

[54] **DEVICE FOR MAKING A THRICE
PARALLEL FOLDED SHEET IN WHICH
THE OPEN BENT COVERS ARE DIRECTED
TOWARDS THE MIDDLE**

[75] Inventor: **Hermann F. Kistner,**
Neckarweihingen, Germany

[73] Assignee: **Maschinenbau Oppenweiler Binder
& Co., Oppenweiler, Germany**

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[63] Continuation-in-part of Ser. No. 97,559, Dec. 4, 1970, abandoned.

[30] Foreign Application Priority Data

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270/83

[51] Int. Cl. B65h 45/12

[58] Field of Search..... 270/67, 79, 80-85

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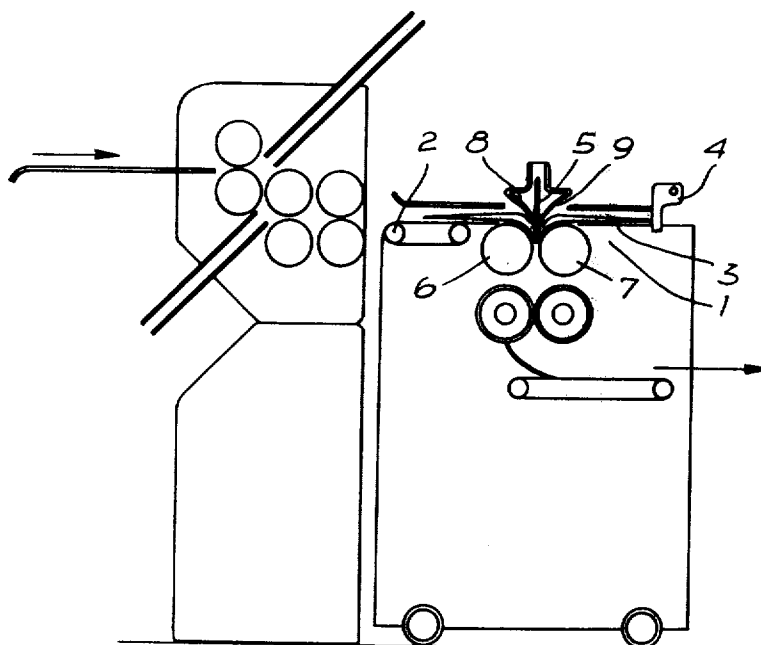
Primary Examiner—Robert W. Michell

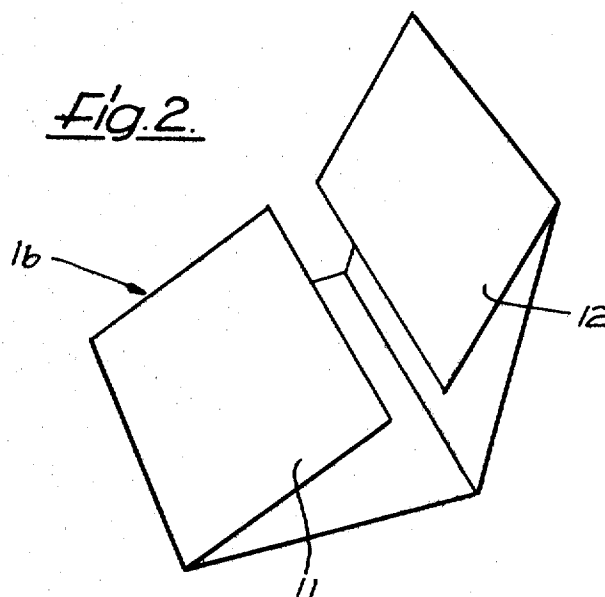
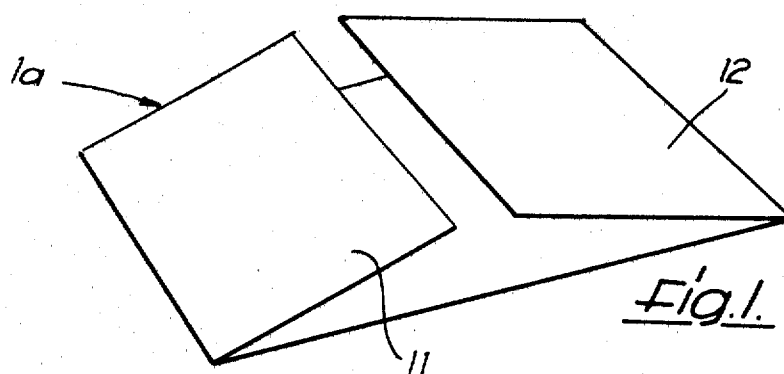
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[57] ABSTRACT

A device for folding a sheet in a thrice folded parallel fold, in which the open folding flaps are directed towards the middle of the sheet. Both of the first two folds be formed with the aid of an upsetting folding mechanism. A folding sword is provided, for making the third fold, with guiding means such as tongues, which are operatively connected directly or indirectly with the sword for joint movement and are arranged on both sides of the folding sword. During the third fold formation these guiding means are caused to move with the sword, thereby introducing the open fold flaps in a forced manner into the fold slit formed, for example, by the bight of opposed folding rollers.

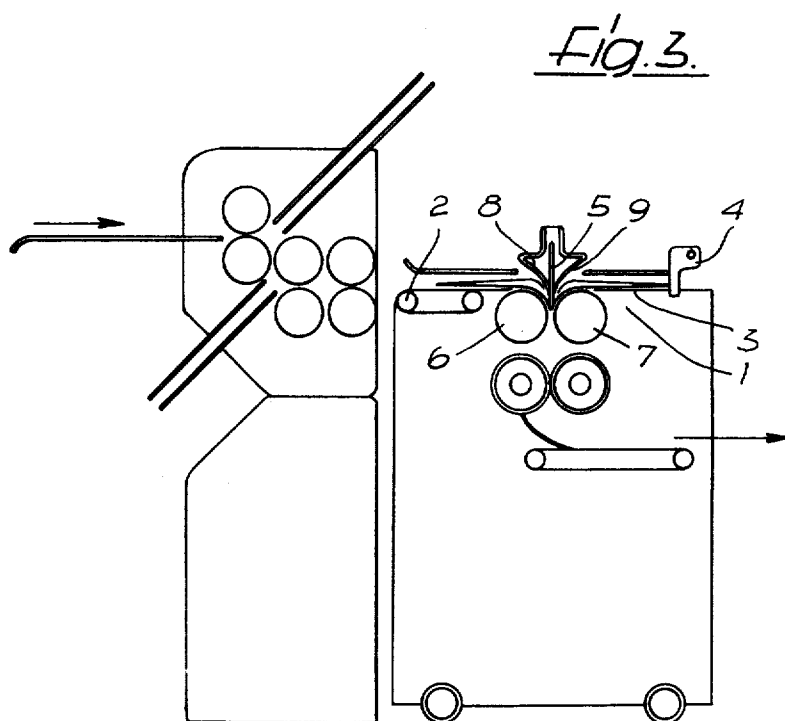
4 Claims, 7 Drawing Figures





Inventor:

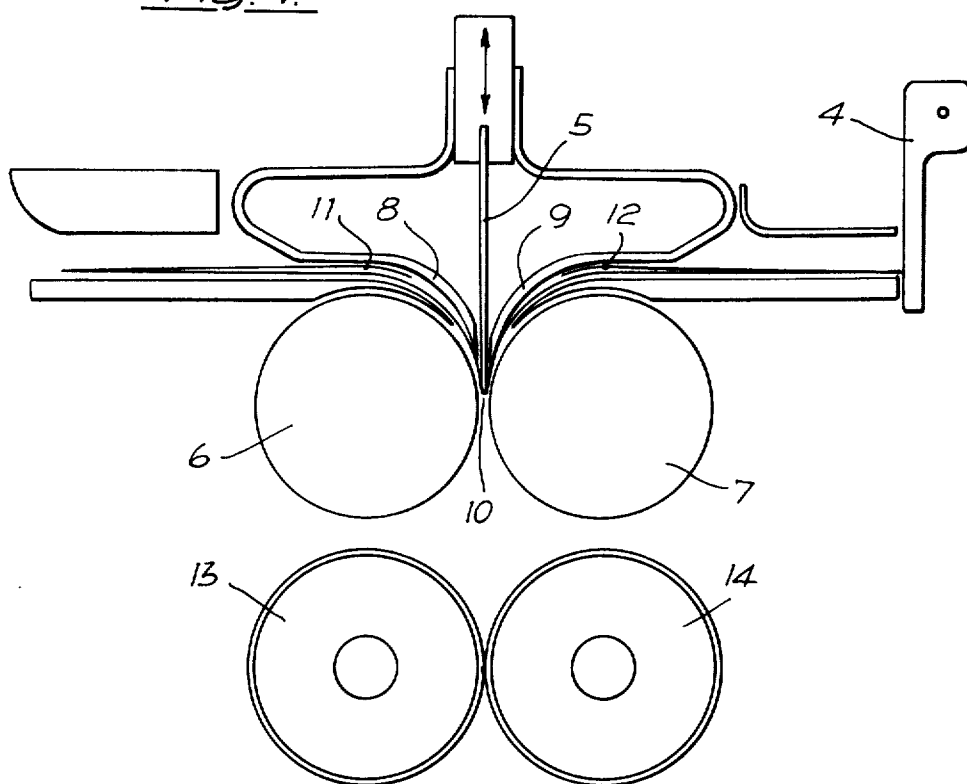
Hermann F. KISTNER
by: Arthur O. Klein



Inventor:

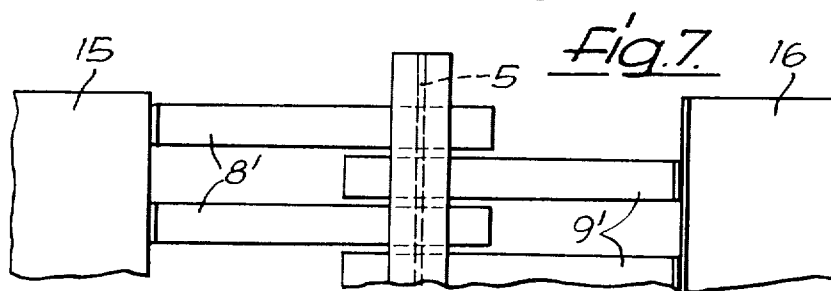
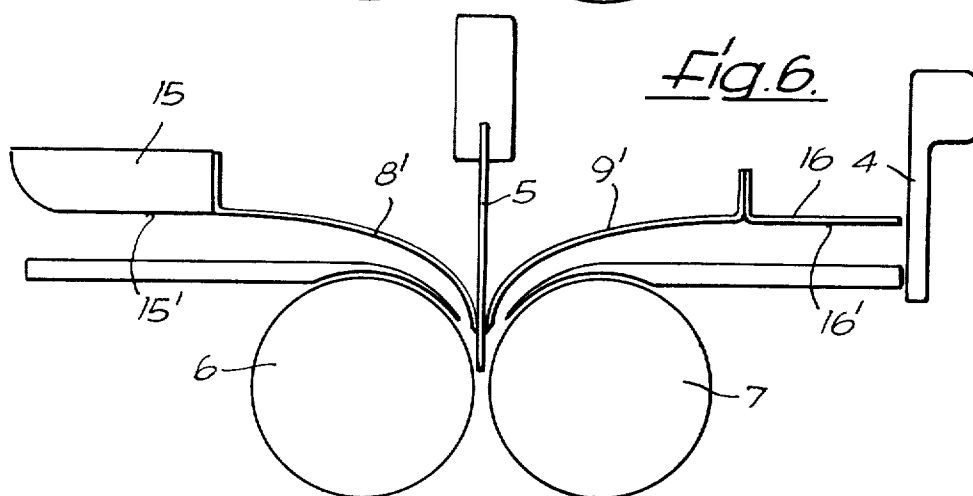
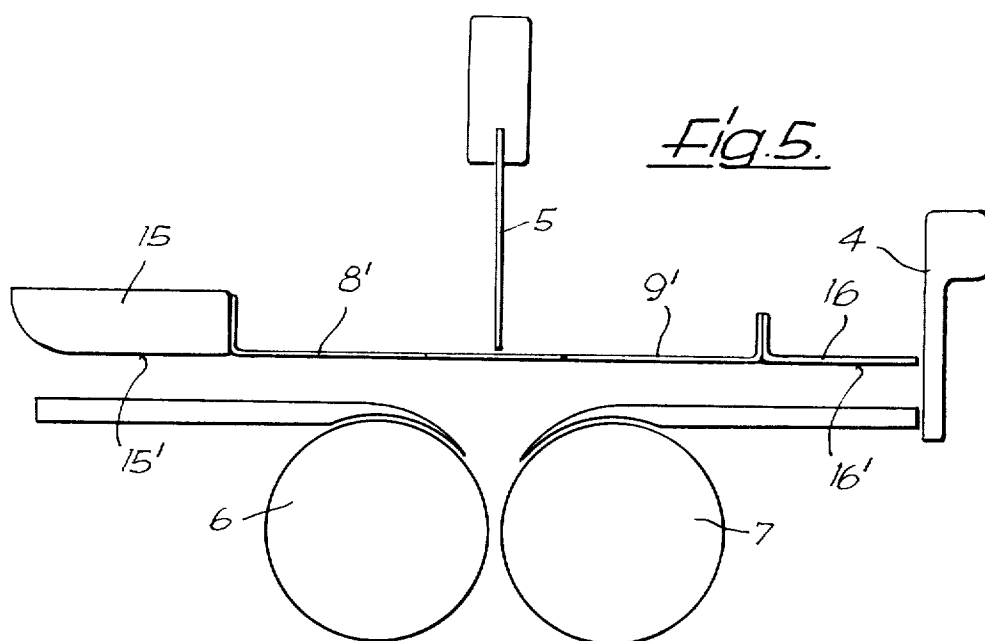
Hermann F. KISTNER

Fig. 4.



Inventor:

Hermann F. KISTNER



DEVICE FOR MAKING A THRICE PARALLEL FOLDED SHEET IN WHICH THE OPEN BENT COVERS ARE DIRECTED TOWARDS THE MIDDLE

CROSS-REFERENCE TO RELATED APPLICATION

This is a continuation-in-part application of my co-pending application Ser. No. 97,559, filed Dec. 4, 1970, now abandoned.

The invention relates to a device combined with upsetting folding machines for the manufacture of the so-called window or gate fold. This type of fold, at which the open bent edges are directed towards the middle, cannot be produced by the known upsetting folding machines because at the last parallel fold the subsequent following fold is opened again.

In order to remove this drawback, there are provided additional controlling members at fold pockets, by means of which the last fold pocket, shortly before the upsetting process, is closed in such a way, that it fulfills the function of a guide or translator.

According to the German utility model 1,955,933, this translating means for the fold pocket is released by means of a light barrier which converts the fold pocket, via an electromagnet and a mechanical arrangement in a short time into a translator.

With the high operating velocities of modern upsetting folding machines, such an arrangement can no longer work at such speeds without fault, because there is available only a very minute time period for the switching process. It has therefore been shown in practice that with the known arrangements there can be carried out only those types of window or gate folds at which the inwardly directed fold edge is spaced a predetermined distance from the middle; only with this type of operation is there enough time available to carry out the translation or deflection.

The instant invention has among its objects the removal of this drawback by providing a folding arrangement which is independent from the spacing through the middle of the open fold edge. The folding arrangement of the invention consists of a specially constructed sword folding arrangement for the last third parallel fold. The sheet is folded twice parallelly in the usual upsetting folding machine and is then at the output of this machine conducted to a sword folding arrangement. When the sheet has reached this special sword folding arrangement in accordance with the invention, the sword movement is released. At the same time, special left and right guiding tongues adjacent to the sword sheet are activated to move jointly with the sword. By this method there are introduced into the fold rollers simultaneously with the introduction of the sword fold both of the open edges which are directed towards the middle of the sheet. Such open edges are forcibly guided together into the fold rollers, so that it is of no importance how far the open sheet flaps are spaced from the middle of the sheet. Since the movement of these guide tongues is directly or indirectly related to the sword movement, there remains sufficient time for this process, so that no limitation on the operation is necessary. In the lowermost position of the fold sword, and also at the instant at which the take-up of the sheet nose is effected by means of the fold rollers, there are situated also adjacent to the sword the arranged guiding tongues in their lowermost position, so that the open edges of the sheet are also introduced

into the fold rollers with little play. Therefore the so-called "after fold," or "double fold," will not occur; if this were present, it would ordinarily force the fold rollers to be adjusted with considerable play so that the product after folding can not be cut to exact dimensions. Cutting after folding is particularly preferred today with advertising material, because it permits the simultaneous processing of several folded sheets or "applications." Under "applications" one understands the members or strips which result by dividing a printed sheet into a plurality of pieces.

The present arrangement therefore affords a plurality of advantages when compared to the arrangements of the prior art. The arrangement is illustrated in the accompanying drawing in conjunction with two embodiments thereof.

FIGS. 1 and 2 illustrate schematically in perspective a folded sheet in the first and second phase, respectively in the production of a gate fold;

FIG. 3 is a schematic side illustration of an upsetting folding device in combination with a sword folding device in accordance with the invention;

FIG. 4 is an enlarged sectional view of a portion of the device of FIG. 3 with a downwardly moving folding sword;

FIG. 5 is an enlarged sectional view of a portion of a modified version of a folding sword device forming a second embodiment of the invention wherein the folding sword is in the upper position;

FIG. 6 is an enlarged sectional view of the second embodiment wherein the folding sword is in its lower position; and

FIG. 7 is a partial plan view of FIG. 5.

FIGS. 1 and 2 illustrate a folded sheet in two phases of the production of a gate fold. Phase 1a, illustrated in FIG. 1, of the two-fold parallel fold, is manufactured by the usual known upset folding machine, whereas phase 1b, shown in FIG. 2, is effected in the succeeding arranged sword fold device according to the invention. In FIG. 2 the outer fold is shown in a halfopen condition.

FIG. 3 illustrates schematically the entire arrangement incorporating a first embodiment of the invention; an upsetting folding device of a known type with a connected and accompanying sword folding arrangement 1 in accordance with the invention is illustrated. After the phase 1a, FIG. 1, the pre-folded sheet with the open folded flaps 11 and 12 runs over the rollers or hands 2 of a conveyor onto a sword folding table 3 and, after it has reached the folding stops 4, is engaged by a sword 5 which moves downwardly between the fold rollers 6 and 7. Simultaneously with the lowering movement of the fold sword 5, there also move downwardly adjacent to the sword 5 the guiding tongues 8 and 9; tongues 8 and 9 form in the lowermost position a forced guiding means for the open sheet flaps 11 and 12 between the fold rollers 6 and 7. It will be seen that the flaps 11 and 12 lie upwardly of the main body of the sheet and directly engage the tongues 8 and 9.

This arrangement is illustrated in an enlarged scale in FIG. 4. At the instant in which the fold sword 5 has reached its lowermost position, the fold nose 10 is taken up by the rotating driven fold rollers 6 and 7. Here the open flaps 11 and 12 are already formed so precisely that they are forcibly following the folding process. The fold rollers do not require any loose adjustment; this makes it possible to arrange after or below the fold rollers so-called driven knife shafts 13

and 14, which divide the folded product into the plurality of utilities.

In the embodiment shown in FIG. 4, the guiding tongues 8 and 9 are directly mounted upon the folding sword. These tongues may, however, be separately mounted and guided as is shown in FIGS. 5 to 7.

These tongues thus function as first sheet engaging means while the curved portions of the table surface functions as second sheet engaging means.

With all of the embodiments, in which the guiding tongues 8 and 9 are used, the latter may be made of elastic material or may be provided at their underside with a soft slipping layer, which presses the sheet flaps with the sheet without any intermediate space into the fold rollers and press the blank in the folding space.

This soft layer can be made in the form of a short-haired, natural or synthetic fiber material on a backing, the hairs of which are inclined in the direction of movement, and which exert a small pressure onto the sheet portion and create very little friction.

In a still further non-illustrated embodiment, the guiding tongues 8 and 9 are formed as hollow bodies, which have at their underside a number of bores through which there may be blown air-under-pressure against the open sheet flaps, so that these move in contact with the remaining portions of the sheet during the following process.

In the illustrated embodiment of FIGS. 1 - 7, the prefolded sheet with the open folded flaps 11 and 12 runs over the rollers or bands 2 onto the folding table 3 as shown in FIG. 3. The folding table 3 comprises the downwardly curved portions 3a and 3b as in the embodiment of FIG. 4. Similarly, support members 15 and 16 are arranged above the folding table 3 as in the embodiment of FIG. 4. When the folding sword 5 is, in its inoperative position its lowermost edge surface 5a is situated slightly above the horizontal plan defined by the undersides 15' and 16' of the support members 15 and 16. In this embodiment the tongues 8' and 9' are not mounted on the folding sword but are mounted independently on the support members 15 and 16. The tongues 8' and 9' are made of springy flexible preferably metallic material in the form of a plurality of rectangular strips the ends of which remote from the folding sword 5' are bent upwardly at an angle of 90° and are secured to the respective vertical sides of the support members 15 and 16 as per welding or glueing. As can be noted from FIG. 7 the rectangular strips 8', 9' are evenly spaced in the plane normal to FIGS. 5 and 6 which coincides with the undersides 15' and 16' of the support members 15 and 16. As can also be noted from FIG. 7 the free ends of the rectangular strips 8', 9' overlap each other in the region immediately underneath the folding sword 5' by about 1 centimeter. As can be noted from FIG. 6 the free ends of the tongues 8', 9' are bent downwardly by the bottom edge of the folding sword 5' as it is lowered so that the free end edges of the tongues 8', 9' slidably abut against the vertical sides of the folding sword 5' and form jointly with the downwardly curved portions 3a, 3b guide passages for the open folded flaps 11 and 12. The afore-described arrangement of tongues 8', 9' can be easily mounted in any existing upsetting folding device.

Although the invention is illustrated and described with reference to a plurality of preferred embodiments thereof, it is to be expressly understood that it is in no way limited to the disclosure of such a plurality of pre-

ferred embodiments, but is capable of numerous modifications within the scope of the appended claims.

What is claimed is:

1. In a device for folding a twice prefolded sheet having two open inwardly directed sheet flaps on one side of said sheet and two folded end edges, said two end edges being formed by two folds connecting said flaps to said sheet, the improvement comprising means for making a gate fold in said sheet as a third fold parallel to and midway between said end edges on said one side of said sheet so that said sheet flaps abut against each other:

a folding table having a table plate forming an upper table surface, said table plate having a slot which divides said table surface into a front part and a back part, said twice prefolded sheet being adapted to be movingly fed onto said upper table surface; a folding stop arranged on said back part of said table surface for engaging one of said end edges of said prefolded sheet, the distance between said table slot and said folding stop corresponding substantially to the distance between said gate fold and one of said end edges;

a pair of parallel fold rollers being rotatably mounted underneath said table surface and forming a folding gap therebetween which extends underneath and parallel to said slot;

a folding sword operatively mounted in said device above said table slot and being disposed above and parallel to said slot, said folding sword being movable between a first position which is located above said table surface and a second position in which said folding sword extends through said table slot and into said folding gap and thereby introduces such twice prefolded sheet therein;

first upper sheet engaging guiding means arranged at both sides of said folding sword above said table surface and cooperable with said folding sword to define concavely curved upper guiding surfaces when said folding sword is at least in the second position;

said first upper guiding means are made of elastic material;

second lower sheet engaging guiding means integral with said table surface at opposite side of said table slot and cooperable with said first upper guiding means to define convexly curved lower guiding surfaces, said convexly curved lower guiding surfaces respectively cooperating with said concavely curved upper guiding surfaces of said first upper guiding means to form a curved guiding slot leading from said table surface into said folding gap to hold said sheet flaps near such sheet when such sheet is introduced into said folding gap and to introduce said sheet flaps into said folding gap.

2. An arrangement according to claim 1, wherein said first upper guiding means form guiding tongues which are formed as longitudinal bendable opposite rows of elastically bendable strips which are mounted at opposite sides of said slot and having free ends, the free ends of said strips overlapping each other in the region immediately underneath said folding sword in said first position.

3. An arrangement according to claim 2, in which said guiding tongues extend in a plane parallel to and spaced from said upper table surface.

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4. An arrangement according to claim 1, further comprising second upper guiding means associated with and disposed adjacent said first upper guiding means, said second upper guiding means including second upper guiding surfaces which respectively form continuations of said concavely curved upper guiding surfaces of said first upper guiding means when said folding sword is in the second position, and wherein the

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continuations formed by said first and second upper guiding means define guiding tongues which are formed as longitudinally bendable, opposite rows of elastic strips which are mounted at opposite sides of said slot and having free ends, the free ends of said strips overlapping each other.

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