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

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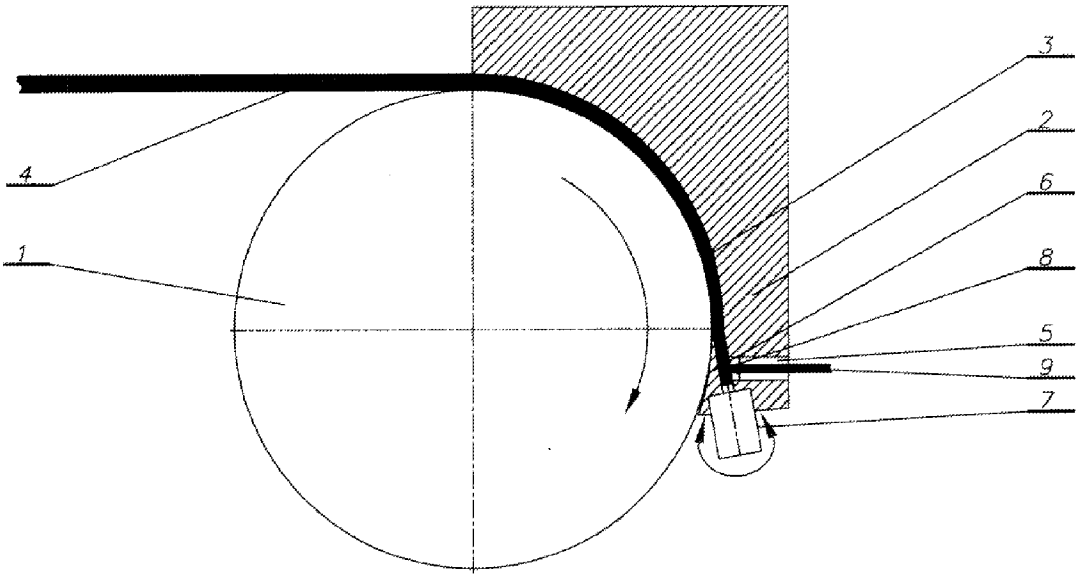
(57) **ABSTRACT**

A method of extruding elements, especially made of metal, and a system for extruding elements, especially made of metal, are employed for production of elements by means of extrusion. The material is deflected from the infeed wheel tangentially or at an angle within 90° and is caused to flow locally within the area of the die, by the mandrel's rotary action. This method is executed in a system where in the gap's output area there is a wedge to deflect the direction of exit of the material fed by the rotating infeed wheel, and in the space between the friction block and the deflection wedge there is a mandrel caused to cyclically move bidirectionally at frequency of (0.1-10) Hz, whose face contacts the material in the area of transfer into the die.



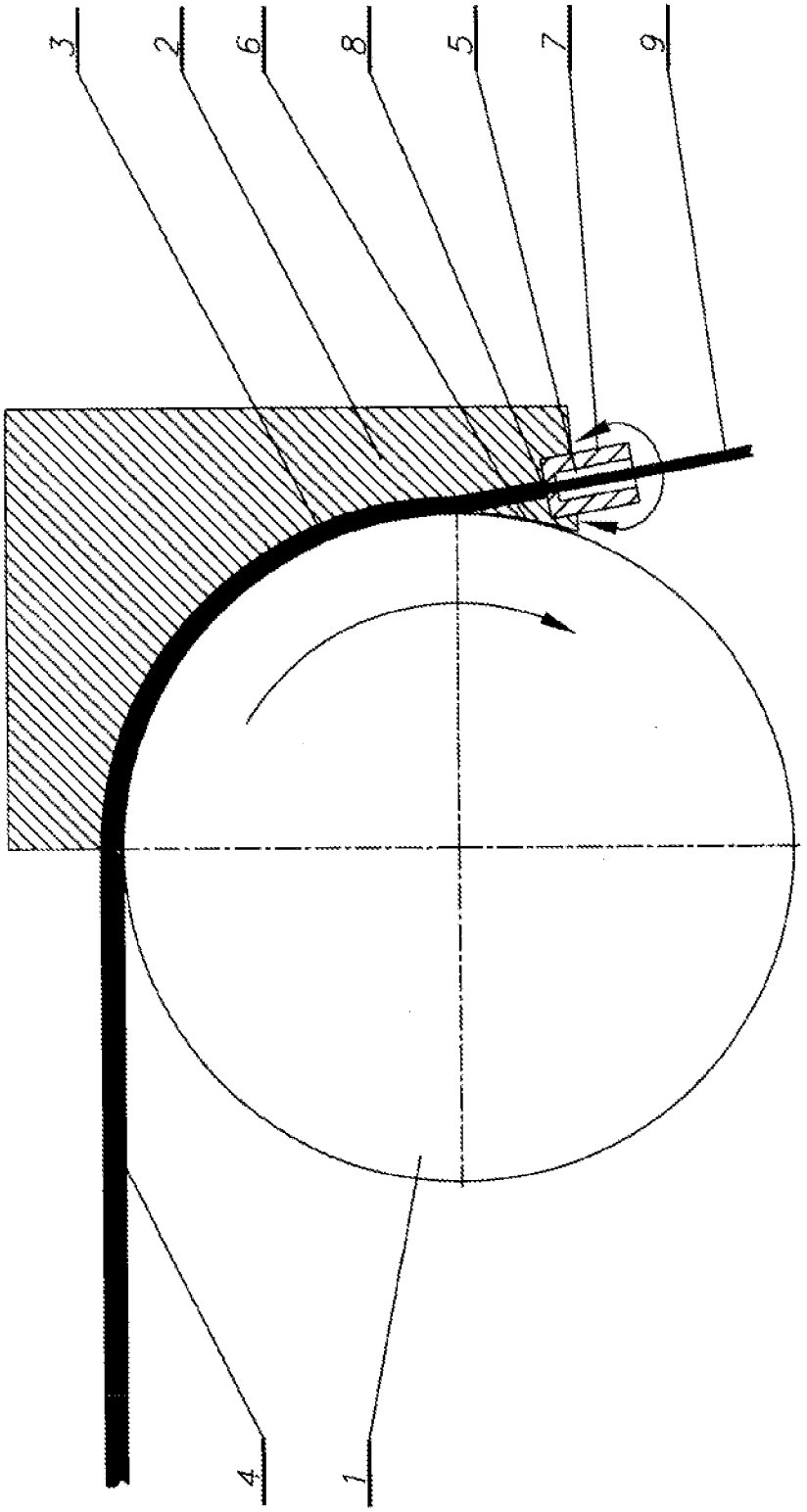



Fig.1

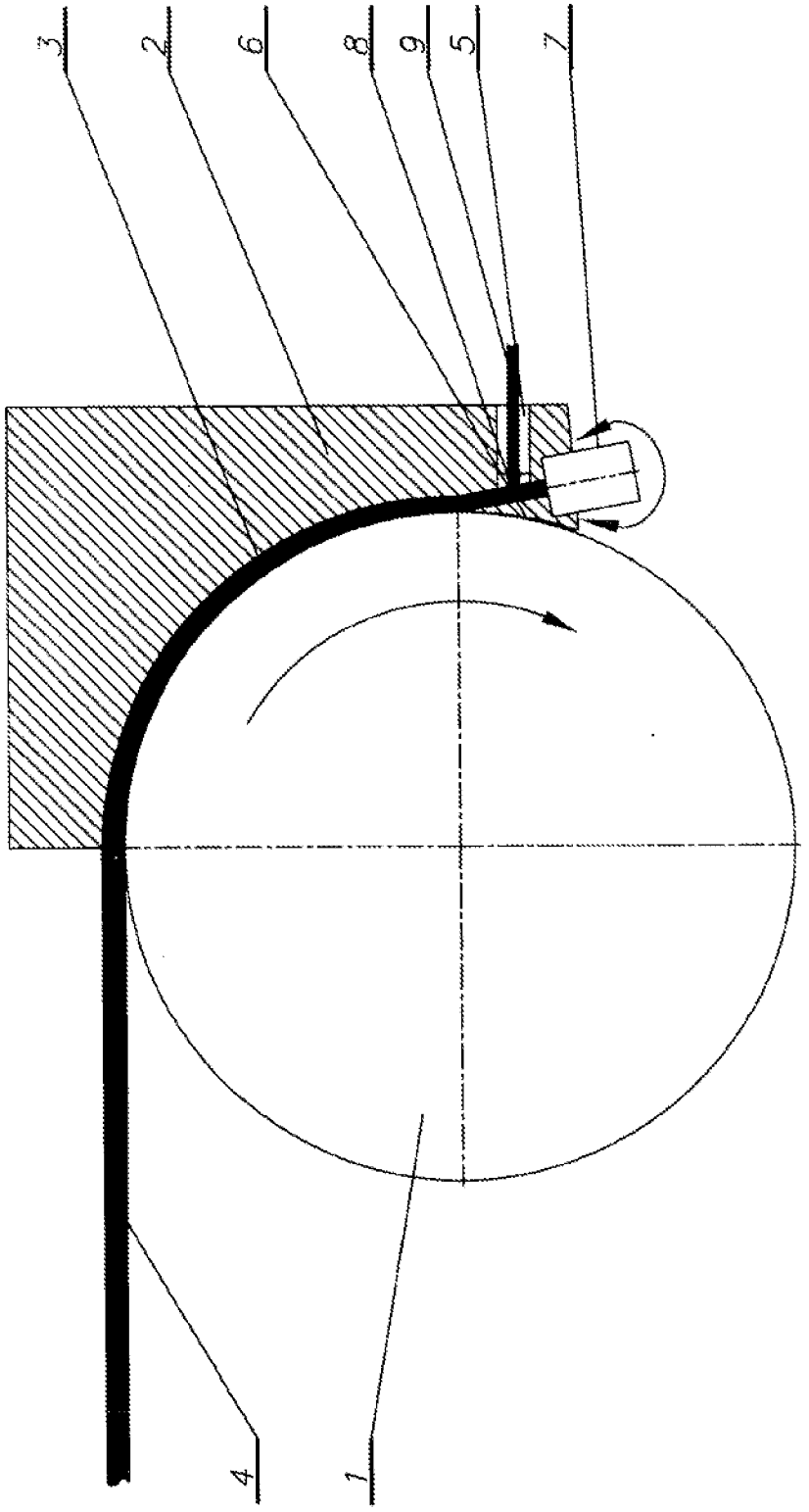



Fig 2

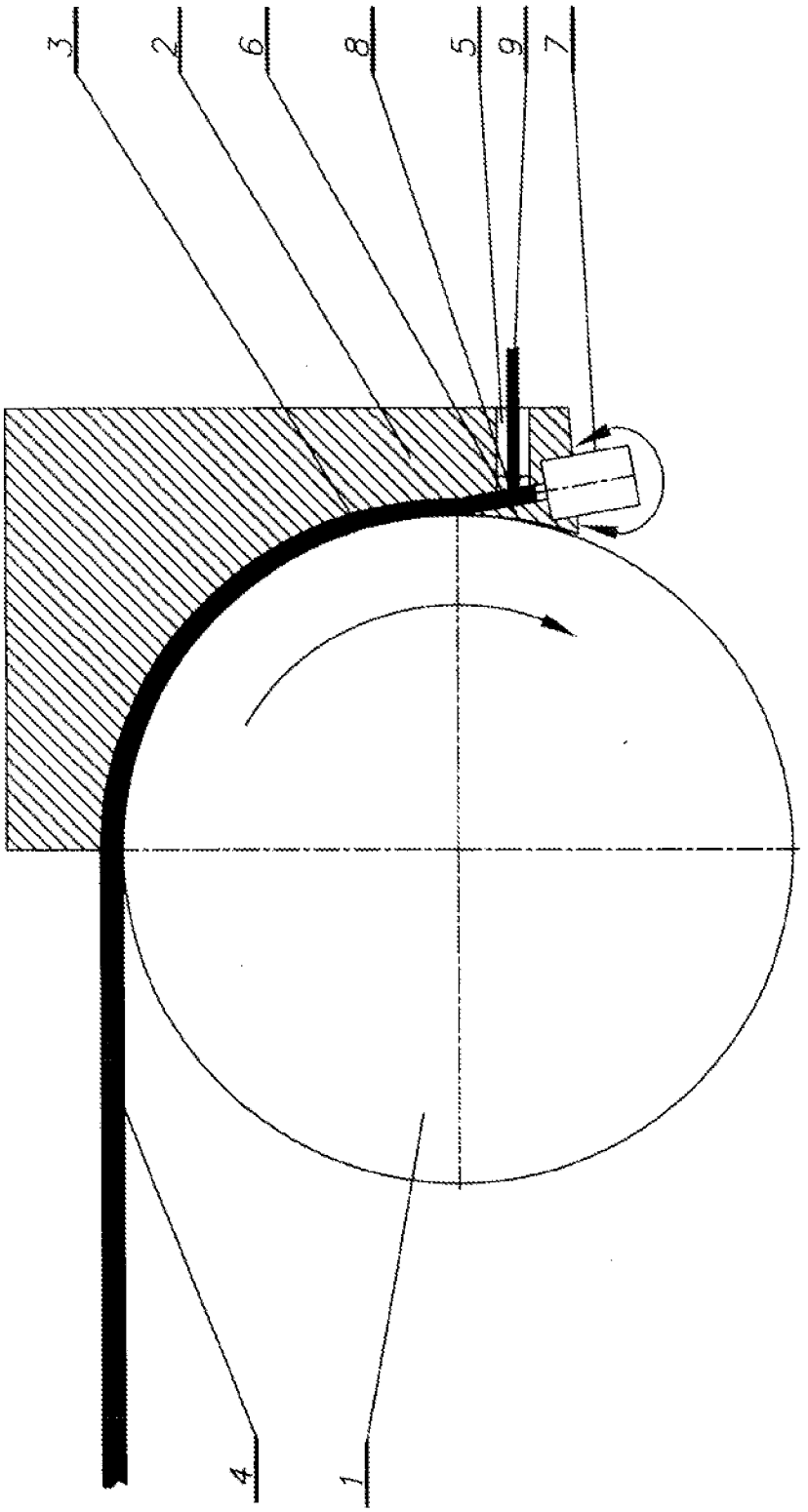



Fig. 3

# METHOD OF EXTRUDING ELEMENTS, ESPECIALLY MADE OF METAL, AND A SYSTEM FOR EXTRUDING ELEMENTS, ESPECIALLY MADE OF METAL

## CROSS-REFERENCE TO RELATED U.S. APPLICATIONS

**[0001]** Not applicable.

## STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

**[0002]** Not applicable.

## NAMES OF PARTIES TO A JOINT RESEARCH AGREEMENT

**[0003]** Not applicable

## REFERENCE TO AN APPENDIX SUBMITTED ON COMPACT DISC

**[0004]** Not applicable.

## BACKGROUND OF THE INVENTION

**[0005]** 1. Field of the Invention

**[0006]** 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.

**[0007]** 2. Description of Related Art Including Information Disclosed Under 37 CFR 1.97 and 37 CFR 1.98

**[0008]** 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.

**[0009]** 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.

**[0010]** The Polish patent claim P 388159 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 die's calibrating orifice.

## BRIEF SUMMARY OF THE INVENTION

**[0011]** 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, consists in that in the output area the material is deflected from the infeed wheel tangentially or at an angle within 90° and the mandrel's rotary action causes it to flow locally within the area of the die.

**[0012]** 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 area there is a wedge to deflect the direction of exit of the material fed by the rotating infeed wheel, and in the space between the friction block and the deflection wedge there is a mandrel caused to cyclically move bidirectionally at a frequency of (0.1-10) Hz, whose face contacts the material in the area of transfer into the die.

**[0013]** It is preferred that the die makes up the mandrel.

**[0014]** It is also preferred that the mandrel is made up by a roller, whose face is situated in the area of the die's calibrating orifice, with outflow axis generally perpendicular to the direction of movement of the material.

**[0015]** 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 area of the die's calibrating orifice.

**[0016]** It is also preferred that the mandrel's face has shaped inlets and splines.

**[0017]** 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.

## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

**[0018]** 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 area of the die's calibrating orifice, and FIG. **3** shows the mandrel made up by the two-diameter roller.

## DETAILED DESCRIPTION OF THE INVENTION

**[0019]** 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 area, the gap **3** has a wedge **6** to deflect the direction of exit of the material **4** after it is supplied with the inked 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 area of transfer into the die **5**.

**[0020]** There is a version of the system, shown in FIG. **1**, where the mandrel **7** is made up by the die **5**.

**[0021]** 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 area of the calibrating orifice **8** of the die **5**,

whose outflow axis is generally perpendicular to the direction of the movement of the material.

**[0022]** 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 area of the calibrating orifice **8** of the die **5**.

**[0023]** 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.

**[0024]** 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 area, 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 area 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.

**[0025]** By subjecting the material **4** to vibrational action of the mandrel **7**, the material **4** is plasticized in the area 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**.

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

**2**. A system for extruding elements, especially made of metal, wherein 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 area there is a wedge to deflect the direction of exit of the material fed by the rotating infeed wheel and in the space between the friction block and the deflection wedge there is a mandrel caused to cyclically move bidirectionally at frequency of (0.1-10) Hz, whose face contacts the material in the area of transfer into the die.

**3**. (canceled)

**4**. The system according to claim **2**, wherein the mandrel is made up by the die.

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

**6**. (canceled)

**7**. The system according to claim **2**, wherein 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 area of the calibrating orifice of the die.

**8**. The system according to claim **2**, wherein the mandrel's face has shaped inlets and splines.

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