Dec. 4, 1945. R. S. SANFORD 2,390,331

CARTRIDGE BELT LINK

Filed Dec. 21, 1942 2 Sheets-Sheet 1

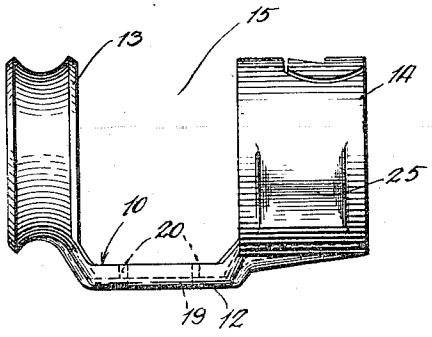


Fig. 1.

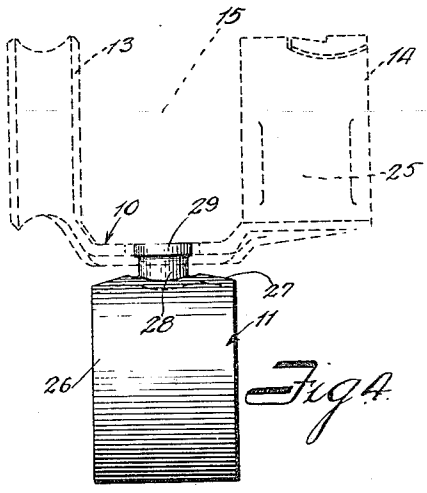


Fig 4.

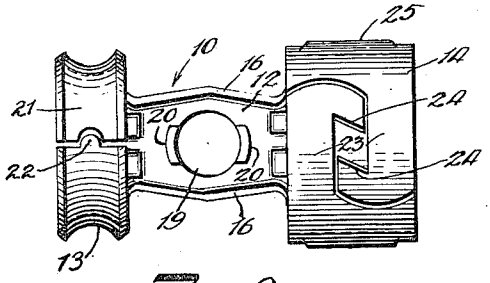


Fig. 2.

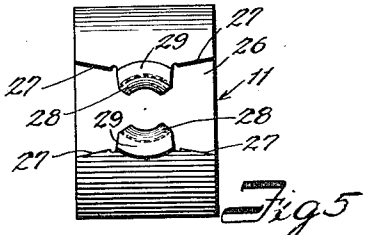


Fig 5

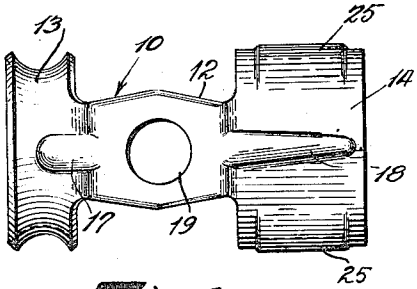


Fig. 3.

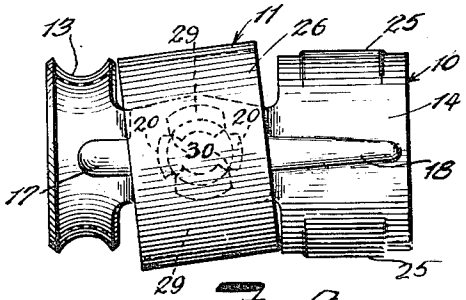


Fig 7.

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CARTRIDGE BELT LINK

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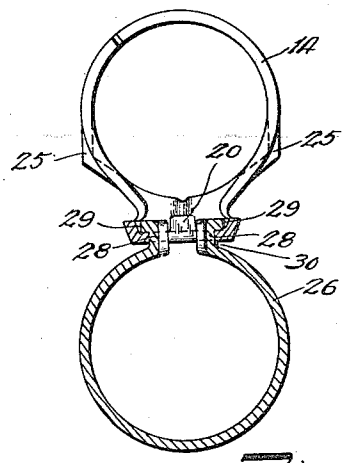


Fig. 6.

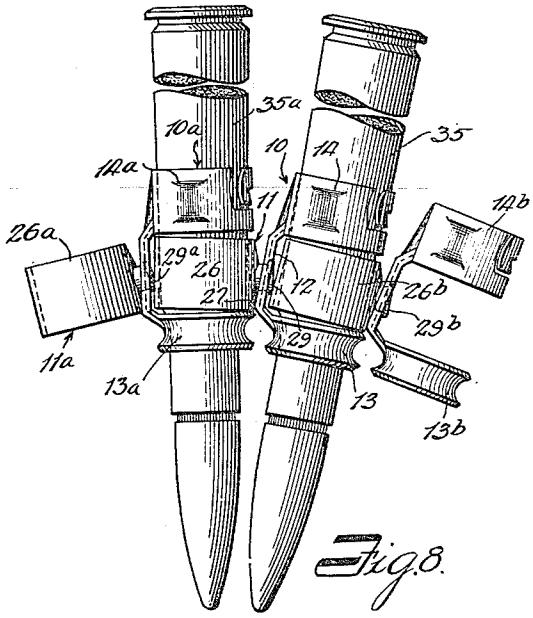


Fig. 8.

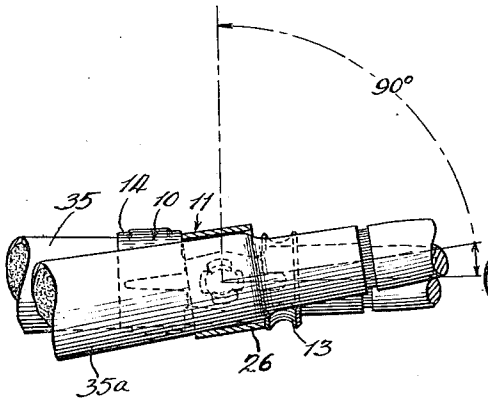


Fig. 9.

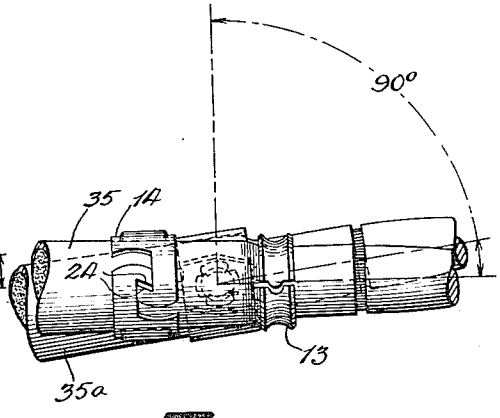


Fig. 10.

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CARTRIDGE BELT LINK

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Application December 21, 1942, Serial No. 469,679

16 Claims. (Cl. 89—35)

This invention relates to cartridge belt links, more particularly to metallic belts of the type wherein the cartridges form the hinge pins or pintles between the successive links of the belt, and the invention has for an object the provision of improved links and belts of this character.

Metal cartridge belt links of the above-indicated character have heretofore been provided for feeding ammunition to machine guns and automatic cannon of various types, and it has previously been appreciated that considerable flexibility must be provided in the belt in order to insure proper feeding of the ammunition. One accepted type of link comprises an integrally formed one-piece link having a supporting bridge portion with a pair of aligned, axially spaced cartridge-receiving loops on one side thereof, and with a single hinge loop extending from the other side at a point opposite the space between the aligned loops. In assembling the cartridge belt, the single hinge loop of one link is placed between and in alignment with the two spaced loops of the next link, and a cartridge is then inserted through the three aligned loops. To insure that the cartridges will not drop out of the belt accidentally during the feeding operation, the two aligned loops of each link are formed so that one or both of these loops tightly and frictionally engage a cartridge.

Flexibility of the belt in a plane at right angles to the axes of the cartridges is obtained by providing sufficient clearance between the single hinge loop and the cartridge to permit curvature of the belt in this plane with a minimum of friction. Curvature of the belt in this plane of course permits the belt to be looped around feed and guide rolls as it passes from the ammunition box to the gun. The installation of machine guns and automatic cannon on military airplanes, such as fighter planes or bombers, particularly in view of the large increase in fire power provided on modern airplanes of this type, has made it increasingly necessary that the ammunition belt be capable not only of bending around feed and guide rollers in the above described plane, but also be capable of flexing in various other planes or directions. For example, the space limitations in military airplanes require that the ammunition boxes be located in comparatively accessible places, which may be remote from the guns or cannon because of the necessity of leaving clear for the gunner the space adjacent the gun. Not only is it necessary to feed the ammunition from these remote places to the guns along paths which lead around other parts or equipment in the airplane and along paths which do not obstruct other usable spaces in the airplane, but it is necessary that the ammunition belt be sufficiently flexible in a variety of directions to permit the complicated and substantially universal movements through which the gun may be manipulated during firing. The ammunition belt thus must be capable of twisting, flexing and curving in various directions under various feeding and firing conditions.

Previous attempts to obtain the necessary flexibility in metallic cartridge belts of this character have consisted mainly in the expedient of narrowing or altering the shape of the single hinge loop on each link to provide increased clearance between this single loop and the adjacent edges of the spaced loops, and in the further expedient of increasing the diameter of the single hinge loop to provide more clearance between this loop and the cartridge. Such attempts, however, obviously have resulted merely in a sloppy joint with all its attendant evils.

It will of course be understood that the feed mechanisms of modern machine guns and automatic cannon are, in substantially all cases, of such a character that the cartridge belt is advanced during the feeding operation in short rapid steps, so that each of the cartridges in turn will be moved to a desired loading position. Obviously such an intermittent movement, consisting of short, sharp jerks, imparts to the belt heavy loads which tend to stretch the belt and vary the spacing or pitch distance between successive cartridges. Any excessive variation in the pitch distance between cartridges is fatal to the proper operation of the machine gun or automatic cannon, and in airplanes where servicing under battle conditions is difficult, if not impossible, it is imperative that the belt not only be capable of the necessary flexing, but that it also be capable of withstanding both the strains and stresses imposed by the feeding mechanism and the additional strains which may be imposed on the belt by high-speed maneuvering of the airplane.

As a result of experience and difficulties encountered in operating machine guns and automatic cannon on modern military airplanes, certain standards for metallic cartridge belts have been set up which require that the belt be capable of twisting without strain through a 90° angle in a maximum distance or maximum number of rounds (12", or 13 rounds for 50 caliber belts), that the belt be capble of bending without strain in a plane through the axes of the adja-

cent cartridges into a curve having a fixed maximum diameter (9", taken through the tips of the noses of the bullets with the noses of the bullets toward the center for 50 caliber belts), and that the belt be capable of bending substantially without friction in a plane transverse to the axes of the cartridges, as for example about a feed or guide roller.

Of course, the previously provided cartridge links of the type having the hereinbefore referred to "sloppy joint" can be constructed so as to meet these requirements merely by providing sufficiently large clearances between the loops and the cartridges, but the provision of such clearances will, on the other hand, render the belt incapable of satisfying other and equally important standards.

For example, as previously indicated, the links must not permit any excessive change in the pitch distance between consecutive rounds, the links must not permit any locking or cramping action between the single loop of one link and the spaced loops of the next link, and the links must maintain the cartridges in substantial alignment during the feeding operation. Obviously the provision of a fixed pitch distance requires a degree of rigidity in the cartridge belt which is antithetical to the large clearances necessary in the "sloppy joint" type of links to provide the required flexibility. The "sloppy joint" construction also has a tendency to cause locking or clamping due to the single loop of one link crawling over and becoming wedged on one of the spaced loops of the next link when the belt is flexed in certain directions.

It will thus be apparent that something is yet to be desired in a cartridge belt link which will meet the standards necessary to insure proper operation of machine guns or automatic cannon on modern military aircraft, and accordingly it is a further object of the present invention to provide an improved cartridge link and belt having not only the necessary flexibility characteristics, but also the equally necessary rigidity and strength characteristics, and to provide a cartridge link or belt in which sloppy joints are completely eliminated.

In carrying out the invention in one form, a two-piece link is provided and the two pieces thereof are mechanically connected together by a universal joint connection. One of the two pieces from which the link is formed consists of a bridge portion having spaced loops extending from one side thereof, and the other piece constitutes a single hinge loop. The mechanical joint means for connecting the two pieces for relative universal movement is so arranged that the single loop will be mounted on the opposite side of the bridge from the two spaced loops and opposite the space between these two loops.

More particularly, the bridge portion is provided with a centrally disposed aperture and the single loop is in the form of a split resilient loop having finger means extending from the spaced apart opposed ends thereof. Assembly of the two pieces is accomplished by compressing the resilient loop, inserting the fingers thereof through the aperture in the bridge, and releasing the compression. The resilient character of the split loop causes the fingers to engage the edges of the aperture to form a snugly fitting joint, the aperture and the fingers being shaped to permit the swiveling of the single loop relative to the bridge through any desired angle, thereby permitting tilting or twisting of the cartridges to form a helix.

The fingers which extend through the aperture in the bridge are provided with outwardly extending lugs on the ends thereof for engaging the opposite side of the bridge to lock the two parts of the link against lateral separation. The spacing of the lugs from the end of the single loop is greater than the thickness of the bridge, and the limited clearance thus provided permits axial tilting of the single loop relative to the spaced loops so that the belt may be curved with the noses of the bullets pointing either inwardly or outwardly. Increased tilting in this direction is provided by tapering the ends of the single loop outwardly from the fingers.

The diameter of the single loop is slightly greater than the diameter of that portion of the cartridge which it is intended to surround, so that the hinge movement of the adjacent links about the cartridges may be accomplished with a negligible friction. In order to hold the cartridges firmly in the belt after insertion into the links, the two spaced loops are in the form of split rings having normal diameters respectively smaller than those portions of the cartridge which these loops are intended to engage. Insertion of the cartridge into the links of course causes expansion of the spaced split loops, and one of these loops is provided with interengaging fingers having hook-shaped portions for positively limiting the extent to which the loop may be expanded.

For a more complete understanding of the invention, reference should now be had to the drawings in which:

Figs. 1, 2, and 3 are respectively side, top, and bottom views of one of the two parts employed in cartridge belt links embodying the present invention;

Figs. 4 and 5 are respectively side elevational and top plan views of the other of the two parts employed in cartridge belt links embodying the present invention, the first part being shown in broken lines in Fig. 4 in order to illustrate the manner in which the two parts are assembled;

Fig. 6 is an elevational sectional view of an assembled link taken substantially through the center of the single loop and looking toward the larger of the two loops on the spaced loop part;

Fig. 7 is a top view of an assembled link showing the single loop in swiveled relation, so that the axes of the two parts are horizontally tilted with respect to each other;

Fig. 8 is a partial view of an assembled cartridge belt link showing two cartridges and the associated links with the cartridges tilted so that the noses thereof define a circle of the prescribed radius;

Fig. 9 is a fragmentary view of an assembled cartridge belt illustrating the manner in which the belt may be twisted by swiveling the two parts of the link so that the cartridges form a helix, the single loop surrounding one cartridge being shown in section and the spaced loops of the next link being omitted more clearly to illustrate the relation of the cartridge to the single loop under these conditions; and

Fig. 10 is a similar view looking from the opposite direction, with the single loop which would surround the front cartridge omitted to illustrate more clearly the relation of the parts of the link under these twisted conditions.

Referring now to the drawings, the invention is shown as embodied in a two-piece cartridge

belt link comprising a first part 10 (Figs. 1 to 3, inclusive) and a second part 11 (Figs. 4 and 5). The part 10 comprises a bridge portion 12 having a pair of aligned spaced apart loops 13 and 14 extending from one side thereof at its opposite ends. The bridge portion 12, as shown best in Fig. 1, is substantially U-shaped in longitudinal cross section so that the central portion thereof is offset from the sides of the loops 13 and 14, thereby providing a center space 15 into which a cooperating loop of a similar link may be inserted into aligned relation with the loops 13 and 14 without interference by the bridge portion. Likewise, the bridge portion 12 is substantially U-shaped in transverse cross section, and includes upwardly extending flanges 16 extending from end to end thereof. In order further to increase the strength of the part 10, suitable embossments 17 and 18 (Fig. 3) may be provided extending outwardly from the ends of the bridge portion 12 across the lower sides of the loops 13 and 14. Intermediate its ends the bridge portion 12 is provided with a substantially circular aperture 19, and adjacent two opposite edges of the aperture the bridge portion 12 is provided with upstanding lugs or stops 20 the purpose of which will be more fully described hereinafter.

The loop 13, which is intended to receive the reduced diameter portion of the usual cartridge is smaller in diameter than the loop 14 and is likewise smaller in diameter than the portion of the cartridge to be inserted therethrough. Consequently, the loop 13 is in the form of a split ring and the opposed ends thereof are respectively provided with a notch 21 and a cooperating tongue 22 which serve to maintain the two halves of the ring in proper alignment during manufacture and prior to assembly of the links with the cartridges to form a cartridge belt. Although the loop 13 may take any desired form, it is preferably curved in cross section, as shown, to facilitate insertion of the cartridge therethrough.

The larger loop 14, which is also of a smaller diameter than the portion of the cartridge which it is intended to receive, is split, as shown best in Fig. 2, and the opposed ends of the two arcuate portions forming the loop are provided with suitably formed overlapping hook-shaped end portions 23 having inwardly extending fingers 24 which are adapted to engage and positively limit expansion of the split loop, as will be more fully pointed out hereinafter. Although the end edges of the end portions 23 may be shaped as desired to engage similarly shaped shoulders, as shown, they are preferably curved to eliminate any possibility that portions of other links may become engaged therein during tumbling or other finishing operations. Adjacent each side thereof the loop 14 is provided on its outer surfaces with projecting portions 25 (Fig. 6) which provide suitable flat surfaces for engaging the feed pawls of the feeding mechanism with which the machine gun or cannon is provided.

The part 11, as shown, consists merely of a split resilient ring 26 having spaced apart opposed ends which are in the form of tapered shoulders 27, the tapered shoulders terminating in centrally disposed fingers 28 adapted to be inserted as shown best in Figs. 4 and 6, through the aperture 19 in the bridge portion 12. As shown in Fig. 6, each of the fingers 28 terminates in an outwardly extending lug 29 adapted to engage the opposite side of the bridge 12 when the fingers are inserted through the aperture 19, the lugs 29 being spaced from the ends of the loop 26 a distance greater than the thickness of the bridge 12 so that a slight clearance 30 is provided.

Each of the parts 10 and 11 may of course be separately formed, and assembly of the links may be accomplished simply by compressing the loop 26 sufficiently to permit the lugs 29 to be inserted through the aperture 19 in the bridge 12, with the lugs 29 extending at right angles to the stop lugs 20 on the bridge. When the compression on the loop 26 is released, the resilient character of the loop 26 will cause the ends thereof to spread and the two parts will be locked together, as shown in Fig. 6, so as to prevent lateral separation thereof. When thus locked together, however, relative rotation or swivel movement of the links is permitted and the stops 20 are provided so as to limit this swivel movement to any predetermined angularity. If desired, the stops 20 can of course be omitted entirely so as to permit a 360° rotation between the two parts of the link. In Fig. 7 an assembled link is shown with the parts 10 and 11 in swiveled relation, and it will be apparent that the lugs 29 on the singie loop 26 are in engagement with the lugs 20 on the bridge 12 at the points indicated by the reference numeral 30.

In Figs. 8, 9, and 10, a plurality of cartridges are shown in assembled relation with a plurality of links to form a portion of an ammunition belt. Although only two cartridges 35 and 35*a* are shown, it will of course be understood that any desired number of additional cartridges and links are assembled in the same manner to form a continuous belt containing the desired number of rounds. As shown best in Figs. 8 and 10, the loop 14 of each link is expanded by insertion of the cartridges thereinto and therefore firmly and frictionally grips the cartridges, the loop 13 engaging the shoulder of the cartridge to properly limit the insertion into the link. Preferably, with the cartridges inserted to the desired position, there will be a slight clearance remaining between the locking portions 24 on the loops 14. Forces tending to stretch the ammunition belt will tend to further expand the loops 13 and 14 with the result that the slight clearance between the locking surfaces 24 will be taken up and engagement of these surfaces will positively lock the loop against further expansion. Thus excessive stretching of the belt will be prevented, the clearance between these surfaces normally being on the order of .005".

In Fig. 8 the belt is shown curved so that the noses of the cartridges describe an arc having approximately a 9" diameter. It will be observed that the single loop 26, which surrounds the cartridge 35*a*, is only slightly larger in diameter than the portion of the cartridge which extends therethrough and is only slightly narrower than the space between the loops 13*a* and 14*a*. Consequently, only a very limited movement of the loop 26 relative to the cartridge 35*a* is permitted, and a sloppy joint is avoided. The tilting movement necessary to permit curvature of the belt in this fashion is principally provided by the connection between the single loop 26 and the bridge 12 of the part 10. Thus the clearance 30 provided between the bridge and the ends of the loop 26, in conjunction with the sloping shoulders 27 on the ends of the loop 26, permits the parts 10 to tilt, which of course provides for tilting of the associated cartridges and curvature of the belt. In the position of maxi-

mum tilting shown in Fig. 8, one side of the lugs 29 will engage one side of the bridge, and one set of shoulders 27 on the loop 26 will engage the other side of the bridge. It will of course be apparent that the belt may be curved in the opposite direction so that the noses of the bullets point outwardly from the center of curvature rather than toward the center of curvature, as shown in Fig. 8. With this reversed curvature the maximum tilting will be limited by engagement of the ends of the adjacent cartridges.

In Fig. 9 the cartridges 35 and 35*a* are shown in swiveled or twisted relation to each other, so that the belt assumes the form of a helix. In Fig. 9 the cartridge 35*a* is shown on top and the single loop 26 which encircles it is shown in section, the spaced loops 13*a* and 14*a* being omitted in order more clearly to show the relation of the parts 10 and 11 in this twisted position. Again, due to the small clearance provided between the single loop 26 and the cartridge 35*a*, only a small portion of the swivel movement is obtained by relative movement of the cartridge in the loop, the major portion of the swivel movement being provided by the mechanical connection between the parts 10 and 11. Although the lugs 29 on the fingers 28 of the loop 26 and the cooperating stops 20 on the bridge portion 12 are arranged in the embodiment shown to limit the swivel movement to a relatively small angle, such that a total twist of approximately 90° may be obtained in a belt length of approximately 12", or 13 rounds, it will of course be appreciated that by changing or eliminating the stops 20 any desired angularity may be obtained. In Fig. 10 the belt is shown twisted in the same direction but with the cartridge 35 on top, the single loop 26*b* being omitted in order more clearly to illustrate the relationship of the parts.

It will now be apparent that cartridge links embodying the present invention are capable of permitting curvature or flexure of the ammunition belt formed therefrom in a variety of planes and directions, while at the same time maintaining the desired rigidity as to the pitch distances which is sacrificed in belts made up of one-piece links providing large clearances. Links embodying the present invention may be economically manufactured, the two parts being separately blanked and heat treated before assembly, and the assembly operation being simply and easily performed.

While I have shown particular embodiments of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A cartridge belt link comprising a pair of cartridge-engaging parts, one of said parts having an aperture therein, and spaced apart finger means on the other of said parts extending through said aperture frictionally engaging the edges of said aperture under pressure to form a swiveling connection therebetween.

2. A cartridge belt link comprising a pair of cartridge-engaging parts, one of said parts having an aperture therein, and spaced apart finger means on the other of said parts extending through said aperture frictionally engaging opposed edges of said aperature to form a universal joint connection therebetween, said finger means having outwardly extending lugs overlapping the edges of said aperture to prevent separation of said parts.

3. A cartridge belt link comprising a first part having cartridge-engaging axially spaced loops connected by an integral bridge portion, a second part comprising a single cartridge-engaging loop, said bridge portion having an intermediately disposed aperture therein, and spaced apart finger means extending from one side of said single loop and through said aperture, said finger means cooperating with the edges of said aperture to position said single loop on said bridge portion opposite the space between said axially spaced loops and to permit limited swiveling of said single loop on said bridge portion.

4. A cartridge belt link comprising a first part having cartridge-engaging axially spaced loops connected by an integral bridge portion, a second part comprising a single cartridge-engaging loop, said bridge portion and said single loop having cooperating connecting means including an aperture and extending spaced apart finger means received by said aperture in interlocking relation, said interlocking relation permitting limited tilting of said single loop on said bridge portion.

5. A cartridge belt link comprising a first part having cartridge-engaging axially spaced loops connected by an integral bridge portion, a second part comprising a single cartridge-engaging loop, said bridge portion and said single loop having cooperating means for securing said single loop on said bridge portion opposite the space between said spaced loops, said means including an aperture formed in one part, and spaced apart finger means on the other part extending through said aperture in interlocking relation with the edges of said aperture.

6. A cartridge belt link comprising a first cartridge-engaging part having axially spaced loops integrally connected by a bridge portion, said bridge portion having an aperture therein, a second part comprising a resilient split loop, finger portions extending from the opposed ends of said split loop for insertion through said aperture, and outwardly extending lugs on the ends of said finger portions for engaging the side of said bridge portion opposite from said single loop to secure said loop on said bridge portion.

7. A cartridge belt link comprising a first cartridge-engaging part having axially spaced loops integrally connected by a bridge portion, said bridge portion having an aperture therein, a second part comprising a resilient split loop, finger portions extending from the opposed ends of said split loop for insertion through said aperture, and outwardly extending lugs on the ends of said finger portions for engaging the side of said bridge portion opposite from said single loop to secure said loop on said bridge portion for swiveling movement with respect thereto, and stops on said bridge portion for engaging said lugs to limit said swiveling movement.

8. A cartridge belt link comprising a first cartridge-engaging part having axially spaced loops integrally connected by a bridge portion, said bridge portion having an aperture therein, a second part comprising a resilient split loop having the opposed ends thereof in spaced relation, fingers extending from said spaced ends through said aperture engaging opposed edges thereof, said fingers and apertures being shaped to permit swiveling of said split loop on said bridge, and outwardly extending lugs on said fingers

spaced from said split loop a distance greater than the thickness of said bridge portion to lock said split loop on said bridge and permit tilting of said split loop.

9. A cartridge belt link comprising a first cartridge-engaging part having axially spaced loops integrally connected by a bridge portion, said bridge portion having an aperture therein, a second part comprising a resilient split loop, finger portions of less width than said split loop extending from the opposed ends thereof and through said aperture, outwardly extending lugs on said fingers spaced from said ends of said split loop a distance greater than the thickness of said bridge portion to lock said split loop on said bridge in swiveling relation, said ends of said split loop being tapered on opposite sides of said finger portions, said spacing of said lugs and said tapered ends permitting limited tilting of said split loop relative to said bridge portion.

10. A cartridge belt link comprising a first cartridge-engaging part having axially spaced loops integrally connected by a bridge portion, said bridge portion having an aperture therein, a second part comprising a resilient split loop, finger portions extending from the opposed ends of said split loop, said finger portions being of arcuate form and in opposed relation, said fingers extending through said aperture and engaging the edges thereof to mount said split loop on said bridge portion for swivel movement thereon, said aperture and said arcuate fingers being formed with substantially equal radii.

11. A cartridge belt link comprising a first part including axially spaced cartridge-engaging loops and a bridge portion extending between said loops at one side thereof, said bridge portion being substantially U-shaped in cross-section and having a substantially centrally located aperture, a second part comprising a single cartridge engaging loop, and spaced apart finger means on said second part extending through said aperture for mounting said single loop on said bridge portion.

12. A cartridge belt link comprising a first part including axially spaced cartridge-engaging loops and a bridge portion extending between said loops at one side thereof, said bridge portion being substantially U-shaped in cross-section and having a substantially centrally located aperture, a second part comprising a split resilient loop, finger means extending from the opposed ends of said loop and through said aperture, and lugs extending from the ends of said finger means nesting between the sides of said U-shaped bridge for interlocking said bridge with said loop, said lugs being of less width than said bridge to permit swivelling of said split loop.

13. In a cartridge belt link, the combination of a supporting bridge, a pair of arcuate portions extending from said bridge to form a loop of smaller diameter than the cartridge to be received, said arcuate portions having interfitting ends permitting expansion of said loop upon insertion of a cartridge thereinto, and oppositely extending fingers on said ends normally in spaced apart relation engageable to limit said expansion of said loop.

14. In a cartridge belt link, the combination of a supporting bridge, a pair of arcuate portions extending from said bridge to form a loop of smaller diameter than the cartridge to be received, said arcuate portions having interfitting hook-shaped end portions movable in opposite directions upon expansion of said loop, said hook-shaped portions being engageable to prevent excessive expansion of said loop.

15. In a cartridge belt link, a loop comprising a pair of arcuate portions forming a loop of smaller diameter than the cartridge to be received therein, said arcuate portions having interfitting ends permitting expansion of said loop upon insertion of a cartridge thereinto, and oppositely inwardly extending fingers on said ends normally in spaced apart relation engageable to limit said expansion of said loop.

16. In a cartridge belt link, a loop comprising a pair of arcuate portions forming a loop of smaller diameter than the cartridge to be received therein, said arcuate portions having interfitting end portions terminating in curved edges and normally lying closely adjacent a similarly curved shoulder on the opposite arcuate portion, said interfitting end portions permitting expansion of said loop upon the insertion of a cartridge thereinto, and opposed inwardly extending fingers on said end portions normally in spaced apart relation and engageable to limit said expansion of said loop.

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