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(54) **Method and device for reinforcing coil wires**

Verfahren und Vorrichtung zur Verstärkung von Wicklungsdrähten

Méthode et dispositif pour le renforcement de fils pour enroulement

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Description

FIELD OF THE INVENTION

This invention relates to the wire reinforcement that has to be carried out when a wire end is tied onto a terminal provided on a rim of a bobbin.

BACKGROUND OF THE INVENTION

In coil manufacturing processes, when a wire is wound onto a bobbin, the bobbin is generally rotated by a rotating mechanism, and the bobbin takes up the wire as it is supplied under a certain tension from a tensioning device. The wire is supplied to the bobbin through a long, thin cylindrical nozzle, and by allowing the nozzle to move parallel to the bobbin's rotation axis as the wire is wound, the wire is wound uniformly on the bobbin.

The ends of the wire are tied onto terminal pins provided on a rim of the coil bobbin respectively at the beginning and end of the winding process. This is achieved by having the nozzle move around the terminal pins of the bobbin, however if the wire is thin, it breaks easily in this process or on the way from the bobbin to the pins. In such a case, the part to be wound onto the terminal pins must first be reinforced, and methods or devices for this purpose are described for example in Japanese Tokkai Hei 2-198983, 3-85707 and 3-227508.

These methods consist of hanging the wire over a pin and a hook, rotating the hook so as to twist the wire between the pin and the hook, and finally removing the wire from the pin and the hook. The wire is then partially twisted so that the wire has a reinforced portion.

Wire loops are thus formed at the two reinforced ends, but as part of this reinforced portion is wound on the bobbin as the beginning or end of the wire in the winding process, some of the loops come to be under the other portion of the wire wound on the bobbin.

If these loops are standing in the outer circumference of the bobbin while the coil is wound on it, therefore, there is a risk that coiled layers of wire having a large difference of electrical potential come into contact with each other and reduce the breakdown voltage of the wire.

If the wire is twisted by winding it around the pin and the hook a plurality of times, a plurality of loops at the reinforced ends are also formed. If wire is sandwiched between these loops, and the coil is molded by a molding agent after winding, there is also a risk that the wire sandwiched between the loops might break due to the mold pressure.

Further, if the reinforced part is formed before the wire passes through the aforesaid nozzle, there is a risk that this part will catch on the nozzle when it passes through and break the wire.

The reinforcing of the wire by twisting it therefore caused various problems.

SUMMARY OF THE INVENTION

It is an object of this invention to reinforce a part of a coil wire without forming a loop.

It is a further object of this invention to provide an automatic, efficient means of reinforcing wire.

In order to achieve the above objects, this invention reinforces coil wire between a wire supplying device which supplies the wire and a wire winding device which winds the supplied wire onto a coil bobbin, by guiding the wire over a certain distance in close contact with a reinforcing wire which fuses to the coil wire under predetermined conditions, and applying the fusing conditions to the reinforcing wire within this guide distance.

Preferably, the reinforcing wire has a fusible layer which melts by the action of heat, and is fused to the coil wire by blowing hot air onto it.

This invention also provides a device for reinforcing coil wire provided between a wire supply device which supplies the wire and a wire winding device which winds the supplied wire onto a coil bobbin. This device comprises a mechanism for supplying a reinforcing wire which fuses to the coil wire under predetermined conditions, a guide for guiding the coil wire together with the reinforcing wire, a mechanism for threading the tip of the reinforcing wire through the guide, a chuck for gripping and displacing the coil wire together with the reinforcing wire which have passed through the guide, and a mechanism for establishing the predetermined conditions near the guide.

Preferably, the reinforcing wire has a melting layer which melts due to the action of heat, and the establishing mechanism comprises a hot air blower which blows hot air on the reinforcing wire.

Also preferably, the guide comprises a conduit having an inlet of large diameter and an outlet of small diameter, and the coil wire and the reinforcing wire pass through this conduit.

Also preferably, the threading mechanism comprises a releasable holder which holds the reinforcing wire and a mechanism which moves the holder relative to the guide such that the tip of the reinforcing wire penetrates the guide.

Also preferably, the device is further provided with a cutter which cuts the reinforcing wire between the holder and the guide.

Also preferably, the chuck comprises a pair of V-shaped grip surfaces which overlap with each other to grip the coil wire and the reinforcing wire.

The details as well as other features and advantages of this invention are set forth in the remainder of the specification and are shown in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a wire reinforcing device according to this invention.

Fig. 2, 3, 4 and 5 are enlarged partially broken away side elevations of a part of the wire reinforcing device showing various states of a reinforcing operation according to this invention.

Fig. 6 is an enlarged view of the essential parts of a chuck according to this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Fig. 1 of the drawings, a coil wire 3 led via tensioner 4 from a wire supply device, not shown, is wound on a rotating bobbin 2 via a tensioner 4, and a reinforcing device 5 installed between the winding device 1 and tensioner 4 attaches a reinforcing wire 7 to the coil wire 3. This reinforcing wire 7 has a melting layer which melts under the action of heat.

The reinforcing device 5 is built around a base 11, this base 11 being parallel to the coil wire 3 which stretches from the tensioner 4 to the winding device 1. The device 5 comprises a nozzle 8 which supplies reinforcing wire 7 to the coil wire 3, a guide 6 which guides the coil wire 3 and reinforcing wire 7, a chuck 9 which grasps the coil wire 3 and reinforcing wire 7, a cutter 10 which cuts the reinforcing wire 7, a clamp 12 which functions as a holder for supporting the reinforcing wire 7, and a hot air blower 25 shown in Fig. 2.

The nozzle 8 and clamp 12 are fixed to a moving platform 14 which moves along the base 11 according to the elongation or contraction of an air cylinder 13. The nozzle 8 is a cylindrical member through which the reinforcing wire 7 is threaded, and is supported on the platform 14 at a predetermined inclination angle above the coil wire 3.

The clamp 12 slides transversely to the reinforcing wire 7 according to the elongation or contraction of an air cylinder 16 provided on the moving platform 14, such that the reinforcing wire 7 is gripped between the clamp 12 and a stopper 17 formed on the moving platform 14. The reinforcing wire 7 is supported at a predetermined inclined downward angle above the coil wire 3 by means of the clamp 12 and a roller 19 fixed to the base 11, and is kept under tension by a tensioner 15.

A path 18 is formed in the moving platform 14 by cutting out a part of it so that the platform 14 and the coil wire 3 do not obstruct each other.

A reinforcing wire guide 20 is fixed to the base 11 in front of the nozzle 8. The guide 20 has a throughhole near its lower end through which the reinforcing wire 7 passes. A cutter 10 is supported at the outlet of this throughhole via an air cylinder 22 by a supporter 21 fixed to the base 11. The cutter 10 moves transversely across the outlet of the throughhole according to the elongation and contraction of the air cylinder 22, and thereby cuts the reinforcing wire 7. The coil wire 3 passes underneath the cutter 10 and the reinforcing wire guide 20.

A guide 6 consists of a conduit in a block 6A fixed to the base 11 in front of the cutter 10, and comprises

an inlet of large diameter and an outlet of small diameter. The coil wire 3 is always threaded through this guide 6.

The hot air blower 25 faces the outlet of this guide 6.

The chuck 9 is supported on the base 11 in front of the hole 6 via an air cylinder 23, and slides parallel to the wire 3 according to the elongation and contraction of this air cylinder 23. The chuck 9 opens and closes according to the elongation and contraction of an air cylinder 24, and grips the coil wire 3 in a vertical direction.

Parts 9A and 9B of the chuck 9 which grasp the coil wire 3 and the reinforcing wire 7 both have V-shaped surfaces as shown in Fig. 6, the coil wire 3 and reinforcing wire 7 being supported in a diamond-shaped area formed by the two V-shaped surfaces when the parts 9A and 9B are superposed by sliding them in the directions shown by the arrows in the figure.

The reinforcing of the coil wire 3 by the reinforcing device 5 is performed according to the following procedure.

In Fig. 2, the moving platform 14 is held in its retracted position, and the tip of the reinforcing wire 7 cut by the cutter 10 is situated at the outlet of the through-hole of the reinforcing wire guide 20. The clamp 12 has moved down, and the reinforcing wire 7 is gripped between the clamp 12 and stopper 17.

The platform 14 then moves forward so that the reinforcing wire 7 held by the clamp 12 advances, its tip passes through the reinforcing wire guide 20 to penetrate the inlet of the guide 6, and passes through the guide 6 to project forward from the outlet of same.

As the inlet of the guide 6 has a large diameter, the tip of the reinforcing wire 7 enters the guide 6 smoothly. On the other hand, as the outlet has a small diameter, the tip of the reinforcing wire 7 must necessarily touch the coil wire 3 in the neighborhood of the outlet.

The chuck 9 driven by the air cylinder 23 approaches the guide 6, and grasps the tip of the reinforcing wire 7 projecting from the guide 6 together with the coil wire 3 as shown in Fig. 3.

After the chuck 9 has grasped the reinforcing wire 7 and coil wire 3 by moving the V-shaped grips 9A and 9B closer together and superimposing them to form a diamond-shaped area as shown in Fig. 6, the superposition of the grips is increased so as to hold the reinforcing wire 7 and coil wire 3 in close contact.

The clamp 12 is then raised so as to release the reinforcing wire 7, the chuck 9 is driven forward by the air cylinder 23, and while the coil wire 3 and reinforcing wire 7 are pulled out of the guide 6, hot air is blown from the hot air blower 25. The melting layer of the reinforcing wire 7 therefore melts, and the tip of the reinforcing wire 7 fuses to the adjacent coil wire 3.

When the tip of the reinforcing wire 7 has fused with the coil wire 3 over a certain length, the chuck 9 is temporarily released, the chuck 9 is moved back toward the guide 6, and the coil wire 3 and reinforcing wire 7 are again grasped in the neighborhood of the outlet of the guide 6 as shown in Fig. 5. The moving platform 14 is

then retracted to its original position.

Next, the bobbin 2 of the winding device 1 is rotated so as to pull the coil wire 3 out of the guide 6. The coil wire 3 is therefore pulled out of the guide 6 together with the reinforcing wire 7 whose tip is fused to it. Hot air is also blown onto the coil wire 3 and reinforcing wire 7 which have been pulled out of the guide 6, thereby forming a reinforced portion behind and continuous with the reinforced portion already formed. As the chuck 9 is closed, the coil wire 3 and reinforcing wire 7 which has been fused with it must pass through the diamond-shaped area formed by the V-shaped grips 9A and 9B while their transverse displacement is restricted. The coil wire 3 and reinforcing wire 7 therefore always pass a fixed point between the guide 6 and the chuck 9 while they are in close contact, and fusing of the reinforcing wire 7 to the coil wire 3 is ensured.

After the reinforcing wire 7 and coil wire 3 have been fused over a predetermined length, the rotation of the bobbin 1 is stopped, the reinforcing wire 7 is held by the clamp 12, and then cut at the outlet of the throughhole in the reinforcing wire guide 20 by means of the cutter 10.

After cutting, the rotation of the bobbin 2 is recommenced, and while pulling the reinforcing wire 7 and coil wire 3 between the cutter 10 and guide 6 out in front of the guide 6, hot air is blown from the hot air blower 25 so that the end portion of the reinforcing wire 7 is also fused to the coil wire 3. This completes the reinforcing of the coil wire 3. The coil wire 3 can thus be reinforced at any desired position and over any desired length.

By means of the aforesaid procedure, the reinforcing necessary at the end of winding the coil wire 3 and the reinforcing necessary at the beginning of winding the wire 3 onto the next bobbin 2, can be performed continuously in one operation. If it necessary to wind the wire 3 onto the terminal pin of the bobbin 2 during the winding procedure, the reinforcing device 5 can be operated on each such occasion.

As there is no loop in the coil wire 3 or the reinforcing wire 7 when forming the reinforced portion, therefore, there is no risk that the coil wire 3 will have a reduced breakdown voltage or that the coil wire 3 will be damaged when molding is carried out after winding, even if part of the reinforced portion is wound onto the bobbin 2 during winding. Besides there is no risk that a loop will catch on the nozzle of the winding device 1.

In the aforesaid embodiment, the guide 6 may instead take the form of a V-shaped groove, the coil wire 3 and reinforcing wire 7 being brought into close contact by leading them into this groove. In this case, hot air is blown not toward the outlet of the guide 6, but toward the inside of the groove which forms the guide 6.

An alcohol applicator may also be used instead of the hot air blower as a means of fusing the reinforcing wire 7 to the coil wire 3. In this case, a fusible layer which liquefies due to the action of alcohol is provided on the reinforcing wire 7, an alcohol applicator is installed near

the guide 6 instead of the hot air blower 25, and alcohol is applied to the reinforcing wire 7 so as to fuse the reinforcing wire 7 to the coil wire 3. The hot air blower 25 and the alcohol applicator may of course also be used in conjunction. Further, the fusion may also be performed by means of a laser.

In the aforesaid embodiment, the reinforcing wire 7 is guided into the fixed guide 6 by moving the clamp 12, however, such arrangement is also possible wherein the clamp 12 is fixed and the guide 6 moves instead.

Claims

1. A method for reinforcing coil wire (3) between a wire supplying device which supplies said wire (3) and a wire winding device (1) which winds said supplied wire (3) onto a coil bobbin (2), characterized in that:

said wire (3) is guided over a certain distance in close contact with a reinforcing wire (7) which fuses to said coil wire (3) under predetermined conditions, and the fusing conditions are applied to said reinforcing wire (7) within said guide distance.

2. A reinforcing method as defined in claim 1 wherein said reinforcing wire (7) has a fusible layer which melts by the action of heat, and is fused to said coil wire (3) by blowing hot air onto it.

3. A device for reinforcing coil wire (3) provided between a wire supply device which supplies said wire (3) and a wire winding device (1) which winds said supplied wire (3) onto a coil bobbin(2), comprising:

means for supplying a reinforcing wire (7) which fuses to said coil wire (3) under predetermined conditions, a guide (6) for guiding said coil wire (3) together with said reinforcing wire (7) means for threading the tip of said reinforcing wire (7) through said guide (6), a chuck (9) for gripping and displacing said coil wire (3) together with said reinforcing wire (7) which have passed through said guide (6), and means for establishing said predetermined conditions near said guide (6).

4. A device for reinforcing coil wire (3) as defined in claim 3 wherein said reinforcing wire (7) has a melting layer which melts due to the action of heat, and said establishing means comprises a hot air blower (25) which blows hot air on said reinforcing wire (7).

5. A device for reinforcing coil wire (3) as defined in claim 3 wherein said guide (6) is a conduit through which said coil wire (3) and said reinforcing wire (7)

pass, said conduit having an inlet of large diameter and an outlet of small diameter.

6. A device for reinforcing coil wire (3) as defined in claim 3 wherein said threading means comprises a releasable holder (12) which holds said reinforcing wire (7) and a mechanism (13, 14) which moves said holder (12) relative to said guide (6) such that the tip of said reinforcing wire (7) penetrates said guide (6).

7. A device for reinforcing coil wire (3) as defined in claim 6 further comprising a cutter (10) which cuts said reinforcing wire (7) between said holder (12) and said guide (6).

8. A device for reinforcing coil wire (3) as defined in claim 3 wherein said chuck (9) comprises a pair of V-shaped grip surfaces (9A, 9B) which overlap with each other to grip said coil wire (3) and said reinforcing wire (7).

Patentansprüche

1. Verfahren zur Verstärkung von Wicklungsdraht (3) zwischen einer den Draht (3) zuführenden Drahtzuführvorrichtung und einer dem zugeführten Draht (3) auf einen Spulenkörper (2) wickelnden Drahtwickelvorrichtung (1),
dadurch gekennzeichnet,

daß der Draht (3) über eine bestimmte Strecke einen Verstärkungsdraht (7) berührend geführt wird, der mit dem Wicklungsdraht (3) unter vorbestimmten Bedingungen verschweißt, und

daß die Verschweißbedingungen innerhalb der Führungsstrecke auf den Verstärkungsdraht (7) aufgebracht werden.

2. Verfahren zur Verstärkung nach Anspruch 1, **dadurch gekennzeichnet,** daß der Verstärkungsdraht (7) eine leicht schmelzbare Schicht aufweist, die bei Einwirkung von Wärme schmilzt, und mit dem Wicklungsdraht (3) verschweißt wird, indem darauf heiße Luft aufgeblasen wird.

3. Vorrichtung zur Verstärkung von Wicklungsdraht, der zwischen einer den Draht (3) zuführenden Drahtzuführvorrichtung und einer den zugeführten Draht (3) auf einen Spulenkörper (2) wickelnden Drahtwickelvorrichtung (1) ausgebildet ist, mit:

Mitteln zum Zuführen eines Verstärkungsdrahtes (7), der unter vorbestimmten Bedingungen mit dem Wicklungsdraht (3) verschweißt wird,

einer Führung (6) zum Führen des Wicklungsdrahtes (3) zusammen mit dem Verstärkungsdraht (7),

Mitteln zum Einfädeln der Spitze des Verstärkungsdrahtes (7) in die Führung (6),

einem Spannfutter (9) zum Greifen und Fördern des Wicklungsdrahtes (3) zusammen mit dem Verstärkungsdraht (7), nachdem diese durch die Führung (6) hindurchgelaufen sind, und

Mitteln zum Einstellen der vorbestimmten Bedingungen in der Nähe der Führung (6).

4. Vorrichtung zur Verstärkung von Wicklungsdraht (3) gemäß Anspruch 3, **dadurch gekennzeichnet,** daß der Verstärkungsdraht (7) eine leicht schmelzbare Schicht aufweist, die bei Einwirkung von Wärme schmilzt, und daß das Einstellungsmittel ein Heißluftgebläse umfaßt, das warme Luft auf den Verstärkungsdraht (7) bläst.

5. Vorrichtung zur Verstärkung von Wicklungsdraht (3) gemäß Anspruch 3, **dadurch gekennzeichnet,** daß die Führung (6) einen Durchlaß aufweist, durch den der Wicklungsdraht (3) und der Verstärkungsdraht (7) hindurchlaufen, wobei der Durchlaß einen Einlaß mit großem Durchmesser und einen Auslaß mit kleinem Durchmesser aufweist.

6. Vorrichtung zur Verstärkung von Wicklungsdraht (3) gemäß Anspruch 3, **dadurch gekennzeichnet,** daß das Einfädelmittel einen lösbaren Halter (12), der den Verstärkungsdraht (7) hält, sowie einen Mechanismus (13, 14) umfaßt, der den Halter (12) relativ zu der Führung (6) bewegt, so daß die Spitze des Verstärkungsdrahtes (7) durch die Führung (6) hindurchtritt.

7. Vorrichtung zur Verstärkung von Wicklungsdraht (3) gemäß Anspruch 6, **dadurch gekennzeichnet,** daß sie weiterhin eine Schneidvorrichtung (10) umfaßt, die den Verstärkungsdraht (7) zwischen dem Halter (12) und der Führung (6) durchtrennt.

8. Vorrichtung zur Verstärkung von Wicklungsdraht (3) gemäß Anspruch 3, **dadurch gekennzeichnet,** daß das Spannfutter (9) ein Paar von V-förmigen Greifflächen (9A, 9B) aufweist, die sich gegenseitig überlappen, um den Wicklungsdraht (3) und den Verstärkungsdraht (7) zu greifen.

Revendications

1. Procédé de renforcement d'un fil métallique pour

enroulement (3) entre un dispositif d'alimentation en fil métallique qui fournit ledit fil métallique (3) et un dispositif (1) d'enroulement de fil métallique qui enroule ledit fil métallique (3) fourni sur une bobine d'enroulement (2), caractérisé en ce que :

ledit film métallique (3) est guidé sur une certaine distance en contact étroit avec un fil métallique de renforcement (7) qui fond sur ledit fil métallique pour enroulement (3) dans des conditions prédéterminées, et en ce que les conditions de fusion sont appliquées audit fil métallique de renforcement (7) dans les limites de ladite distance de guidage.

2. Procédé de renforcement défini dans la revendication 1, dans lequel ledit fil métallique de renforcement (7) possède une couche fusible qui fond sous l'action de la chaleur et est fondue sur ledit fil métallique pour enroulement (3) en soufflant de l'air chaud sur celui-ci.

3. Dispositif de renforcement d'un fil métallique pour enroulement (3) placé entre un dispositif d'alimentation en fil métallique qui fournit ledit fil métallique (3) et un dispositif d'enroulement de fil métallique (1) qui enroule ledit fil métallique fourni (3) sur une bobine d'enroulement (2) comportant :

des moyens pour fournir un fil métallique de renforcement (7) qui fond sur ledit fil métallique pour enroulement (3) dans des conditions prédéterminées,

un guide (6) pour guider ledit fil métallique pour enroulement (3) en même temps que ledit fil métallique de renforcement (7),

des moyens pour enfiler l'extrémité dudit fil métallique de renforcement (7) dans ledit guide (6),

un mandrin de serrage (9) pour saisir et déplacer ledit fil métallique pour enroulement (3) en même temps que ledit fil métallique de renforcement (7), qui sont passés par ledit guide (6), et

des moyens pour établir lesdites conditions prédéterminées près dudit guide (6).

4. Dispositif de renforcement d'un fil métallique pour enroulement (3) défini dans la revendication 3, dans lequel ledit fil de renforcement (7) possède une couche de fusion qui fond sous l'action de la chaleur, et lesdits moyens d'établissement comportent une soufflante d'air chaud (25) qui souffle de l'air chaud sur ledit fil métallique de renforcement (7).

5. Dispositif de renforcement d'un fil métallique pour enroulement (3) défini dans la revendication 3 dans lequel ledit guide (6) est un conduit dans lequel pas-

sent ledit fil métallique pour enroulement (3) et ledit fil métallique de renforcement (7), ledit conduit ayant une entrée de grand diamètre et une sortie de petit diamètre.

6. Dispositif de renforcement d'un fil métallique pour enroulement (3) défini dans la revendication 3, dans lequel lesdits moyens d'enfilage comportent un organe de maintien desserrable (12) qui tient ledit fil métallique de renforcement (7) et un mécanisme (13, 14) qui déplace ledit organe de maintien (12) par rapport audit guide (6) de manière que l'extrémité dudit fil métallique de renforcement (7) pénètre dans ledit guide (6).

7. Dispositif de renforcement d'un fil métallique pour enroulement (3) défini dans la revendication 6 comportant en outre un couteau (10) qui coupe ledit fil métallique de renforcement (7) entre ledit organe de maintien (12) et ledit guide (6).

8. Dispositif de renforcement d'un fil métallique pour enroulement (3) défini dans la revendication 3, dans lequel ledit mandrin (9) comporte une paire de surfaces de saisie en forme de V (9A, 9B) qui se recouvrent l'une l'autre pour saisir ledit fil métallique pour enroulement (3) et ledit fil métallique de renforcement (7).

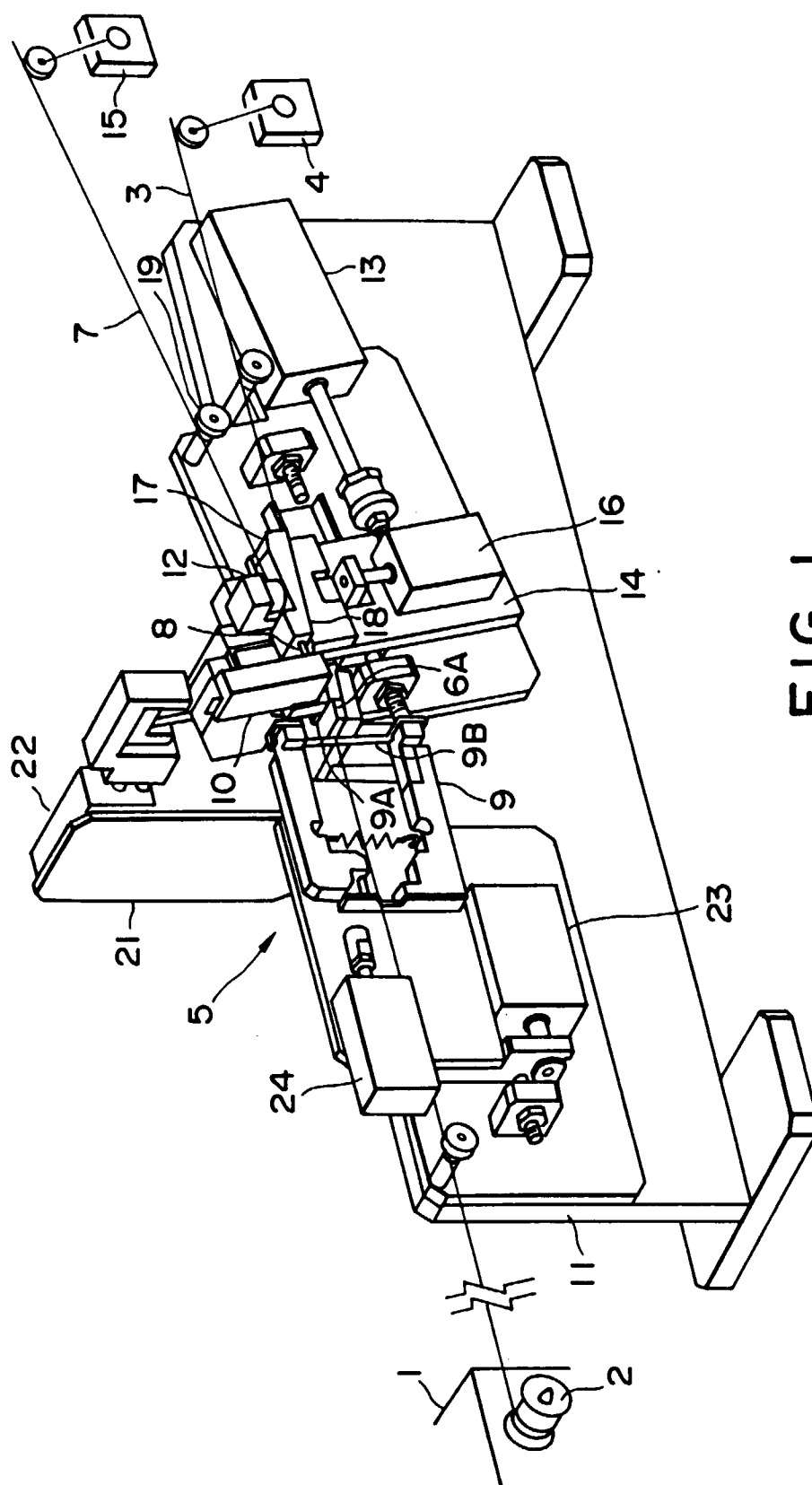
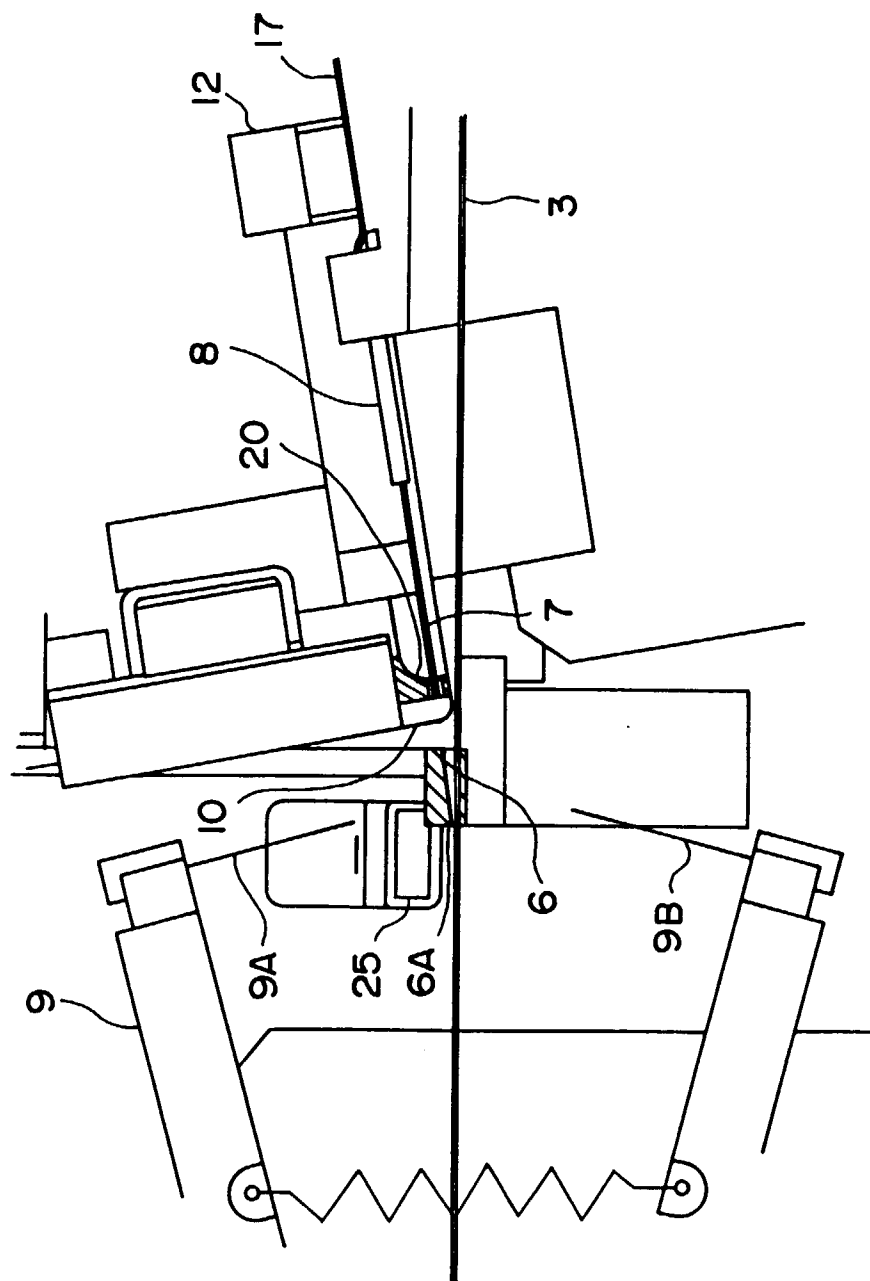


FIG. 1



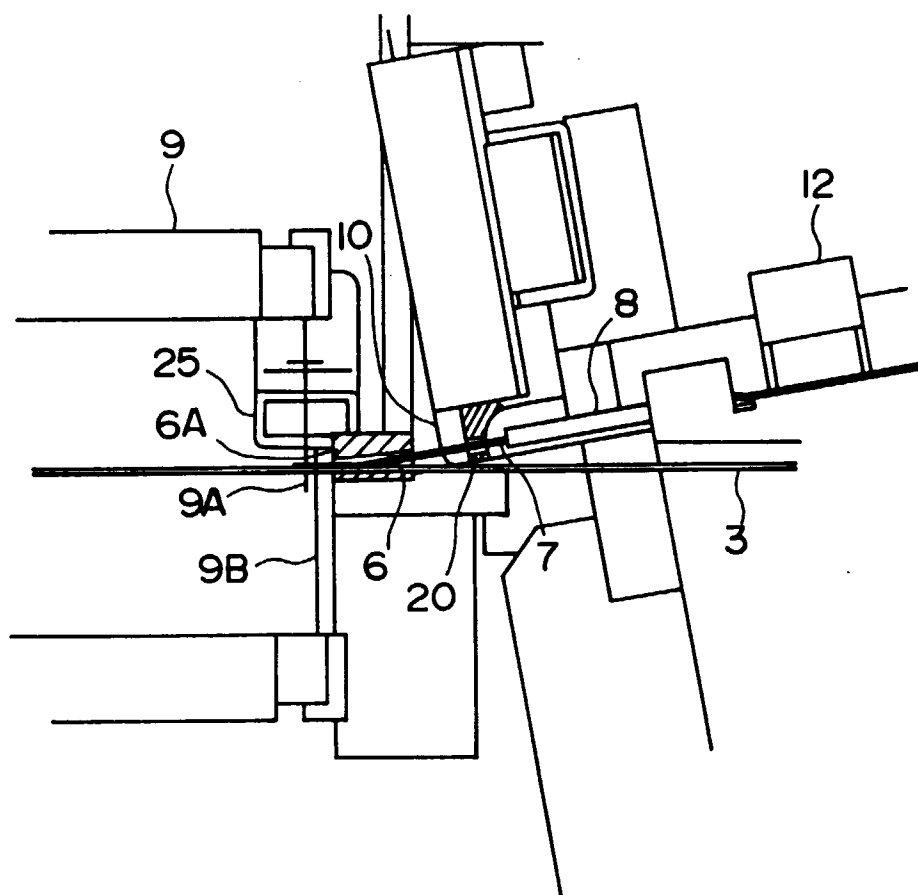


FIG. 3

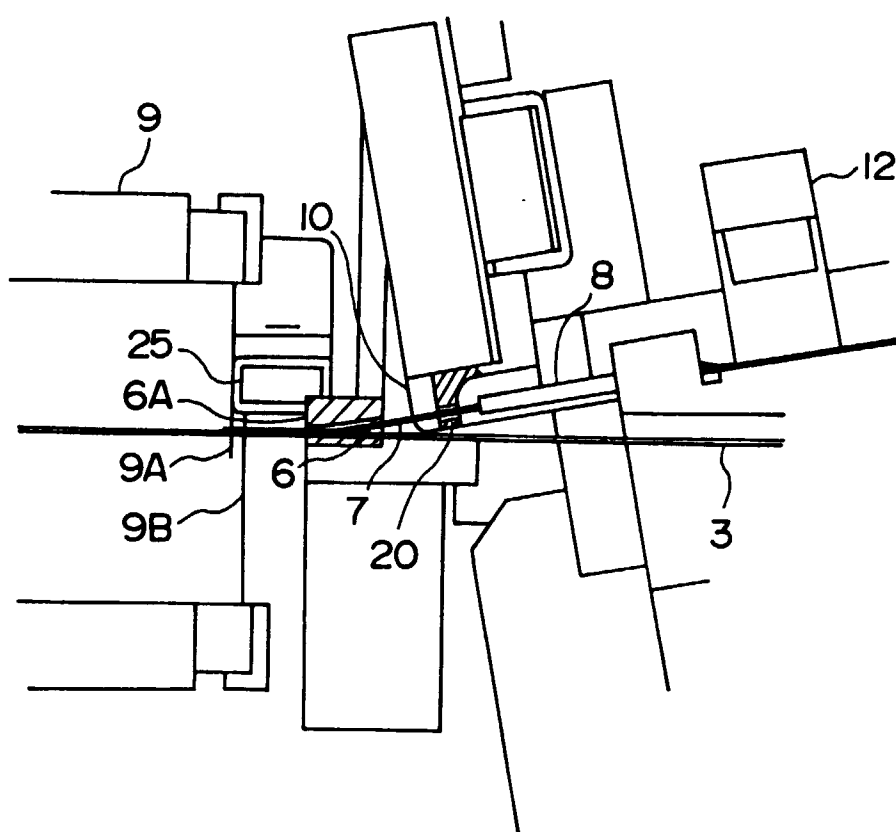


FIG. 4

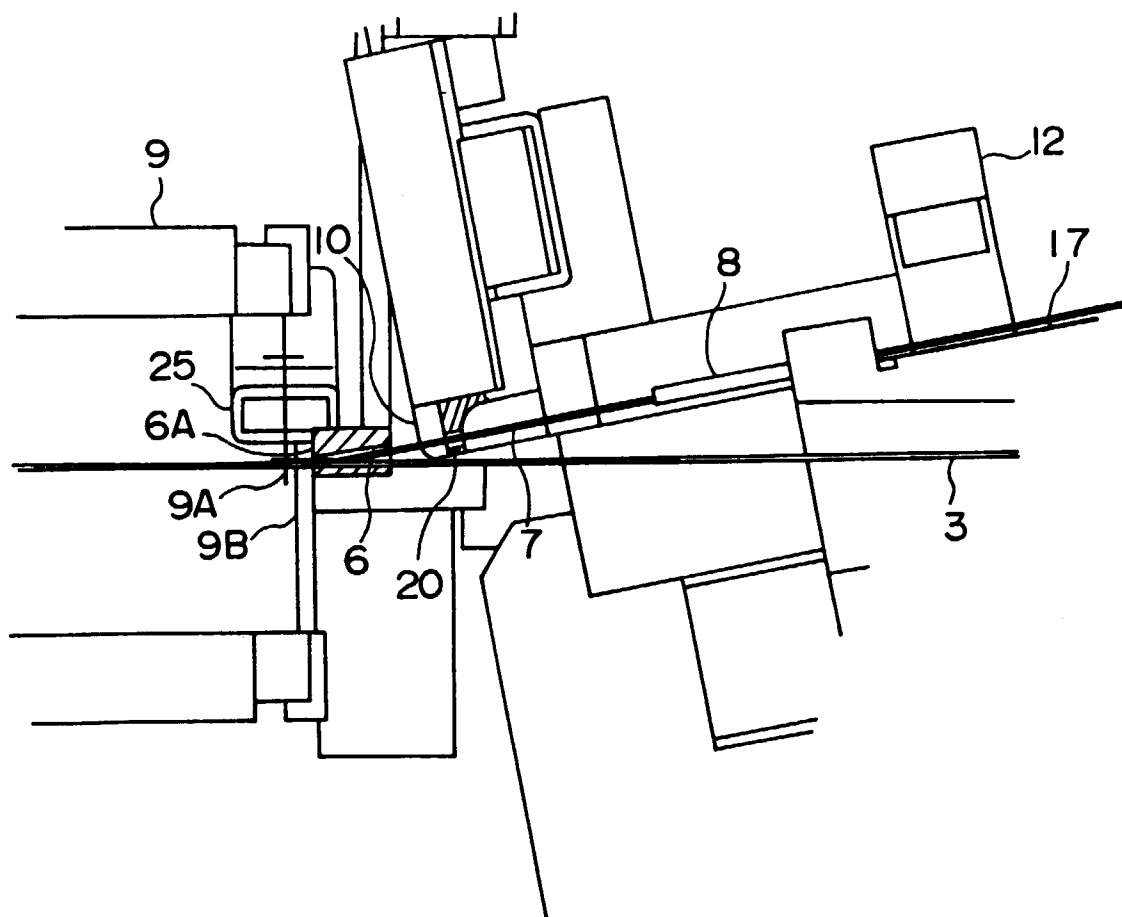


FIG. 5

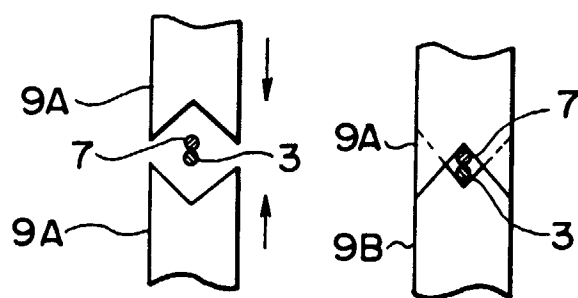


FIG. 6