(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 183 531**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **85308602.3**

(51) Int. Cl.⁴: **B 21 D 7/06**

(22) Date of filing: **27.11.85**

(30) Priority: **28.11.84 GB 8429982**

(43) Date of publication of application:
04.06.86 Bulletin 86/23

(84) Designated Contracting States:
AT DE FR GB

(71) Applicant: **MINNOVATION LIMITED**
Mulberry House Chevet Lane
Sandal Wakefield WF2 6HS(GB)

(72) Inventor: **Parrott, George Albert**
Mulberry House Chevet Lane
Sandal Wakefield WF2 6HS(GB)

(74) Representative: **Long, Edward Anthony et al,**
Hulse & Co. Cavendish Buildings West Street
Sheffield S1 1ZZ(GB)

(54) **Portable bending apparatus.**

(57) A portable bending apparatus (1) for bending elongate, deformable material (2), comprises first and second clamps (3), (4) adapted, in use, to be located in a selected, spaced-apart relationship along a length of material (2) to be bent, each clamp (3), (4) providing a fixed jaw (8) adapted, in use, to engage one side of the material (2) to be bent in the plane in which bending is required, and pivotably carrying a lever (13) having lever portions (15), (18) extending to opposite sides of a laterally spaced, lever pivot axis (14), with a first lever portion (15) provided with a jaw (16) adapted to engage the opposite side of the material (2) to be bent in the plane in which bending is required, and with a second lever portion (18) providing a pivotal attachment point (21) for power means extending between the levers and hence between the clamps for imposing bending moments on the material to be bent via the clamps, the power means comprising a double-acting, hydraulic piston and cylinder unit (5).

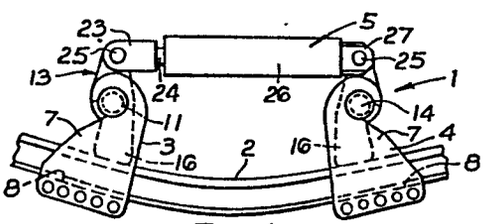

Fig. 1

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PORTABLE BENDING APPARATUS

This invention relates to portable bending apparatus, for bending elongate, deformable material, e.g. of metal and of symmetrical or asymmetrical solid or hollow section, to a required curvature. In the installation or maintenance of railway track for example it is usually necessary to provide curved lengths of rail for various locations, while curved arches, e.g. of "I"-section, are frequently employed as permanent roof supports in mine roadways.

According to the present invention, there is provided a portable bending apparatus for bending elongate, deformable material, comprising first and second clamps adapted, in use, to be located in a selected, spaced-apart relationship along a length of material to be bent, each clamp providing a fixed jaw adapted, in use, to engage one side of the material to be bent in the plane in which bending is required, and pivotably carrying a lever having lever portions extending to opposite sides of a laterally spaced, lever

pivot axis, with a first lever portion provided with a jaw adapted to engage the opposite side of the material to be bent in the plane in which bending is required, and with a second lever portion providing a pivotal attachment point for power means extending between the levers of each clamp for imposing bending moments on the material via the clamps, the power means comprising a double-acting, hydraulic piston and cylinder unit.

In detail, each clamp may comprise a pair of parallel cheeks, spaced apart by a distance such that the cheeks may embrace the maximum material section, in one direction, required to be bent by the apparatus. Although the clamps could be threaded along the material to be bent, or conversely the material fed through the clamps, it is preferred for one clamp cheek to be releasable from the other. Thus, with this arrangement, the fixed jaw may be welded to the fixed cheek and the releasable cheek secured to the fixed jaw by releasable attachment means such as bolts or studs.

Preferably, the pivotal attachment of

the lever to its jaw is of a construction that may readily be disassembled, so that the lever may readily be removed from its cheeks. With this arrangement, a pivot pin is preferably carried by the lever, to be pivotably received in support holes provided in the cheeks. Although disassembly could be effected by providing removable pivot pins, the latter are preferably permanently attached, e.g. by welding, to the levers, and are provided with a flat, and the cheeks with a suitably dimensioned lead-in throat to the support holes, so that the pivot can only be inserted, and removed, when in a predetermined angular position with respect to the cheeks. In detail, it is preferred for each pin to be provided with two, reduced-diameter necks to engage the support holes, and consequently spaced apart by the cheek spacing.

Pivotal attachment of the piston and cylinder unit to the levers is conveniently effected by providing a bifurcated end fitting on both the piston rod and the cylinder of the piston and cylinder unit, with a pivot pin, conveniently readily removable and replaceable, passing through aligned holes in

the bifurcated end fitting and in their associated levers. If such a spacing between the clamps is required, to produce the desired curvature, that the piston and cylinder unit is of insufficient length, then one or more tie bars e.g. of 1m or 2m length can be used to extend the effective length of the piston and cylinder unit. Such tie bars will need to have compatible end fittings.

It will be appreciated that the jaw positions, or lever positions, need to be changed on the material to be bent when adapting the apparatus from one for effecting say concave bends, to one for effecting convex bends, and vise versa.

It is also preferred for each movable jaw to be provided with a serrated gripping surface, while hydraulic power to the piston and cylinder unit may be provided by a portable, manually operable pump, so that the apparatus, apart from itself being portable, is provided with a portable power pack, so that the apparatus may be used in remote locations where no hydraulic power, or electrical energy to power an electric motor to drive a hydraulic pump, is available.

It will be appreciated that the distance between the support holes of the cheeks and their fixed jaw determines, at least for one set of two levers, one maximum external dimension of the material intended to be bent, and to adapt the apparatus for bending smaller dimensioned materials, one or more sizing blocks may be provided to seat on the fixed jaw and to fill the gap that would otherwise be present. If the apparatus is to be used for instance for the bending of railway rail, or other sections having a web interconnecting spaced-apart flanges, the fixed jaw is conveniently provided with a projecting jaw extension, a terminal end of which is adapted to engage one side of the web.

The invention will now be further described, in greater detail, by way of examples, with reference to the accompanying drawings, in which:-

Figures 1 and 2 are diagrammatic plan views of a first embodiment of apparatus in accordance with the invention, for producing respectively concave and convex bends in a vertical plane for bending railway rail

intended to be located respectively in holes or on humps;

Figure 3 is an enlarged plan view of one of the clamps of Figures 1 and 2;

Figure 4 is a view in the direction of arrow A of Figure 3;

Figures 5 and 6 are diagrammatic plan views of a second embodiment of apparatus in accordance with the invention, for producing respectively curves in a horizontal plane, for bending railway rail to suitable curvature;

Figure 7 is an enlarged plan view of one of the clamps of Figures 5 and 6; and

Figure 8 is a view in the direction of arrow B of Figure 7.

In all Figures, like components are accorded like reference numerals.

Figures 1 and 2 illustrate the bending, by a first embodiment of portable rail bending apparatus 1 in accordance with the invention, of a bull head railway rail 2 in a vertical plane, the Figure 1 arrangement producing a concave bend so that the rail may accurately follow a dip or swilley as are frequently encountered in mine roadway systems, and the Figure 2 arrangement

producing a convex bend so that the rail may accurately follow a hump.

Basically, the portable rail bending apparatus 1 comprises first and second clamps 3, 4 located in selected, spaced-apart relationship along the rail 2, and interconnected by a double-acting hydraulic piston and cylinder unit 5, so that with the clamps 3 and 4 mounted on the rail 2 in the manner illustrated in Figure 1, then upon retraction of the unit 5 from an intermediate position to the position illustrated in Figure 1, bending moments are applied to the rail 2 by the clamps 3, 4 to produce the concave bend indicated, whilst with the clamps 3 and 4 mounted on the rail 2 in the manner illustrated in Figure 2, then upon extension of the unit 5 from an intermediate position to the position illustrated in Figure 2, bending moments are applied to the rail 2 by the clamps 3, 4 to produce the convex bend indicated.

In detail, each clamp 3, 4 comprises a pair of parallel cheeks 6, 7 spaced apart from one another such that the cheeks 6, 7 may embrace the maximum section, in one direction,

of the rail 2 which is required to be bent by the apparatus 1. In the embodiment of Figures 1 to 4, the cheek 6 is welded to a fixed jaw 8, while the cheek 7 is releasably attached to the fixed jaw 8 by three screw-threaded studs 9, the fixed jaw 8 being provided with a rail engaging surface 10. Distal from the fixed jaw 8, the cheeks 6 and 7 are provided with co-axial support holes 11 having a reduced diameter lead-in throat 12.

A lever 13 is pivotally supportable in the holes 11 for rotation about a lever pivot axis 14 which is laterally spaced from the rail 2, the lever 13 having a first lever portion 15 extending to one side of the axis 14, constituting a movable jaw 16 and terminating in a serrated gripping surface 17, and a second lever portion 18 extending to the other side of the axis 14. Each lever 13 is provided with a pivot pin 19 co-axial with the axis 14, and welded to the lever portions 15 and 18, the pin 19 being provided with two, reduced-diameter necks 20 adapted to be engaged in the support holes 11, and each neck 20 being provided with a flat so that the lever 13 needs to be manoevered in the

position illustrated in chain-dotted line in Figure 3 to align the flat with the throat 12, and after engagement of the necks 20 and the support holes 11, the lever 13 is rotated to the position shown in full and dotted line in Figure 3, for connection to its piston and cylinder unit 5. In detail, the second lever portion 18 is provided with a hole 21, which is aligned with corresponding holes 22 in a bifurcated end fitting 23 of a piston rod 24 of the piston and cylinder unit 5, with a removable pivot pin 25 being inserted into the aligned holes. Cylinder 26 of the piston and cylinder unit 5 is provided at its other end with a bifurcated end fitting 27 to receive a pivot pin 25 of the other jaw 4.

In the embodiment of Figures 1 to 4, the apparatus 1 has been located around conventional bull head rail 2, with the rail foot being located on the surface 10 of the fixed jaw 8, and with the gripping surface 17 of the movable jaw 16 engaging the top of the rail head.

In the embodiment of Figures 5 to 8, the fixed and movable jaws are required to engage a web 28 of the rail 2, and the fixed

jaw 8 is consequently provided with a jaw extension 29 whilst both cheeks 6, 7 are releasably secured to the fixed jaw 8 by two headed bolts 30 passing through aligned holes in the cheeks 6, 7 and jaw 8, to be secured by a nut 31 with a washer 32.

In both Figures 4 and 8 is illustrated the possibility of using the apparatus to bend an asymmetric rail section 2A, and in Figure 4 this requires the insertion of a sizing block 33, illustrated in chain-dotted line between the surface 10 and the rail foot.

It will be appreciated that, in use, the apparatus 1 is assembled in the manner illustrated in Figures 1, 2, 5 or 6 in accordance with the bend that the user wishes to impart to the rail in question. It will also be appreciated that if it is required to space the jaws 3, 4 by a distance greater than that that can be accommodated by the particular length of piston and cylinder unit 5, then one or more tie rods can be interposed, in a generally known manner, between the bifurcated end fitting 23 and/or 27 and the lever 13 to which that end would otherwise be attached.

CLAIMS

1. A portable bending apparatus 1 for bending elongate, deformable material 2, comprising first and second clamps 3, 4 adapted, in use, to be located in a selected, spaced-apart relationship along a length of material 2 to be bent, each clamp 3, 4 providing a fixed jaw 8 adapted, in use, to engage one side of the material 2 to be bent in the plane in which bending is required, and pivotably carrying a lever 13 having lever portions 15, 18 extending to opposite sides of a laterally spaced, lever pivot axis 14, with a first lever portion 15 provided with a jaw 16 adapted to engage the opposite side of the material 2 to be bent in the plane in which bending is required, and with a second lever portion 18 providing a pivotal attachment point 21 for power means extending between the levers and hence between the clamps for imposing bending moments on the material to be bent via the clamps, the power means comprising a double-acting, hydraulic piston and cylinder unit 5.

2. Apparatus as claimed in Claim 1, wherein each clamp 3, 4 comprises a pair of parallel cheeks 6, 7, spaced apart by a distance such that the cheeks 3, 4, may embrace the maximum material section, in one direction, required to be bent by the apparatus 1.

3. Apparatus as claimed in Claim 2, wherein one clamp cheek 6 is a fixed cheek and the other clamp cheek 7 is releasably attached to the fixed cheek 6.

4. Apparatus as claimed in Claim 3, wherein the fixed jaw 8 is welded to the fixed cheek 6 and the lever jaw 16 is secured to the fixed jaw 8 by releasable means.

5. Apparatus as claimed in any preceding Claim, wherein a pivot pin 19 is carried by each lever 13, to be pivotally received in support holes 11 provided in the cheeks 6, 7.

6. Apparatus as claimed in Claim 5, wherein each pivot pin 19 is permanently attached to its lever 13, and is provided with a flat, and the cheeks 6, 7 provided with a suitably dimensioned lead-in throat 12 to the support holes 11, so that the pivot pin 19 can

only be inserted, and removed, when in a predetermined angular position with respect to the cheeks 6, 7.

7. Apparatus as claimed in Claim 6, wherein each pivot pin 19 is provided with two, reduced-diameter necks 20 to engage the support holes 11, the necks 20 consequently being spaced apart by the cheek spacing.

8. Apparatus as claimed in any preceding Claim, wherein the piston and cylinder unit 5 is pivotally attached between the levers 13 by providing a bifurcated end fitting 23, 27, on both the piston rod 24 and the cylinder 26 of the piston and cylinder unit 5, with a pivot pin 25 passing through aligned holes in a bifurcated end fitting 23, 27 and in its associated lever 13.

9. Apparatus as claimed in any preceding Claim, wherein each movable jaw 16 is provided with a serrated gripping surface 17.

10. Apparatus as claimed in any preceding Claim, wherein the fixed jaw 8 is provided with a projecting, jaw extension 29.

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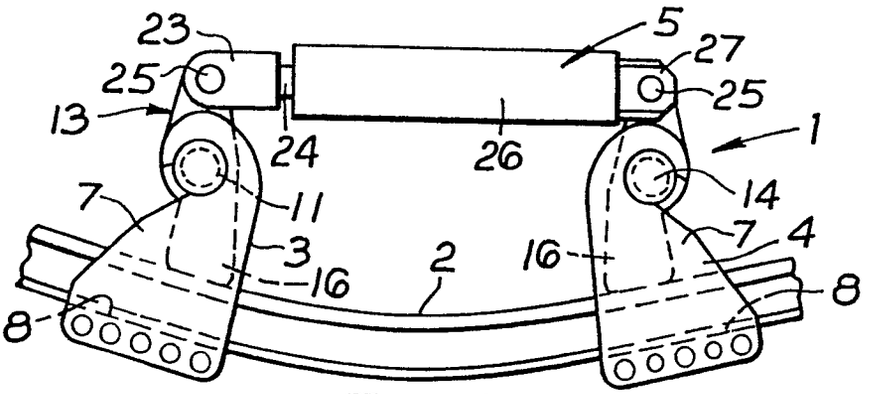

Fig. 1

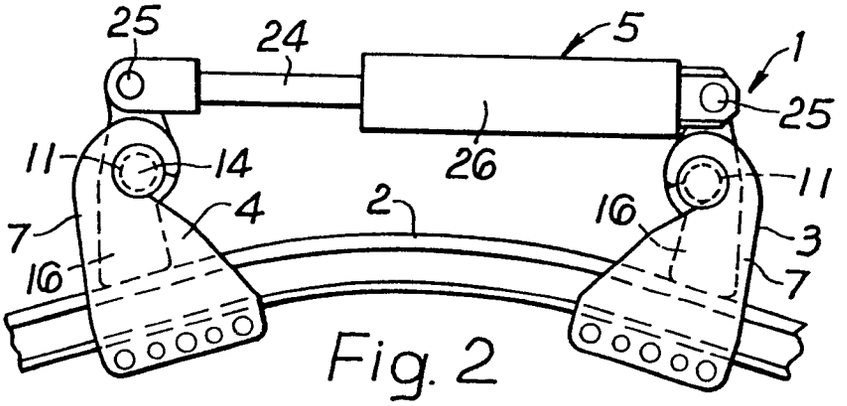

Fig. 2

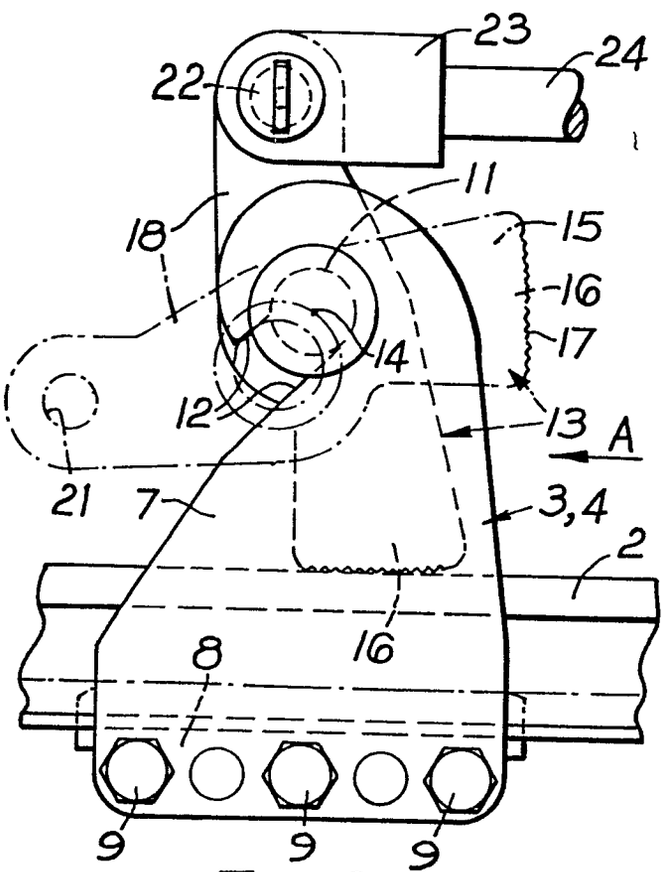

Fig. 3

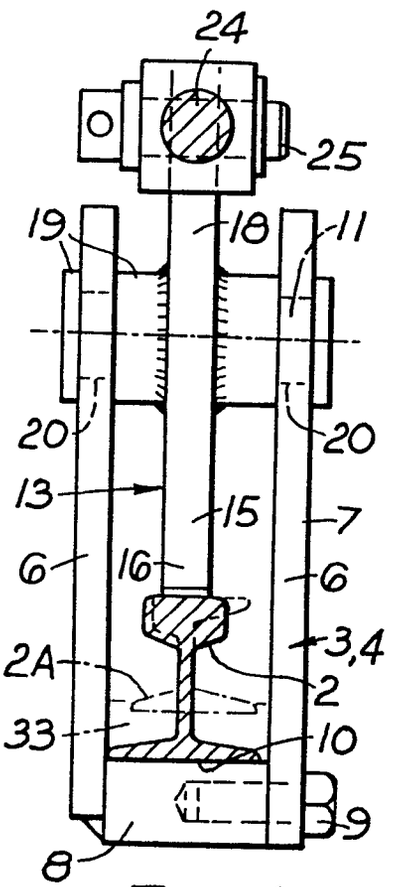

Fig. 4

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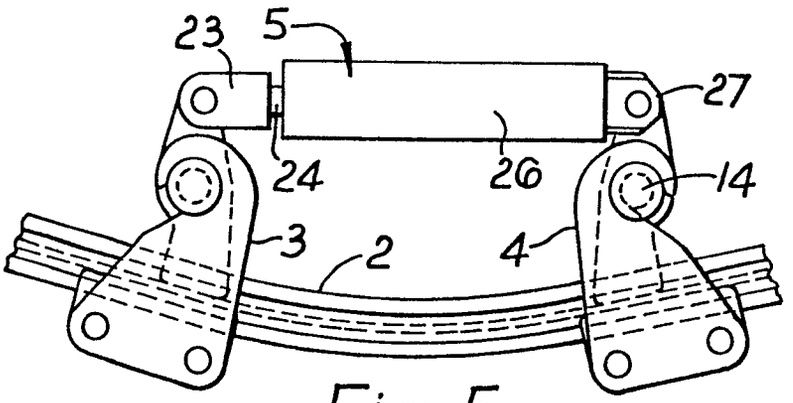

Fig. 5

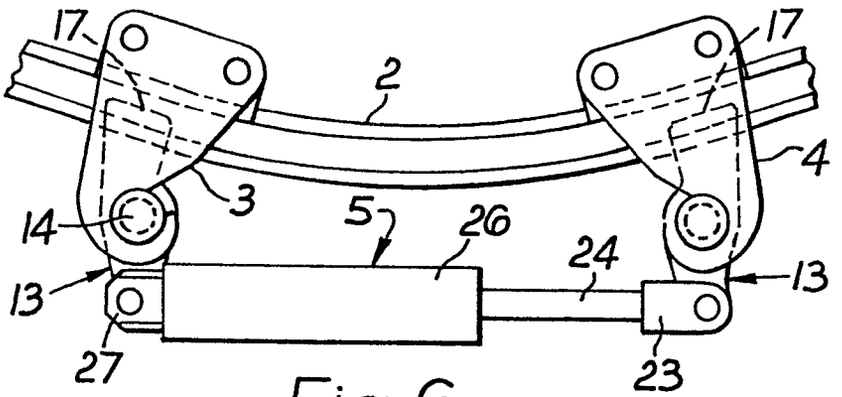

Fig. 6

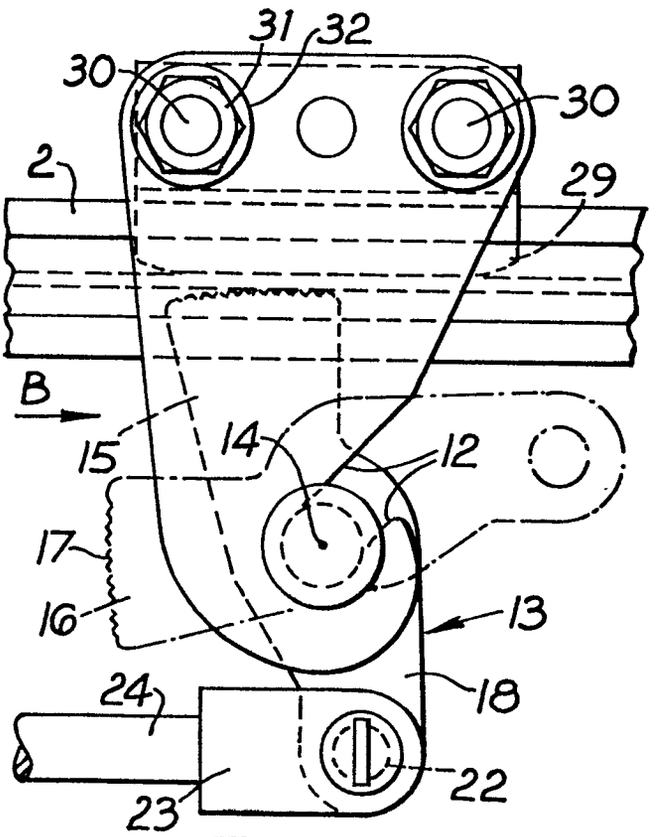

Fig. 7

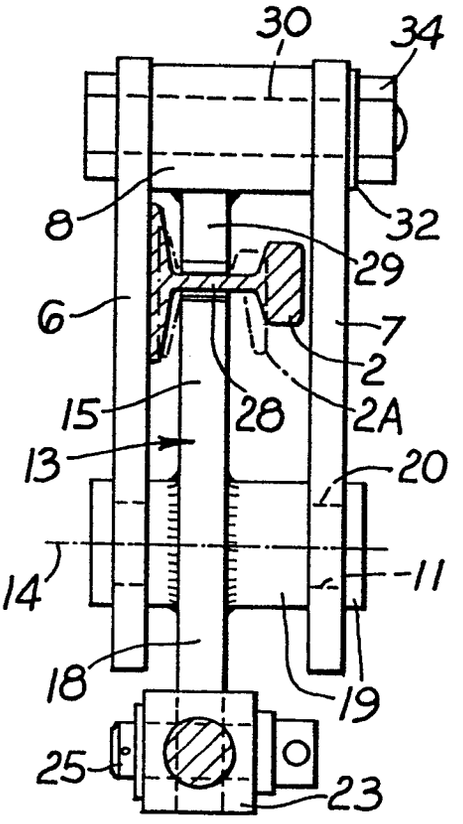

Fig. 8