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(54) METHOD AND SYSTEM OF PRODUCTION OF SPRINGS FROM WIRE OF CIRCULAR OR OTHER CROSS-SECTIONAL AREA

VERFAHREN UND SYSTEM ZUR HERSTELLUNG VON FEDERN AUS DRAHT MIT KREISFÖRMIGER ODER ANDERER QUERSCHNITTSFLÄCHE

SYSTEME ET PROCEDE DE PRODUCTION DE RESSORTS A PARTIR D'UN FIL A SECTION TRANSVERSALE DE FORME CIRCULAIRE OU AUTRE

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(73) Proprietors:
- **Anagnostopoulos, Panagiotis**
  136 71 Athens (GR)
- **Anagnostopoulos, Antonios**
  151 26 Marousi Athens (GR)

(72) Inventors:
- **Anagnostopoulos, Panagiotis**
  136 71 Athens (GR)
- **Anagnostopoulos, Antonios**
  151 26 Marousi Athens (GR)

(74) Representative: **Schuhmann, Albrecht**
Allersberger Strasse 185
90461 Nürnberg (DE)

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Description

TECHNICAL SCOPE OF THE INVENTION

[0001] The present invention refers to a method and a system of production of springs of wire of circular or other cross-sectional area, that are produced not directly from raw wire but after first producing cylindrical springs with a diameter smaller or equal to the smallest diameter and have pitch smaller or equal to the smallest pitch of the desired finalized spring. A system according to the preamble of claim 6 is e.g. known from SU-A-988430.

STATE OF THE ART

[0002] The springs are produced in many ways that are all without exception based on the following method: for bending the spring at least three points (a, b, c) are required on which the wire has to be pressed in order to be bent. The two outer points (a & c) push the wire in the same direction and the middle one (b) in an opposite direction (Figure 1). If the spring is advanced from one side so as to go through these three points, then the result is to have production of circular springs (9). The spring turns always tend to be produced tangent to one another with about zero pitch advance. If though we compress the produced spring turn at a fourth point after production in a direction normal to its plane, then analogous pitch is generated.

[0003] The state of the art as well as the details of the method and the system according to the present invention will become understood from the description of a specific embodiment, in the sense of a non-restrictive example and by the attached figures:

Figure 1: Depicts conceptually the method of production of springs according to the state of the art.

Figure 2: Depicts a system that satisfies the kinematic demands of the method according to the positions and the way of motion of its individual components during the production phase of the initial spring.

Figure 3: Depicts a system that meets the kinematic requirements of the method according to the positions and the way of motion of the individual components during the production phase of the final spring.

Figure 4: Depicts a side view section of an initial spring when it is being formed of constant diameter and small pitch.

REVELATION OF THE INVENTION

[0004] With our method each spring is produced in two stages. First, the spring is produced (6) that is cylindrical of constant diameter and small pitch. The spring can leave a minimal zero pitch (8). The initial spring (6) does not acquire many spring turns because from its inception we utilize it to form the final spring (7) that has the desired spring turn diameters and pitches.

[0005] The initial spring (6) is produced as follows: the wire is wrapped around a central roller (1) of selected diameter that has a revolving motion. The wire is compressed by one or multiple rollers (2), (3), (4) onto the perimeter of the central roller (1). The rollers (2), (3), (4) can have motion. Thus, there exists a strong pulling force, acting on the wire that is reinforced by the wrapping of the wire.

[0006] With the revolution of the central roller (1) and with the compression of the other rollers the wire is wrapped around it and thus the spring is produced. This initial spring (6) is formed such as to have a diameter smaller or equal to the smallest of the diameters that we desire to impart to the final spring (7).

[0007] It is produced easily because the wire is easily pulled through by the revolving roller (1) onto which a frictional resistance force is generated, in contrast to other methods of spring production, where the spring is being advanced compressed only at points, held in by roller pairs.

[0008] Our innovation rests on the following: When the first spring turn of the initial spring (6) is emerging, then we press it with a suitably formed pin (5) that encompasses it and pulls it in a direction from its centre towards the outside. Thus the spring turn is forced to enlarge and to bend acquiring the controlled desired diameter. In the same way the same spring turn is compressed in the longitudinal direction of the spring in the sense of the spring turn advance. In this fashion it bends creating a regulated pitch. The effecting force in the spring turn advance direction can also be generated with the same pin (5) that creates the diameter or from a second other suitably formed pin. There is a difference with the till recently existing methods. With these methods the rectilinear wire passing through the rollers is compressed to enter through three point mechanisms so as to be bent and thus with the continuous advance to form the spring turn and the desired diameter. The pressure exerted to transform the straight wire to a circle is accomplished from the outer direction towards the inner one. In our method, the pressure exerted to create the diameters is accomplished in a totally different fashion from the inner direction towards the outer one because we have to form not the wire, that has first been straightened, but an already prepared cylindrical spring whose existing diameter and pitch we would like to enlarge.

[0009] When with continuous advancement of new spring turns and consecutive movements of the pins (5) the desired final spring (7) is formed with the desired diameter and pitches then with a suitable severing mechanism the spring is cut to the desired point and then again commences the production of the subsequent spring. In the regulation for the production of the initial springs (6) the diameter of the wire is taken into consideration as

well as the smallest diameter that the final spring (7) will have, so as to select the proper diameter of the central revolving roller (1) so as to form the analogous initial cylindrical spring (6). Around the central roller (1) it is not necessary to wrap many spring turns, since already with the turning of the wire onto a portion only of the circumference, the bending corresponding to the diameter of the initial spring (6) has been achieved.

[0010] It is possible for the central roller (1) to have a width of only a few millimetres or at minimum as much as the diameter of the processed wire. The formed spring turns are exiting axially from the roller (1) being pushed by each newly produced spring turn.

[0011] The cylindrical spring can also be accomplished by a fewer 180° turning of the wire around the roller (1). In such a case, the start of the first spring turn that leaves its encapsulation between the central roller (1) and the final roller (3) that compresses it, is ready to accept its further formation in order to develop the desired final diameter and to impart the final desired pitch.

[0012] When the first spring turn emerges it has, due to rigidity, a diameter larger than that of the central roller (1) onto which it has been wrapped around and thus there is room in order for the pin (5) to come underneath it, that comes into the space between the spring turn and the central roller (1), contacting it at the interior.

[0013] With this pin (5) we achieve a pushing effect of the spring turn towards the outside so as to form its diameter, but as well as the advancement of the spring turn towards the longitudinal direction of the spring, so as to form the pitch. The source of motion of the pin (5) to form the diameter and spring turn pitch can be situated on an axle (10) that is suitably situated on a base (11).

[0014] From the axle (10) via an elbow member (12) onto one end of which the properly shaped pin (5) is attached, we reach from beneath at the interior space of the formed spring turn so that the pin (5) in contact at its inner side of it, encapsulates it.

[0015] Thus, when we revolve the axle (10), then the pin (5) that has encapsulated the spring turn pushes it towards the spring forming direction producing thus the diameter. Thus, with the same axle (10) combining its axial and its revolving movements, we have the necessary combinations of diameters and spring turn pitch for the formation of the desired springs (7). It is possible alternatively the pin (5) that is set at the end of one elbow member (12) that in turn is connected to an axle (10) that is suitably resting upon a base (14), to effect only the pushing of the spring turn towards the outside for the creation of the spring diameter, whereas the movement of the spring turn in the direction of the longitudinal spring advance direction to create its pitch to be effected by a second independent mechanical element with a pin that is resting on an elbow member, that in turn is connected to an axle, that is suitably resting on a base. This second mechanical element is not shown in the accompanying figures.

[0016] Preferably, the motion of the rollers that have motion and of the axle (10) that transmits the motion through the elbow (12) to the pin (5) is directed, controlled and coordinated by a suitable electronic computer, through which we can input the proper variables and characteristics of the final spring undergoing production, which are selectively the diameter and the pitch of each spring turn, so as to direct properly the operation of the system.

ADVANTAGES OF OUR METHOD

[0017] With the usage of the initial spring (6), which is easy in its production, we achieve the following:

1. It is not necessary to have one or two sets of rollers to pull the wires from the spools and for its advancement into the processing area. The rollers, besides being expensive to manufacture, damage the wire because they compress it at a point while its revolution and its wrapping around a roller is both simple and easy to accomplish and does not harm the wire material.

2. The wire does not need to be straightened as in the other methods, which both are difficult to achieve and with production costs that are expensive.

3. Due to the rolling around a roller, the resistance to the pull of the wire due to the weight inertion of the material spool is met by the frictional forces of the wire around this roller.

4. The alternating resistance force value coming from heavy wire spools in the method of advancement of the wire with rollers to produce spring diameters directly from straight wire, generates problems in the quality of the product that do not exist in our method. In the existing method, special type motors are needed and control of the wire payload station- This creates additional expenses. With our method, the strong pulling force and the non-influence of various types of resistant forces in the quality of the springs solve this problem.

5. Due to the fact that the first constant diameter has been created in the initial spring, the subsequent spring diameters necessitate fewer frictional forces and less energy to be consumed for their production.

6. There is large economisation of space with the abolishment of the pulling rollers of the straightening systems and the revolution control mechanisms of the wire payload stations. Additionally our method is most suitable for the production of multi-head mechanical complexes.

[0018] A system that consists of a special embodiment of the described method is depicted in Figure 3.

[0019] The present invention is not restricted by any means in the depicted embodiment that is described and presented in the fig ures as an example, but can be accomplished in many forms and dimensions without deviation from the protection rights as defined by the scope of the appended claims. In the embodiment of the invention, the materials utilized as well as the dimensions of the individual mechanical components can be adapted to the needs of the individual construction design.

[0020] In each claim where technical characteristics are presented and are followed by references, those are included only to enhance the understanding of the claim and in this fashion the references do not influence the review of the elements that are recognized through these in the example.

Claims

1. Method of production of springs of wire of circular or other type cross-sectional area, comprising the steps of producing initially from the wire a cylindrical spring (6) with diameter and pitch equal or smaller than the smallest diameter or pitch of the final under production spring (7) respectively, wherein each spring turn of the initial cylindrical spring (6) at the instance that it has been formed to the selected diameter is controllably pushed from the inner side towards the outside and simultaneously along the direction of the lengthwise axis of the spring of the spring advancement sense with a suitable means, where the energy has as a consequence its initial diameter to enlarge analogously acquiring the selected dimension of the spring turn of the final spring (7) where by the simultaneous controlled force of the same spring turn in the direction of the spring advance sense, it is properly bent and acquires the selected pitch of the spring turn of the final spring (7), wherein by the continuous adjustment onto each new spring turn of the initial spring (6) that is produced the final spring (7) is manufactured.

2. Method according to Claim 1 that is **characterized by** the fact that the further processing of the spring turn of the initial spring (6) can begin to take effect before the initial spring has been finished, soonest after the wire has already acquired the permanent bending that corresponds to the diameter of the initial spring (6).

3. Method according to Claim 1 that is **characterized by** the fact that the wire during the production of the initial cylindrical spring (6) that is formed by the pull and the wrapping of the wire around a suitable revolving central roller (1) it is compressed onto it, by preference by more than one roller (2, 3, 4).

4. Method according to Claim 1 that is **characterized by** the fact that the cylindrical spring is produced by wrapping of the wire onto a revolving roller (1) pressing simultaneously the wire onto it with rollers (2, 3, 4) with proper pressure, so that besides the bending of the wire to create also the analogous function so as to ensure strong pull of the wire.

5. Method according to Claim 1 that is **characterized by** the fact that the creation of the pitch and diameter of each spring turn of the final spring (7) can be generated successively one after another with independent movements.

6. System of production of springs of wire of circular or other cross-sectional area consisting of a central revolving roller (1) onto which are contacting with pressure perimetrically other rollers more than one, so as to encapsulate it, as to pull and to bend the wire creating the initial spring (6), **characterized by** the fact that it further consists of an elbow member (12) with a suitable pin (5) at its one end, and that it is adapted to contact the emerging spring turn from its inner and lower side, where the elbow (12) is connected to an axle (10) that is resting on a suitable base (11), which can rotate controllably around its axis, thereby moving the elbow with the pin(5) towards the outside of the spring and can simultaneously move controllably along the direction of the axis of the spring.

7. System of production of spring of wire of circular or other cross-sectional area according to Claim 6 that is **characterized by** the fact that it comprises two elbows with pins at their respective ends connected to suitably supported axles, wherein said first pin is designed to contact the spring turn of the initial spring (6) and to move pressing it from the inner side towards the outside to develop the selected spring turn diameter of the final spring (7) and the second pin is designed to contact the spring turn of the initial spring (6) and to move along the direction of the longitudinal axis of the spring in the spring advance sense in order to create the selected spring turn pitch of the final spring (7).

8. System of production of springs of circular or other type cross-sectional area according to Claim 6 that is **characterized by** the fact that rollers (2, 3, 4) that are in contact with the central roller (1) are more than one according to the cross-sectional area of the wire, and by preference three.

9. System of production of springs of circular or other type cross-sectional area according to Claim 6 that is **characterized by** the fact that besides to the main roller (1), it is possible to impart motion selectively to other rollers (2, 3, 4).

10. System of production of springs of circular or other type cross-sectional area according to Claim 6 that is **characterized by** the fact that the movements of rollers (1, 2, 3 and 4) that have motion and of the axle (10) which through the elbow (12) moves the pin (5) are directed, controlled and coordinated by a suitable electronic computer through which the necessary characteristics of the processed final spring (7) are entered which are the selected diameter and the selected pitch at each spring turn.

Patentansprüche

1. Verfahren zur Herstellung von Federn aus Draht mit kreisförmigem oder anders geartetem Querschnitt, umfassend die Schritte des Herstellens, zunächst aus dem Draht, einer zylindrischen Feder (6) mit einem Durchmesser und einer Steigung, die kleiner gleich dem kleinsten Durchmesser bzw. der kleinsten Steigung der produziert werdenden fertigen Feder (7) sind, wobei jede Federwindung der zylindrischen Ausgangsfeder (6) in dem Moment, in dem sie gemäß dem gewählten Durchmesser geformt wurde, mit einem geeigneten Mittel regelbar von innen nach außen und gleichzeitig entlang der Richtung der Längsachse der Feder der Federvorschubrichtung gedrückt wird, wobei die Energie infolgedessen ihren Ausgangsdurchmesser zu vergrößern hat, der dementsprechend die gewählte Abmessung der Federwindung der fertigen Feder (7) annimmt, wobei sie durch die gleichzeitige geregelte Kraft derselben Federwindung in Richtung der Federvorschubrichtung geeignet gebogen wird und die gewählte Steigung der Federwindung der fertigen Feder (7) annimmt, wobei durch die kontinuierliche Einstellung auf jeder neuen Federwindung der Ausgangsfeder (6), die hergestellt wird, die fertige Feder (7) hergestellt wird.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Weiterverarbeitung der Federwindung der Ausgangsfeder (6) beginnen kann, ehe die Ausgangsfeder fertiggestellt wurde, frühestens nachdem der Draht bereits die dauerhafte Biegung angenommen hat, die dem Durchmesser der Ausgangsfeder (6) entspricht.

3. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** der Draht während der Herstellung der zylindrischen Ausgangsfeder (6), die durch das Ziehen und das Wickeln des Drahtes rund um eine geeignete umlaufende mittige Walze (1) geformt wird, auf diese gedrückt wird, vorzugsweise mittels mehr als einer Walze (2, 3, 4).

4. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die zylindrische Feder durch Wikkeln des Drahtes auf eine umlaufende Walze (1) hergestellt wird, wobei der Draht zugleich mit Walzen (2, 3, 4) mit geeignetem Druck an diese gepresst wird, so dass neben dem Biegen des Drahtes auch die analoge Funktion, einen starken Zug des Drahtes zu gewährleisten, vorgesehen wird.

5. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** das Herstellen der Steigung und des Durchmessers jeder Federwindung der fertigen Feder (7) nach einander mit unabhängigen Bewegungen realisiert werden kann.

6. System zur Herstellung von Federn aus Draht mit kreisförmigem oder anders geartetem Querschnitt, bestehend aus einer mittigen umlaufenden Walze (1), an welche um den Umfang mehr als eine andere Walze mit Druck angedrückt werden, um diese zu umgeben, um den Draht zu ziehen und zu biegen und so die Ausgangsfeder (6) herzustellen, **dadurch gekennzeichnet, dass** es ferner besteht aus einem Ellbogenglied (12) mit einem geeigneten Stift (5) an dessen einem Ende und dass es ausgebildet ist, um die hervortretende Federwindung von ihrer inneren und unteren Seite zu kontaktieren, wobei der Ellbogen (12) mit einer Achse (10) verbunden ist, die auf einer geeigneten Basis (11) aufliegt, die sich regelbar um ihre Achse drehen kann und **dadurch** den Ellbogen mit dem Stift (5) zu der Außenseite der Feder hin bewegt und sich zugleich regelbar die Richtung der Achse der Feder entlang bewegen kann.

7. System zur Herstellung von Federn aus Draht mit kreisförmigem oder anders geartetem Querschnitt nach Anspruch 6, **dadurch gekennzeichnet, dass** es zwei Ellbogen mit Stiften an deren jeweiligen Enden umfasst, die mit geeignet gelagerten Achsen verbunden sind, wobei der erste Stift ausgebildet ist, um die Federwindung der Ausgangsfeder (6) zu berühren und sich zu bewegen und diese dabei von innen nach außen zu drücken, um den gewählten Federwindungsdurchmesser der fertigen Feder (7) herzustellen, und der zweite Stift ausgebildet ist, um die Federwindung der Ausgangsfeder (6) zu berühren und sich die Richtung der Längsachse der Feder entlang in der Federvorschubrichtung zu bewegen, um die gewählte Federwindungssteigung der fertigen Feder (7) zu herzustellen.

8. System zur Herstellung von Federn mit kreisförmigem oder anders geartetem Querschnitt nach Anspruch 6, **dadurch gekennzeichnet, dass** Walzen (2, 3, 4), die mit der mittigen Walze (1) in Kontakt stehen, mehr als eine dem Querschnitt des Drahtes entsprechende, und vorzugsweise drei sind.

9. System zur Herstellung von Federn mit kreisförmigem oder anders geartetem Querschnitt nach An-

spruch 6, **dadurch gekennzeichnet, dass** es möglich ist, neben der Hauptwalze (1) anderen Walzen (2, 3, 4) selektiv in Bewegung zu versetzen.

10. System zur Herstellung von Federn mit kreisförmigem oder anders geartetem Querschnitt nach Anspruch 6, **dadurch gekennzeichnet, dass** die Bewegungen der Walzen (1, 2, 3 und 4), die bewegt werden, und der Achse (10), die den Stift (5) über den Ellbogen (12) bewegt, durch einen geeigneten elektronischen Rechner gelenkt, gesteuert und koordiniert werden, mittels welchem die erforderlichen Eigenschaften der fertigverarbeiteten Feder (7), wobei es sich um den gewählten Durchmesser und die gewählte Steigung an jeder Federwindung handelt, eingegeben werden.

Revendications

1. Procédé de production de ressorts de fil circulaire ou d'un autre type de coupe transversale, comprenant les étapes consistant à produire initialement à partir du fil un ressort cylindrique (6) avec un diamètre et un pas inférieur ou égal au plus petit diamètre ou pas du ressort final en production (7) respectivement, dans lequel chaque tour de ressort du ressort cylindrique initial (6) à l'instance à laquelle il est formé au diamètre sélectionné est poussé de manière contrôlable du côté intérieur vers l'extérieur et simultanément dans la direction de l'axe longitudinal du ressort dans le sens d'avancement de ressort avec des moyens adaptés, où l'énergie en conséquence fait en sorte que son diamètre initial s'agrandisse de manière analogue en acquérant la dimension sélectionnée du tour de ressort du ressort final (7) où par la force contrôlée simultanée du même tour de ressort dans la direction du sens d'avancée de ressort, il est correctement plié et il acquiert le pas sélectionné du tour de ressort du ressort final (7), dans lequel par l'ajustement continu sur chaque nouveau tour de ressort du ressort initial (6) qui est produit, le ressort final (7) est fabriqué.

2. Procédé selon la revendication 1 qui est **caractérisé par le fait que** le traitement supplémentaire du tour de ressort du ressort initial (6) peut commencer à prendre effet avant que le ressort initial a été fini, au plus tôt après que le fil a déjà acquis la flexion permanente qui correspond au diamètre du ressort initial (6).

3. Procédé selon la revendication 1 qui est **caractérisé par le fait que** le fil pendant la production du ressort cylindrique initial (6) qui est formé par le tirage et l'enroulement du fil autour d'un rouleau central rotatif adapté (1) est compressé sur celui-ci de préférence par plus d'un rouleau (2, 3, 4).

4. Procédé selon la revendication 1 qui est **caractérisé par le fait que** le ressort électrique est produit par l'enroulement du fil sur un rouleau rotatif (1) pressant simultanément le fil sur celui-ci avec des rouleaux (2, 3, 4) à une pression appropriée, de manière à, en plus de la flexion du fil, créer également la fonction analogue pour assurer le tirage fort du fil.

5. Procédé selon la revendication 1 qui est **caractérisé par le fait que** la création du pas et du diamètre de chaque tour de ressort du ressort final (7) peut être générée successivement l'un après l'autre avec des mouvements indépendants.

6. Système de production de ressorts de fil de coupe circulaire ou d'autre coupe transversale, **caractérisé en ce qu'**il comprend un rouleau rotatif central (1) sur lequel sont en contact par pression de périmètre d'autres rouleaux qui sont plus d'un, de manière à l'encapsuler, pour tirer et plier le fil créant le ressort initial (6), **caractérisé en ce qu'**il comprend en outre un membre de coude (12) avec une broche adaptée (5) à son extrémité, et **en ce qu'**elle est adaptée pour être en contact avec le tour de ressort émergent de son côté intérieur et inférieur, où le coude (12) est connecté à un essieu (10) qui repose sur une base adaptée (11), qui peut tourner de manière contrôlable autour de son axe, ce qui déplace le coude avec la broche (5) vers l'extérieur du ressort et qui peut simultanément se déplacer de manière contrôlable dans la direction de l'axe du ressort.

7. Système de production de ressorts de fil de coupe circulaire ou d'autre coupe transversale selon la revendication 6 qui est **caractérisé par le fait qu'**il comprend deux coudes avec des broches à leurs extrémités respectives connectées à des essieux supportés de manière adaptée, dans lequel ladite première broche est conçue pour être en contact avec le tour de ressort du ressort initial (6) et pour se déplacer en le pressant du côté intérieur vers l'extérieur pour développer le diamètre de tour de ressort sélectionné du ressort final (7) et la seconde broche est conçue pour être en contact avec le tour de ressort du ressort initial (6) et pour se déplacer dans la direction de l'axe longitudinal du ressort dans le sens d'avancée de ressort pour créer le pas de tour de ressort sélectionné du ressort final (7).

8. Système de production de ressorts de coupe circulaire ou d'autre coupe transversale selon la revendication 6 qui est **caractérisé par le fait que** des rouleaux (2, 3, 4) qui sont en contact avec le rouleau central (1) sont plus d'un en fonction de la coupe transversale du fil et de préférence sont au nombre de trois.

9. Système de production de ressorts de coupe circu-

laire ou d'autre coupe transversale selon la revendication 6 qui est **caractérisé par le fait qu'**en plus du rouleau principal (1), il est possible d'appliquer un mouvement sélectivement à d'autres rouleaux (2, 3, 4).

10. Système de production de ressorts de coupe circulaire ou d'autre coupe transversale selon la revendication 6 qui est **caractérisé par le fait que** les mouvements des rouleaux (1, 2, 3 et 4) en déplacement et de l'essieu (10) qui à travers le coude (12) déplace la broche (5) sont dirigés, contrôlés et coordonnés par un ordinateur électronique adapté à travers lequel les caractéristiques nécessaires du ressort final traité (7) sont entrées, à savoir le diamètre sélectionné et le pas sélectionné à chaque tour de ressort.

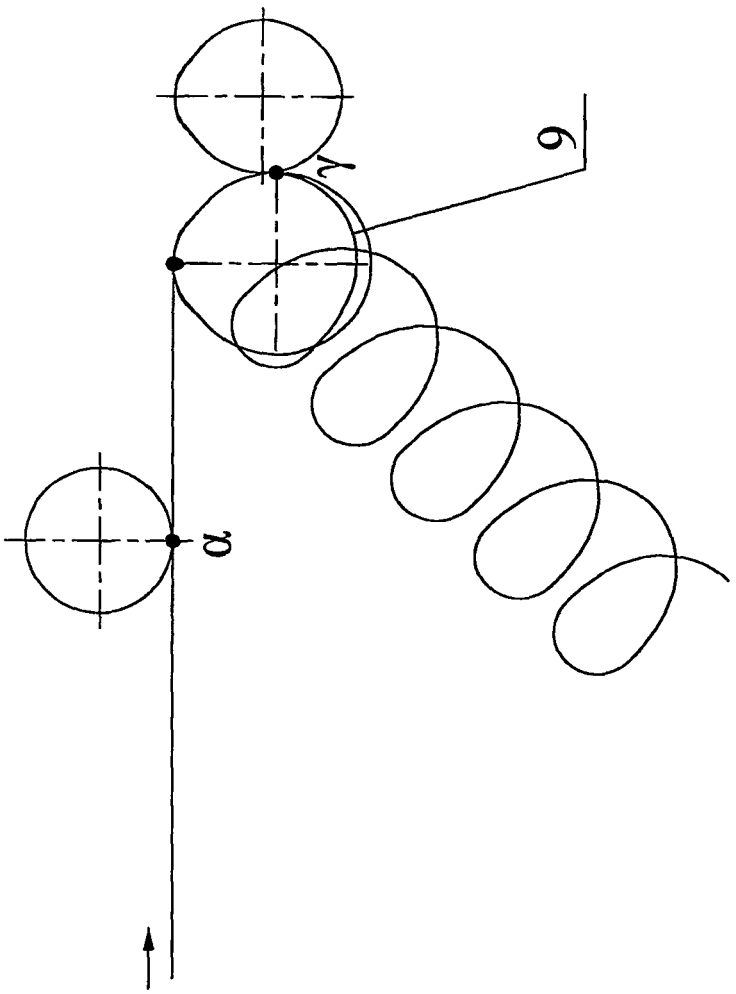


FIGURE 1

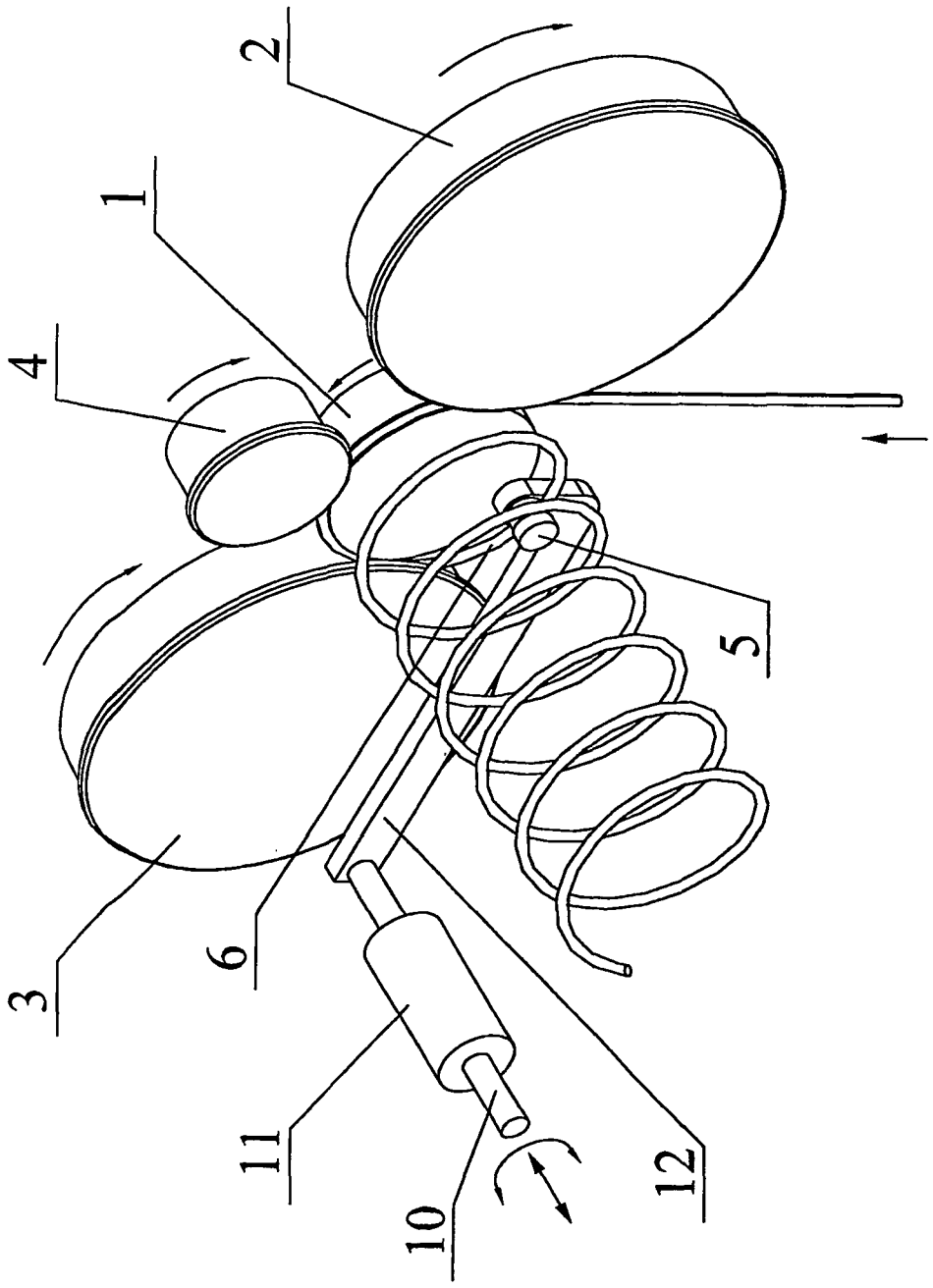


FIGURE 2

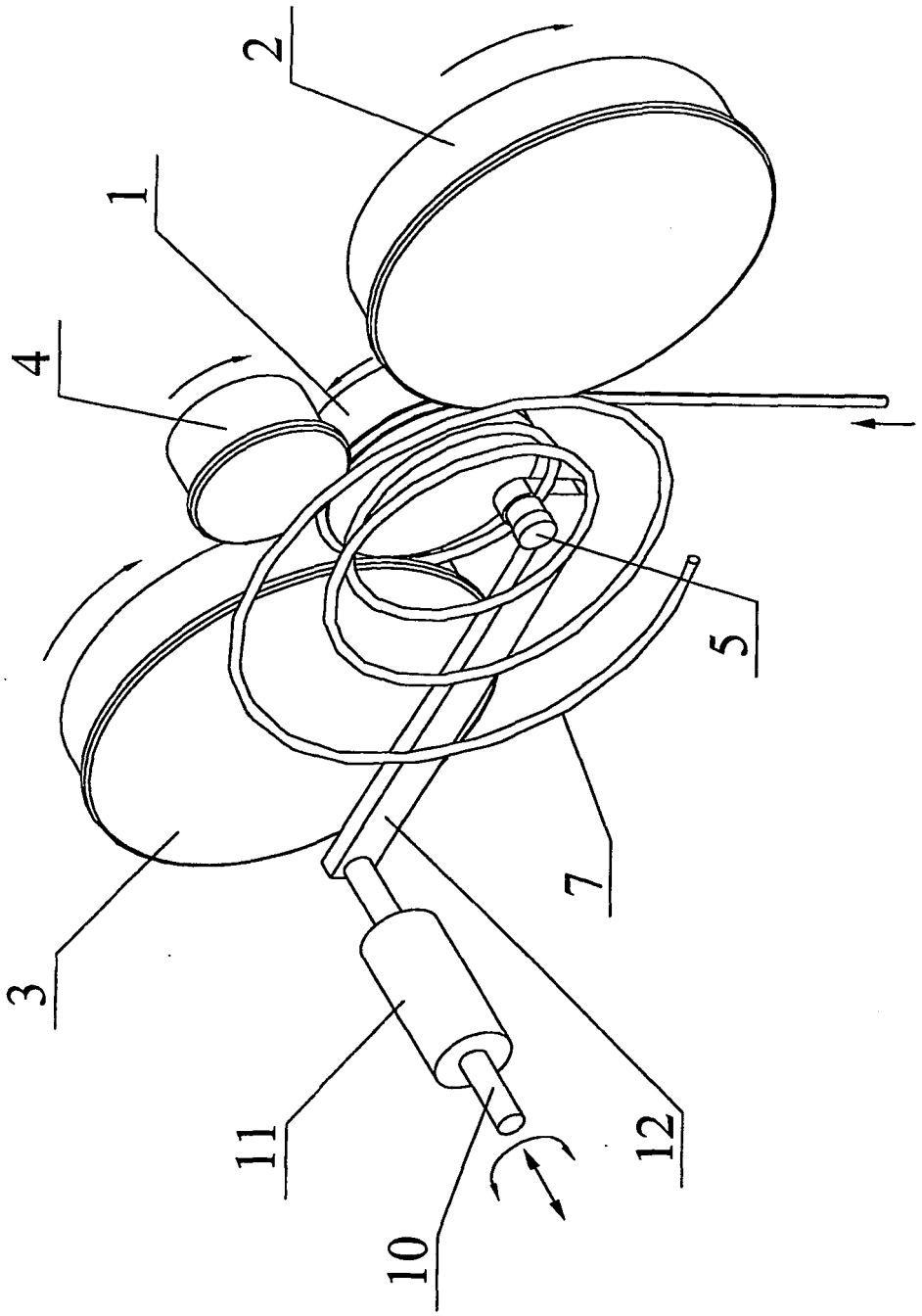


FIGURE 3

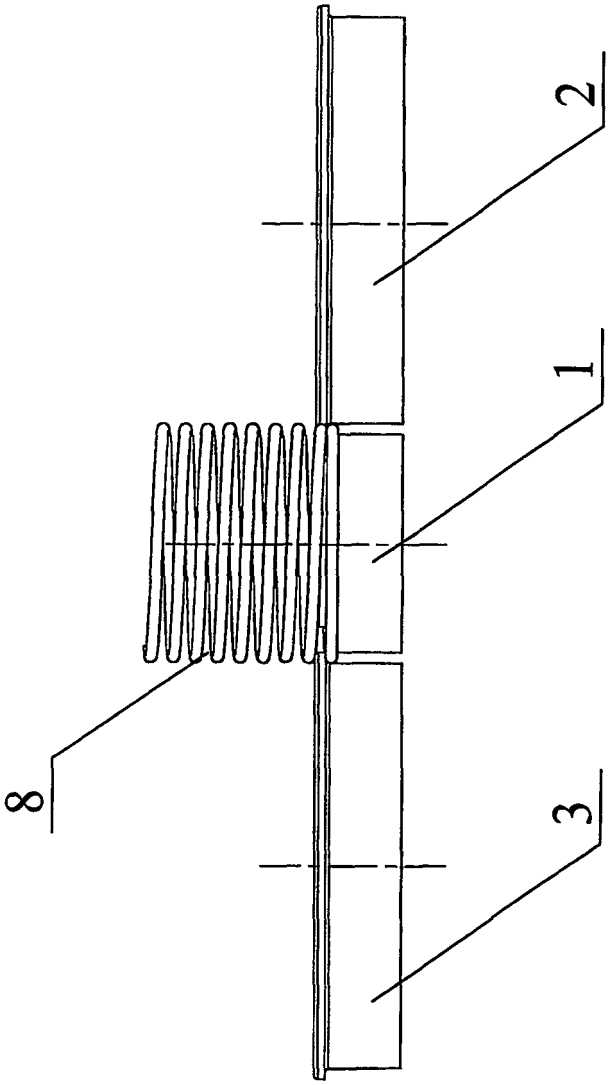


FIGURE 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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