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(54) **MACHINE FOR BENDING EXACT DIAMETERS**

(57) The invention relates to a profile-bending machine comprising a series of radial guides (2) centred on a point, with a bending die (4) mounted on one guide (2) and profile-supporting skates (3) disposed on the remaining guides (2). The machine also comprises a length-adjustable guide arm (5) concentric with the guides (2). The skates (3) and the bending die (4) are connected by a mechanism for coordinating the position thereof on the respective guide (2), such that they are all equidistant from the centre point.

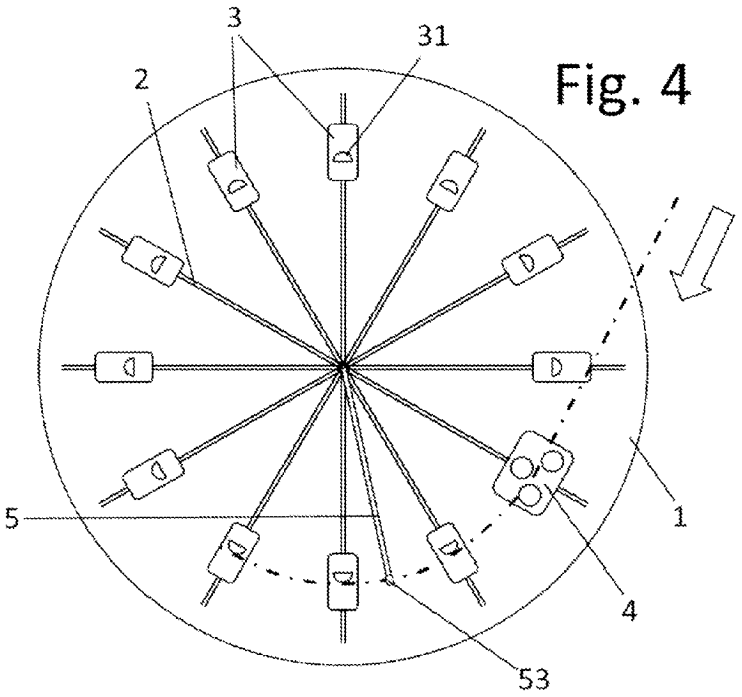

Fig. 4

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Description

TECHNICAL FIELD

[0001] This application relates to a profile-bending machine which allows producing curves, circles and other curved objects with a particularly exact and accurate radius or diameter.

STATE OF THE ART

[0002] The existence of machines for bending bars and other profiles is known in the state of the art. A well-known example is made up of three pulleys or rollers. When passing between the rollers, which are closer than the thickness of the bar or profile, the latter must bend. Depending on the distance, the diameter or radius of curvature is larger or smaller.

[0003] However, the elasticity of the profile means that the accuracy of that radius or diameter is less than desirable. The profile more or less recovers its position, so the result is approximate but not exact. Even more so when the thickness of the bar has tolerances.

[0004] The applicant is not aware of any equipment that can solve all these problems as simply as the invention.

BRIEF EXPLANATION OF THE INVENTION

[0005] The invention consists of a machine for bending exact diameters according to the independent claims, the variants of which solve the problems of the prior art.

[0006] The profile-bending machine is based on a two- or three-roller bending die. It comprises a series of radial guides centred on a point. The bending die is mounted on one of the guides and profile-supporting skates are disposed on the remaining guides. In addition, it incorporates a length-adjustable guide arm concentric with the guides, and freely rotatable about the centre point of the guides, with an adjustable guide.

[0007] In the preferred embodiment, the skates and the bending die are connected to each other by a mechanism for coordinating the position thereof on the respective guide.

[0008] Other variants are shown in the rest of the specification.

DESCRIPTION OF THE FIGURES

[0009] For a better understanding of the invention, the following figures are included.

Figure 1 shows a diagram of an exemplary embodiment, from an upper view.

Figure 2 shows an exemplary embodiment of the guide arm.

EMBODIMENTS OF THE INVENTION

[0010] An embodiment of the invention is briefly described below, as an illustrative and nonlimiting example thereof.

[0011] The bending machine shown in figure 1 comprises a generally round table (1), with several radial guides (2) starting from the same point. On each guide (2), except for a first guide (2), there is a sliding skate (3), movable by means of a drive, which may be mechanical, hydraulic, manual, pneumatic or of any other type... The position of the skates (3) is controlled so that the imaginary line joining same is the exact curve to be defined with the profile to be bent. The position of each skate (3) can be measured digitally or analogically.

[0012] The skates (3) have a simple positioning function of the profile to be bent by means of stops (31) that define the position of the profile on the skates (3). These skates (3) mark the inside diameter of the ring. On the guide (2) lacking skate (3), there is a bending die (4) with two or three rollers (41,42) that collects the profile and gives it a curvature approximating that which is required, while orienting same towards the other skates (3). This type of bending dies is made up of two or three pulleys or rollers between which the profile passes. At least one roller (41,42) is motorised and moves the profile between the rollers, for which it needs to receive a certain deformation.

[0013] In the case of the example shown in figure 1, the inner roller (41) is disposed in the same position on the guide (2) as the stops (31). The outer rollers (42) are the motorised ones.

[0014] The movement of the skates (3) is coordinated by a mechanism, so that the position of the skates (3) and the bending die (4) on the corresponding guide (2) is identical. For example, the mechanism may be similar to that of an umbrella, with a central element movable along a bar perpendicular to the guides (2) and connected by means of tie rods to all the skates (3) (not shown). For example, with an endless screw carrying the movable central element. Other mechanisms are possible.

[0015] The precision of the bending diameter is achieved due to one guide arm (5) disposed in the centre of the guides (2) and of extendable length. This guide arm (5) is calibrated to ensure that its length is exact and the target diameter can thus be defined. The purpose of this guide arm (5) is to guide the profile so that it fits the skates (3) of the table without deflection. As can be seen in figure 3, the guide arm (5) has one first end (51) that is fixed freely rotatable about the centre of the guides (2). This allows the guide arm (5) to rotate freely and without resistance. A capsule or guide (53) for the passage of the profile is defined at the second end (52). The figure shows that the guide arm (5) is adjustable in length so that the guide (53) is in the correct position. It can also be of a fixed length and the guide (53) can be moved on the guide arm (5). The guide arm (5) is moved merely by the friction generated by the profile as it passes through the guide

(53) and carries the profile to the skates (3). This ensures that the profile is in the exact position, passing through all the skates (3) until the circle is approximately closed.

[0016] At this point, the machine operator temporarily joins the two ends together, and the bent profile can be sent to the shearing machine and the welding station. The connection can be made with adhesive tape, to prevent any movement of the ends.

[0017] In addition, the machine includes a power supply source, and other elements such as emergency stop button, start/stop indicators...

[0018] The machine has a control panel for adjusting its parameters, such as spacing between rollers, position of the skates (3)... and containing the electrical (circuit breakers...) and electronic safety elements.

Claims

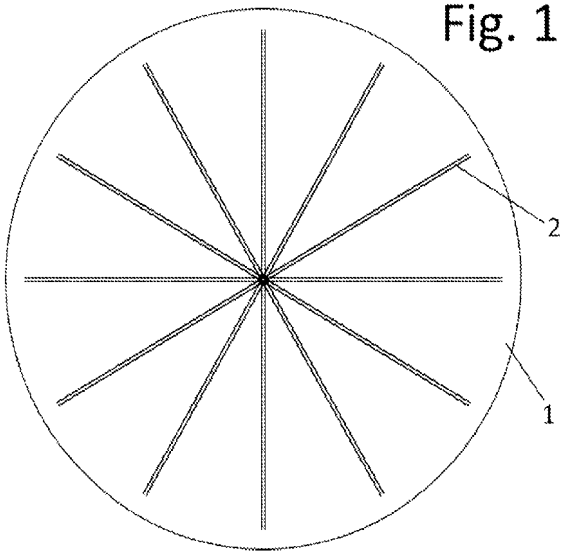
1. A machine for bending exact diameters, with a bending die (4) with two or three rollers, **characterised in that** it comprises a series of radial guides (2) centred on a point, the bending die (4) being mounted on one guide (2) and profile-supporting skates (3) disposed on the remaining guides (2), and a length-adjustable guide arm (5) concentric with the guides (2) and freely rotatable about the centre point of the guides (2), with an adjustable guide (53).

2. The machine for bending exact diameters according to claim 1, **characterised in that** the skates (3) and the bending die (4) are connected by a mechanism for coordinating the position thereof on the respective guide (2).

3. The machine for bending exact diameters according to claim 1, **characterised in that** the bending die (4) has three rollers.

4. The machine for bending exact diameters according to claim 1, **characterised in that** the guides (2) are supported on a round table (1).

Fig. 1



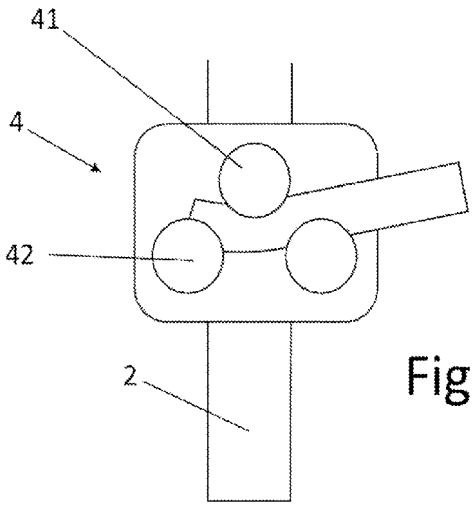


Fig. 2

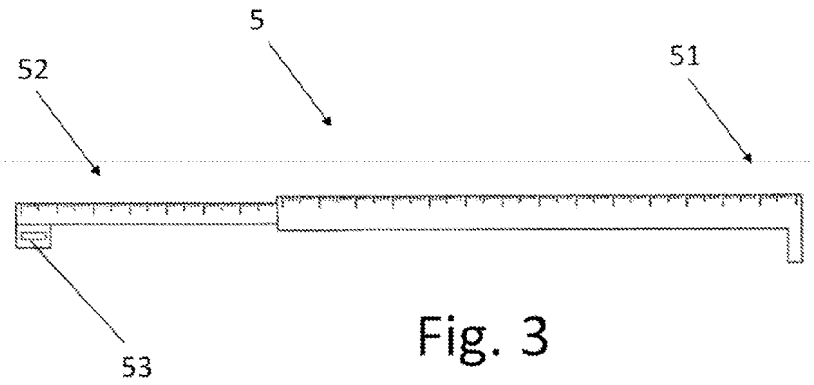


Fig. 3

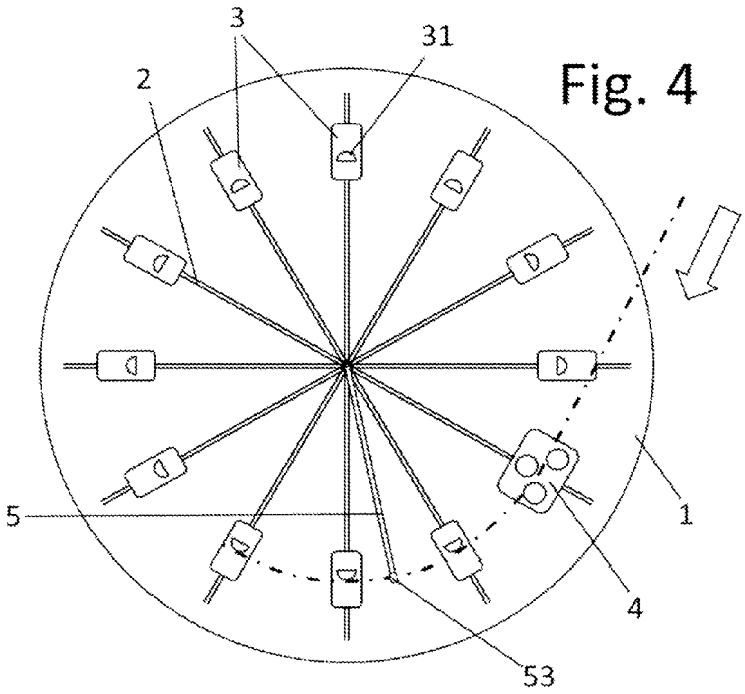


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2023/070151

A. CLASSIFICATION OF SUBJECT MATTER

B21D7/03 (2006.01)
B21D43/00 (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, INVENES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 113305184 A (SHANGHAI MONEYPANTHER AUTOMATION SYSTEMS CO LTD) 27/08/2021, paragraphs [27 - 40].	1-4
A	EP 3320993 A1 (UNIV DORTMUND TECH) 16/05/2018, figure 10.	1-4
A	US 3888103 A (RENSHAW ROBIN) 10/06/1975, the whole the document.	1-4
A	US 4055065 A (WHETSTONE JR CECIL ET AL.) 25/10/1977, the whole document.	1-4

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance.
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other documents , such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03/05/2023	**(03/05/2023)**
Name and mailing address of the ISA/ OFICINA ESPAÑOLA DE PATENTES Y MARCAS Paseo de la Castellana, 75 - 28071 Madrid (España) Facsimile No.: 91 349 53 04	Authorized officer J. Celemín Ortiz-Villajos Telephone No. 91 3495493

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/ES2023/070151

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
CN113305184 A	27.08.2021	NONE	
EP3320993 A1	16.05.2018	DE102016012677 A1	26.04.2018
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