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(54) **Method of heat treating leather, and a clip for use in the method.**

(57) In the heat treatment of leather, a piece of leather is placed on a frame and attached thereto by a plurality of clips so that the leather lies substantially flat on the frame. The frame and the leather are subjected to heat treatment and shape memory effect (SME) elements serve to apply stretching forces to the piece of leather.

A suitable clip comprises a first part which is securable to the frame, a second part which is movable relative to the first part and grips the leather and an SME element which in its transition range of temperatures displaces the second part relative to the first part to stretch the leather.

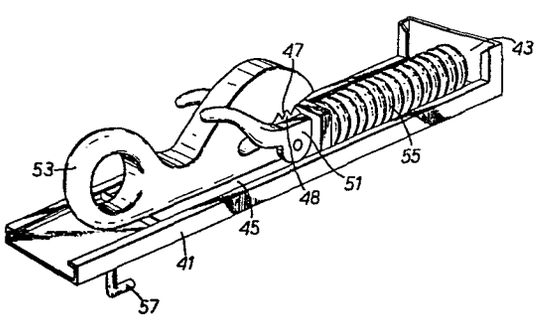

FIG.4

EP 0 028 918 A2

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HEAT TREATMENT OF LEATHER

This invention relates to a method of heat treating leather and to apparatus suitable for use in this method.

During the manufacture of leather from animal skin, it is necessary to apply a heat treatment to the leather in order to dry it. It is usual for the leather to be removably attached to a frame and for the frame and the leather to be inserted into a drying machine for the heat treatment. To ensure that as large an area of the leather as possible is usable after the heat treatment, it is usual to lie the leather substantially flat on the frame and to pull the edges of the leather outwardly to apply stretching forces thereto before attaching the leather to the frame by means of removable clips. To this end, an operator grips a portion of the leather close to one edge with a clip, applies a considerable stretching force to the leather and attaches the clip to the frame. This is repeated a number of times until the leather is stretched in all directions and is firmly attached to the frame. In practice, it is difficult to stretch the leather evenly in all directions and, since the leather shrinks as it is dried, this may result in a heat treated piece of leather which has a smaller usable area than would have been the case if the leather had been stretched substantially evenly in all directions.

According to a first aspect of the present invention, in a method of treating leather, the leather is placed on a frame and is attached thereto by a plurality of clips so that the leather lies substantially flat on the frame, the frame and the leather are subjected to heat treatment to dry the leather and, during the heat treatment, shape memory effect (SME) elements serve to cause stretching forces to be applied to the leather.

Preferably stretching forces are applied in a plurality of different directions to the leather.

When the piece of leather is secured to the frame it is not necessary for considerable stretching forces to be applied to the leather. It is sufficient to apply only enough force to cause the piece of leather to be substantially flat on the frame without being unduly stretched. The stretching forces are applied to the piece of leather due to the action of the SME elements during the heat treatment.

The SME elements may be associated one with each of the clips. According to a second aspect of the invention such a clip may comprise a first part, adapted for releasable securement to the frame, a gripper part, slidable relative to the first part, and an SME element, acting between the first part and the gripper part and serving, during its transition range of temperatures, to displace the gripper part relative to the first part.

By a "shape memory effect element" (SME) as used herein is meant an element of a material, usually an alloy, having an elastic modulus which varies significantly with temperature in a reversible manner over a transition temperature range dependent on the material employed. There are a number of known alloys which display shape memory effect when subject to a pre-conditioning heat treatment. A suitable alloy is one having a composition by weight of the order of copper 70%, aluminium 4% and zinc 26%. Above and below the transition temperature range, changes of temperature have no appreciable effect on the thermal properties of the material. In the transition range, however, increase in temperature results in progressive increase in the elastic modulus, and hence in decrease in the strain of the stressed element.

In order that the invention may be more readily understood it will now be described, by way of example only,

with reference to the accompanying drawings, in which:-

Figure 1 is a perspective view of an expandible frame for use in the treatment of leather in accordance with embodiment of the method of the present invention;

Figure 2 is a perspective view of an alternative form of frame for use in the treatment of leather in accordance with an alternative embodiment of the method of the present invention;

Figure 3 is a perspective view of part of the frame shown in Figure 2,

Figure 4 is a perspective view of a clip suitable for use in the treatment of leather.

Figure 5 is a sectional side elevation of an alternative form of a clip to that shown in Figure 4, and

Figure 6 is a side elevation of a still further form of clip to those shown in Figure 4 and 5

Referring to Figure 1, a metal frame 1 comprises two generally similar frames 3, 5, each of rectangular form and each having a perforated or expanded metal plate 7 secured to it. The two frames 3, 5 are arranged side-by-side and a pair of rods 9 extend through the shorter sides of the frames in the direction of their length. The rods 9 serve as guides to enable the two frames 3, 5 to move towards and away from each other. A plurality of SME elements in the form of coil springs 11 are positioned between the adjacent longer sides of the frames. To treat leather in accordance with the present invention, the piece of leather is laid on the metal plate 7 and is spread out until it lies substantially flat on the frame 1. The leather is attached to the frame 1 by means of a plurality of gripper clips (not shown). An operator grips a portion of the leather adjacent its edge by means of a clip and applies a limited amount of tension to the leather to remove any wrinkles or folds in it and connects the clip to the plate 7 by inserting a peg on the clip into one of the

perforations in the plate. This is repeated for each clip until the leather lies substantially flat on the surface of the frame and is connected at spaced intervals around its edges to the frame. The frame and the leather are then placed in a drying machine where they are subjected to a heat treatment with a maximum tmperature of say 75-85°C in order to dry the leather. The transition range of temperatures of the SME elements 11 is arranged to be above ambient and less than the maximum temperature to which the elements are subjected in the drying machine and, when they reach their transition temperature range, the elements 11 suddenly expand causing the two frames 3, 5 to move away from each other. Since the leather is firmly attached to the frame, the movement of the frames 3, 5 causes the leather to be stretched. Thus, during the heat treatment of the leather, it is held in a stretched condition. At the end of the heat treatment, when the leather has been allowed to return to ambient temperature, the leather remains stretched and presents an increased surface area from which usable leather can be obtained.

In the arrangement shown, the SME springs 11 act directly between the Figures 3, 5 to bring about separation of the frames but the SME elements could act upon mechanical linkages which in turn bring about separation of the frames when the elements expand. Although two frames 3, 5 are shown in Figure 1, more than two frames could be used with each frame being movable relative to the other frames to apply a stretching force to the part of the leather secured thereto. If the frames are arranged to move substantially radially then a piece of leather secured to the frames is stretched radially in many directions.

Figure 2 shows a frame by which stretching forces in different directions can be applied to the leather

A metal rectangular frame 21 has a cross supports 25 secured to it and they support a pair of concentric metal

rings 27, 29. The outer ring 29 of the pair has a plurality of radial holes 31 formed in it and each hole has a corresponding hole 33 aligned with it in the outer frame. Each pair of aligned holes 31, 33 has a metal rod 35 freely slidable therein and one end of each rod abuts against the inner ring 27. Outwardly of the ring 29 each rod carries a gripper clip 37 which is locked to the rod and an SME element, in the form of a coil spring 39, surrounds the rod and the ends of the spring abut against the clip and the ring 29 respectively. To accommodate springs of different lengths, each clip can be moved along the rod and a locating nib on the clip locates with one of a plurality of notches spaced apart on the rod in the direction of its length.

In use, the leather is placed on the frame and it is gripped adjacent its edges by the plurality of clips. The leather is pulled sufficiently tight to remove wrinkles and folds in the leather. The frame and the leather are then located in the drying machine and subjected to the heat treatment. When the temperature in the drying machine reaches the transition range of temperature of the SME element, the elements expand rapidly and force the clips and the rods outwardly relative to the rings 27, 29, thus applying stretching forces to the leather. With this type of frame, the stretching forces act radially of the rings and they are not limited to one direction, as is the case with the frame shown in Figure 1.

Figure 4 illustrates a gripper clip which can be used with a frame comprising a metal framework supporting a perforated or expanded metal plate. The gripper clip comprises a channel shaped metal member 41 having an upturned end 43. A metal block 45 is freely slidable within the channel shaped member 41. On the block is mounted a gripper comprising a set of fixed teeth 47 and a co-operating set of teeth 49 mounted on a pivoted arm 51. The sets of teeth are biased together by a spring (not

shown). A finger loop 53 on the block enables the block and the sets of gripper teeth to be easily moved relative to the channel member 41. An SME element in the form of a coil spring 55 is fitted between, and in abutting relation with, the upturned end 43 and the block 45. A hook 57 is mounted on the base of the channel shaped member 41.

In use, the leather to be heat treated is laid on the frame and its edges are pulled outwardly to cause the leather to be substantially flat free from wrinkles and folds. The sets of teeth on a clip are separated by pivoting the arm 51 and an edge portion of the leather is introduced between the sets of teeth. The teeth are then allowed to grip the leather. The clip is then pulled in the direction away from the leather to tighten the gripped portion of the leather and the hook 57 on the clip is introduced into one of the holes in the plate on the frame to locate the clip relative to the frame. This is repeated for a number of clips positioned around the edge of the leather, thus causing the leather to be flat on the frame but with only a limited amount of stretching of the leather. The frame with the leather clipped to it is then introduced into the drying machine for the heat treatment and, when the temperature rises to the transition range of temperature of the SME elements, the elements expand rapidly causing the block 45 and the sets of gripper teeth to move relative to the channel member in the direction away from the upturned end thereof thereby applying stretching forces to the leather.

The gripper clip as shown in Figure 5 is an alternative form of that shown in Figure 4 and is used on the leather in the same manner as described above.

The clip comprises a tube 60 having a hook 61 attached to its underside by rivets. The tube shown is of metal such as aluminium but alternatively the tube and hook may be integral and formed of a plastics material such as

fibre filled polypropylene. A gripper clip has a cylindrical portion 62 having a longitudinally extending slot in its wall and which is of such a size as to permit the cylindrical portion to slide on the tube 60 with the hook 61 located in the slot. A set of fixed teeth 63 and a finger loop 64 are formed on an outward extension of the portion 62. A co-operating set of teeth 65 are provided on an arm 66 which is pivotable about a rod 67 which projects normal to the length of the tube through a pair of oppositely disposed elongate slots 68 formed in the wall of the tube. The rod 67 projects through a bush 69 which is freely slideable within the tube 60. A further bush 70 is fixed at the end of the tube which is away from the hook 61 and a rod 71 projects through the bush and the wall of the tube. A coiled tension spring 72 is located within the tube with one end attached to the rod 71 and the other attached to the rod 67. The tension spring thus serves to bias the bush 69 towards the bush 70.

An SME compression spring 73 located within the tube 60 surrounds the spring 72 and opposite ends of the SME spring abut against the bushes 69 and 70 respectively.

In use, the clip is attached to the frame by means of the hook 61 and a portion of the leather is gripped between the sets of teeth 63, 65. When the leather and the clip are subjected to the heat treatment and the temperature rises to the transition range of temperature of the SME spring, then the spring 73 rapidly increases in length and forces the bush 69 along the tube 60 away from the fixed bush 70. The movement of the bush causes the fixed and movable teeth 63, 65 to be displaced in the direction away from the fixed bush 70 thereby applying a stretching force to the leather.

In the clips shown in Figures 4 and 5, the SME spring expands at the transition range of temperature to apply stretching force to the piece of leather but as the

leather tries to shrink as it is dried, the shrinkage forces in the leather oppose the stretching forces applied by the SME spring and this may cause the SME spring to be slowly compressed, thus allowing the leather to shrink. The clip shown in Figure 6 is arranged such that this can be prevented. An elongate body member 80 has a hooked portion 81 at one end and ratchet teeth 82 formed on its underside adjacent said end. An upstanding member 83 is secured to the end of the body member which is opposite the hooked portion 81. A block 84 has a pair of spaced apart upper and lower rollers 85 which engage the upper and lower surfaces respectively of the body member 80 and a further roller 86 engages the lower surface of the body member 80. The block 84 defines a finger loop 87 and a set of gripper teeth 88. A second set of gripper teeth 89 co-operate with the teeth 88 and the teeth 89 are mounted on an arm 90 which is pivoted about a pin carried by the block coaxial with the axis of the lower roller 85. Thus by pivotting the arm 90, the sets of gripper teeth can be opened and closed. A spring 91 biasses the sets of gripper teeth together.

A metal loop 92 is carried by the block and is pivotable about the axis of the upper one of the rollers 85. A portion 93 of the loop 92 extends beneath the block 84 and serves as a ratchet latch which cooperates with the ratchet teeth 82. A coil spring 94 is attached at its opposite ends to the member 83 and to the adjacent end of the block 84 thus biassing the block towards the member 83. An SME coil spring 95 is fitted on to the member 80 and abuts against the member 83 and the adjacent end of the block 84 but is not attached to either of them.

In use, an edge portion of a piece of leather is gripped between the sets of teeth 88, 89 and the hooked portion 81 is attached to the frame on which the leather is positioned. At the transition temperature of the SME spring the spring rapidly expands, forcing the block 84 to roll

along the member 80. At its maximum extension the portion 93 of the loop engages with one of the teeth of the ratchet. Any forces applied to the block 84 due to shrinkage of the leather are taken by the ratchet of these forces are not applied to the SME spring. When the SME spring cools it contracts leaving the block held in position by the ratchet. To release the leather from the gripper teeth, the block is tipped slightly to release the loop 93 from the ratchet and the spring 94 pulls the block towards the member 83, thus releasing the tension applied to the leather. The gripper jaws can then be readily opened. The ratchet mechanism can be made inoperative if desired by pivotting the loop 92 so that it does not engage with the ratchet teeth 82.

By the use of SME elements, stretching forces are applied to the leather during its heat treatment and this overcomes the natural tendency for the leather to shrink during the heat treatment and results in a piece of leather having a larger usable surface area than would be the case if the leather was allowed to shrink naturally during the heat treatment. Furthermore, in some embodiments of the invention, substantially uniform stretching forces can be applied to the leather in different directions.

A typical heat treatment cycle consists of quickly raising the temperature from ambient to its maximum value maintaining the temperature at its maximum value for about two hours and allowing the temperature to fall naturally to ambient.

S.M.E. elements suitable for use in the apparatus of this application are obtainable from Delta Metal Company Limited, London England.

Claims:

1. A method of treating leather in which a piece of leather is placed on a frame and is attached thereto around its edges by a plurality of clips and the frame and the leather are subjected to heat treatment to dry the leather, characterised in that the leather is attached to the frame by the clips with only sufficient force being applied to the leather to cause it to lie substantially flat on the frame and during the heat treatment, shape memory effect (SME) elements cause stretching forces to be applied to the piece of leather.

2. A method of treating leather as claimed in claim 1 characterised in that the leather is attached to at least two separate parts of the frame and the SME elements cause the parts to move away from each other to thereby apply the stretching forces to the piece of leather.

3. A method of treating leather as claimed in claim 1 characterised in that the leather is attached to the frame by clips which have a first part for attachment to the frame and a second part for gripping the leather and the SME elements cause relative movement between the two parts to thereby apply the stretching forces to the piece of leather.

4. A method of treating leather as claimed in claim 3 characterised in that the SME elements are associated one with each of the clips.

5. A method of treating leather as claimed in claim 4 characterised in that during the heat treatment the second part of each clip is displaced relative to the first part by said SME element to apply a stretching force to the piece of

leather.

6. A clip for use in the method of treating leather as claimed in claim 5, said clip comprising a first part adapted for releasable attachment to a frame and a second part having means for gripping the leather characterised in that the second part is displaceable relative to the first part and an SME element serves in its transition range of temperature to displace the second part relative to the first part.

7. A clip as claimed in claim 6 characterised in that the second part is slideable on the first part and the SME element is in the form of a coil spring engaging against a fixed portion of the first part and the second part.

8. A clip as claimed in claim 7 characterised in that the first part is an elongate member and the fixed portion thereof is an upstanding end portion.

9. A clip as claimed in claim 7 characterised in that a non-SME tension spring biasses the second part towards the fixed portion of the first part.

10. A clip as claimed in claim 7 characterised in that the first part includes a tubular member, the second part includes a tube slidable over the first part and the SME element is in the form of a coil spring contained within the first part and acting between a closed end of the first part and the second part.

11. A clip as claimed in claim 6, 7, 8 or 9 characterised in that there is a ratchet mechanism between the two parts, said mechanism permitting the second part to be displaced relative to the first part by the action of the SME element in its transition range of temperature but not permitting relative movement in the opposite direction.

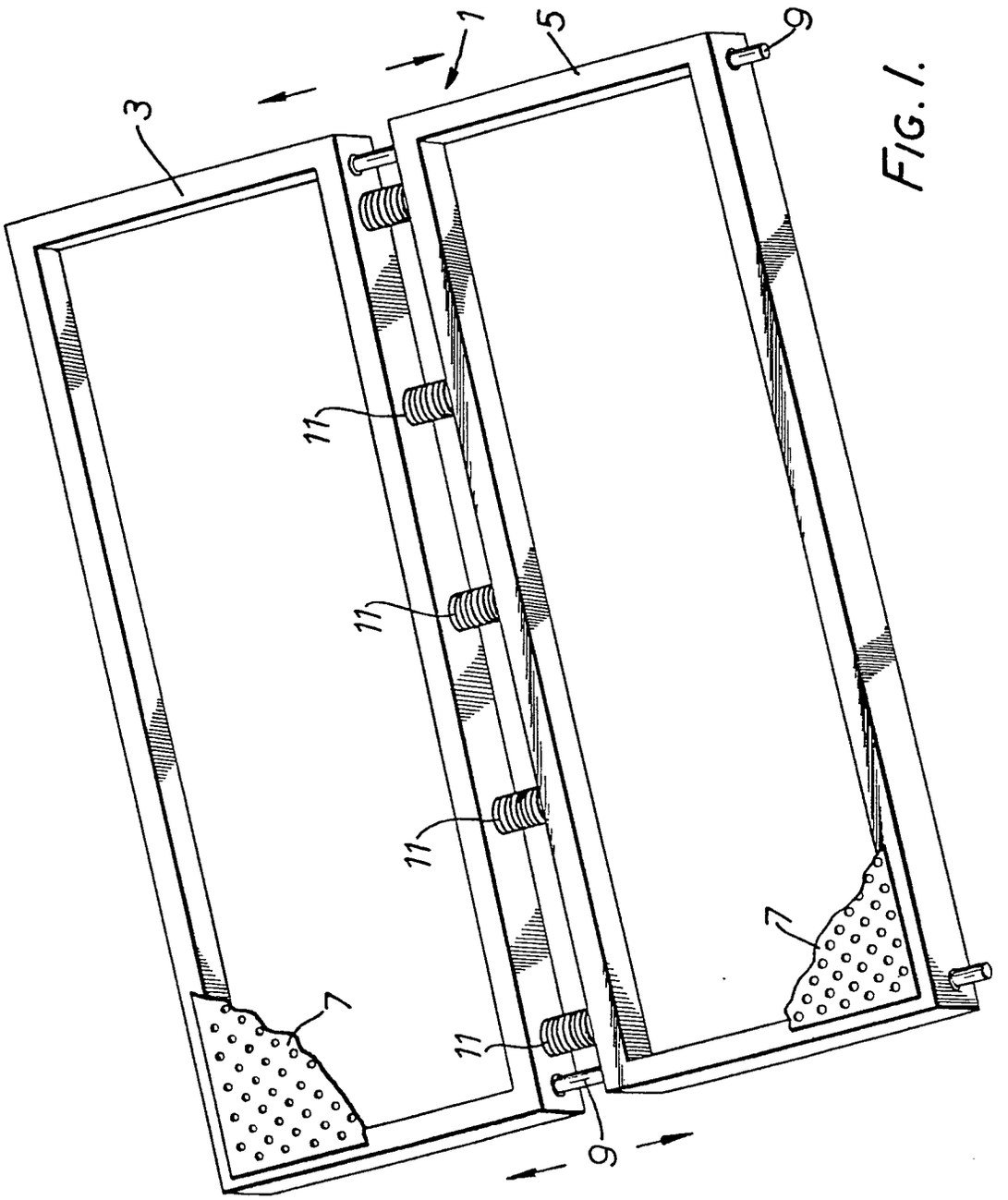

FIG. 1.

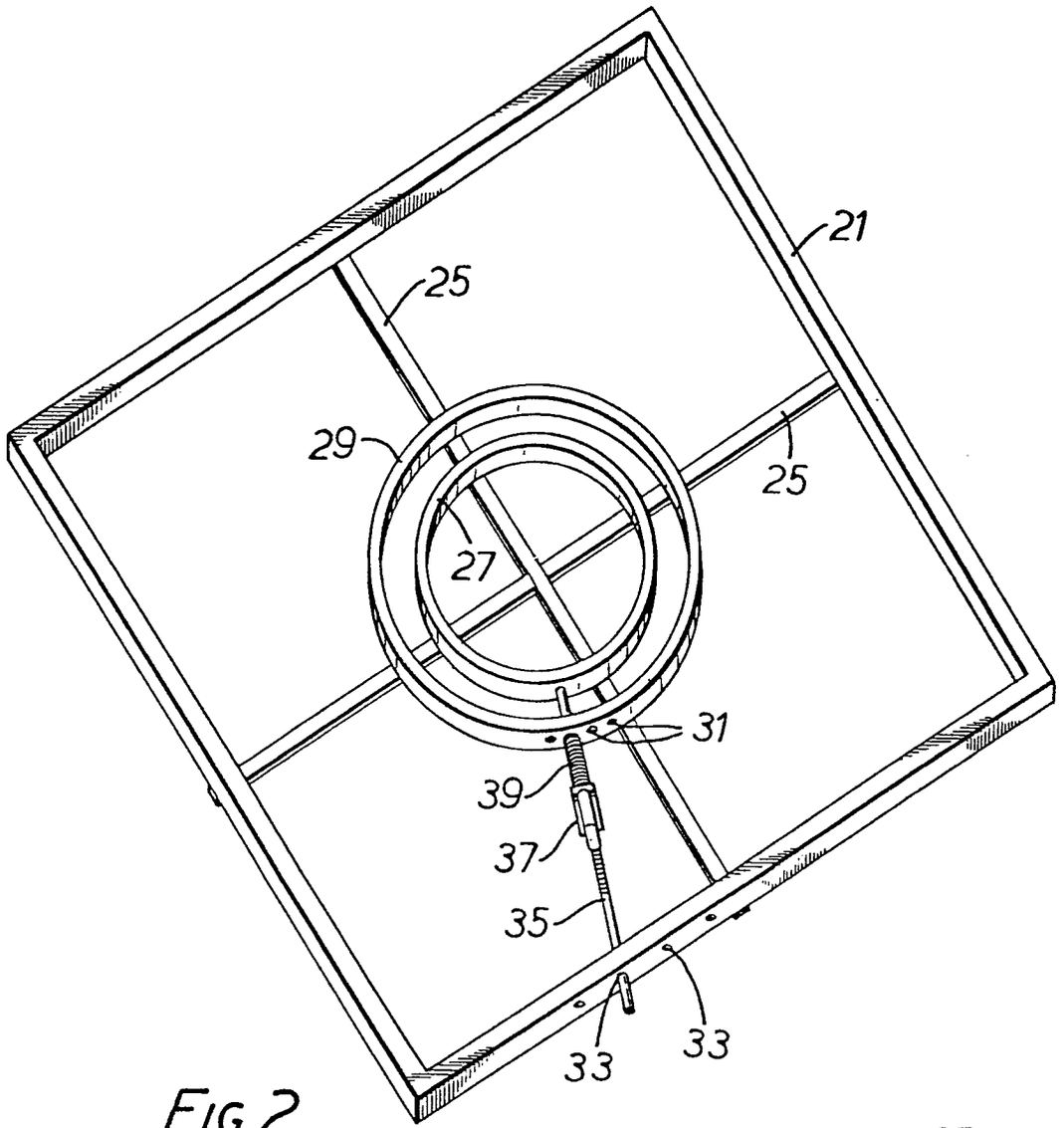

FIG.2.

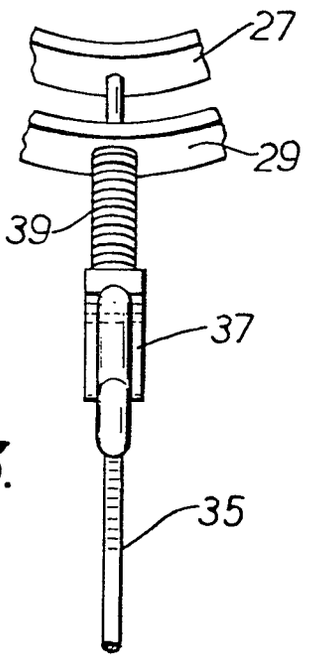

FIG.3.

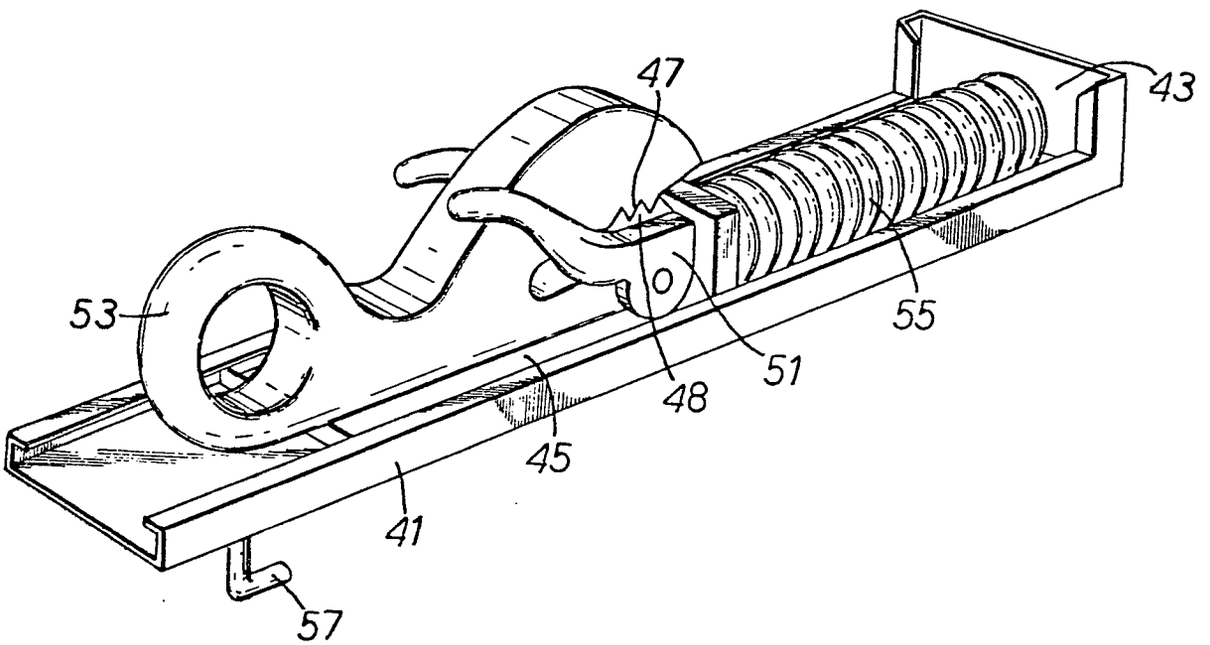

FIG.4

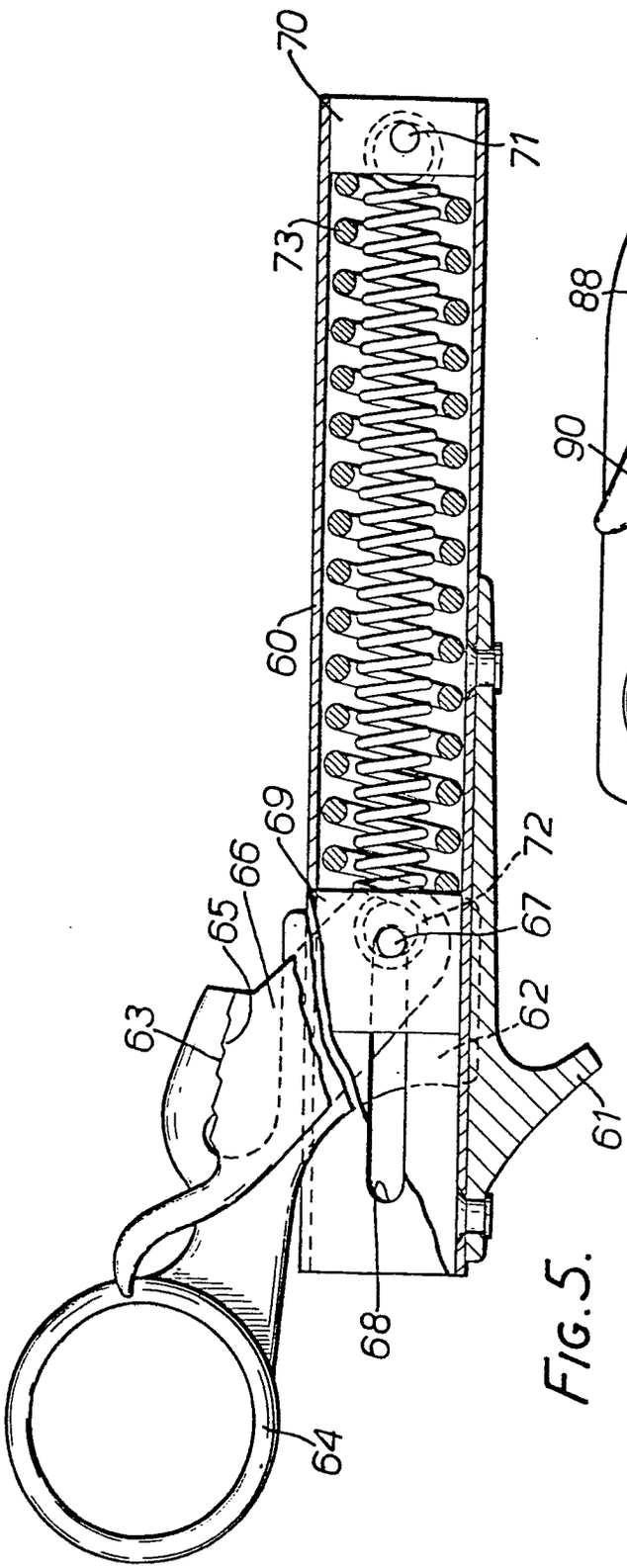
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FIG. 5.

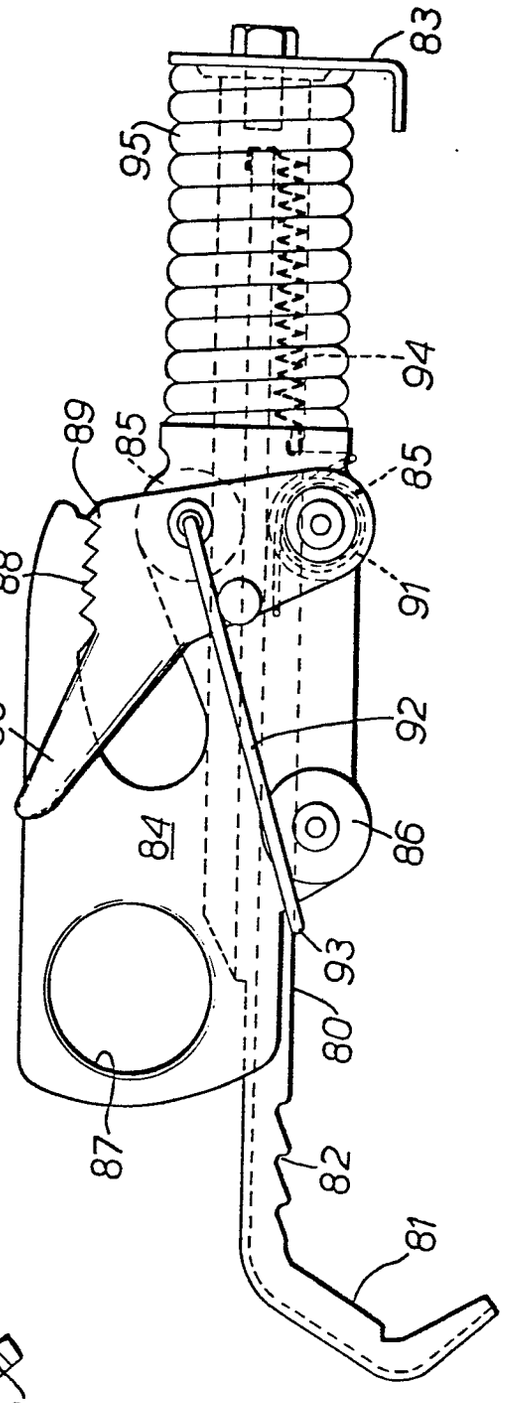
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FIG. 6.