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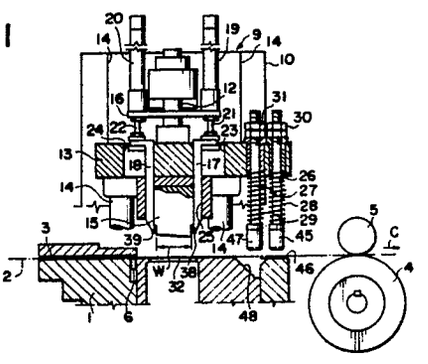
## (54) Method of forming space section devoid of coupling elements in continuous slide fastener chain.

(57) An improved method of forming space sections devoid of coupling elements disposed, with a predetermined distance, in a slide fastener chain which is composed of a pair of continuous rows of interengaged coupling elements. In the method of forming one space section in a one-cycle, the slide fastener chain is transported intermittently below an element-removing apparatus. According to the preferred embodiment, the element-removing apparatus includes a punch and downstream and upstream locating pins are provided at the both ends of the punch. These pins engage to two elements respectively, which are terminal end elements of a normal portion not to be the space section, for positioning a downstream side part and an upstream side part of a portion to be the space section respectively. The pins and the punch move vertically so as not to interfere with each other. The punch descends to cut the rows of the elements of the both parts of the portion separately. By carrying out this one-cycle repeatedly, the space sections can be formed repeatedly one by one in the slide fastener chain, with the predetermined distance, without forming a faulty element at the opposite adjacent sides of the space section.

FIG. 1




EP 0 407 846 A2

# METHOD OF FORMING SPACE SECTION DEVOID OF COUPLING ELEMENTS IN CONTINUOUS SLIDE FASTENER CHAIN

This invention relates to an improved method of forming space sections devoid of coupling elements disposed, with a predetermined distance, in a slide fastener chain which is composed of a pair of continuous rows of interengaged coupling elements.

There have been proposed a variety of methods of forming space sections devoid of coupling elements automatically and continuously, which is disposed, with a predetermined distance, in a slide fastener chain composed of a pair of continuous rows of interengaged coupling elements. Since fastener tapes are made of fabric piece, they are locally elongated or shrunk. Accordingly, in these conventional methods, cumulative errors in element pitch are produced and the slide fastener chain cannot always be brought to stop at a desired position for forming the space section precisely. If the slide fastener chain with the space section were processed under such element condition, the result would be that terminal coupling elements at either or both ends of the space section and either or both of the coupling elements adjacent to such terminal coupling elements are cut only partly away. In Fig. 18, an element B, which is adjacent to the terminal element of the space section A and which is cut only partly away, is shown. Due to such faulty elements, high quality products can not be obtained. In order to prevent such elements from being produced, methods are disclosed in USP No. 4,428, 264 and Japanese Patent Publication No. 63-44363.

In the specification of the present invention, a proceeding side as viewed from the feed direction of a slide fastener chain will be expressed as a downstream side. Then, a following side will be expressed as an upstream side.

In the apparatus related to USP No. 4,428, 264, due to an indexing means disposed at only upstream side of a punch blade, the upstream side terminal elements of a portion to be a space section of a continuous slide fastener chain can be brought to stop at a desired position. Then, the slide fastener chain is cut by the punch blade after being stretched. However, as described before, a fastener tape is locally elongated or shrunk. Then, the downstream side terminal elements of the portion can not be brought to stop at another desired portion. Accordingly, the space section cannot always be formed at a desired position. On the other hand, a pair of relief portions are formed at opposite ends of the punch blade so as to protect the coupling elements disposed adjacent to the terminal coup ing elements lying at opposite ends of the space section, from being cut by the punch blade. However, since the relief portions are not always placed precisely for the rows of the coupling elements to be protected, it is feared that the upper surface of these coupling elements are damaged by the punch blade.

In the apparatus related to Japanese patent publication No. 63-44363, due to two indexing means, the portion of a continuous slide fastener chain to be a space section can be placed below a mechanism for removing the raws of fastener elements from the fastener chain. The two indexing means are disposed at the upstream side and the downstream side of the mechanism respectively and operated simultaneously. However, as described before, a fastener tape is locally elongated or shrunk, thus, there is a possibility of changing of a length of the portion. In this case, one of the two indexing means acts on desired elements precisely while another indexing means can not act on other desired elements precisely. Therefore, it is feared that a faulty element as described before is produced in this apparatus also.

An object of the present invention is to provide a method by which, even if a fastener tape is locally elongated or shrunk, a space section devoid of coupling elements can be formed in a continuous slide fastener chain accurately and surely without forming a faulty element at the opposite adjacent sides of the space section.

According to the present invention, a method of forming repeatedly one by one space sections devoid of coupling elements in a continuous slide fastener chain having a pair of rows of interengaged coupling elements is provided. This method of forming one space section in a one-cycle comprises the following steps.

A portion to be the space section in the slide fastener chain is transported below an element-removing apparatus and the transportation of the slide fastener chain is stopped.

A downstream locating means, as viewed from the feed direction of the slide fastener chain, is engaged to a fastener element of a normal portion not to be the space section adjacent to the downstream side end of the portion to be the space section. In this case, a small tension is given to the slide fastener chain so that the pair of rows of the interengaged coupling elements at the downstream side of the portion are located below a cutting means of the element-removing apparatus. Accordingly, if the length of the portion to be the space section is changed due to being elongated or shrunk of the fastener tape, the pair of rows of the

elements at the downstream side of the portion are brought to stop precisely for being removed in a next step.

The pair of rows of the interengaged coupling elements at the downstream side of the portion are removed.

The downstream locating means and the cutting means are returned to positions at which the both means are not operated respectively.

An upstream locating means is engaged to a fastener element of a normal portion not to be the space section adjacent to the upstream side end of the portion to be the space section. In this case, a small tension is given to the slide fastener chain so that the unremoved rest of the pair of rows of the interengaged coupling elements at the upstream side of the portion is located below the cutting means of the element-removing apparatus. Accordingly, if the length of the portion to be the space section is changed due to being elongated or shrunk of the fastener tape, the unremoved rest of the pair of rows of the elements at the upstream side of the portion is brought to stop precisely for being removed in a next step.

The unremoved rest of the pair of rows of the interengaged coupling elements at the upstream side of the portion is removed.

The upstream locating means and the cutting means are returned to positions at which the both means are not operated respectively.

Then, after the one-cycle of the above mentioned steps is finished, a next one-cycle can be started by transporting the slide fastener chain again as a first step of the next one-cycle. As a result, the space sections are formed repeatedly one by one in the slide fastener chain, with the predetermined distance, accurately and surely without forming a faulty element at the opposite adjacent sides of the space section.

Further objects and advantages of the present invention will be apparent from the following description, reference being made to the accompanying drawing wherein various embodiments of the present invention are clearly shown. and are to be considered as non limitative examples of the present invention.

Fig. 1 is a schematic elevational view, partly broken away, of an apparatus as an example related to the present invention;

Figs. 2 and 3 are enlarged schematic vertical longitudinal sectional views showing a step for cutting and removing coupling heads of fastener elements by a punch;

Figs. 4, 5, 6 and 7 are schematic elevational views, partly broken away, showing operation in an important part of the apparatus in Fig. 1 according to the order of operation;

Figs. 8 and 9 are enlarged schematic elevational views showing operation of a downstream locating pin according to the order of operation;

Figs 10, 11, 12 and 13 are enlarged schematic plan views showing operation of a portion to be a space section, downstream and upstream locating pins and a punch according to the order of operation;

Fig. 14 is an enlarged schematic elevational view of a punch in another embodiment;

Fig. 15 is an enlarged schematic elevational view of a punch in still another embodiment;

Fig. 16 is an enlarged schematic plan view of a part of a slide fastener chain before a space section is formed;

Fig. 17 is an enlarged schematic plan view of a part of a slide fastener chain after a space section is formed;

Fig. 18 is an enlarged schematic elevational view of one end of a space section which is formed by a conventional method and which has a faulty element.

The method of the present invention is embodied with an apparatus such as shown in Figs. 1, 2, and 3. As shown in Figs. 16 and 17, the rows 34 of coupling elements of a portion 8 are removed from a continuous slide fastener chain 2 to be a space section 7 which has a predetermined length L.

A base 1 has in its top surface a longitudinal guide path 3 along which the slide fastener chain 2 is transported intermittently in a direction indicated by an arrow C by operation of a drive roller 4 and a pinch rollers.

A sensor 6 is equipped at the guide path 3 so as to detect that the portion 8 is brought to a desired position to form the space section 7 below an element-removing apparatus 9 described hereinafter . In case that the fastener elements are made of metal, a metal detector is adopted as a sensor 6. The detector detects that the portion 8 is brought to the desired position below the element-removing apparatus 9 by means of counting the number of the fastener elements which are fed over the detector. Then, the metal detector sends signals so that the rotation of the drive roller 4 is stopped. On the other hand, in case that the fastener elements are made of synthetic resin, a photo electric cell or a roller are adopted respectively as a sensor 6. In case that the roller is used, it rotates touching the slide fastener chain and is interconnected to an encorder so that the length of the fed chain is detected.

In the element-removing apparatus 9, a link 12 is interconnected to a motor (not shown) mounted on a support frame 10 through the intermediary of an eccentric wheel. Then, a movable block 13 is fixed to the link 12 so as to move vertically guided by a guide rod 14 provided at the support frame

10.

A punch 15 serves as a cutting member and is connected to the center of the underside of the movable block 13. The longitudinal length W of the punch 15, as viewed from the feed direction of the slide fastener chain 2, is set to be shorter than the longitudinal length L of the space section 7 and longer than half of the length L.

Air cylinders 19, 20 are mounted on a bracket 16 fixed to the support frame 10. A downstream locating pin 17 and an upstream locating pin 18 serve as a downstream locating means and an upstream locating means respectively. The pins 17, 18 are separately operated by the cylinders 19, 20 respectively and are connected to piston rods 21, 22 respectively.

As shown in Fig. 1, the downstream locating pin 17 and the upstream locating pin 18 are placed to touch the both sides of the punch 15 respectively over the guide path 3 for the fastener chain 2 so as not to be interfered with each other. Then, they move vertically through halls 23, 24 and 25 formed in the movable block 13 by means of the air cylinders 19, 20 respectively. The vertical movement of the punch 15 does not interfere with the movements of the locating pins 17, 18.

A chain-pressuring rod 26 and a chain-stretching rod 27 are vertically movably provided at the downstream side end of the movable block 13 so as to locate over the guide path 3 of the base 1. Then, the rods 26, 27 are urged downward by coil springs 28, 29 respectively and their length of the portions which are projected downward from the movable block 13 can be adjusted by double nuts 30, 31 respectively.

As shown in Figs. 2 and 3, a pair of dies 32, 33 are disposed on each side of the guide path 3 of the base 1 so as to support undersides of legs of the slide fastener chain 2 which are attached to the fastener tape. Each die 32, 33 has the same longitudinal length which is corresponding to the longitudinal length W of the punch 15. Each edge 35, 36 is formed along each fastener tape. Heads 37, 37 of the both rows 34, 34 of the coupling fastener elements are interengaged each other. The punch 15 descends to cut and remove a group of the interengaged heads 37, 37 formed between the edges 35, 36, while the front and back faces of the punch 15 having the longitudinal length W touch the edges 35, 36 respectively.

The legs of the elements of the rows 34, 34, which are uncut and are left to be attached to the edges 35, 36 respectively, are removed by brushing and the like later.

The both locating pins 17, 18 are provided with tip ends 38, 39 respectively. Each tip end 38, 39 is placed so as to be spaced from each end of the punch 15 with a length of predetermined element pitch. When the fastener elements of the portion are cut and removed, the chain-pressuring rod 26 and the chain-stretching rod 27 are operated. In this case, as shown in Figs. 9, 11 and 13, each tip end 38, 39 is set to engage to each leg 43, 44 of each fastener element 41, 42 of one fastener stringer 40 of the slide fastener chain 2. These fastener elements 41, 42 are adjacent to the downstream side end and the upstream side end of the portion to be the space section respectively.

A fore end pad 45 of the chain-pressuring rod 26 is provided to be faced to a plane top surface 46 of the base 1. As shown in Figs. 5 and 7, when the rod 26 descends, the pad 45 pinches the slide fastener chain 2 in the guide path 3 with the surface 46 so as to pressure and clamp the fastener chain 2.

On the other hand, a recess 48 is formed on the top surface of the base 1 transversely through the guide path 3 below a fore end pad 47 of the chain-stretching rod 27. As shown in Figs. 5 and 7, when the rod 27 descends, the pad 47 pushes the slide fastener chain 2 into the recess 48 so as to give a small tension to the fastener chain 2. The both pads 45, 47 are placed so as to be projected downward deeper than a position of the cutting edge of the punch 15 before cutting arid removing operation.

The method of the present invention with this apparatus is embodied as follows.

As shown in Fig. 1 , the continuous slide fastener chain 2 is transported intermittently along the guide path 3 on the base 1 in the direction indicated by the arrow C by operation of the drive roller 4 and the pinch roller 5. When the portion 8 to be the space section 7 is brought to below the element-removing apparatus 9, the sensor 6 detects that. Then, corresponding to the signals from the sensor 6, the rotation of the rollers 4, 5 are stopped. Accordingly, the transportation of the slide fastener chain 2 is stopped.

Next, as shown in Figs. 8 and 10, the air cylinder 19 is operated to move the downstream locating pin 17 downward to strike against the leg of a fastener element, which is adjacent to the fastener element 41.

As shown in Figs. 11, 12, 16 and 17, this fastener element 41 is the terminal element of a normal portion 50 not to be the space section 7 and adjacent to the downstream side end 49 of the portion 8 to be the space section 7.

Although in Figs. 8 and 10, a tip end 38 of the downstream locating pin 17 strikes against the upper surface of the leg of the fastener element adjacent to the fastener element 41, the tip end 38 might be inserted between the leg 43 of the fastener element 41 and the leg of the above mentioned fastener element which is adjacent to the

element 41 due to a position at which the slide fastener chain 2 is brought to stop.

Then, the motor (not shown) is operated to move the movable block 13 downward through the intermediary of the link 1 2. As shown in Fig. 5, the slide fastener chain 2 is pressured and clamped between the fore end pad 45 of the chain-pressuring rod 26 and the plane top surface 46 of the base 1, further the chain 2 is pushed slightly into the recess 48 by means of the fore end pad 47 of the chain-stretching rod 27.

As described before, the tip end 38 of the downstream locating pin 17 has struck against the upper surface of the leg of the fastener element adjacent to the fastener element 41 as shown in Figs. 8 and 1 0or has been inserted between the leg 43 of the fastener element 41 and the leg of the fastener element adjacent to the element 41, although this condition is not shown. However, by the above mentioned operation of the both pads 45, 47, the tip end 38 engages to the leg 43 of the fastener element 41 as shown in Figs. 9 and 11, because, the slide fastener chain 2 located below the element-removing apparatus 9 is stretched slightly toward downstream side. Accordingly, the downstream side end 49 of the portion 8 to be the space section 7 is located precisely.

The link 12 is operated to move the punch 15 in a way as shown in Figs. 2, 3, 5 and 11 so that a group of interengaged heads 37 of the rows 34 of the fastener elements with a length 1 disposed at the downstream side of the portion 8 is cut by the cutting edge of the punch 15 to be removed from the fastener chain 2.

Next, the link 12 and the air cylinder 19 are moved upward and the punch 15, the downstream locating pin 17, the chain-pressuring rod 26 and the chain-stretching rod 27 are returned to original positions at which they can not be operated. By this operation, a forming process for the downstream side part of the space section in the continuous slide fastener chain is finished.

Then, the slide fastener chain 2 is transported again in the direction indicated by the arrow C. When the rest of the rows 34 of the fastener elements in the portion 8 to be the space section 7 are brought to below the punch 15, the sensor 6 detects that. Therefore, corresponding to the signals from the sensor 6, the rotations of the rollers 4, 5 are stopped. Accordingly, transportation of the slide fastener chain 2 is stopped.

Next, as shown in Figs. 6 and 12, the air cylinder 20 is operated to move the end tip 39 of the upstream locating pin 18 downward to strike against the leg of a fastener element which is adjacent to the fastener element 42 of a normal portion 52 not to be the space section 7, As shown in Figs. 1 2 and 13, this element is adjacent to the upstream side end 5 1 of the portion 8 to be the space section 7

This striking operation of the tip end 39 for the elements is same as that of the tip end 38 of the downstream locating pin 17. That is to say, the tip end 39 strikes against the upper surface of the leg of the fastener element adjacent to the fastener element 42 as shown in Fig. 12, or is inserted between the leg of the fastener element 42 and the leg of the fastener element adjacent to the element 42.

Then, as shown in Fig. 7, by operation of the link 12, the chain-pressuring rod 26 and the chain-stretching rod 27 act on the slide fastener chain 2 in the same manner as the above mentioned forming process for the downstream side part of the space section. Accordingly, as shown in Fig. 13, the upstream side rest of the portion 8 to be the space section 7 with a length $l_2$ is located precisely, even if the slide fastener chain 2 is locally elongated or shrunk.

The link 12 is operated to move the punch 15 in a way as shown in Figs. 7 and 13 so that a group of interengaged heads 37 of the rows 34 of the fastener elements with the length 12 disposed at the upstream side of the portion 8 are cut by the cutting edge of the punch 15 and removed from the fastener chain 2.

Next, the link 12 and the air cylinder 19 are moved upward and the punch 15, the upstream locating pin 18, the chain-pressuring rod 26 and the chain-stretching rod 27 are returned to the original positions at which they can not be operated. By this operation, a forming process for the upstream side part of the space section in the continuous slide fastener chain is finished. By the above mentioned two forming processes for the downstream side part and the upstream side part of the space section respectively, the one-cycle for forming one space section 7 is finished.

Therefore, the continuous slide fastener chain 2 is transported again as a first step so that a next one-cycle is started. As a result the space sections 7 are formed repeatedly one by one in the slide fastener chain 2, with a predetermined distance.

In the above mentioned embodiment, the slide fastener chain 2 is moved within a part of the guide path 3 which has a longitudinal length corresponding to the length L of the space section 7 and the punch 15 is moved on only a vertical line. On the other hand, in another embodiment shown in Fig. 14, during cutting and removing operation for the raws of fastener elements, a continuous slide fastener chain 2 is kept at one position. Then, a punch as a cutting means composes of a downstream punch 53 and an upstream punch 54, both of which serve as cutting members respectively and both of which have the same length corresponding to the

half of the length L of a space section. In the forming process for the downstream side part of the portion, a downstream locating pin 17 as a downstream locating means and the downstream punch 53 are operated, then in the forming process for the upstream side part of the portion, an upstream locating pin 18 as an upstream locating means and the upstream punch 54 are operated. A chain-pressuring rod and a chain-stretching rod are operated in the same manner as the above mentioned embodiment.

In still another embodiment in Fig. 15, during cutting and removing operation for the fastener elements, a continuous slide fastener chain 2 is kept at one position, while a punch 55 as a cutting member moves downstream side and upstream side (backward and forward) within a part which has a length corresponding to the longitudinal length L of a space section. In this case, the punch 55 has a longitudinal length being shorter than the longitudinal length L of the space section and longer than the half of it. A downstream locating pin and an upstream locating pin, both of which serve as locating means respectively, a chain-pressuring rod and a chain-stretching rod are operated in the same manner as the above mentioned embodiment.

## Claims

1. A method of forming repeatedly one by one space sections (7) devoid of coupling elements in a continuous slide fastener chain (2) having a pair of rows (34) of interengaged coupling element by operating an element-removing apparatus (9) after transporting a portion (8) to be said space section (7) in said slide fastener chain (2) below said element-removing apparatus (9), stopping the transportation of said slide fastener chain (2) and locating said portion (8), said method of forming one space section (7) in a one-cycle characterized by provisions of the steps of;

(a) engaging a downstream locating means (17), as viewed from the feed direction of said slide fastener chain (2), to a fastener element (41) of a normal portion (50) not to be said space section (7) adjacent to the downstream side end (49) of said portion (8) to be said space section (7), while giving a small tension to said slide fastener chain (2) so that said pair of rows (34) of said interengaged coupling elements at the downstream side part of said portion (8) are located below a cutting means (15, 53, 55) of said element-removing apparatus (9);

(b) removing said pair of rows (34) of said interengaged coupling elements at said downstream side part of said portion (8);

(c) returning said downstream locating means (17) and said cutting means (15, 53, 55) to positions at which said both means (1?, 15, 53, 55) are not operated respectively;

(d) engaging an upstream locating means (18) to a fastener element (42) of a normal portion (52) not to be said space section (7) adjacent to the upstream side end (51) of said portion (8) to be said space section (7), while giving a small tension to said slide fastener chain (2) so that the unremoved rest of said pair of rows (34) of said interengaged coupling elements at the upstream side part of said portion (8) is located below said cutting means (15, 54, 55) of said element-removing apparatus (9);

(e) removing said unremoved rest of said pair of rows (34) of said interengaged coupling elements at said upstream side part of said portion (8);

(f) returning said upstream locating means (18) and said cutting means (15, 54, 55) to positions at which said both means (18, 15, 54, 55) are not operated respectively.

2. A method according to claim 1, said cutting means (15) consists of one cutting member (15) which has a longitudinal length (W), as viewed from the feed direction of said slide fastener chain (2), being shorter than a longitudinal length (L) of said space section (7) and longer than the half of said length (L) of said space section (7) and between said step (c) and said step (d), added is a step;

(c') transporting said unremoved rest of said pair of rows (34) of said interengaged coupling elements at said upstream side part of said portion (8) to be said space section (7) below said cutting member (15).

3. A method according to claim 1, said element-removing apparatus (9) locates over said portion (8) to be said space section (7) and said cutting means (53, 54) consists of two cutting members (53, 54) one of which is a downstream cutting member (53) operated in said step (b) and another of which is an upstream cutting member (54) operated in said step Ce) which have the same longitudinal length respectively corresponding to the half of a longitudinal length (L) of said space section (7).

4. A method according to claim 1, said element-removing apparatus (9) locates over said portion (8) to be said space section (7) and said cutting means (55) consists of one cutting member (55) which has a longitudinal length being shorter than a longitudinal length (L) of said space section (7) and longer than the half of said length (L) of said space section (7) and which moves downstream side and upstream side within a part having a length corresponding to said length (L) of said space section (7).

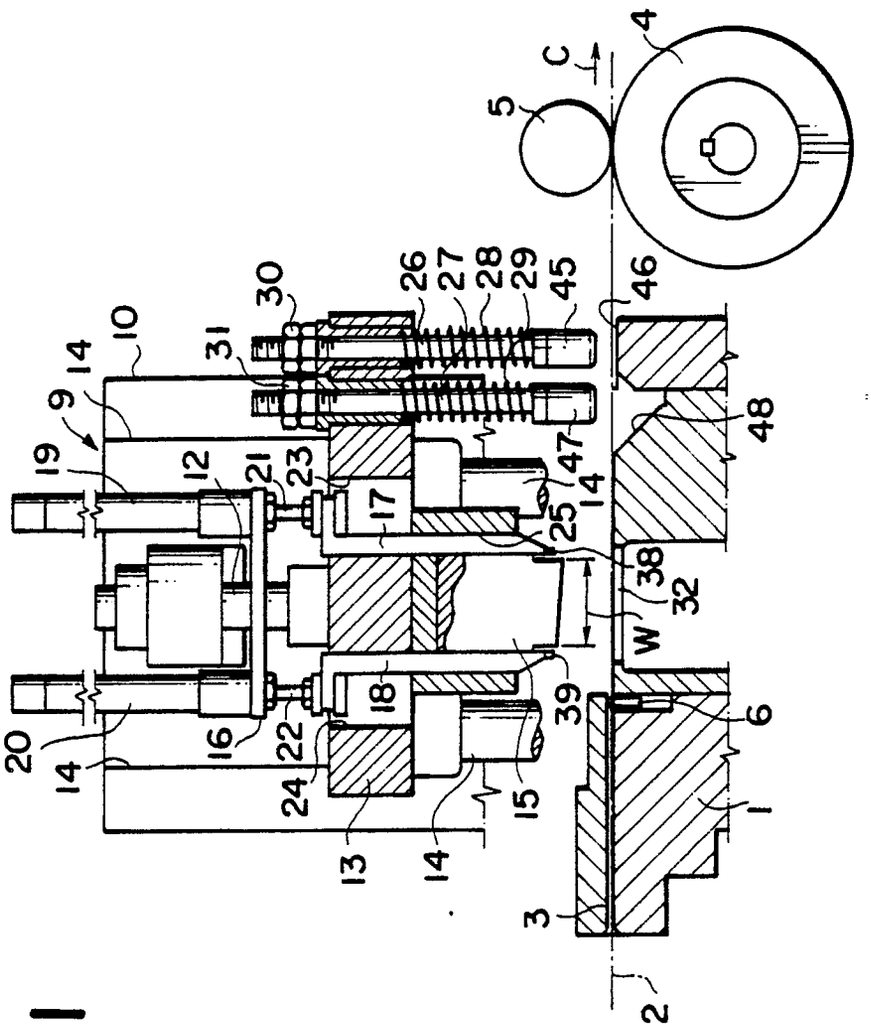

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FIG. 1

FIG. 2

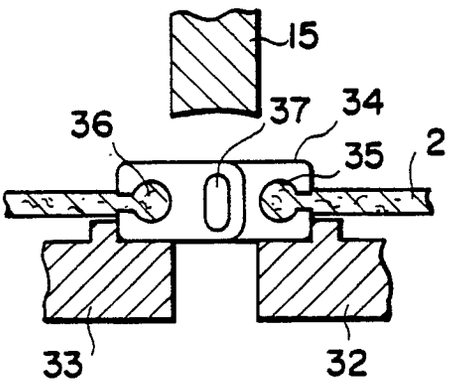



FIG. 3

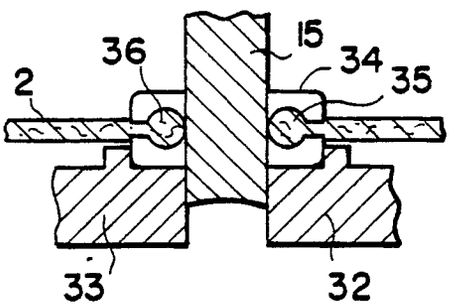


FIG. 4

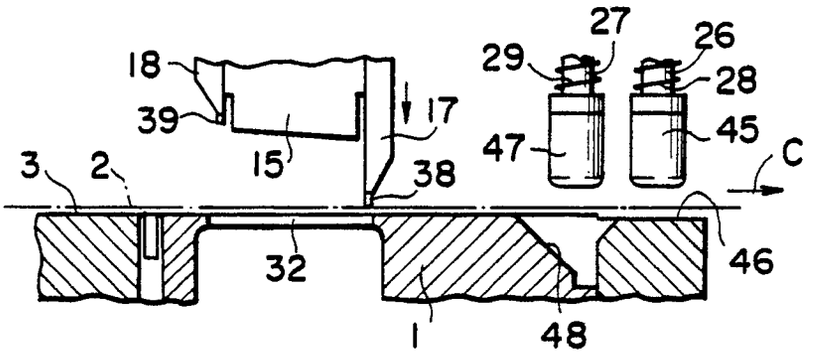



FIG. 5

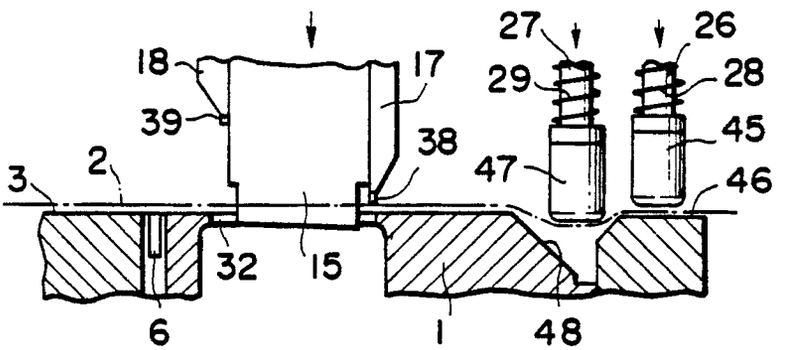



FIG. 6

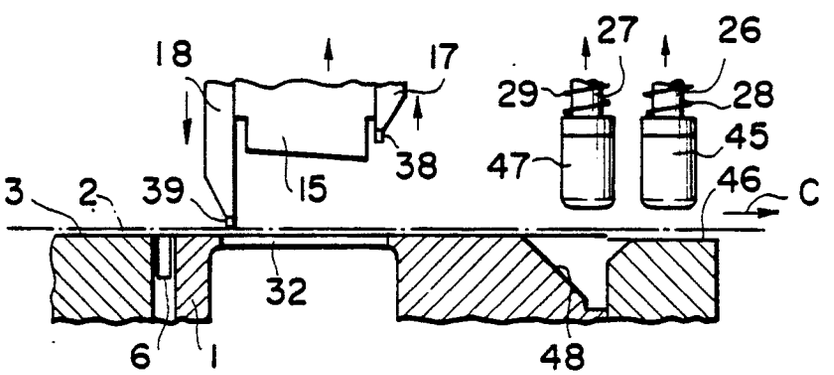


FIG. 7

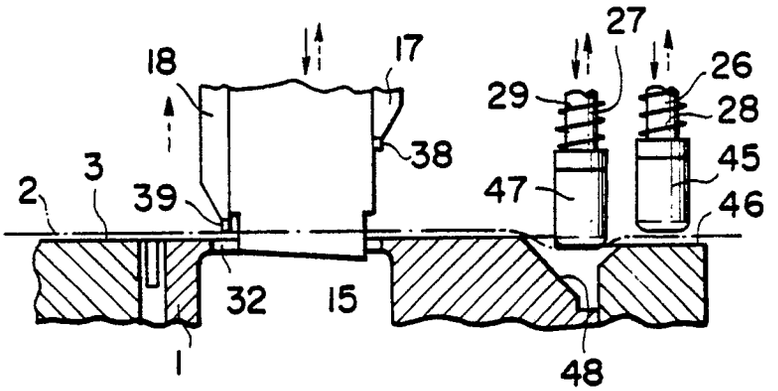



FIG. 8

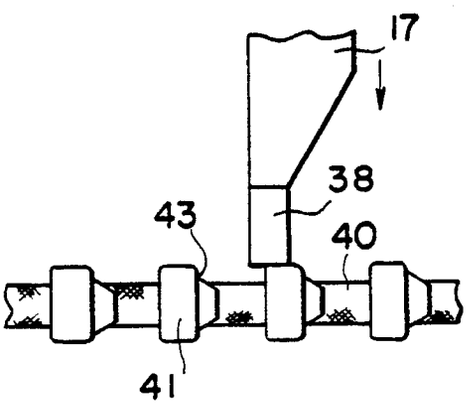
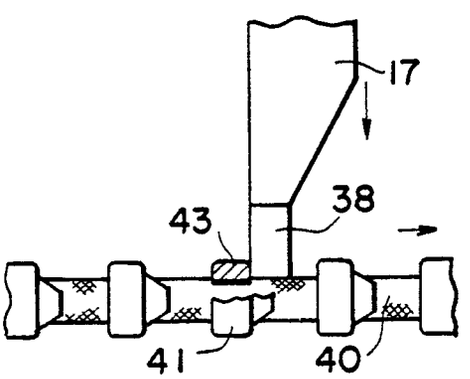



FIG. 9



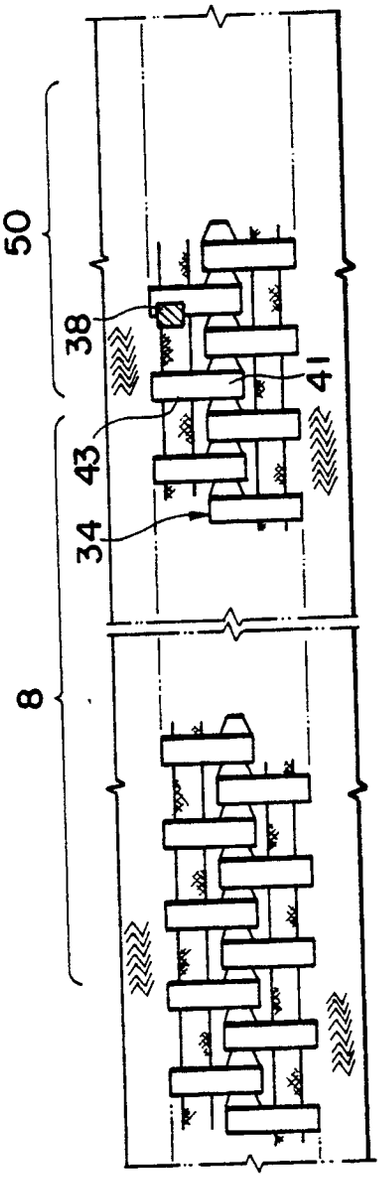



FIG. 10

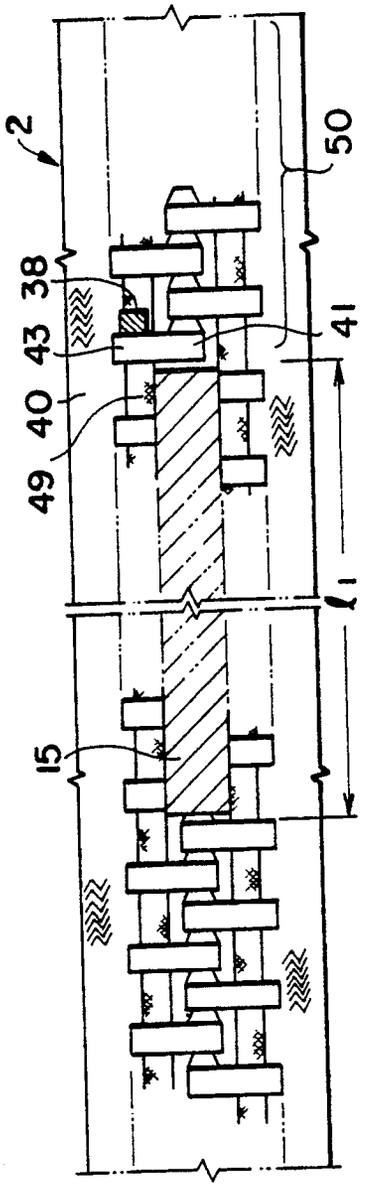



FIG. 11

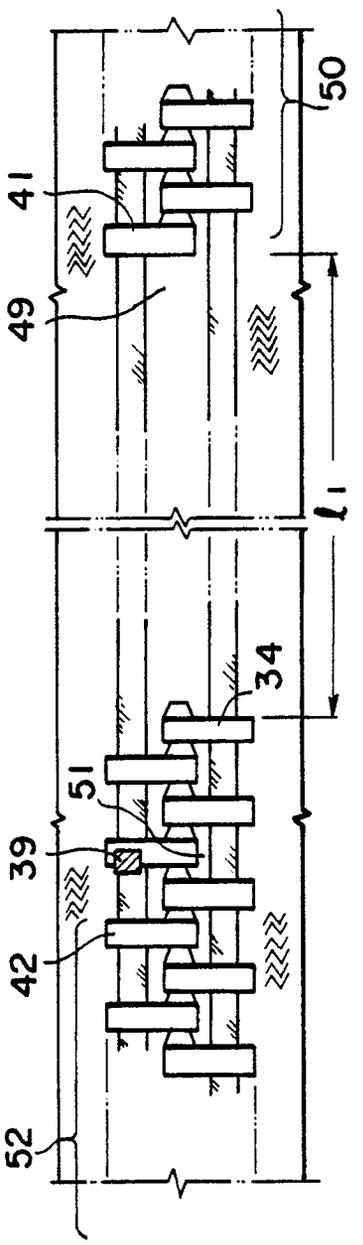



FIG. 12

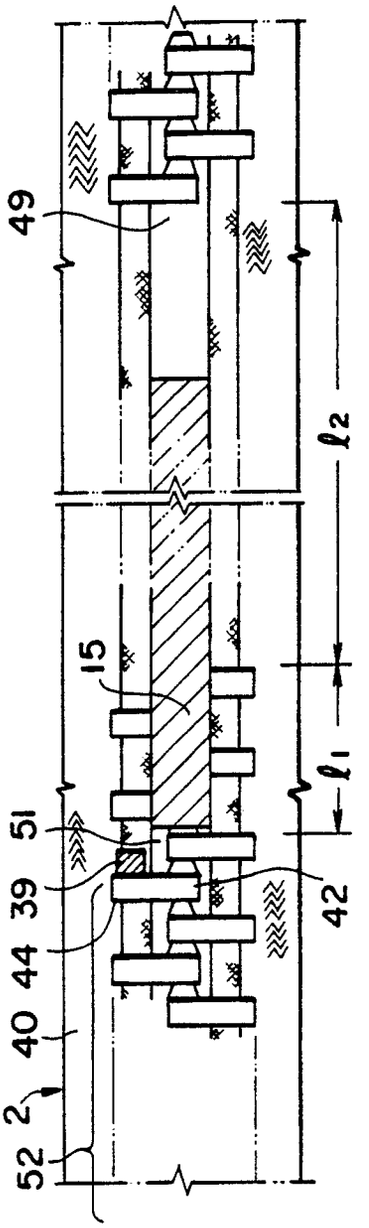



FIG. 13

FIG. 15

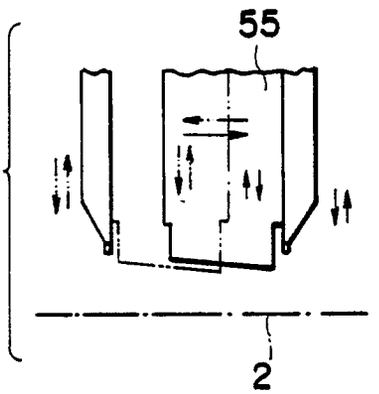



FIG. 14

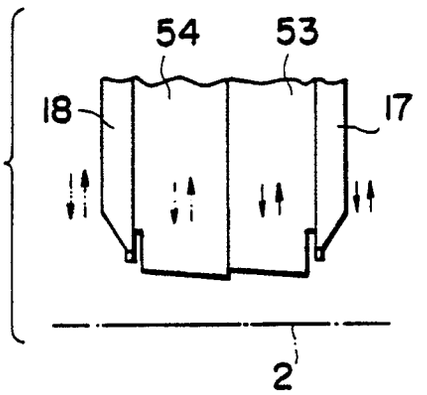



FIG. 16

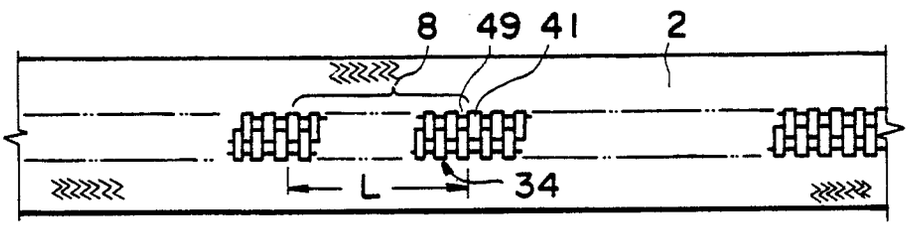



FIG. 17

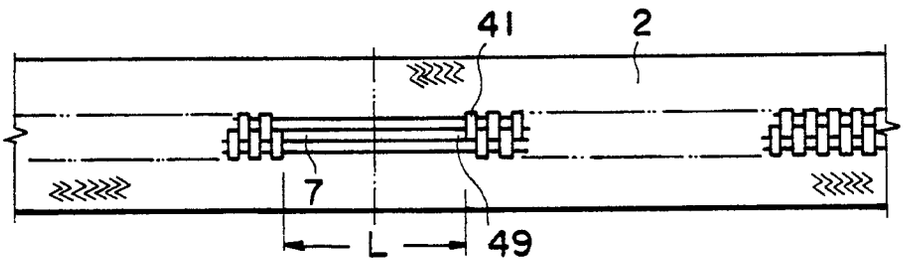


FIG. 18