

Nov. 22, 1955

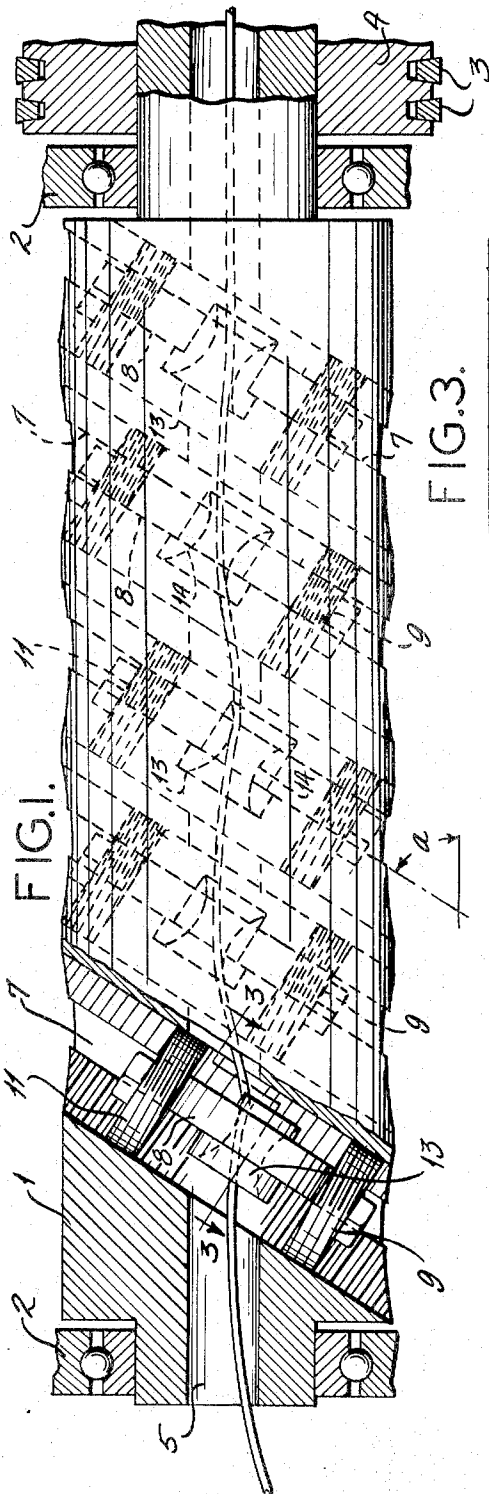
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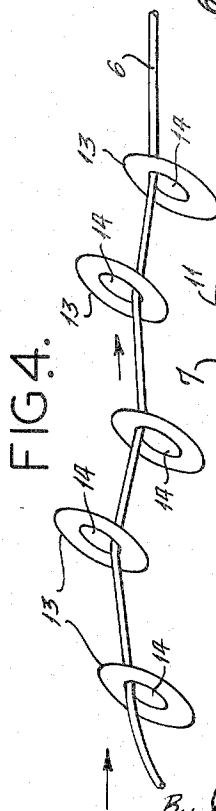
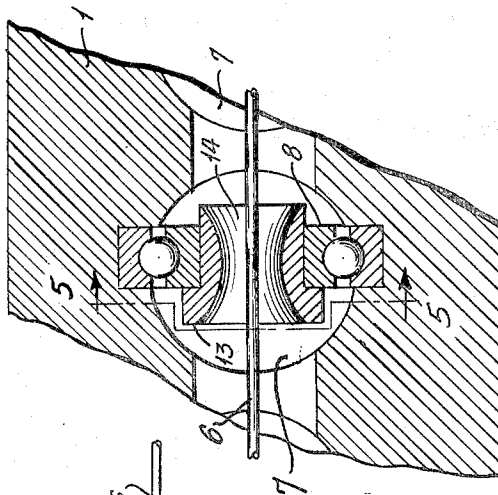
WIRE STRAIGHTENING MACHINE

Filed June 2, 1952

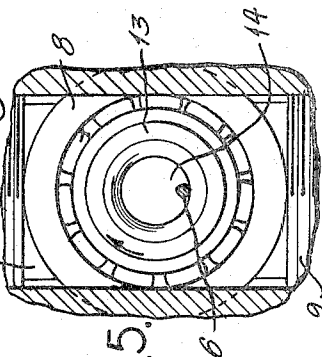
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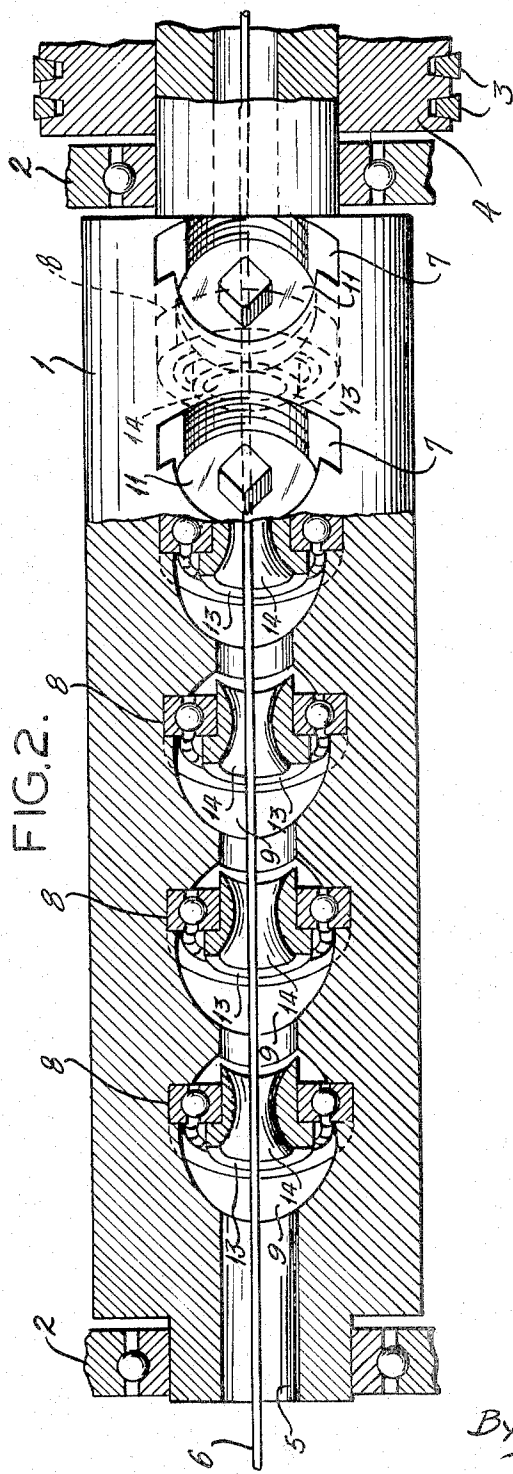
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WIRE STRAIGHTENING MACHINE

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2,724,422

WIRE STRAIGHTENING MACHINE

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Application June 2, 1952, Serial No. 291,250

2 Claims. (Cl. 153—98)

This invention relates to wire straightening machines and is more particularly directed to a hollow die type mechanism whose major axis is disposed at an angle to the longitudinal axis of the work piece.

The primary object of the invention is to provide a wire straightening device that will eliminate circumferential rubbing between the die and the work piece, thus preventing injury to the surface thereof.

Another object of the invention is to provide a wire straightening device having dies therein whose operating surfaces provide a two-directional support for the work piece.

The invention consists in the provision of a rotatable cylinder having a plurality of dies therein, the major axes of which are disposed at an angle to the longitudinal axis of the cylinder and in which the relieved die throats are hyperboloids of revolution, the dies being offset with respect to each other and feeding the work piece through without injury to the surface as well as providing a two-directional support for the work piece.

In the drawings:

Fig. 1 is a view of the wire straightening device with parts in section to show detail,

Fig. 2 is a view of the device shown in Fig. 1 rotated at 90°,

Fig. 3 is an enlarged cross sectional view of the straightening die for the device shown in Fig. 1 and taken substantially along the line 3—3 of Fig. 1,

Fig. 4 is a schematic view taken at right angles to that shown in Fig. 1 and illustrating the path of the work piece through the straightening device; and

Fig. 5 is a view looking in the direction of the line 5—5 of Fig. 3 showing the straightening die and its bearing in rectilinear projection.

The invention is embodied in the device illustrated in Figs. 1, 2, and 3 of the drawings in which the numeral 1 designates a cylindrical carrier casing rotatably mounted in bearings 2 and driven by V belts 3 connected to a suitable source of power and disposed about a pulley 4 secured to the reduced diameter end of the casing. The carrier casing is provided with a longitudinal bore 5 through which work piece 6 passes, and this casing is also provided with a plurality of straightening die receiving slots 7 disposed transversely thereof or at an angle of less than 90° to the longitudinal axis of the carrier casing, the angle between the plane of the faces of the slots 7 and a line parallel to the longitudinal axis of bore 5 being designated by the letter "a" (Fig. 1). A bearing 8 is installed in slot 7, a plug 9 being threaded in one end of the slot for supporting and positioning the outer raceway of the bearing. A second plug 11 is threaded into the opposite end of slot 7 for adjusting the position of bearing 8 with respect to slot 7, plug 9 being correspondingly adjusted therein. The eccentricity of the straightening die and the bearing is shifted so that the generating line of the hyperboloidal surface always moves parallel to the axis of cylinder rotation.

The die in each of the slots 7 must be made to move

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and be adjusted at substantially right angles to the line generating the hyperboloidal surface. This imposes a translation of the die such that the angle of the intersection of the axes of the die and the carrier (Fig. 1) does not change but remains constant, as indicated.

A die 13 having a bore 14 therein is secured to the inner raceway of bearing 8. The inner surface of the rotatable die 13 is a modified hyperboloid of revolution. The modification consists in the substitution of a cylinder for the conventional wind-sheaf line as the generating element. The wind-sheaf line is the straight line disposed at an angle to an axis and rotated at a fixed distance about this axis, thereby generating a surface known as a hyperboloid of revolution. In effect, this produces what can be termed a relieved surface at the openings with practically a true hyperboloid in the midsection or throat of the die. The hyperboloidal internal die shape is generated by the generating element disposed at an angle to the axis of the working surface somewhat greater than 90° minus angle α . Another way of expressing the idea of the angularity of the wind-sheaf line is to say that it makes an angle with the axis of the work surface approximately equal to the angle that the axis of the carrier makes with the axis of the work surface of the die. This means that, in the example shown in Fig. 1, the wind-sheaf generating line and the axis of the carrier approximately coincide. This is necessary to provide for bent work piece clearance when a work piece assumes the shape shown in Figs. 4 and 5.

A plurality of dies are installed in the casing 1 and offset with respect to each other so that in passing through the dies, the work piece assumes a substantially sinusoidal shape that is damped or eased off at the outlet end of the carrier casing. The hollow die imposes a two-directional movement on the work piece. The contact line of the work piece with respect to the die lies on the surface thereof and is a helical line passing from below the center line of the work piece to a position above the center line, or vice versa, depending upon the direction of rotation of the carrier casing 1.

The helical path of contact is that path which is followed by the successive points of contact between the hollow die and the work piece as the carrier is rotated. The die is free to rotate within the bearing 8 and the work piece is drawn through the die at the feeding rate proportional to the lead angle of the path of contact. The feeding force is equal to the coefficient of friction of the work piece surface against the die surface multiplied by the bending moment reaction. This force is not sufficient for certain material to insure uniform feeding. When a rod or wire made of these materials is processed, it is necessary to use conventional feeding rolls or a drawhead for the purpose of assisting the self-feeding action of the spinner or carrier casing equipped with the hyperboloidal dies. The speed of any supplemental feeding must be the same as the natural feeding rate of the feed angle of the dies in order to prevent injury to the surface of the work piece. The feeding rate is also increased or decreased in proportion to the speed variation of the carrier casing 1.

It is apparent that the hyperboloidal die spinner or carrier casing provides, within itself, the motion of translation to the work piece. The contact between the die and the work piece is a true rolling motion following the helical path. The surface of the work piece is not crushed or twisted by reason of any action between the die and the work piece, thereby producing a rubbing torque, as in the case of the conventional stationary die type of wire straightener. Conversely, the hollow die has a supporting contact line that maintains or conforms to the cylindrical cross section of the work piece. This favorable action makes possible the straightening of tubes

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in the above device because there is an absolute minimum of bending moment and twisting torque reaction and whatever action is produced is distributed over the line of contact. For this reason the hyperboloidal die straightening device will not only straighten solid, round sections, but will also straighten tubes wound on coils without damage to the surface or to the section of the work piece. These dies will also straighten deformed reinforcing bars and similar structural elements on account of the long contact line.

What I claim is:

1. A straightening machine comprising a rotatably mounted carrier casing, a plurality of longitudinally spaced offset dies in said casing, the surface of the bore through said dies being a hyperboloid of revolution, means for rotatably supporting said dies in said casing with the axes of the bores substantially parallel, said means being disposed at an angle to the major dimension of said casing; and a device for varying the offset spacing between said dies at right angles to windsheaf line of the hyperboloid of revolution so that the angle of the intersection of the axes of rotation of said die and carrier casing is constant.

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2. A wire straightening machine comprising a rotatable carrier casing, a plurality of die holders mounted in said casing in series relation, with the die holders mounted in alternate relation on opposite sides of the longitudinal axis of said casing, means for translating said die holders in said casing so that the angle of intersection of the axis of each die holder and said casing axis is substantially equal and constant; and a die in each holder, the dies each having a bore which is a modified hyperboloid of revolution, together the dies providing right hand helical line contact with the work piece on one side of the axis of rotation of said casing and left hand helical contact with the work piece on the opposite side of said axis of rotation.

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