United States Patent [19]

Wilke

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[54] **ROTARY ARBOR WIRE STRAIGHTENER**

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[52] **U.S. Cl.** **72/79,** 140/147

[51] **Int. Cl.** **B21f 1/04**

[58] **Field of Search** 72/79, 77; 140/147

[56] **References Cited**

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[57] **ABSTRACT**

A rotary arbor wire straightener having wire straightening dies constructed and arranged to be adjustable during continuous operational rotation of the arbor.

4 Claims, 5 Drawing Figures

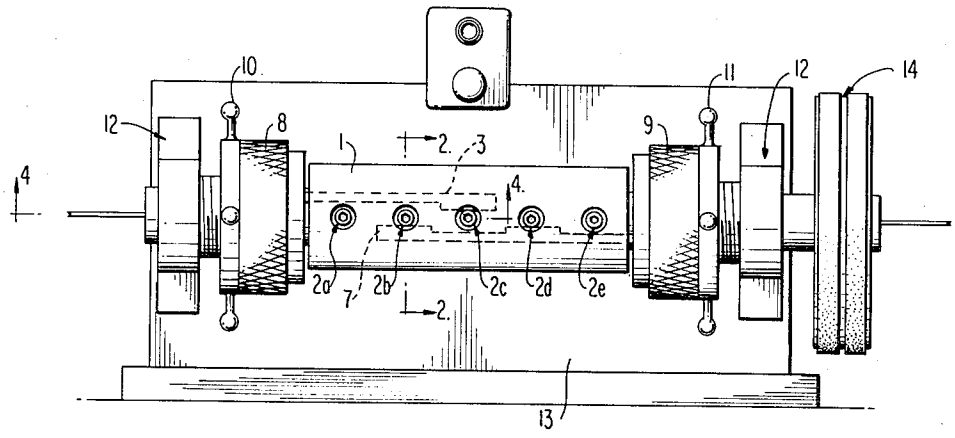
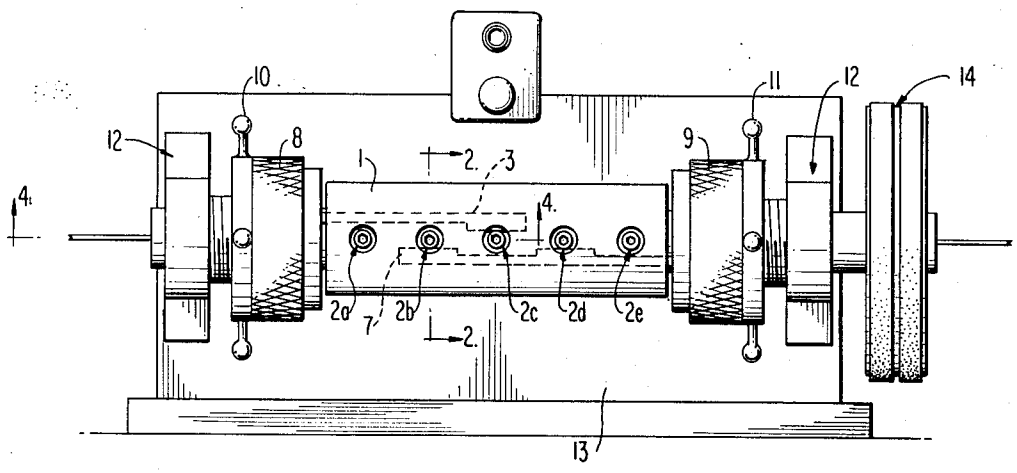


FIG. 1



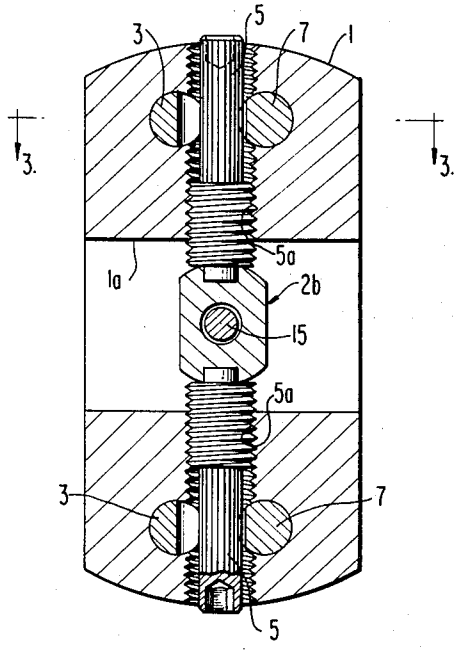


FIG. 2

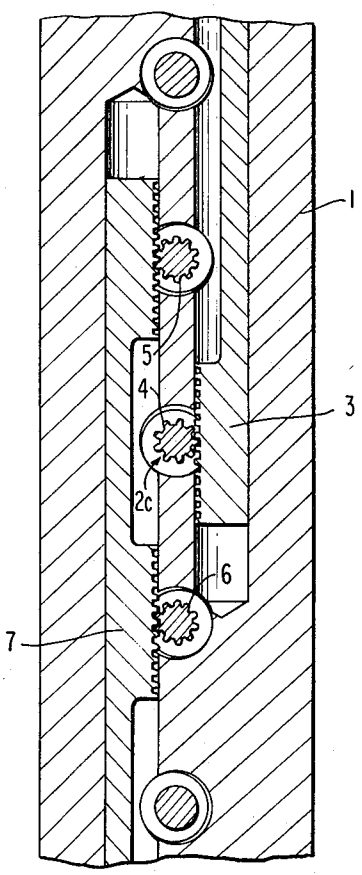


FIG. 3

FIG. 4

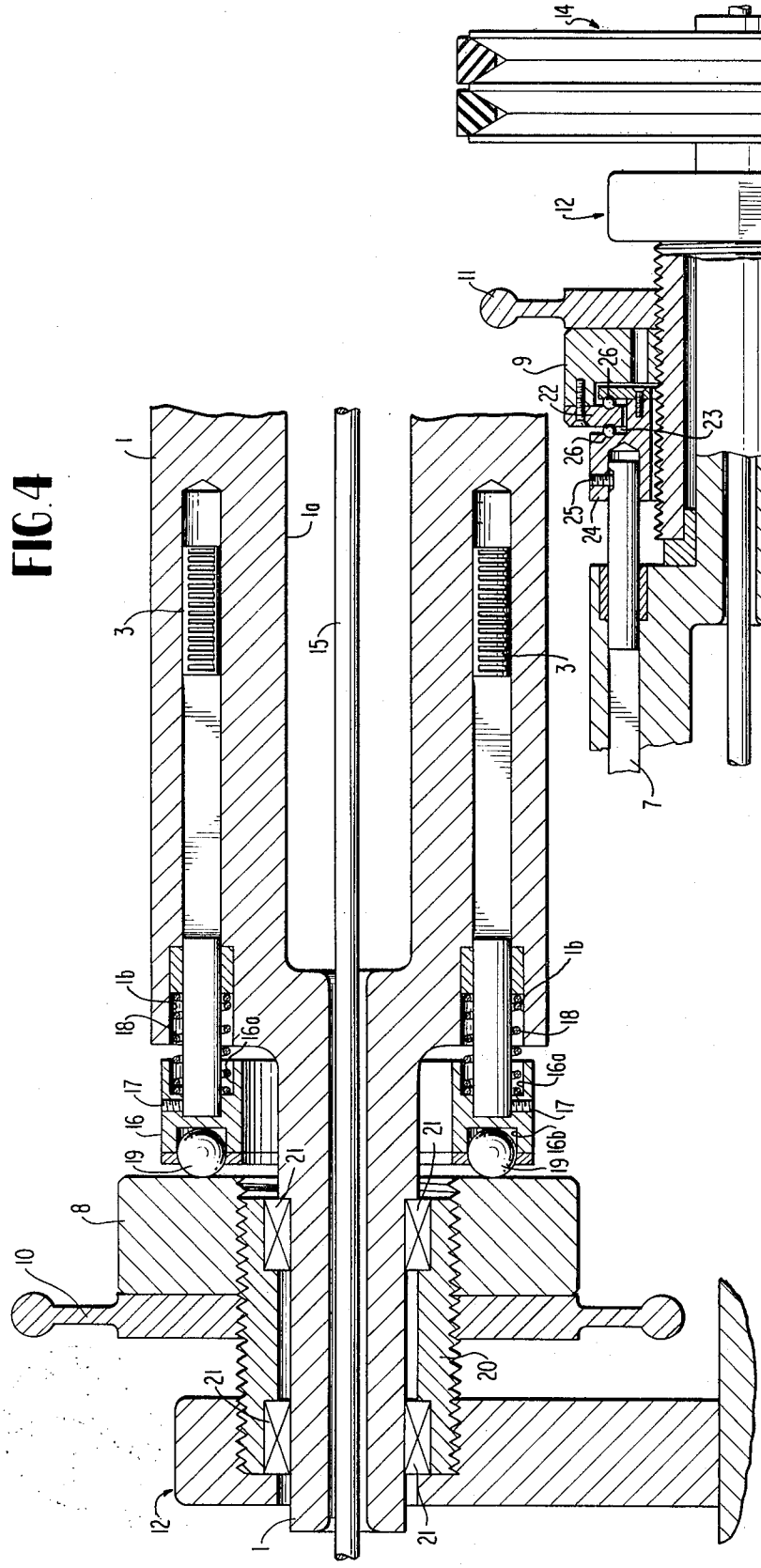


FIG. 5

ROTARY ARBOR WIRE STRAIGHTENER

BACKGROUND OF THE INVENTION

Rotary arbor wire straighteners, often referred to as "whizzers" are employed for straightening a workpiece such as wire, rod or tubing of circular cross-section, wherein the straightening of the workpiece is effected by drawing the workpiece through a series of dies, normally five in number, which have a bore a little larger in diameter than the diameter of the workpiece, and which are located with their longitudinal axes generally parallel with respect to one another but displaced laterally, or offset, with respect to one another by a suitable distance. The dies are adjustably mounted in a suitable carriage referred to as an "arbor" which rotates around the workpiece on an axis parallel to the direction of travel of the workpiece, the arbor having a longitudinally extending passageway through which the workpiece travels through the successive dies. The workpiece is thus required to follow a rotating sinuous or serpentine path through the series of dies during which time, the workpiece is flexed essentially in all directions. When a bent or kinked section of the workpiece passes through the series of dies, it is flexed in a direction to correct the bend or kink by an amount which exceeds the elastic limit of the workpiece and the bend or kink is thus removed and the workpiece is straightened.

While the above-noted rotary arbor wire straighteners have been satisfactory for their intended purpose, they have been characterized by the inherent disadvantage of requiring the arbor to be brought to a full stop before necessary adjustments to the dies can be made. In a five-die straightener, it has been found that the three intermediate dies require adjustment, with the center die requiring the most frequent adjustment. The stopping of the arbor to make the necessary adjustment results in a loss of time and production which is overcome by the rotary arbor wire straightener of the present invention which is constructed and arranged whereby the lateral or offset adjustment of the dies with respect to one another can be effected during the continuous operational rotation of the arbor, thus obviating the down-time for die adjustment required heretofore in rotary arbor wire straighteners.

The rotary arbor wire straightener of the present invention comprises essentially, rack and pinion assemblies mounted within the arbor and connected to selected dies, the free ends of the racks are connected to adjustable nuts or collars movable axially relative to the arbor which impart axial movement to the racks which in turn impart radial movement of the dies relative to the longitudinal axis of the arbor.

IN THE DRAWINGS

FIG. **1** is a side elevational view of the rotary arbor straightener;

FIG. **2** is a sectional view taken along line **2—2** of FIG. **1**;

FIG. **3** is a fragmentary, sectional view taken along line **3—3** of FIG. **2**;

FIG. **4** is an enlarged, fragmentary, sectional view taken along line **4—4** of FIG. **1**; and

FIG. **5** is an enlarged, fragmentary, sectional view similar to FIG. **4** but showing another embodiment of the arbor bearing assembly.

Referring to the drawings and more particularly to FIG. **1** thereof, the wire straightening device of the present invention comprises a rotary arbor **1** having a series of dies, five in number, **2***a*, **2***b*, **2***c*, **2***d* and **2***e* adjustably mounted therein. In accordance with the invention, necessary adjustments to the three intermediate dies can be made during the operational rotation of the arbor. This is accomplished by a pair of racks **3** slidably mounted within the arbor and meshing with pinion stems **4** (FIG. **3**) connected to the die **2***c*. Dies **2***b* and **2***d* are similarly provided with pinion stems **5** and **6**, respectively, which mesh with a pair of racks **7**. The free ends of racks **3** are connected to a collar **8** adjustable axially relative to the arbor, and the free ends of racks **7** are connected to a collar **9** positioned at the other end of the arbor and axially adjustable relative thereto. By this construction and arrangement, when collar **8** is rotated, racks **3** are caused to slide axially of the arbor to impart rotational movement to the stems **4**. Similarly, when collar **9** is rotated, racks **7** are caused to slide axially of the arbor to impart rotational movement to stems **5** and **6**. Lock nuts or collars **10** and **11** are also provided to hold the respective collars **8** and **9** in the adjusted position.

To complete the general description of the wire straightener, as shown in FIG. **1**, each end of the arbor is journaled in suitable brackets **12** mounted on a support frame **13**, rotational movement being imparted to the arbor by a belt and pulley drive assembly **14**.

The details of the die mounting in the arbor are illustrated in FIG. **2**, and while the mounting of die **2**b is shown, it will be understood that the particular mounting is identical for the remaining die members. As will be seen in FIG. **2**, die **2**b is located within a passageway **1**a provided in the arbor, the die having a bore through which the workpiece or wire **15** travels. The die is mounted between the oppositely extending stems **5** which are threadably mounted as at **5***a* to the arbor, the pinion portion of the stem meshing with the racks **7**. By this construction and arrangement, when the racks **7** are moved longitudinally of the arbor, the stems **5** are rotated causing the die **2***b* to move radially with respect to the longitudinal axis of the arbor, thus moving the die laterally of the arbor passageway **1***a*.

FIG. **4** shows the details of the connection between the free ends of racks **3** and the adjustment collar **8**, and while the connection will be described for the racks **3**, it will be understood that an identical connection will be provided at the opposite end of the arbor between racks **7** and adjustment collar **9**. As will be seen in FIG. **4**, an annular rim **16** is connected to the free ends of the racks **3** by set screws **17**. One face of the rim is provided with recesses **16***a*, each of which receives one end of a compression spring **18**, the opposite end of each spring being received within a recess **1**b provided in the end of the arbor. The opposite face of the rim **16** is provided with an annular recess **16**b for receiving a plurality of ball bearings **19** which abut the face of collar **8**. The collar **8** and lock nut **10** are threadably mounted on a stationary sleeve **20** secured to the bracket **12**, the end of the arbor being journaled in the sleeve by suitable bearings **21**. When the nut **8** is rotated to slide the racks inwardly of the arbor, the spring **18**, biasing the rim and associated ball bearings **19** in a direction toward the collar **8**, is compressed. When the collar **8** is rotated in the opposite direction, the biasing force of the springs cause the rim and asso-

ciated free ends of the racks to move outwardly from the arbor. While in the illustrated embodiment ball bearings are used, it will be understood by those skilled in the art that roller bearings could also be employed.

In FIG. **5**, there is illustrated another embodiment of an end connection between the racks and adjustment collar and, while in the illustrated embodiment the connection is shown between the racks **7** and collar **9**, it will be understood that an identical connection will be provided on the opposite end of the arbor between the racks **3** and collar **8**. As will be seen in FIG. **5**, the collar **9** is provided with a ring **22** providing a depending flange which extends into an annular recess **23** formed in an annular rim **24** secured to the free ends of racks **7** by set screws **25**. The flange **22** provides an inner race for anti-friction bearings **26**, and the end walls of the recess **23** providing the outer races for the bearings. A thrust bearing assembly is thereby provided whereby when the collar **9** is rotated, the flange **22** engaging the bearings **26** causes the rim **24** and associated racks **7** to be either pushed inwardly of the arbor or outwardly therefrom depending upon the direction of rotation of the collar.

In the operation of the rotary arbor wire straightener, initial adjustments of the die members are manually accomplished by inserting an Allen wrench into the respective die stems and rotating the stems to adjust the lateral position of the dies with respect to one another. The wire, to be straightened, is fed through the arbor passageway **1**a and through the respective bores of each die. During the operational rotation of the arbor, if it is found that adjustment of die **2***c* is required, collar **8** is rotated by the machine operator to cause rotation of the stems **5** to thereby laterally adjust the die **2***c*. If dies **2***b* and **2***d* need adjustment, collar **9** is rotated whereby the lateral position of dies **2***b* and **2***d* are simultaneously adjusted relative to the remaining dies.

It is to be understood that the forms of the invention herewith shown and described are to be taken as preferred examples of the same, and that various changes in the shape, size and arrangement of parts may be resorted to, without departing from the spirit of the invention or scope of the subjoined claims.

I claim:

1. A rotary arbor wire straightener comprising stationary frame means, an arbor rotatably mounted on said frame means, adjustable die means mounted within said arbor and rotatable therewith, rack means slidably mounted in said arbor, pinion means connected to said die means, one end of said rack means engaging said pinion means, a collar threadably mounted on said frame means, and bearing means connected between said collar and the opposite end of said rack means, whereby the die means is adjustable relative to said arbor during the operational rotation of said arbor.

2. A rotary arbor wire straightener according to claim **1** wherein the bearing means comprises an annular rim connected to said opposite end of said rack means, spring means biased between one face of said rim and an end of said arbor, and ball bearings interposed the opposite face of the rim and a face of the collar.

3. A rotary arbor wire straightener according to claim **1**, wherein the bearing means comprises an annular rim connected to said opposite end of said rack means, an annular recess provided in the outer surface of the rim, a depending flange connected to the collar and extending into said annular recess, said flange being spaced from the end walls of said recess, and bearings mounted between opposite faces of the depending flange and the end walls of said recess.

4. A rotary arbor wire straightener according to claim **1** wherein the die means includes at least three die members, a collar mounted on said frame means at each end of said arbor, first rack means connected to one of said die members, second rack means connected to the remaining two die members, and bearing means positioned at each end of said arbor and connected between the respective collar and rack means.

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