

Oct. 26, 1965

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3,213,663

DIE HOLDER HAVING UNIVERSAL MOVEMENT

Filed Feb. 4, 1964

4 Sheets-Sheet 1

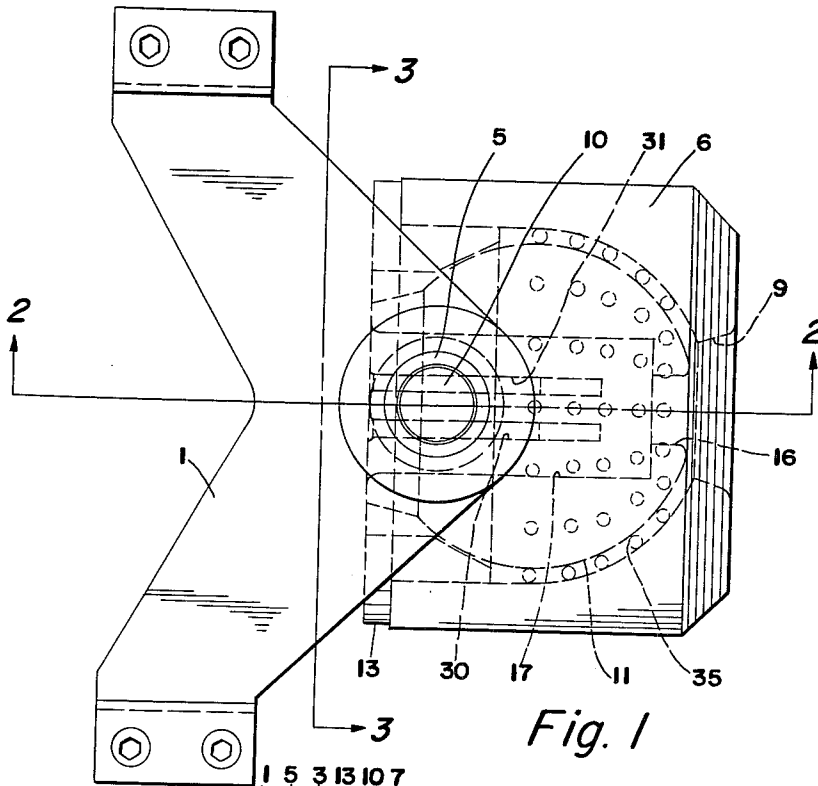


Fig. 1

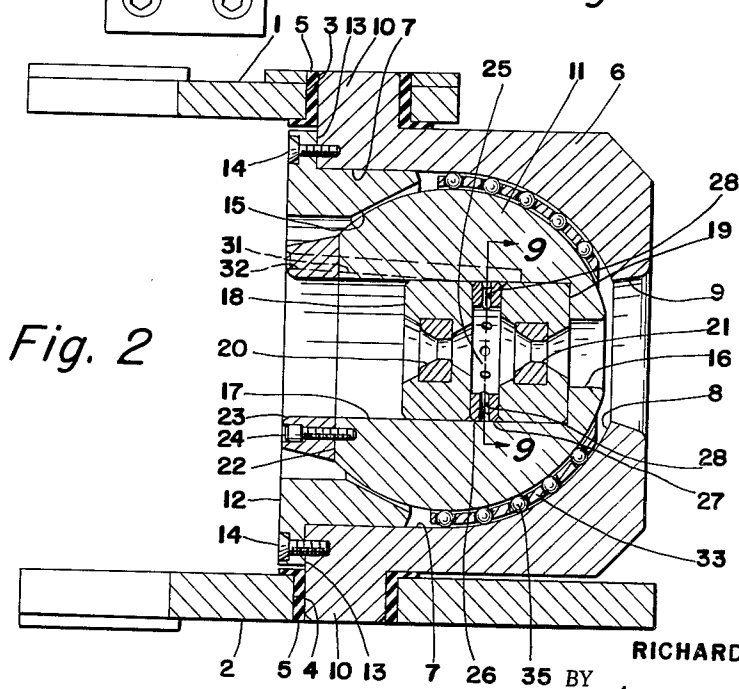


Fig. 2

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Fig. 3

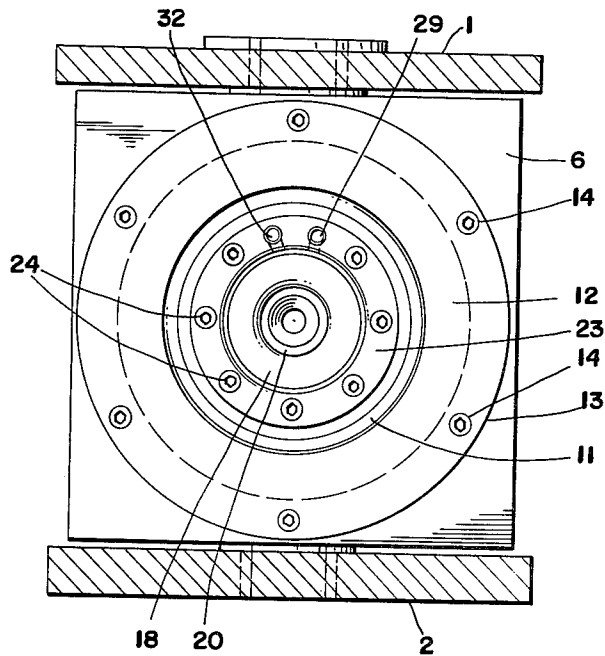
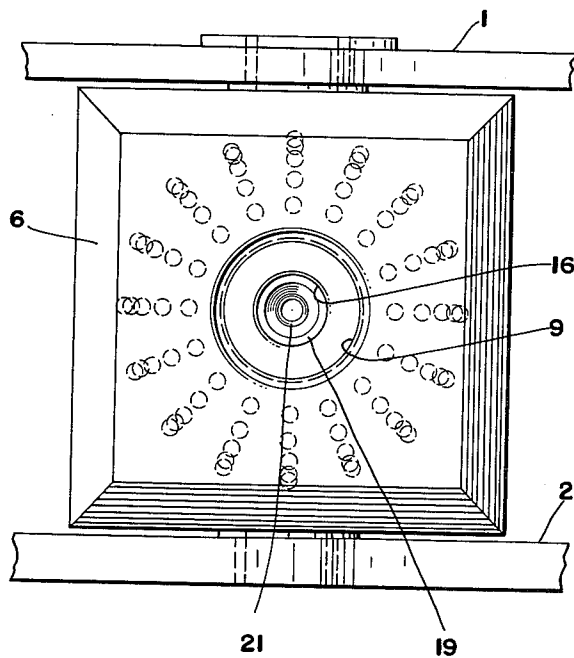


Fig. 4



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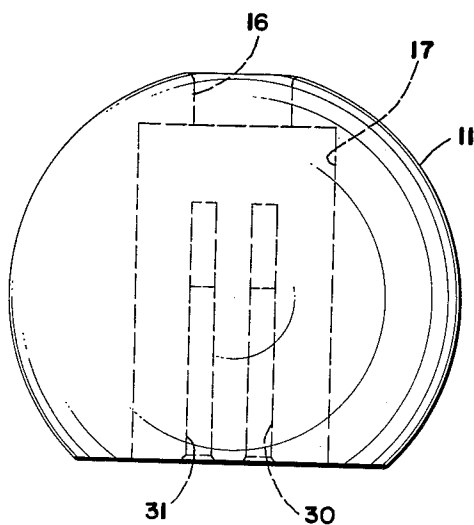


Fig. 5

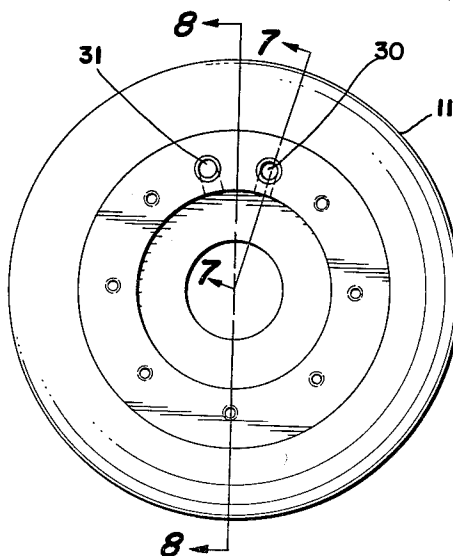


Fig. 6

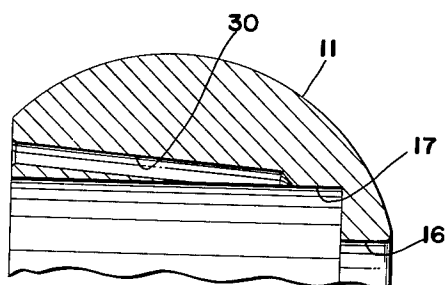


Fig. 7

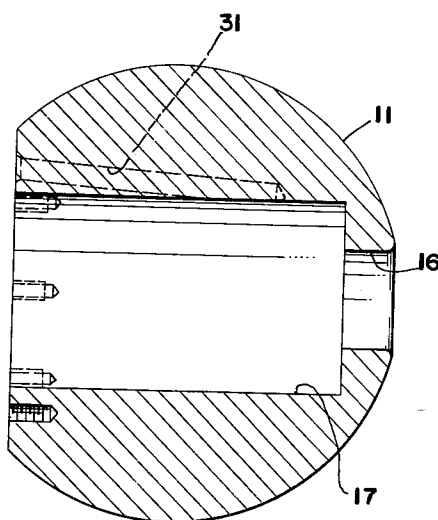


Fig. 8

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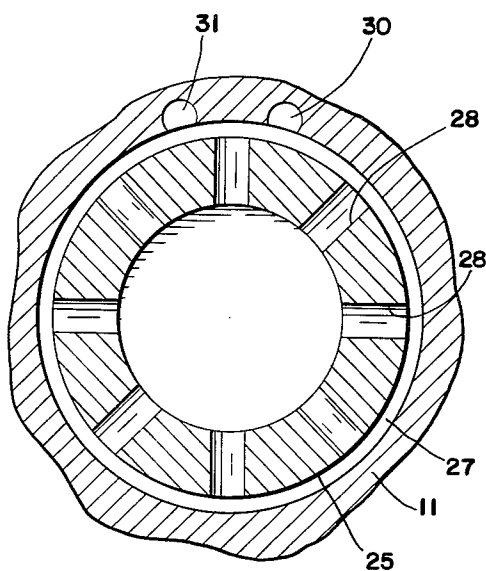


Fig. 9

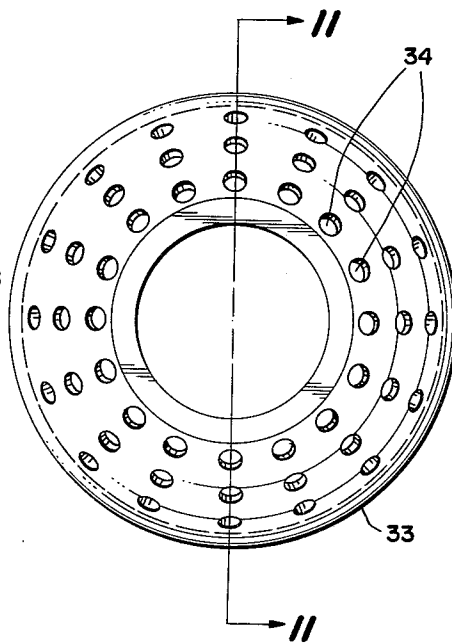


Fig. 10

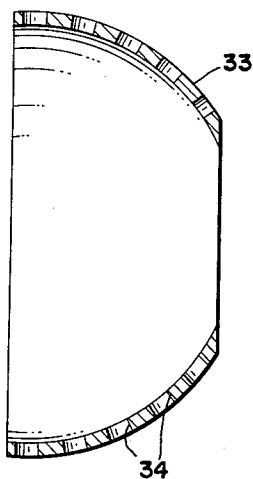


Fig. 11

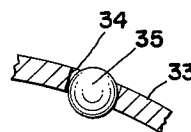


Fig. 12

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DIE HOLDER HAVING UNIVERSAL MOVEMENT
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5 Claims. (Cl. 72-285)

This invention relates generally to die holders, but has reference more particularly to die holders of the type generally employed for reducing or drawing copper tubing and the like.

A primary object of the invention is to provide a die holder of the character described, which, in the course of its use for reducing or drawing copper tubing or the like, and thereafter winding or coiling the tubing onto a rotating drum, is at all times self-aligning, whereby a natural draw line is always established between the true center line or axis of the die or dies and the point from which the tubing is being pulled to and through the die or dies.

Another object of the invention is to provide a die holder of the character described, which is characterized as having a negative mass effect, due to its free floating nature, whereby the weight or mass of the holder has little or no effect on the self-aligning function of the die holder.

A further object of the invention is to provide a die holder of the character described, in which a novel hollow spherical cage is employed having balls mounted therein for virtually eliminating frictional resistance to universal movement of the die holder.

Other objects and advantages of my invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

FIG. 1 is a top plan view of a die holder embodying the invention;

FIG. 2 is a cross-sectional view, taken on the line 2-2 of FIG. 1;

FIG. 3 is a cross-sectional view, taken on the line 3-3 of FIG. 1;

FIG. 4 is an elevational view, as viewed from the right side of FIG. 1;

FIG. 5 is a top plan view of the die-holding ball or carrier;

FIG. 6 is a rear elevational view of the die-holding ball or carrier;

FIG. 7 is a fragmentary cross-sectional view, taken on the line 7-7 of FIG. 6;

FIG. 8 is a cross-sectional view, taken on the line 8-8 of FIG. 6;

FIG. 9 is a fragmentary cross-sectional view, on an enlarged scale, taken on the line 9-9 of FIG. 2;

FIG. 10 is a front elevational view of the ball cage of the die holder;

FIG. 11 is a cross-sectional view, taken on the line 11-11 of FIG. 10; and

FIG. 12 is a fragmentary view, on an enlarged scale, of a portion of FIG. 2.

Referring more particularly to the drawings, reference numerals 1 and 2 designate vertically-spaced bracket members which are usually found in a tube drawing machine, and which are provided with openings 3 and 4 respectively, in which are mounted bushings 5 of an electrically insulative material.

The die holder comprises a housing block 6 having a recess therein consisting of a cylindrical rear portion 7 and a spherical forward portion 8 which terminates in an axial opening 9 through which the drawn copper

tubing is pulled by a rotating drum (not shown) on which the tubing is wound or coiled. The housing block 6 is provided with trunnions 10 which are journaled for rotation or pivotal movement in the bushings 5.

Disposed within the recess 7-8 of the housing block 6 is a die holder in the form of a ball-shaped member 11, which is retained against displacement from the block 6 by means of a retainer ring 12. The ring 12 extends into the portion 7 of the recess in the block and is provided with a marginal flange 13, which is secured to the rear face of the block by means of screws 14. The ring 12 is provided at its forward end with a conical surface 15, so that any rearward movement of the ball-shaped member 11 results in only a line contact with the surface 15, whereby marring of the ball surface is avoided.

The ball-shaped member 11 is provided with an axial bore 16, which is normally in axial alignment with the opening 9 in the block 6. The bore 16 is counterbored, as at 17, for the reception of a pair of spaced die casings 18 and 19, in which drawing die nibs 20 and 21 are respectively mounted, the tubing being drawn successively through the nibs 20 and 21 in a direction to the right, as viewed in FIG. 2.

The ball-shaped member 11 is also provided at its rear with a flat face 22, to which an annular end member 23 for the ball-shaped member 11 is secured, as by means of screws 24.

Disposed between the die casings 18 and 19 is a spacer ring or die spacer in the form of an annulus 25 and spaced flanges or flange portions 26 and 27 which engage the die casings 18 and 19 respectively. The annulus 25 is as shown in FIGS. 2 and 9, provided with a multiplicity of circumferentially-spaced radially-extending openings or bores 28, which provide passageways for a fluid lubricant. This fluid lubricant is directed to the space between the flanges 26 and 27 through aligned passageways 29 and 30 (see FIGS. 3, 6 and 7), and is drained through aligned passageways 31 and 32 (see FIGS. 3, 6 and 8). This lubricant is employed to lubricate the dies during the tube drawing operation.

An important feature of the invention resides in the provision of means for enabling the ball-shaped member 11 to be self-aligning at all times during the tube drawing operation, whereby a natural draw line is always established between the true centers or axes of the dies 20 and 21 and the point from which the tubing is being pulled to and through the dies.

For this purpose, a hollow hemispherical cage 33 is interposed between the portion 8 of the housing block recess or cavity, and the outer surface of the ball-shaped member 11, in the manner shown in FIG. 2, the construction of this cage being clearly illustrated in FIGS. 10, 11 and 12. The cage 33 is provided with a multiplicity of spaced radially-extending openings 34 in which bearing balls 35 are disposed, these balls, as best seen in FIGS. 2 and 12, being of a diameter slightly larger than the wall thickness of the cage 33, whereby the balls can roll freely on the surface 8 and the exterior surface of the ball-shaped member 11, and, at the same time, are retained against displacement from the openings 34.

The cage 33 and balls 35 are highly effective in permitting movement of the ball-shaped member 11, and therefore of the dies, irrespective of the size or mass of the ball and dies. The cage and balls thus have a negative mass effect, permitting self-alignment of the dies to occur under any and all conditions encountered during the tube drawing operations.

Although the invention has been described more particularly with reference to tube drawing, it will be understood that it is applicable, as well, to wire drawing, extruding, and other uses well understood in the art.

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It is to be understood that the form of my invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes may be made in the shape, size and arrangement of parts thereof, without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. Apparatus for tube drawing and the like, comprising a housing block having a spherical recess and provided with vertically-extending trunnions journaled for rotation about a vertical axis, a ball-shaped member disposed in said recess, dies mounted in said member, means for facilitating universal movement of said member relatively to said recess, said means comprising a hollow hemispherical cage interposed between the wall of said recess and said ball-shaped member, said cage having a multiplicity of radially-extending openings, bearing balls disposed in said openings, said balls rollable on the wall of said recess and on the exterior of said ball-shaped member, and means secured to said housing block for retaining said ball-shaped member and cage against displacement from said block.

2. Apparatus, as defined in claim 1, in which said ball-shaped member has a cylindrical recess extending diametrically thereinto, in which said dies are mounted in spaced relation to each other, and a spacer member is interposed between said dies, said spacer member having means for permitting passage of a lubricant to said dies.

3. Apparatus, as defined in claim 2, in which said last-named means comprises a series of circumferentially-spaced radially-extending openings.

4. Apparatus for tube drawing and the like, comprising

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a housing having a spherical recess, and provided with trunnions having axially-aligned trunnions extending therefrom, which are journaled for rotation about the axes of said trunnions, a ball-shaped member disposed in said recess, dies mounted in said member, means for facilitating universal movement of said member in said recess, said means comprising a hollow hemispherical cage interposed between the wall of said recess and said ball-shaped member, said cage having a multiplicity of radially-extending openings, bearing balls disposed in said openings, said balls rollable on the wall of said recess and on the exterior of said ball-shaped member, and means secured to said housing block for retaining said ball-shaped member and cage against displacement from said block.

5. Apparatus, as defined in claim 4, in which recess has a cylindrical extension, and said last-named means comprises a ring which extends into said cylindrical extension and has a marginal flange which is secured to said block.

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