Aug. 25, 1959 K. EISENBURGER ET AL 2,900,830

LINKAGE FOR DESCRIBING A STRAIGHT LINE

Filed Dec. 17, 1957 2 Sheets-Sheet 1

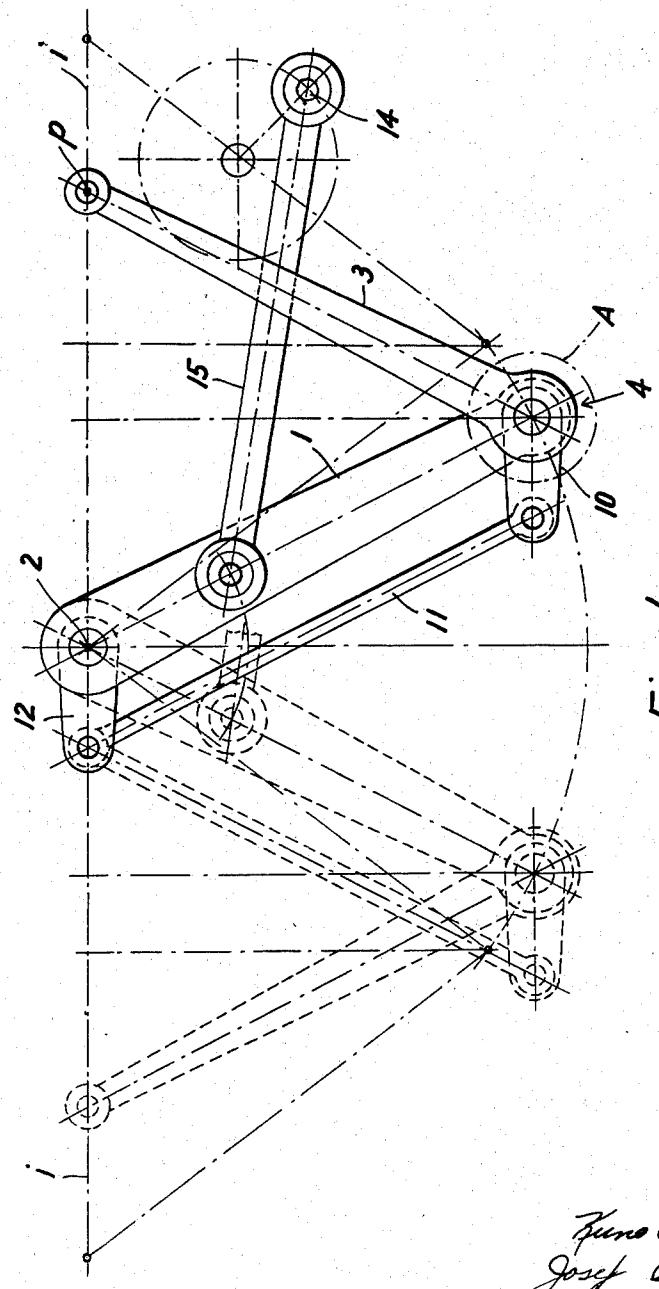

Fig. 1

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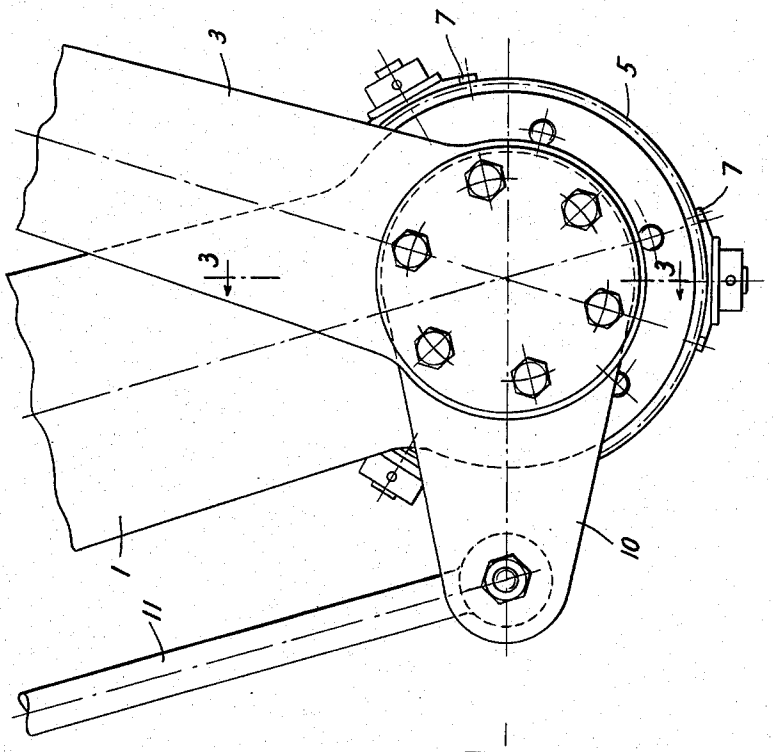

Fig. 2

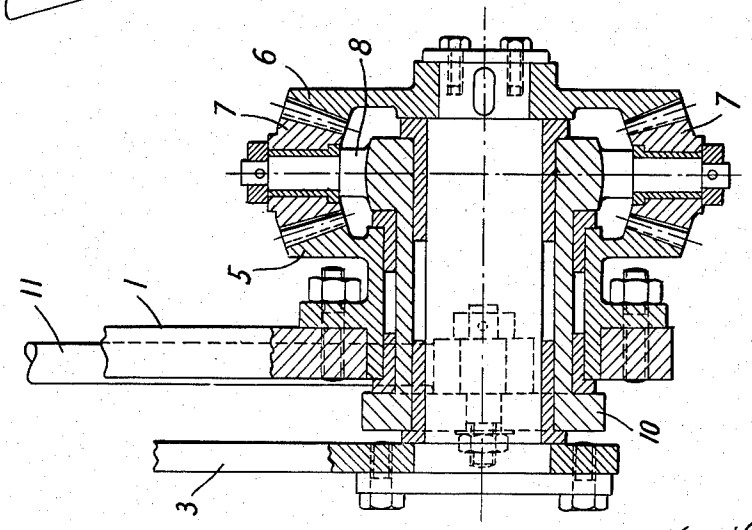

Fig. 3

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LINKAGE FOR DESCRIBING A STRAIGHT LINE

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5 Claims. (Cl. 74—103)

This invention relates to a linkage for describing a straight line, which distinguishes from the known linkage for describing a straight line and a known elliptic-motion link serving for describing a straight line by a simple construction, comprising only a few elements, and which permits of deriving a straight-line movement with the highest possible transmission ratio from any movement received, and which avoids more particularly any sliding movement so that all joints between the several elements may consist of pivoted joints, which enable an easy lubricatoin and facilitate the use of ball bearings.

These advantages are achieved according to the invention in that the linkage for describing a straight line comprises a carrying lever pivoted to a fixed point, and an one-armed rocker lever having the same length as said carrying lever, measured from said fixed point to one pivotally movable end of said carrying lever, one end of said rocker lever being rotatably coupled to said pivotally movable end of said carrying lever by a positive transmission, which causes the two levers to move through angles of equal magnitude but opposite senses with respect to the path of the point moved along a straight line, the other end of said rocker lever forming or being connected to the point moved along a straight line. The parts of the positive transmission between the free end of the carrying lever and the pivoted end of the rocker lever are held by a guide means, e.g. a pantograph, always at the same angle with respect to the path of the point moved along a straight line.

The positive transmission may consist of a lever transmission but consists suitably of a epicyclic gear or a pair of gear-wheels. Where the positive transmission consists of an epicyclic gear the crown wheels are connected for rotation with the carrying lever and the rocker lever, respectively, whereas the shaft of the planetary gear, e.g., the spider carrying the shafts of the set of planetary gears, is held by the guide means always at the same angle with respect to the path of the point moved along a straight line. When the positive transmission is constructed as a pair of gear-wheels, these are connected for rotation with the carrying lever and the rocker lever, respectively, whereas the gear-box carrying the pair of gear-wheels is held by the guide means always at the same angle with respect to the path of the point moved along a straight line. In this case the guide means comprises at least one pantograph link, which is connected to the gear-box of the pair of gear wheels adjacent to the axis of one of the gear-wheels.

The linkage provided by the invention for describing a straight line is of very wide application, particularly because this linkage comprises only pivoted joints for connecting the several elements of the linkage and is capable of adjustment at relatively high speeds owing to these joints. The linkage according to the invention is particularly suitable for laying the transverse wire in a grid welding machine along a winding path by reversing the transverse wire, which is continuously pulled from a supply bobbin, alternatingly, e.g. around the teeth of two

gear rims disposed on the two longitudinal sides of the grid to be manufactured, and then welding the wire between the gear rims to the parallel warp or longitudinal wires. To reciprocate the point moved along a straight line a special embodiment is provided, in which the carrying lever is connected to a gear for mechanically converting a rotary movement into an oscillating movement of the carrying lever, which oscillating movement is suitably variable in amplitude. This gear may preferably consist of a crank or eccentric drive, a swash plate or the like, which is variable in crank length or eccentricity.

An illustrative embodiment of linkages according to the invention is shown in the accompanying drawings. These linkages are suitable, e.g., for laying the transverse wire in grid welding machines in winding or zig-zag paths.

Fig. 1 is a diagrammatic elevation of one embodiment of the linkage; and

Figs. 2 and 3 are enlarged views showing the detail indicated at A in Fig. 1 in elevation and in a sectional view taken on line 3—3 of Fig. 2, respectively.

The linkage shown in Figs. 1 and 3 comprises a carrying lever **1**, which is mounted, e.g. on a machine frame, for pivotal movement about the fixed point **2**. A rocker lever **3** is jointed to the pivotally movable end of the carrying lever **1**. The free end of this rocker lever **3** forms or is connected to the point *p* moved along a straight line. The straight path of this point is indicated at *i—i* in Fig. 1. To constrain the point *p* to move exactly on the line *i—i* it is essential that the carrying lever **1**, measured from the fixed point **2** to the end where it is jointed to the rocker lever, and the rocker lever **3** have the same length. Provision must also be made that the pivotally movable end of the carrying lever **1** is positively coupled to the rocker lever **3** by a transmission **4** in such a manner that the two levers **1**, **3** are moved through angles of equal magnitude but opposite sense with respect to the path *i—i* of the point *p* moved along a straight line. Thus the two levers **1** and **3** form always the sides of an isosceles triangle, the altitude of which is always at right angles to the path *i—i* of the point moved along a straight line. In the embodiment shown in Figs. 1 to 3, the transmission **4** which provides these kinematic relations consists of an epicyclic gear, in which one crown wheel **5** is connected for rotation with the carrying lever **1** and the other crown wheel **6** is connected for rotation with the rocker lever **3**, as is shown in Fig. 3. The planetary gears **7** are carried by a spider **8**, which is held by a guide means **10**, **11**, **12** always at the same angle with respect to the path *i—i* of the point *p* moved along a straight line. In this case the guide means consists of a pantograph, the crank arm **10** of which is connected for rotation with the spider and the crank arm **12**, of the same length as **10**, is held against rotation adjacent to the fixed point **2** to assume always a horizontal position in the embodiment shown.

As is shown in Fig. 3 the epicyclic gear is arranged before and behind the carrying lever **1** and the rocker lever **3**, considered in the direction of the pivotal axis connecting said levers and the pantograph is disposed between the two levers. This enables a construction of very small overall width.

For operating the linkage, a crank drive is provided, the crank pin **14** of which is connected by a connecting rod **15** to the carrying lever. If the crank drive has a crank of adjustable length, the amplitude of the oscillation of the carrying lever and with it the displacement of the point *p* moved along a straight line (control displacement) can be adjusted.

The crank drive may be replaced by an eccentric drive, a swash plate or other known means for mechanically

converting a rotary movement into an oscillating movement.

What is claimed is:

1. A linkage for describing a straight line, which comprises a fixed pivot, a carrying lever pivoted to said fixed pivot and having at least one pivotally movable end, a one-armed rocker lever having the same length as said carrying lever from said pivot to said pivotally movable end thereof, one end of said rocker lever being pivoted to said pivotally movable end of said carrying lever, an epicyclic gear having two crown wheels connected for rotation with said carrying lever and rocker lever, respectively, at least one planetary gear in mesh with both said crown wheels and a planet carrier carrying said planetary gear, and guide means arranged to hold said planet carrier always at the same angle with respect to said straight line.

2. A linkage as set forth in claim 1, which comprises a plurality of said planetary gears and in which said planet carrier consists of a spider.

3. A linkage as set forth in claim 1, in which both said levers are disposed on the same side of said epicyclic gear and said guide means is disposed between said levers.

4. A linkage as set forth in claim 1, in which said guide means comprises a parallel motion link connected to said planet carrier.

5. A linkage as set forth in claim 1, which comprises a crank drive the crank pin of which is connected by a rod to said carrying lever.

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