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## (54) Flat-bed knitting machine with means for facilitating the formation and casting off of stitches

Flachstrickmaschine mit Vorrichtung zur Erleichterung der Maschenbildung und des Maschenabschlages

Métier à tricoter rectiliqne avec des moyens pour faciliter la formation et l'abattage de mailles

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(73) Proprietor: **PROTTI S.p.A. FABBRICA MACCHINE PER MAGLIERIA**
**20010 Cornaredo (Milano) (IT)**

(72) Inventor: **Tansini, Sergio**
**I-20010 Bareggio (Prov. of Milan) (IT)**

(74) Representative: **Modiano, Guido, Dr.-Ing. et al**
**Modiano & Associati SpA**
**Via Meravigli, 16**
**20123 Milano (IT)**

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## Description

The present invention relates to a straight-bar knitting machine with means for facilitating the formation and casting-off of stitches.

A prior patent application in the name of the same Applicant (Italian application no. MI93A 000622, dated March 30, 1993), assumed included herein as reference, discloses a straight-bar knitting machine provided with means for facilitating the formation and casting-off of stitches; said means are substantially constituted by a plurality of secondary sinkers provided in an additional needle holder and slideable in a plurality of slots formed correspondingly with respect to the knitting needles.

The secondary sinkers are provided with a heel located in an upward region; actuation means, provided on the carriage of the straight-bar knitting machine, engage said heel.

With this embodiment, the secondary sinkers act constantly on the knitting and cannot be deactivated or activated in a different position; this fact can sometimes hinder the formation of the knitting.

Another problem that can be encountered with the above described solution resides in the fact that the secondary sinkers are in practice retained in the corresponding slots by friction, and therefore undue vibrations that might occur during the operation of the machine may cause a displacement of said secondary sinkers.

From GB 2.272.003 it is known a circular knitting machine having cast-off sinkers provided with butts controlled by a pair of cam rings: the butts can be controlled by a cam operated by a stepping motor.

From EP-0 311 564 it is known a device which changes the cut-in and cut-out positions of two groups of local parts in a system of a flat-bed knitting machine with an even number of systems. In each system, one group of lock parts selectable and actuable by the device is cut in and the other group is cut out, a group comprising at least one lock part.

From FR-1.458.804 it is known a device for driving the radial sinkers of a circular knitting machine,, having a cylinder which makes a back and forth movement to form the heel and the toe of a tubular article.

From EP-0 238 797 it is known a flat-bed knitting machine provided with two needle beds and sinkers between the needles.

A principal aim of the invention is indeed to eliminate the drawbacks described above by providing a straight-bar knitting machine with means for facilitating the formation and casting-off of the stitches, allowing to automatically facilitate the activation of the secondary sinkers, moving them into different positions or out of action, during the stroke of the carriage.

Within the scope of this aim, a particular object of the invention is to provide a straight-bar knitting machine wherein the carriage is not forced to perform a stroke that is longer than the region affected by the secondary sinkers that must be positioned.

Another object of the present invention is to provide a straight-bar knitting machine wherein the positioning of the secondary sinkers to facilitate stitch formation is stable and can be maintained once it has been assumed.

Another object of the present invention is to provide a straight-bar knitting machine capable of giving the greatest assurances of reliability and safety in use by virtue of its particular constructive features.

This aim, these objects, and others which will become apparent hereinafter are achieved by a straight-bar knitting machine with means for facilitating the formation and casting-off of stitches, according to claim 1.

Further characteristics and advantages will become apparent from the following detailed description of a preferred but not exclusive embodiment of a straight-bar knitting machine with means for facilitating the formation and casting-off of stitches, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figure 1 is a schematic transverse sectional view of the straight-bar knitting machine according to the invention;
figure 2 is a view of the means for positioning the secondary sinkers for the stroke of the carriage in one direction;
figure 3 is a view of the means for positioning the secondary sinkers for the stroke of the carriage in the opposite direction;
figure 4 is a view of the secondary sinker positioning means, arranged so as to keep the secondary sinkers in the inactive position;
figure 5 is a schematic top view of a portion of the machine;
figure 6 is a perspective view of a secondary sinker;
figure 7 is an enlarged-scale view of the arrangement of the secondary sinkers on the two needle holders of the machine;
figures 8 to 11 are sequential views of the steps of the operation of the secondary sinkers.

With reference to the above figures, the straight-bar knitting machine with means for facilitating the formation and casting-off of the stitches, according to the invention, comprises two needle holders 1 and 2, arranged so as to form an inverted V, in a per se known manner. Needles 3 for forming stitches in a conventional manner are slideable on the needle holders 1 and 2.

A first additional needle holder 4 and a second additional needle holder 5 are formed respectively proximate to the vertex of the needle holders 1 and 2 and are arranged symmetrically with respect to the plane of symmetry between the needle holders 1 and 2.

The additional needle holders 4 and 5 form a plurality of slots, designated by the reference numeral 6 for both needle holders; secondary sinkers, generally des-

ignated by the reference numeral 10, are slidingly accommodated in said slots.

The secondary sinkers 10 are slideable inside the slots 6 and are kept in position by a strip 11 that runs longitudinally with respect to the extension of the needle holders, so as to keep all the secondary sinkers in position.

The secondary sinkers 10 have a foot 12 inclined with respect to the central portion or stem 13 of the secondary sinker and ending with an engagement end 14 having the purpose of engaging the stitch being formed in order to facilitate the formation and casting-off of the stitches.

A heel 15 is formed at the opposite end and engages means, generally designated by the reference numeral 20, for positioning the secondary sinkers; as more clearly shown in figures 2 to 4, said means are advantageously constituted by cam sliders 21 that support the cams 22, which engage, during the stroke of the carriage, the heels 15 and can be positioned by virtue of the presence of a positioning pin 23 engageable in contoured slots 24 formed on a bar 25 movable by virtue of the action of motor means 27 that drive a gear 28 engageable with a rack-like portion 29 formed by one edge of the bar 25.

When the bar 25 moves, the contoured slots 24 in practice change the position of the cam sliders 21 and consequently allow to vary the position of the secondary sinkers.

By way of example, figure 2 illustrates the position of the cams for placing the secondary sinkers in the active position during the stroke of the carriage in one direction, and figure 3 illustrates the position of the cam sliders 21 for positioning the secondary sinkers during the stroke of the carriage in the other direction.

Figure 4 illustrates the position of the cam sliders 21 for keeping the sinkers in the deactivated, i.e. raised, position.

It should be noted that the motor means 27 can be activated independently on the two needle holders and can be actuated directly during the stroke of the carriage with a program that can vary in each instance.

This allows to place the secondary sinkers in the desired position according to the type of knitting to be formed, or to deactivate said secondary sinkers if their presence can hinder the knitting being formed.

Another important aspect of the invention resides in the fact that the sinkers 10 are provided with elastic means for stably positioning them.

Said elastic means are formed directly on the stem 13 of the secondary sinker and are constituted by a flexible tab 30 formed by a recess 31 in the material constituting the stem 13.

The flexible tab 30 has a loose end 32 and a concave portion 33 towards the leading region; these parts are engageable with an abutment element 35 formed in the slot.

When the end 32 engages the element 35, the secondary sinker is in the raised position and therefore is in practice deactivated, whereas when the element 35 engages the concave portion 33 the secondary sinker is in the lowered position and therefore in the preset knitting position.

From the above description it is thus evident that the invention achieves the intended aim and objects, and in particular the fact is stressed that a straight-bar knitting machine is formed that allows to automatically adjust the position of the secondary sinkers during the stroke of the carriage without having to intervene with difficult structural modifications.

Furthermore, the particular structure of the secondary sinkers, provided with the flexible tab 30, allows to obtain a stable position for said secondary sinkers.

The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

All the details may furthermore be replaced with other technically equivalent elements.

In practice, the materials employed, as well as the contingent shapes and dimensions, may be any according to the requirements.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

## Claims

1. A straight-bar knitting machine with means for facilitating the formation and casting-off of stitches, comprising two needle holders (1,2) arranged in the shape of an inverted V and on which needles (3) are slidingly mounted, and at least one additional needle holder (4,5) located on at least one of said needle holders (1,2) and forming a plurality of slots (6) wherein secondary sinkers (10) for facilitating the formation and casting-off of the stitches can be accommodated, said secondary sinkers (10) being slideable transversely with respect to said needles (3), characterized in that it comprises secondary sinker positioning means (20) supported by the carriage of the machine and actuatable by motor means (27) that can be activated independently during the stroke of said carriage.

2. A straight-bar knitting machine according to claim 1, characterized in that said secondary sinker positioning means (20) comprise cam sliders (21) supporting cams (22) that can engage the heel (15) of said secondary sinkers (10), said cam sliders (21) being provided with a pin (23) slidingly engageable with contoured slots (24) formed on a movable bar

(25).

3. A straight-bar knitting machine according to one or more of the preceding claims, characterized in that said motor means (27) act on said bar (25) so as to move it.

4. A straight-bar knitting machine according to one or more of the preceding claims, characterized in that said motor means (27) actuate a gear (28) that can mesh with a rack-like portion (29) formed on said bar (25).

5. A straight-bar knitting machine according to claim 1, characterized in that said secondary sinkers (10) have an actuation foot (12) protruding at an angle with respect to a stem (13) thereof, elastic means (30) being formed monolithically with said stem (13) and being engageable with an abutment element (35) rigidly formed in said slots (6).

6. A straight-bar knitting machine according to claim 5, characterized in that said elastic means (30) of said secondary sinkers (10) comprise an elastic tab formed by a recess (31) of said stem (13), said elastic tab (30) having one end (32) that is shaped so as to engage said abutment element (35) in order to retain said secondary sinkers (10) in deactivated position and having a concave portion (33) in a median region of said tabs (30), for positioning said secondary sinkers (10) in the active knitting position.

**Patentansprüche**

1. Flachstrickmaschine mit Vorrichtung zur Erleichterung der Maschenbildung und des Maschenabschlages, aufweisend zwei Nadelhalter (1, 2), die in Form eines umgekehrten V angeordnet sind und auf denen Nadeln (3) verschiebbar angebracht sind, und mindestens einen zusätzlichen Nadelhalter (4, 5), der sich auf mindestens einem der Nadelhalter (1, 2) befindet und eine Vielzahl von Schlitzen (6) bildet, in denen Zusatzhebehaken (10) zur Erleichterung der Maschenbildung und des Maschenabschlags aufgenommen werden können, wobei die Zusatzhebehaken (10) in bezug auf die Nadeln (3) transversal verschiebbar sind, dadurch gekennzeichnet, daß sie eine Vorrichtung (20) zum Positionieren von Zusatzhebehaken aufweist, die durch den Schlitten der Maschine getragen wird und durch eine Motorvorrichtung (27), die während des Stoßes des Schlittens unabhängig aktiviert werden kann, antreibbar ist.

2. Flachstrickmaschine nach Anspruch 1, dadurch gekennzeichnet, daß die Vorrichtung (20) zum Positionieren von Zusatzhebehaken Nockenschieber (21) aufweist, die Nocken (22) tragen, welche mit dem Endstück (15) der Zusatzhebehaken (10) in Eingriff gebracht werden können, wobei die Nokkenschieber (21) mit einem Stift (23) versehen sind, der verschiebbar mit angepaßten Schlitzen (24) in Eingriff gebracht werden kann, die auf einer beweglichen Stange (25) ausgebildet sind.

3. Flachstrickmaschine nach mindestens einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß die Motorvorrichtung (27) auf die Stange (25) wirkt, um sie zu bewegen.

4. Flachstrickmaschine nach mindestens einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß die Motorvorrichtung (27) ein Zahnrad (28) antreibt, das in einen zahnstangenähnlichen Abschnitt (29), der auf der Stange (25) ausgebildet ist, eingreifen kann.

5. Flachstrickmaschine nach Anspruch 1, dadurch gekennzeichnet, daß die Zusatzhebehaken (10) einen Antriebsfuß (12) aufweisen, der in bezug auf einen Stiel (13) derselben unter einem Winkel vorsteht, wobei eine elastische Vorrichtung (30) monolithisch mit dem Stiel (13) ausgebildet ist und mit einem Anschlagselement (35), das starr in den Schlitzen (6) ausgebildet ist, in Eingriff gebracht werden kann.

6. Flachstrickmaschine nach Anspruch 5, dadurch gekennzeichnet, daß die elastische Vorrichtung (30) der Zusatzhebehaken (10) einen elastischen Streifen aufweist, der durch eine Aussparung (31) des Stiels (13) ausgebildet ist, wobei der elastische Streifen (30) ein Ende (32), das so geformt ist, daß es mit dem Anschlagselement (35) in Eingriff steht, um die Zusatzhebehaken (10) in der deaktivierten Position zu halten, und einen konkaven Abschnitt (33) in einem mittleren Bereich der Streifen (30) zum Positionieren der Zusatzhebehaken (10) in der aktiven Strickposition aufweist.

**Revendications**

1. Machine à tricoter à barre droite avec un moyen pour faciliter la formation et l'arrêt des boucles, comprenant deux teneurs d'aiguilles (1, 2) ayant une forme de V inversé et sur lesquels des aiguilles (3) sont montées en glissement, et au moins un teneur d'aiguille supplémentaire (4, 5) situé sur au moins un desdits teneurs d'aiguilles (1, 2) et formant une pluralité de fentes (6) dans lesquelles des platines secondaires (10) pour faciliter la formation et l'arrêt des boucles peuvent être placées, lesdites platines secondaires (10) pouvant glisser transversalement par rapport auxdites aiguilles (3), carac-

térisée en ce qu'elle comprend un moyen de positionnement (20) de platines secondaires, supporté par le chariot de la machine et actionnable par un moteur (27), qui peut être activé indépendamment pendant la course dudit chariot.

**2.** Machine à tricoter à barre droite selon la revendication 1, caractérisée en ce que ledit moyen de positionnement de platines secondaires (20) comprend des coulisses (21) de cames supportant des cames (22) qui peuvent engager le talon (15) desdites platines secondaires (10), lesdites coulisses de came (21) étant équipées d'une broche (23) engagée en glissement avec des fentes profilées (24) formées sur une barre mobile (25).

**3.** Machine à tricoter à barre droite selon une ou plusieurs des revendications précédentes, caractérisée en ce que ledit moteur (27) agit sur ladite barre (25) de manière à la déplacer.

**4.** Machine à tricoter à barre droite selon une ou plusieurs des revendications précédentes, caractérisée en ce que ledit moteur (27) agit sur une roue dentée (28) qui peut s'engrener avec une partie en forme de crémaillère (29) formée sur ladite barre (25).

**5.** Machine à tricoter à barre droite selon la revendication 1, caractérisée en ce que les platines secondaires (10) ont un pied de fonctionnement (12) saillant avec un certain angle par rapport à une tige (13) de celles-ci, un moyen élastique (30) étant formé de manière monolithique avec ladite tige (13) et s'engageant avec un élément d'aboutement (35) formé rigidement dans lesdites fentes (6).

**6.** Machine à tricoter à barre droite selon la revendication 5, caractérisée en ce que ledit moyen élastique (30) desdites platines secondaires (10) comprend une patte élastique formée par un creux (31) de ladite tige (13), ladite patte élastique (30) ayant une extrémité (32) de forme telle qu'elle engage ledit élément d'aboutement (35) pour retenir lesdites platines secondaires (10) dans une position désactivée et ayant une partie concave (33) dans une région médiane desdites pattes (30), pour positionner lesdites platines secondaires (10) dans la position active de tricotage.

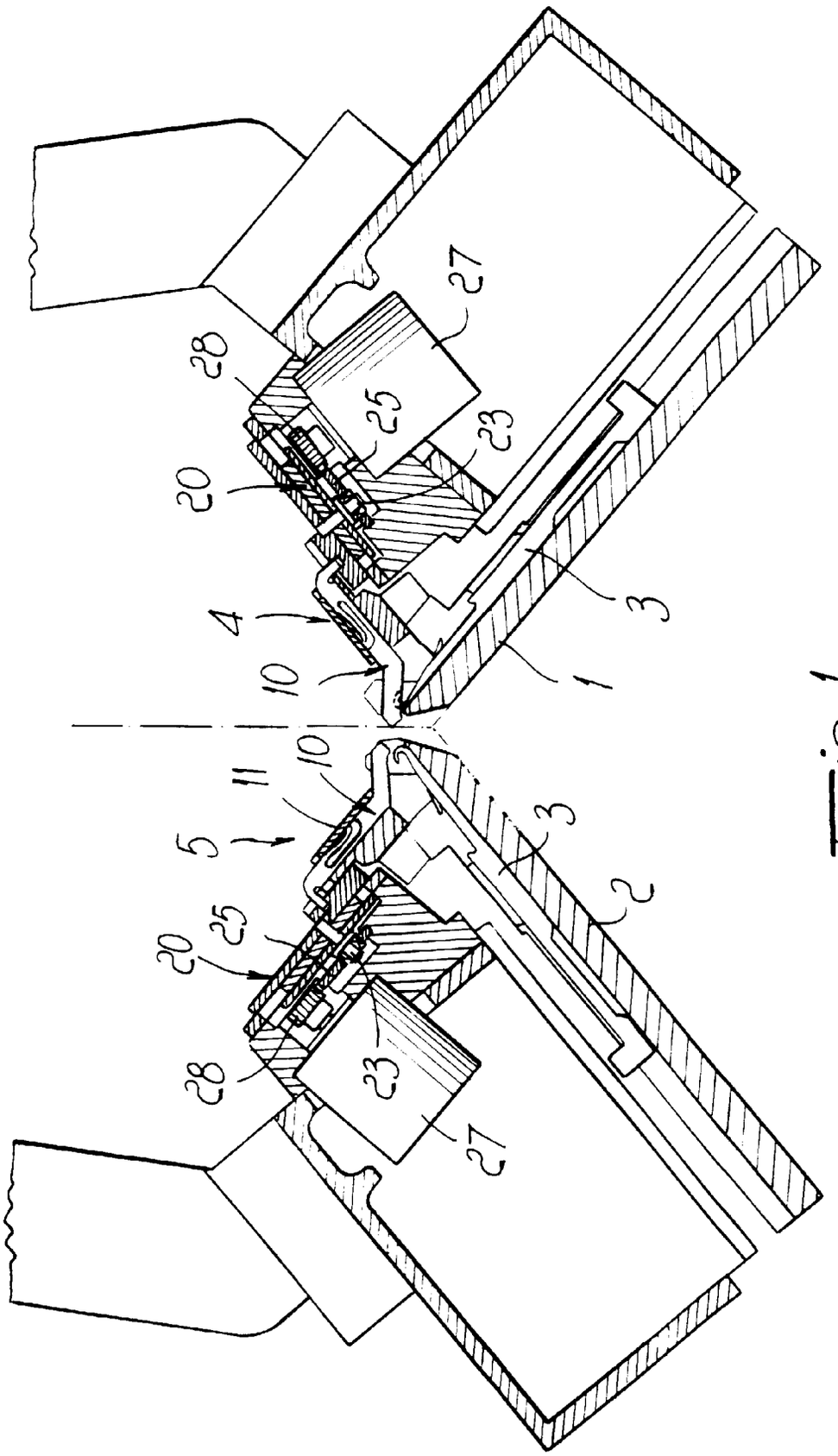


Fig. 1

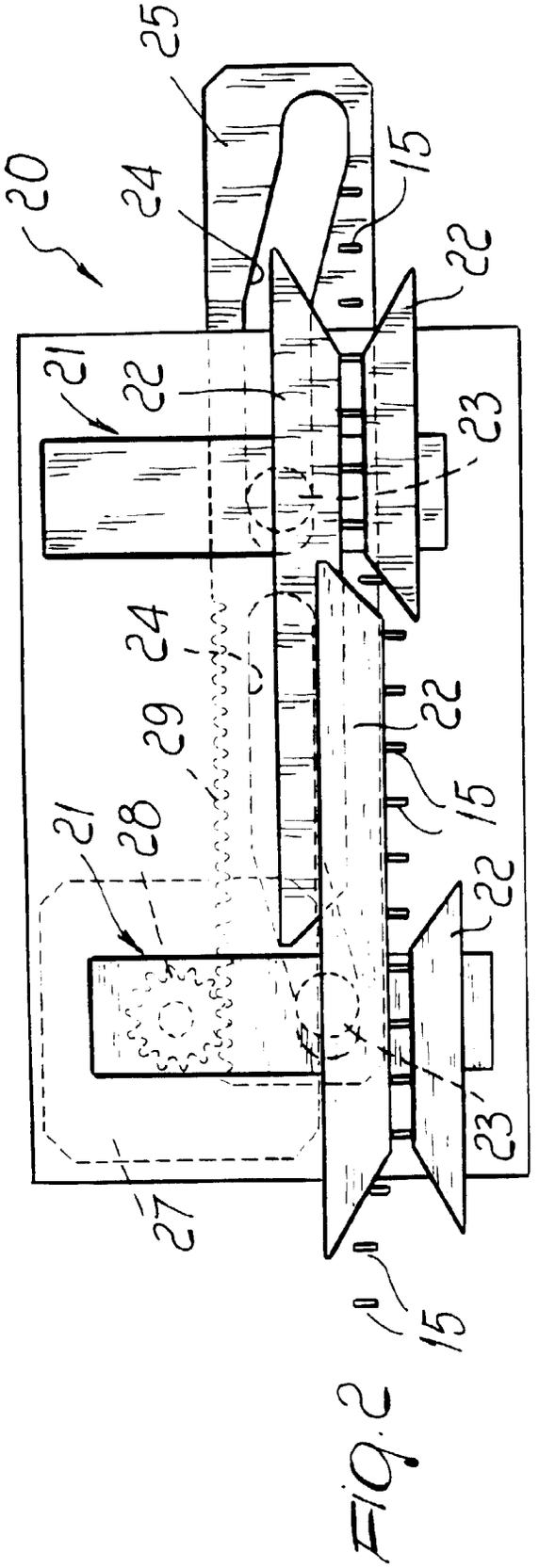


Fig. 2

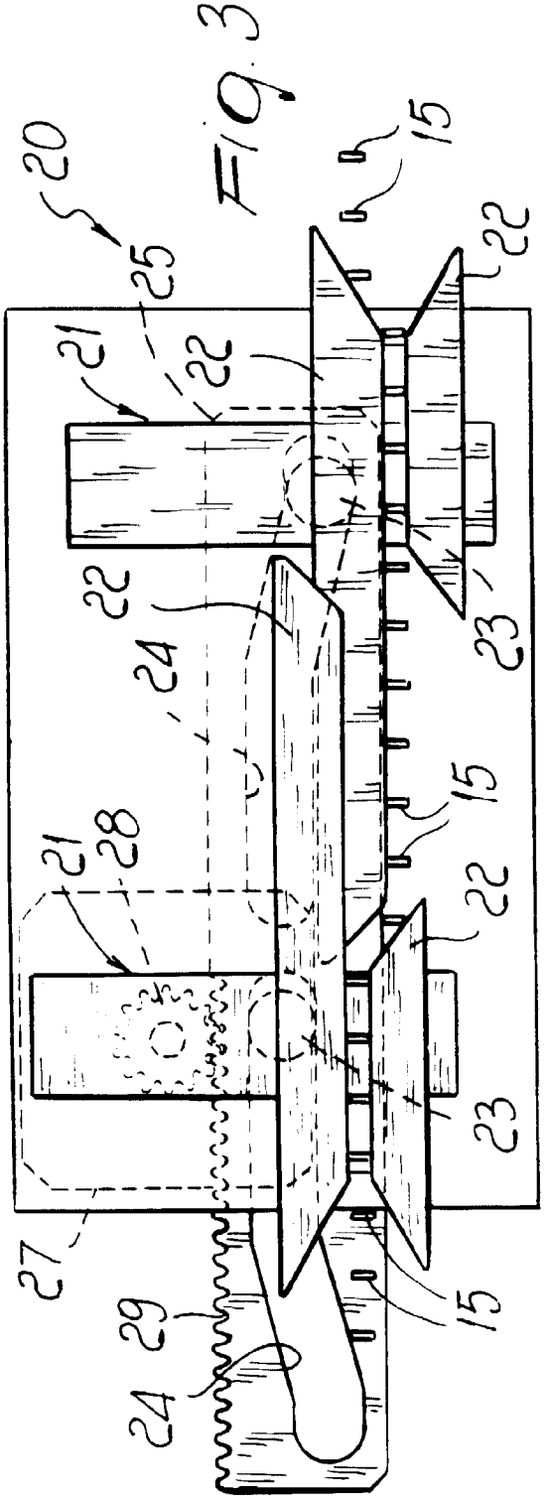


Fig. 3

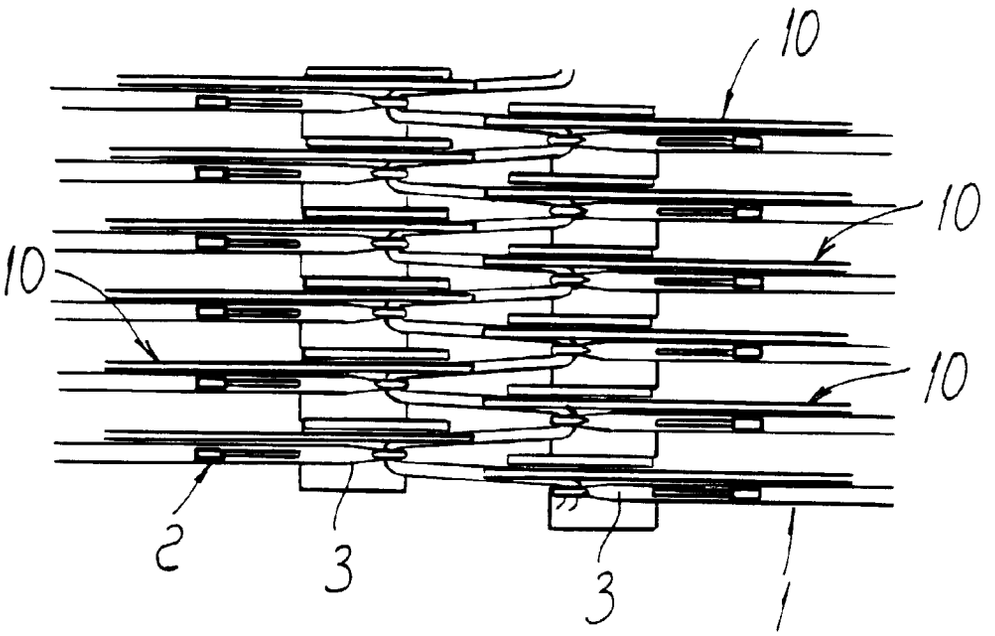


FIG. 5

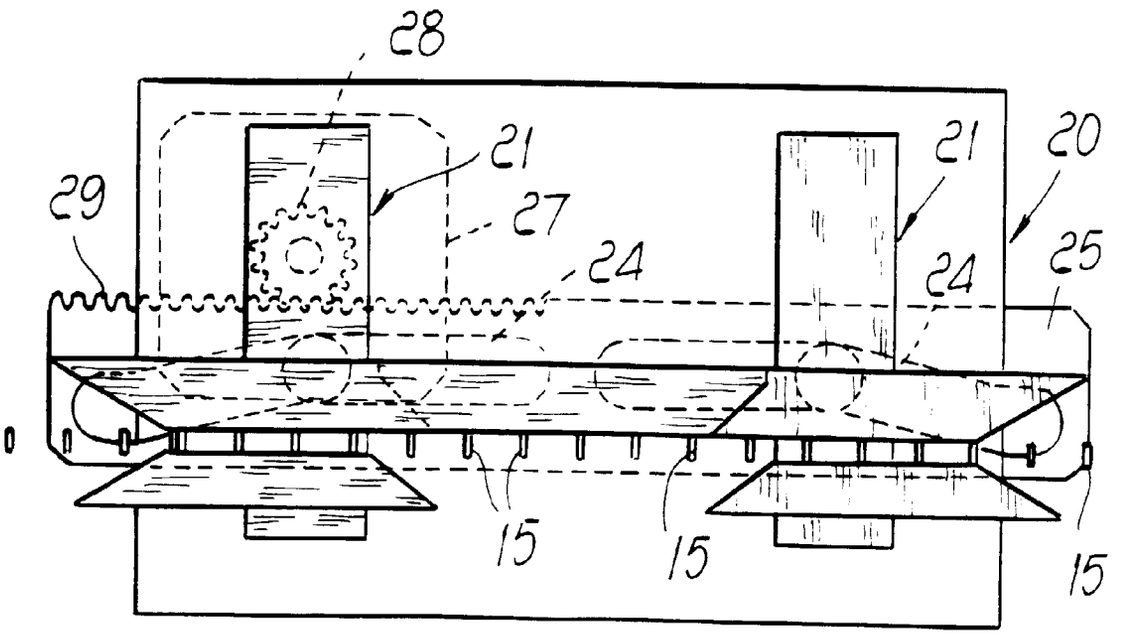


FIG. 4

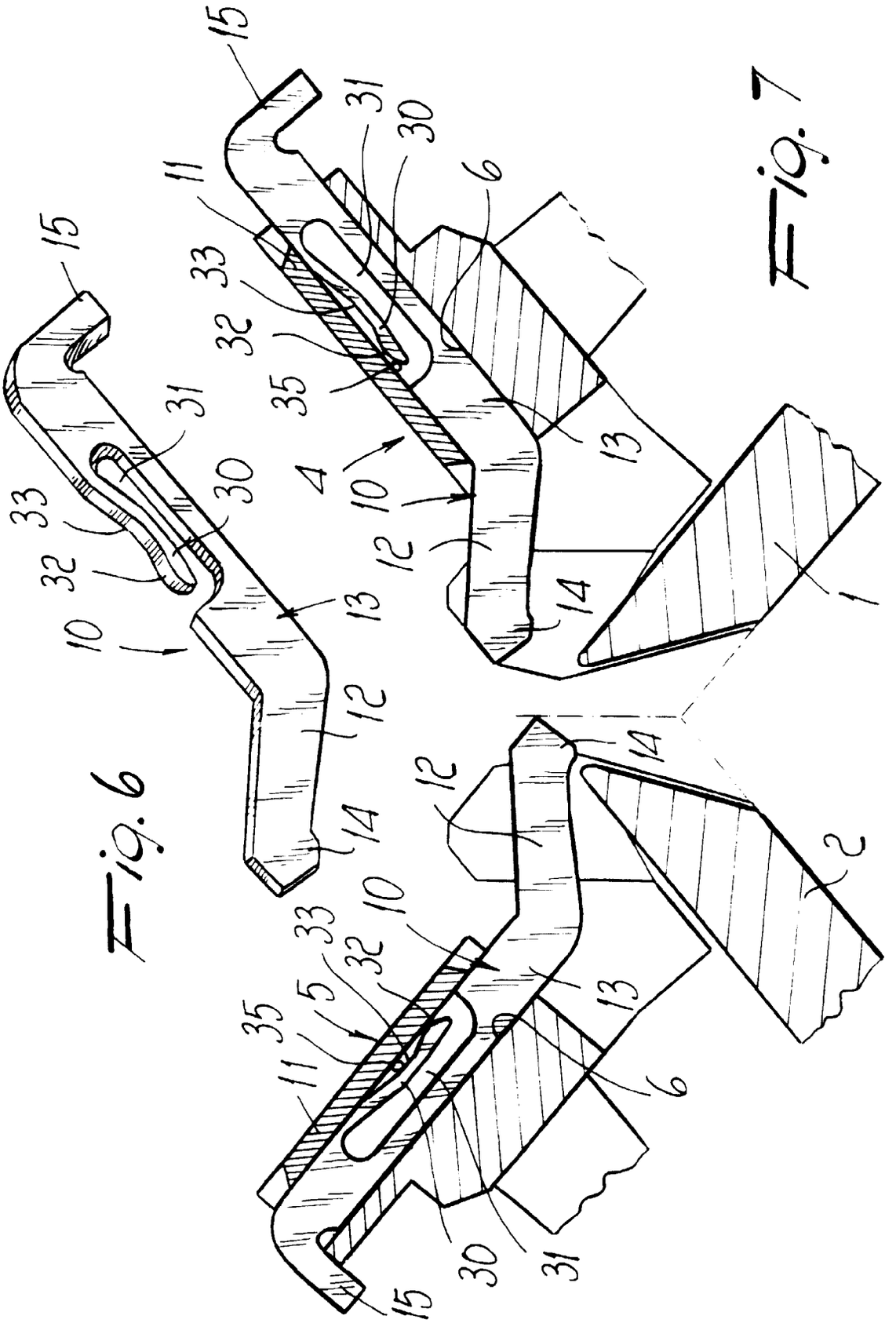


Fig. 6

Fig. 7

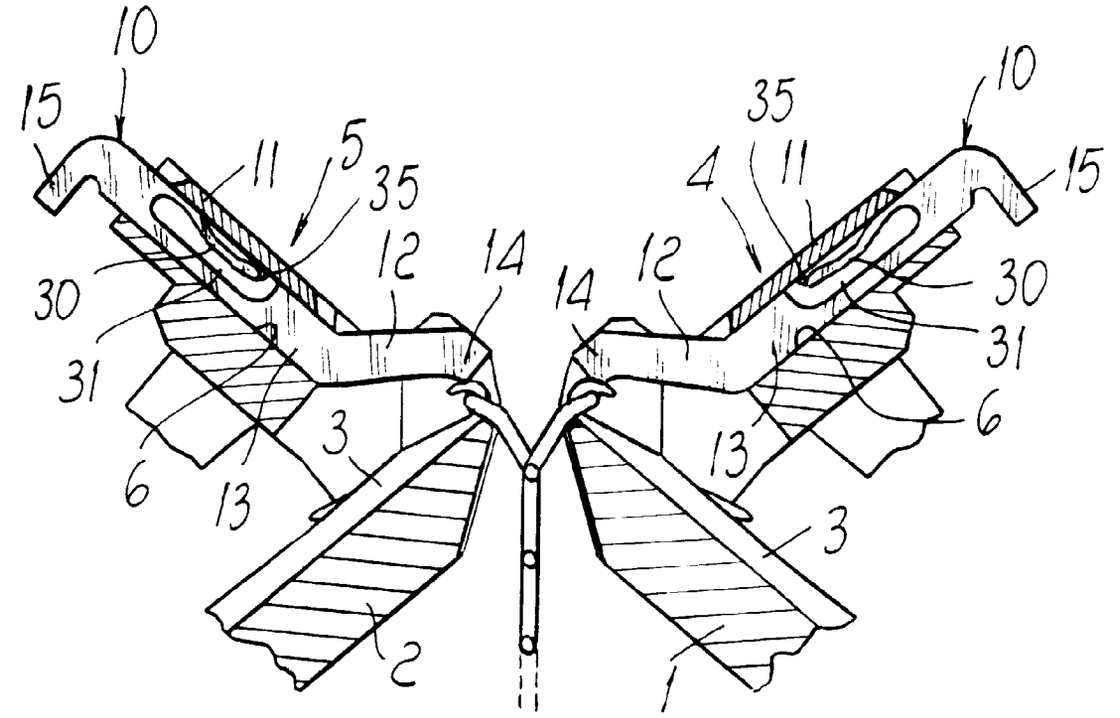
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Fig. 8

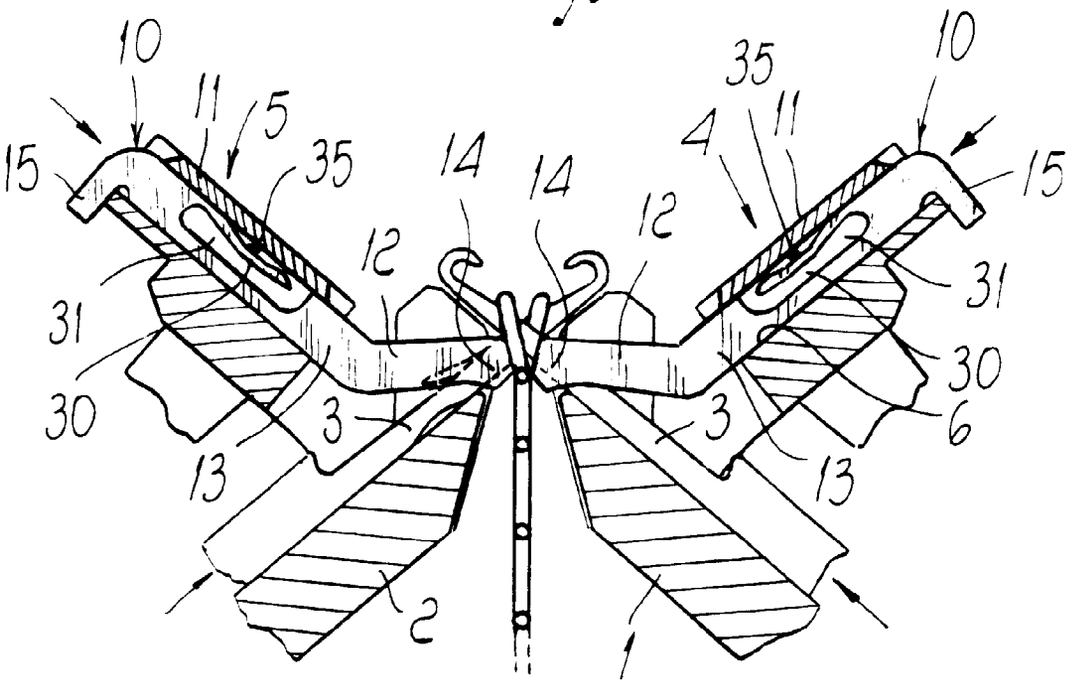
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Fig. 9

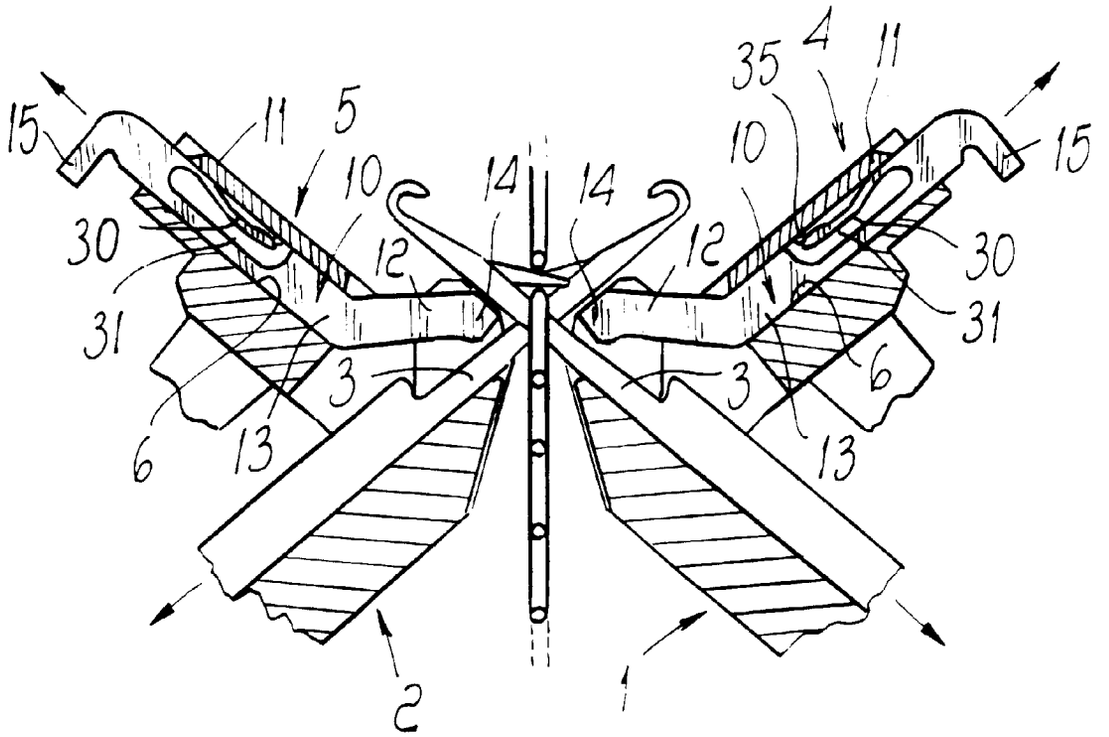
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Fig. 10

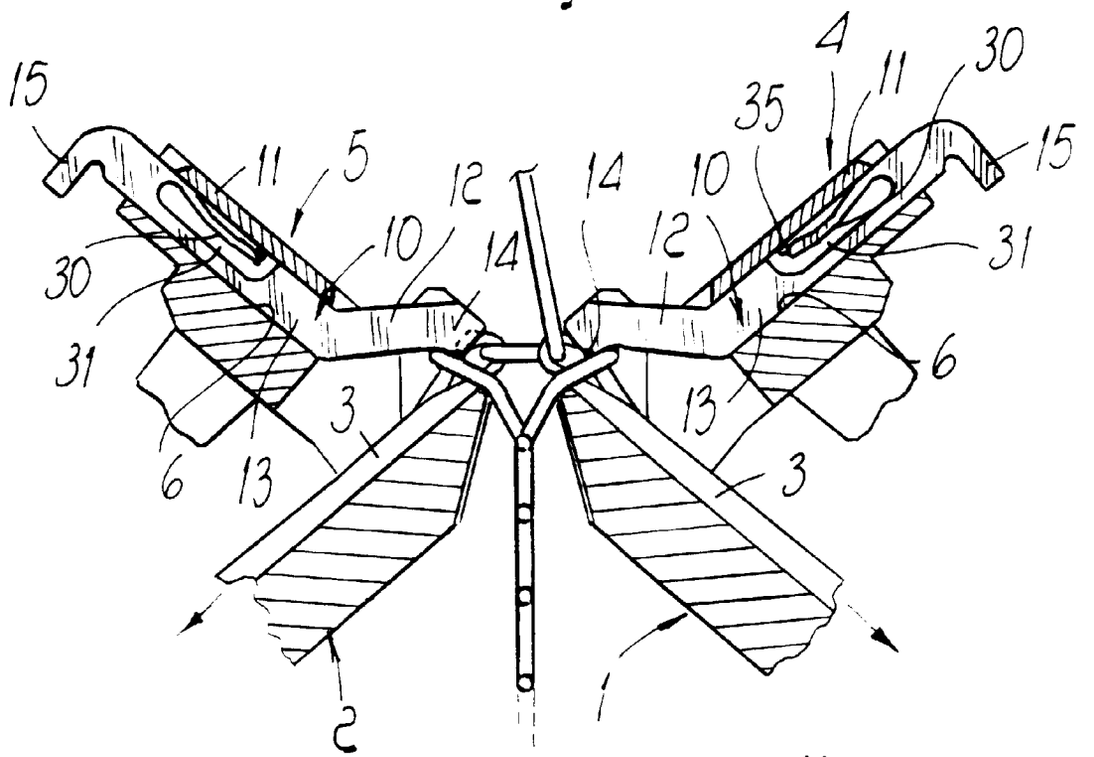
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Fig. 11