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(54) METHOD OF EXTRUDING ELEMENTS, ESPECIALLY MADE OF METAL, AND A SYSTEM FOR EXTRUDING ELEMENTS, ESPECIALLY MADE OF METAL

VERFAHREN ZUM EXTRUDIEREN VON ELEMENTEN, INSBESONDERE AUS METALL, UND SYSTEM ZUM EXTRUDIEREN VON ELEMENTEN, INSBESONDERE AUS METALL

PROCÉDÉ PERMETTANT D'EXTRUDER DES ÉLÉMENTS, EN PARTICULIER CONSTITUÉS DE MÉTAL, ET SYSTÈME PERMETTANT D'EXTRUDER DES ÉLÉMENTS, EN PARTICULIER CONSTITUÉS DE MÉTAL

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Description

[0001] The subject of invention is the method of extruding elements, especially made of metal, and a system for extruding elements, especially made of metal, employed for production of elements by means of extrusion.

[0002] The method of extruding an element by means of cyclic changes of deformation path using the phenomenon of local plasticizing during extrusion was presented in Materials Science and Technology, issue No. 16 (2000), page 664 and following, and called the KOBO method.

[0003] The Materials Processing Technology, issue No. 104 (2000) presents a method of extruding elements on an extrusion wheel, called COMFORM process, using the phenomenon of plasticizing material during rapid change of movement direction within the area of transferring the material through the die's calibrating orifice.

[0004] The Polish patent claim PL 388159 A presents methods of angular extrusion of elements, especially made of metal, where in the input cylinder, the mandrel cyclically performs a rotary movement in the zone die calibrating orifice.

[0005] It is known from Japan patent application No. JP 2003 334609 A, which forms the basis for the preamble of claims 1 and 2, a method of extruding elements, especially made of metal, by transferring the input material in the gap between the infeed wheel and the friction block and extruding it through a die, wherein in the output area the material is deflected from the infeed wheel tangentially or at an angle within 90°.

This rotary wheel type continuous extruding device comprises a rotary wheel having a peripheral groove along an outer peripheral part; a material feeding passage formed between the rotary wheel and a stationary shoe to be arranged on the peripheral side of the rotary wheel; an abutment to close an end of the material feeding passage; a material receiving surface formed on the abutment and facing the material feeding passage; the assembly chamber to be positioned outward in the radial direction of the material feeding passage at the end thereof; a die to be formed in the assembly chamber; and a work hole to be formed in the die. A plurality of secondary work holes to be introduced to the outside of the device are arranged parallel with the bored holes in the assembly chamber and the die.

[0006] It is known from Japan patent application JP 2002 172418 A, apparatus for extruding copper or copper alloy product and method for extruding same using the apparatus, lies in the fact that a groove having an amplitude of vibration of 0.1 mm to 0.5 mm which meanders periodically in the wheel width direction is formed in the wheel. Accordingly, when the wheel rotates, a relative position of the portion where an abutment of the groove against the entrance of a die chamber is inserted fluctuates periodically. Consequently, the flow direction of a plastic fluid in the die chamber begins to fluctuate and the relative position against the entrance of the die where copper oxide absorbed into the die chamber runs begins to fluctuate, too.; Accordingly, copper oxide is unable to stack in the entrance of the die, and even when extruding long sized copper products for a long stretch of time, flaws on the surface of copper products accompanied by stack of copper oxide are not easily generated and copper products having excellent surfaces can be manufactured stably over a long time.

[0007] It is known from U.S. patent No. 6 571 593 B1, continuous shear deformation device, comprising:a mold formed with a curved molding path having an equal channel for obtaining shear deformation of material passing through the molding path; and a rotary guide apparatus installed at the inlet of the molding path for continuously supplying and guiding material into the molding path by frictional contact with the material.

Mold comprises a curved and inclined inlet in order to increase the amount of contact between the guide apparatus and the material.

The clearance space of a supply path formed by the guide apparatus is less than the thickness of materials introduced into the guide apparatus.

A frictional contact with materials in the guide apparatus comprises a groove corresponding to the cross-sectional shape of the material.

[0008] It is known from Japan patent application No. JP 4 178213 A, method and device for controlling extrusion of metallic wire rod, lies in the fact that the sectional area is calculated with the diameter of the wire stock and the supplying quantity is calculated with the moving speed. Further, the generating quantity of the burr is calculated with arithmetic unit from the moving speed, the thickness and the width of the burr, and METSUKE (unit) weight is calculated as the difference of the supplying quantity of the wire stock and the generating quantity of the burr. Accordingly, the yield is calculated. The signal for controlling the pressing force of the pressure adjusting jack is outputted based on the relation set preliminarily corresponding to the calculated yield, and inputted to the controller. The pressing force of the pressure adjusting jack is controlled with this control signal on this result, the generating quantity of the burr, METSUKE (unit) weight and the yield can be controlled.

[0009] The essence of the invention, namely the method of extruding elements, especially made of metal, by transferring the input material in the gap between the infeed wheel and the friction block and extruding it through a die, wherein in the output zone the material is deflected from the infeed wheel tangentially or at an angle within 90°, lies in the fact that the material is caused to flow locally within the die zone, by a mandrel's rotary action.

[0010] This method is executed in the system for extruding elements, especially made of metal, consisting of an infeed wheel and a friction block, with a gap for transferring the material between the infeed wheel and the friction block, the gap ending with a shaped die, and in the gap's output zone there is a wedge to deflect the

direction of exit of the material fed by the rotating infeed wheel, lies in the fact that in the space between the friction block and the deflection wedge there is a mandrel adapted to cyclically rotate bidirectionally at a frequency of 0.1-10 Hz, whose face is adapted to contact the material in the zone of transfer into the die.

[0011] It is preferred that the die makes up the mandrel.

[0012] It is also preferred that the mandrel is made up by a roller, whose face is situated in the zone of the die's calibrating orifice, with outflow axis generally perpendicular to the direction of movement of the material.

[0013] It is also preferred that the mandrel is made up by a two-diameter roller, and the face of the end of the roller with smaller diameter is situated in the zone of the die's calibrating orifice.

[0014] It is also preferred that the mandrel's face has shaped inlets and splines.

[0015] The employment of the solution presented in the invention intensifies the phenomenon of plasticized flow of material in the die's area, which creates optimal conditions for the process of plastic processing of metals, especially with regard to extrusion. The effect consists in a greatly reduced deformation effort, reduced consumption of tools and reduced consumption of energy for the process. It allows the elimination of the thermal processing possibly required during the operation and consequently chemical processing. Significant deformation is achieved in a single operation, which is difficult, or even impossible to achieve with conventional processes. The localized plastic flow of materials makes it possible to obtain small grain structure of elements, which increases the elements' strength properties. Elements manufactured with this method and in a system according to the invention feature very good reflection of the shape of tools.

[0016] The subject of the invention, in the demonstration, but not limited to it, is presented by illustrating the method of extrusion, but for purposes of more accurate illustration, in the first place the diagram in the drawing shows a system for extruding elements, in the form of a fragment of the infeed wheel with the die in a section where the surface is perpendicular to the wheel's axis, and Fig. 1 shows the mandrel, made up by the die, and Fig. 2 shows the mandrel, made up by the roller situated with its face in the zone of the die's calibrating orifice, and Fig. 3 shows the mandrel made up by the two-diameter roller.

[0017] The system for extruding elements, especially made of metal, consists of the infeed wheel 1 and the friction block 2, with the gap 3 for transferring the material 4 between the two parts. The gap 3 ends with the shaped die 5. In the output zone, the gap 3 has a wedge 6 to deflect the direction of exit of the material 4 after it is supplied with the infeed wheel's movement. In the space between the friction block 2 and the deflecting wedge 6 there is a mandrel 7 caused to rotate bidirectionally and cyclically at frequency of 0.1-10 Hz, whose face contacts the material in the zone of transfer into the die 5.

[0018] There is a version of the system, shown in Fig. 1, where the mandrel 7 is made up by the die 5.

[0019] There is also a version of the system, shown in Fig. 2, where the mandrel 7 is made up by the roller, whose face is situated in the zone of the calibrating orifice 8 of the die 5, whose outflow axis is generally perpendicular to the direction of the movement of the material.

[0020] There is also a version of the system, shown in Fig. 3, where the mandrel 7 is made up by a two-diameter roller, and the face of the end of the roller with smaller diameter is situated in the zone of the calibrating orifice 8 of the die 5.

[0021] There are also versions of the system, where the mandrel's 7 face for each of the versions presented above has shaped inlets and splines.

[0022] The system shown above serves to execute the method of extruding elements, especially made of metal. The material 4 to be extruded is introduced into the gap 3 between the infeed wheel 1 and the friction block 2. The gap ends with a shaped die 5. In the output zone, the material 4 is deflected on the wedge 6 in the direction of the material's 4 exit after extrusion. In the space between the friction block 2 and the deflection wedge 6 the material 4 is subject to cyclical vibrations by the mandrel 7 caused to cyclically rotate bidirectionally at frequency of 0.1-10 Hz, whose face is in contact with the material 4 in the zone of transfer to the die 5. In order to increase the mandrel's 7 action on the material, the mandrel's 7 face has inlets and spines, not shown in the figure.

[0023] By subjecting the material 4 to vibrational action of the mandrel 7, the material 4 is plasticized in the zone of the calibrating orifice 8 of the die, which reduces the energy required to execute the process of calibrating the material in the die 5, in order to produce the final product, namely the wire 9.

Claims

1. The method of extruding elements, especially made of metal, by transferring the input material in the gap between the infeed wheel and the friction block and extruding it through a die, wherein in the output zone the material is deflected from the infeed wheel tangentially or at an angle within 90 **characterized in that** the material (4) is caused to flow locally within the die (5) zone, by a mandrel's (7) rotary action.

2. System for extruding elements, especially made of metal, consisting of an infeed wheel and a friction block, with a gap for transferring the material between the infeed wheel and the friction block, the gap ending with a shaped die, and in the gap's output zone there is a wedge to deflect the direction of exit of the material fed by the rotating infeed wheel, **characterized in that** in the space between the friction block (2) and the deflection wedge (6) there is a mandrel (7) adapted to cyclically rotate bidirectionally at

frequency of 0.1-10 Hz, whose face is adapted to contact the material (4) in the zone of transfer into the die (5).

3. The system according to claim 2, **characterized in that** the mandrel (7) is made up by the die (5).

4. The system according to claim 2, **characterized in that** the mandrel (7) is made up by a roller, whose face is situated in the zone of the calibrating orifice of the die (5), with outflow axis deflected from the current direction of movement of the material (4), generally perpendicularly.

5. The system according to claim 2 or 4, **characterized in that** the mandrel (7) is made up by a two-diameter roller, and the face of the end of the roller with smaller diameter is situated in the zone of the calibrating orifice of the die (5).

6. The system according to claim 2, **characterized in that** the mandrel's (7) face has shaped inlets and splines.

Patentansprüche

1. Verfahren zum Fließpressen von Erzeugnissen, insbesondere von Metallerzeugnissen, durch den Vorschub des Ausgangsmaterials über einen Spalt zwischen dem Laderad und dem Reibstück und durch das Fließpressen über das Fließpressgesenk, während das Material im Austrittsbereich vom Laderad tangential bzw. um einen Winkel von bis zu 90° abgelenkt wird, **dadurch gekennzeichnet, dass** das Material (4) zum örtlichen Fließen im Bereich des Fließpressgesenkes (5) durch Rotationseinwirkung des Domes (7) gebracht wird.

2. Fließpressvorrichtung zum Fließpressen von Erzeugnissen, insbesondere von Metallerzeugnissen, welche aus einem Laderad und einem Reibstück mit einem Spalt dazwischen für den Vorschub des Materials besteht, wobei der Spalt mit einem Formgesenk endet, wobei der Spalt im Austrittsbereich über einen Keil zur Ablenkung der Austrittsrichtung des Materials verfügt, welches durch Bewegung des Laderades vorgeschoben wird, **dadurch gekennzeichnet, dass** im Zwischenraum zwischen dem Reibstück (2) und dem Ablenkkeil (6) ein Dorn (7) angeordnet ist, welcher in eine zyklische Wechseldrehung mit einer Frequenz von 0,1-10 Hz versetzt wird und dessen Stirnfläche mit dem Material (4) im Bereich des Vorschubs zum Fließpressgesenk (5) in Berührung kommt.

3. Fließpressvorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** der Dorn (7) das Fließpressgesenk (5) ist.

4. Fließpressvorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** der Dorn (7) eine Welle ist, deren Stirnfläche im Bereich der geformten Öffnung des Fließpressgesenkes (5) angeordnet ist, dessen Austrittsachse annähernd senkrecht Bewegungsrichtung des Materials (4) verläuft.

5. Fließpressvorrichtung nach Anspruch 2 oder 4, **dadurch gekennzeichnet, dass** der Dorn (7) eine Zweidurchmesserwelle, wobei die Stirnfläche des Wellenendes mit dem geringeren Durchmesser im Bereich der geformten Öffnung des Fließpressgesenkes (5) angeordnet ist.

6. Fließpressvorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** der Dorn (7) mit Formnuten/Formkeilen vorgesehen ist.

Revendications

1. Le procédé d'extrusion de pièces, surtout en métal, grâce au déplacement du matériau initial dans l'intervalle existant entre la roue de chargement et le bloc de friction, et ensuite l'écoulement par la matrice, et en outre dans la zone de sortie le matériau est écarté par rapport à la roue de chargement en entrant en contact avec cette dernière ou en restant écarté d'un angle égal ou moins à 90°, **caractérisé en ce que** le matériau (4) est amené ensuite à l'écoulement local dans la zone de la matrice (5) grâce aux mouvements rotatifs de la tige (7).

2. Le dispositif d'extrusion des pièces, surtout en métal, sous forme d'une roue de chargement et d'un bloc de friction, avec une intervalle permettant le déplacement du matériau entre ces derniers, cette intervalle étant terminée par une matrice de formage, en outre l'intervalle existant dans la zone de sortie est dotée d'un déviateur permettant la déviation du sens du matériau à la sortie, une fois chargé grâce au mouvement de la roue de chargement, **caractérisé en ce que** dans l'espace entre le bloc de friction (2) et le déviateur (6) il est placé la tige (7) que l'on met en mouvement rotatif cyclique dans les deux sens, avec une fréquence de 0,1-10 Hz, et dont la surface frontale est en contact avec le matériau (4) dans la zone de passage vers la matrice (5).

3. Le dispositif revendiqué sous le numéro 2, **caractérisé en ce que** la tige (7) est identique à la matrice (5).

4. Le dispositif revendiqué sous le numéro 2, **caractérisé en ce que** la tige (7) est identique à un rouleau dont la surface frontale est située dans la zone de

l'orifice de calibrage de la matrice (5), avec l'axe d'écoulement qui est presque perpendiculaire par rapport au sens du mouvement du matériau (4).

5. Le dispositif revendiqué sous le numéro 2 ou 4, **caractérisé en ce que** la tige (7) est identique à un rouleau présentant deux diamètres différents, la surface frontale de l'extrémité du rouleau présentant le diamètre inférieur étant située dans la zone de l'orifice de calibrage de la matrice (5).

6. Le dispositif revendiqué sous le numéro 2, **caractérisé en ce que** la surface frontale de la tige (7) est dotée de languettes / busettes de formage.

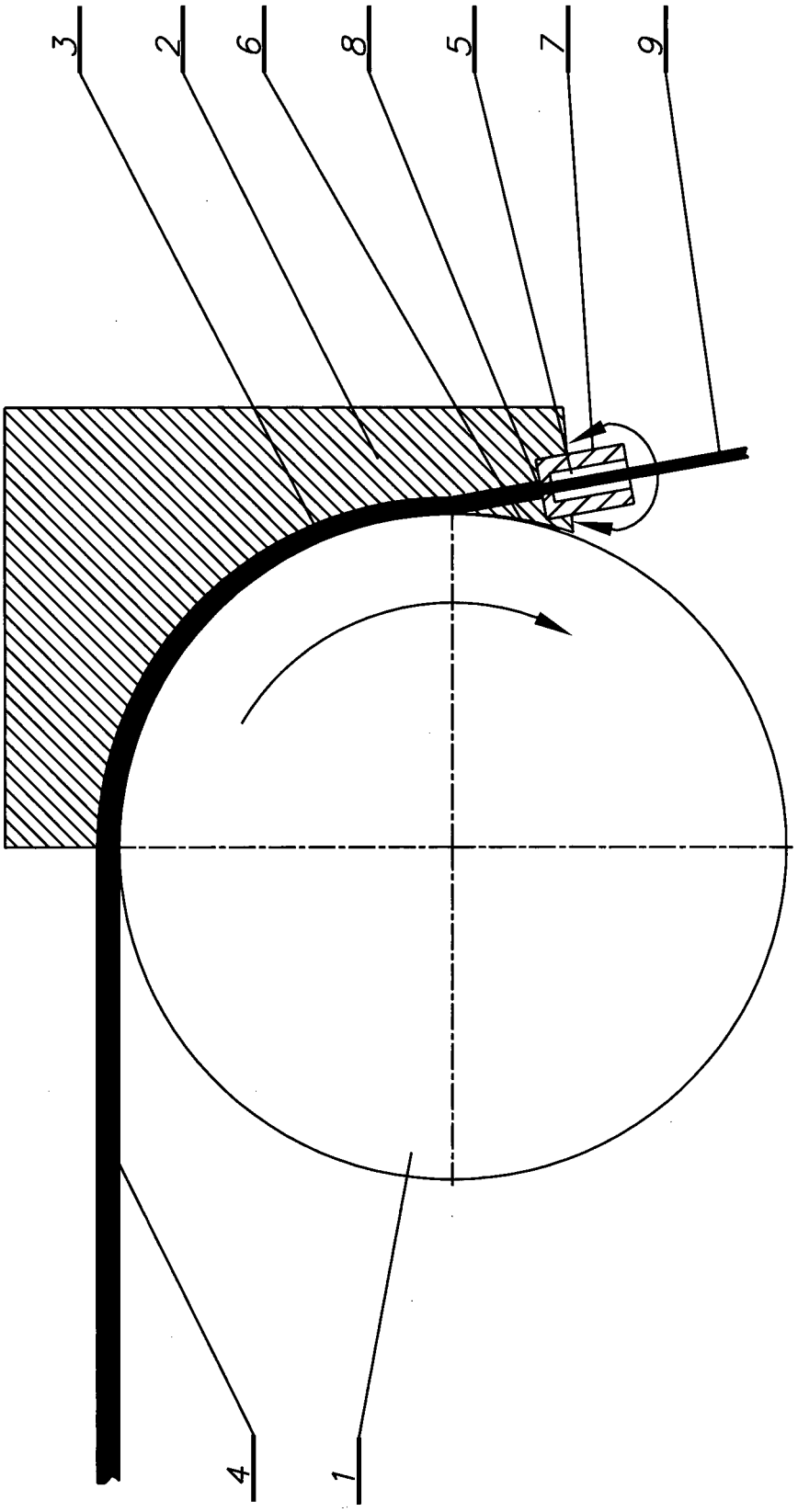

Fig.1

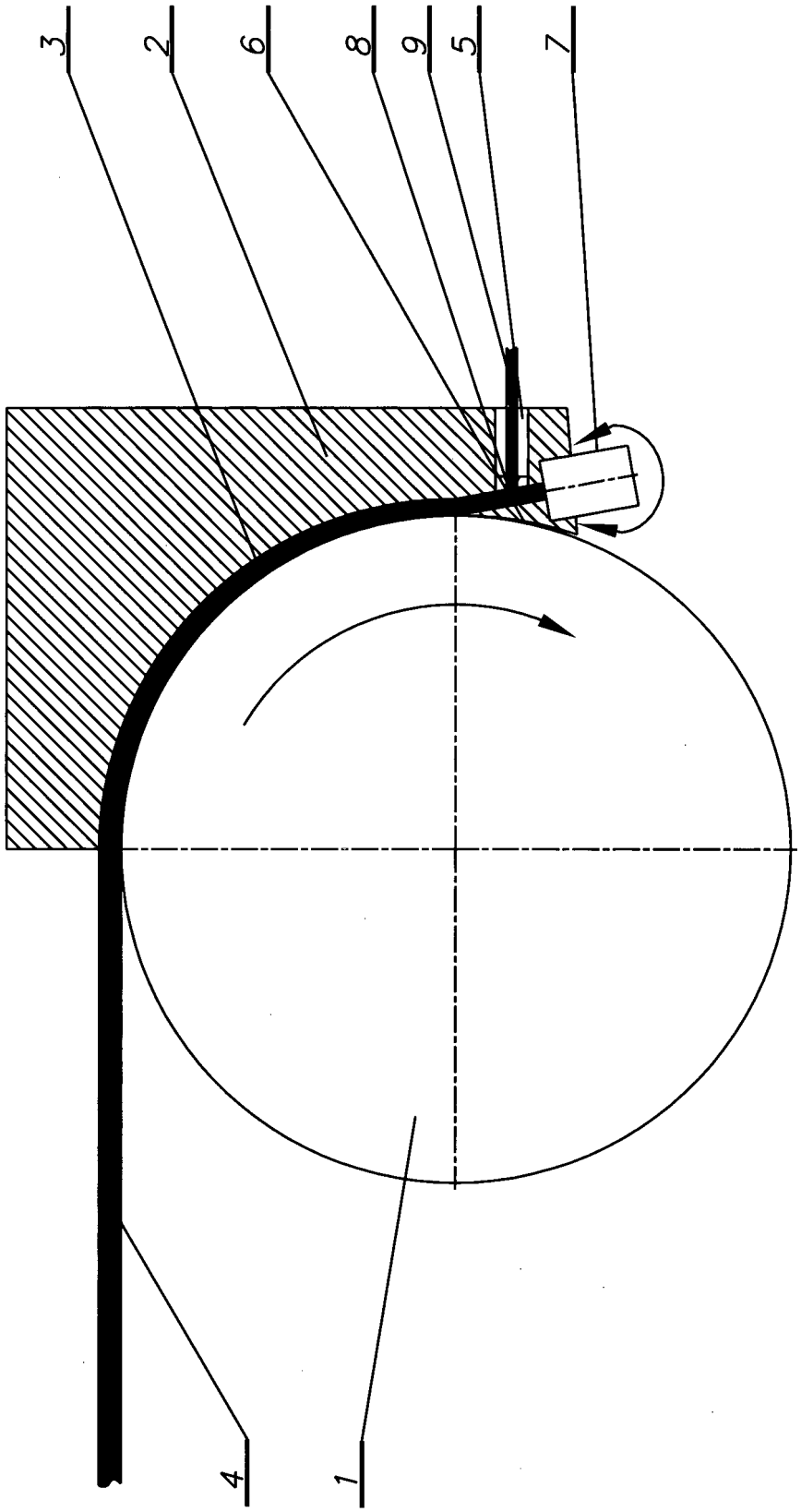

Fig.2

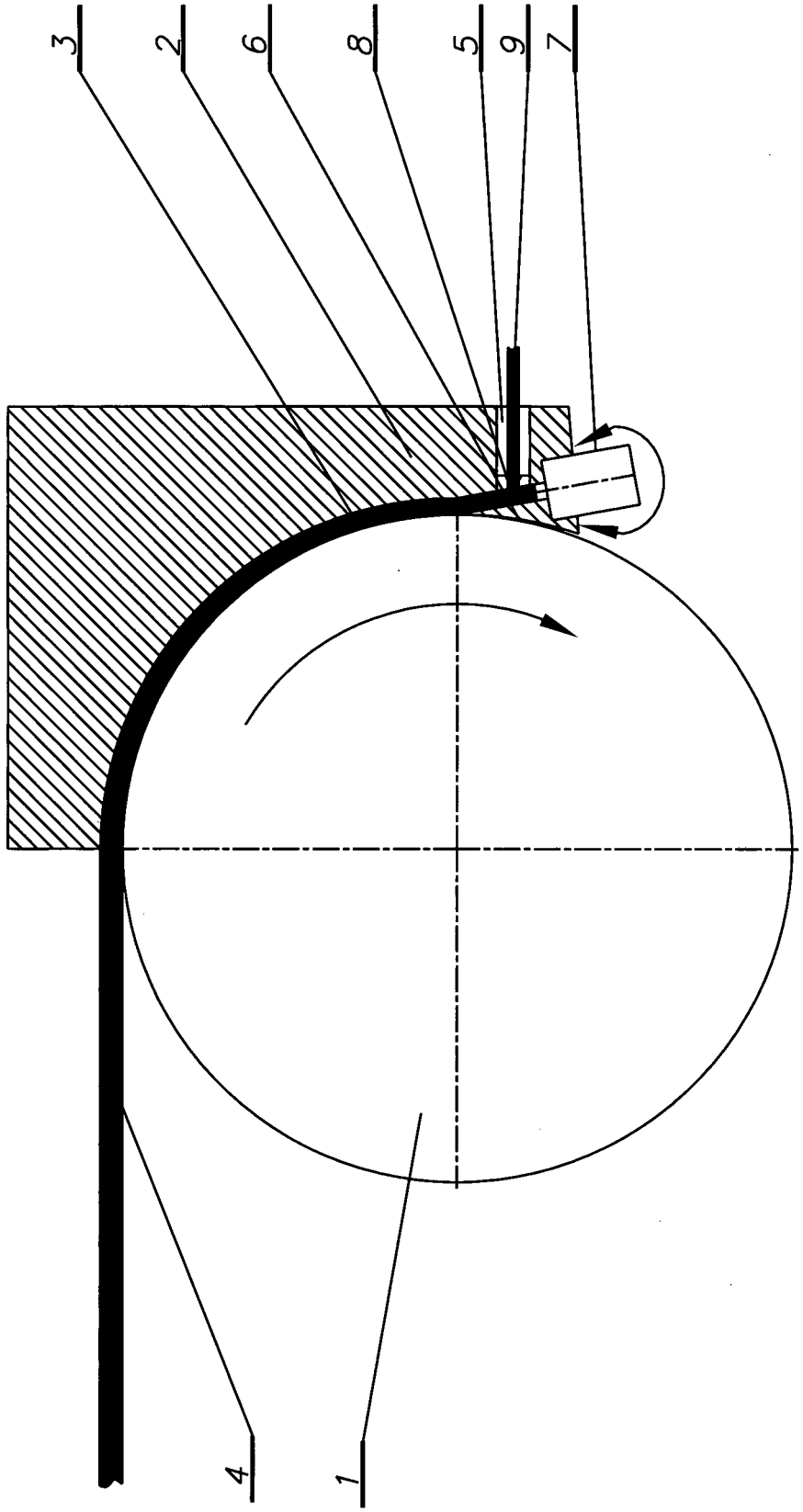

Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- PL 388159 A **[0004]**
- JP 2003334609 A **[0005]**
- JP 2002172418 A **[0006]**
- US 6571593 B1 **[0007]**
- JP 4178213 A **[0008]**

Non-patent literature cited in the description

- *Materials Science and Technology,* 2000, 664 **[0002]**
- *The Materials Processing Technology,* 2000 **[0003]**