 775

![](_page_17_Figure_2.jpeg)

![](_page_18_Figure_2.jpeg)

<u>FIG. 6</u>

![](_page_19_Figure_2.jpeg)

<u>FIG. 7</u>

![](_page_20_Figure_2.jpeg)

<u>FIG. 8</u>