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MOBILE FLASH BUTT WELDING SET

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(56) Prior Art Documents
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AU 528414 42296/78 B23K 11/04
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(57) Claim

1. A mobile flash butt welding set for butt welding rail ends, the welding set comprising: two block assemblies which can be moved towards each other by means of upsetting cylinders along their ength, each block assembly including two components which can be swivelled towards each other in a pinching movement and clamp electrodes for gripping the rail ends, characterized in that each block assembly is connected to clamping mechanisms provided to grip a respective rail therebetween, the clamping mechanisms connected to one block assembly being separted from the clamping mechanisms connected to the other block assembly along the length of the upsetting cylinders.

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MOBILE FLASH BUTT WELDING SET

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The following statement is a full description of this invention, including the best method of performing it known to applicant(s):

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The invention concerns a mobile flash butt welding set for butt welding rail ends, the welding set comprising: two block assemblies which can be moved towards each other by means of upsetting cylinders along their length, each block assembly including two components which can be swivelled towards each other in a pinching movement, and clamp electrodes for gripping the rail ends.

A mobile flash butt welding set of this type which is mounted on a machine travelling on tracks and the height of which is adjustable is known from EP-A-1 0 326 793. Each of the two block assemblies which can be moved towards each other in line with the rail or machine by means of upsetting cylinders has a set of clamping and welding dies which can be pressed on to the rail stem by a hydraulic clamping cylinder. The sets of clamping and welding dies serve not only for clamping but also as electrodes through which the welding current is passed to the areas around the ends of the two rails to be welded together. In order to carry out the welding operation the clamped ends of the rails are moved towards each other at 0.25 mm per second by abutting the two upsetting cylinders and the two block assemblies. When the rail ends are moved the welding current reaches an initial peak value and the forward movement is stopped when a suitable welding temperature is achieved. To finish the welding operation the so-called upset stroke is effected in which the rail ends which have been heated to welding temperature are pressed together using a very high force of pressure.

A ring-shaped rail clamping device is provided around the flash butt welding set especially as a back-stop for this upset stroke in the case of very long and heavy rails. This is

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equipped with clamping dies in the area of both ends which can be moved towards each other in a pinching movement and clamping jaws are provided for gripping the rail stem. The ends of the clamping jaws which face each other along the length of the rails are connected to each other by a hydraulic cylinder. Said upset stroke is synchronised with the upsetting cylinder of the welding set and both of the hydraulic cylinders of the rail clamping device.

A flash butt welding set for use in welding laid rails is described by DE-PS 14 65 042. This type of welding set consists of two block assemblies which can be moved towards each other in line with the rails by two upsetting cylinders. The block assemblies comprise two parts which can be pivoted towards each other about an axis running the length of the upsetting cylinder. On their undersides these parts have clamp electrodes for gripping both sides of the rail at once and are connected at their top ends by pressure cylinders.

The aim of the present invention is to create a generic type of mobile flash butt welding set by means of which a particularly high tensile load can be applied to the rail ends to be joined with only slight modification of the design of both block assemblies.

~~This aim is achieved according to invention by the elements in~~ Claim 1. This solution according to invention enables a constructional unit to be created by means of which considerably higher tensile load can be applied to the rail ends to be welded whilst retaining to a large extent the design features of the best flash butt welding sets which have already proved themselves in use and avoiding overstress of the ~~clamping dies or the parts of the block assemblies~~ connected to

With this aim in mind, the present invention is characterized in that each block assembly is connected to clamping mechanisms provided to grip a respective rail therebetween, the clamping mechanisms connected to one block assembly being separted from the clamping mechanisms connected to the other block assembly along the length of the upsetting cylinders.

The present invention enables a constructional unit to be created by means of which considerably higher tensile load can be applied to the rail ends to be welded whilst retaining to a large extent the design features of the best flash butt welding sets which have already proved themselves in use and avoiding overstress of the clamping dies or the parts of the block assemblies connected to

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them. The mechanical connection of the clamping mechanisms to the two block assemblies ensures the simple synchronous transmission of tensile load through the clamp electrodes of the block assemblies as well as through the external clamping mechanisms without using a costly and complicated synchronised control system. This means that the linking of the clamping mechanisms enables them to be moved automatically together with the longitudinal shift of the clamping dies and the block assemblies. A further advantage of the arrangement besides the two block assemblies can also be seen in that the clamping mechanisms can be generously dimensioned regardless of the design construction of the block assemblies. Consequently, even particularly heavy or long rails can be welded with ease using this type of welding set.

The configuration of the invention characterised by the elements in Claim 2 is characterised in that it adopts a solution which is particularly simple in design and particularly effective in combination with the lever action of the clamping jaws. Moreover, the operation of the two block assemblies when carrying out the welding work is in no way hampered.

The configuration of the welding set as claimed in Claim 3 makes possible a considerable increase in the tensile load which can be applied, and the longitudinal axes of the upsetting cylinder come to rest in close proximity to the horizontal plane of symmetry of the clamping dies when aligned to a common datum. This guarantees that the tensile load can be transmitted to the clamping dies without having a detrimental lever action about an axis running across the rails.

The configuration of the invention as claimed in Claim 4 allows precision control of the opening and closing movements of the clamping jaws and the brace linking the clamping jaws to the block assemblies can be very simply designed to transmit the highest tensile load with ease, avoiding any change in length.

Using the design as stated in Claim 5 it is possible to move the transverse yoke connecting the clamping jaws lengthwise in a particularly even way to carry out the opening and closing movements.

By aligning the clamping jaws and tension members in a common axial plane of symmetry in relation to the height of the clamping dies in accordance with the elements of Claim 6 the advantage is obtained that the high tensile load can be transmitted to the rail ends without a moment of tilt acting on the swivelling axis of the clamping jaws. This effectively rules out a very damaging bending load being created on either the clamping jaw swivelling axis or the rail ends.

The special linking of the tension members as stated in the elements of Claim 7 guarantees an unobstructed opening movement of the two parts of a block assembly which can be swivelled towards each other in a pinching movement to enable the clamping dies to grip the rail stem.

The configuration of the set as stated in the elements of Claim 8 allows the unobstructed lengthwise movement of the upset shearing device without altering the distance between the two block assemblies. This makes it possible to remove the upset

with ease whilst maintaining the tensile load acting on the welded rail ends by means of the upsetting cylinder so that tensile stress only takes effect after the welded joint has cooled.

Finally, a further configuration of the invention as stated in the elements of Claim 9 is characterised in that by using clamping jaws of this type the clamping pressure acting against the rail can be adjusted with the aid of the pressure cylinder regardless of the tensile load running along the length of the rails.

The invention is described below in greater detail with the aid of two embodiments represented as drawings.

They show:

Fig. 1: a side view of a flash butt welding set consisting of two block assemblies where each block assembly is provided with clamping mechanisms to grip the rail on both sides,

Fig. 2: a top view of the flash butt welding set as per Fig. 1, in the bottom half of which the clamping mechanisms are shown in open position and in the top half in closed position,

Fig. 3: a top view of another design variant of the clamping mechanisms connected to one block assembly of the flash butt welding set and

Fig. 4: a side view of the clamping mechanisms shown in Fig. 3.

A flash butt welding set (1) as shown in Fig. 1 and 2 basically comprises two block assemblies (2) separated from each other, and connected by four upsetting cylinders (3) aligned to a common horizontal datum and running parallel to each other and can be moved along the length of the latter. Each of the two block assemblies consists of two parts (4), (5) which can be swivelled towards each other in a pinching movement - about an axis running along the length of the rails - together with clamp electrodes (6), for gripping the rails or rail ends (7) to be welded together. The two parts of the welding set (4), (5) are linked at their top end via a lever system (8) and a vertical clamping cylinder connected to it for pressing the clamping dies (6) on to the rails (7). One block assembly (2) is connected to an upset shearing device (10) which can be moved along the length of the upsetting cylinder (3) by two shearing cylinders (9) and on this are mounted pressure cylinders (11) swivel-mounted on a housing (12) of the block assembly (2).

Each block assembly (2) is connected to clamping mechanisms (13) provided to grip the rail on both sides and these are separated from each other along the length of the upsetting cylinders (3). These clamping mechanisms are in the form of clamping jaws (16) which can be swivelled as if about a vertical swivelling axis (14) and connected to each other in pairs by a crossbar (15). These lever-type clamping jaws (16) are situated opposite each other perpendicular to the upsetting cylinders (3) or to the the rail and are each connected to the clamping die (17) provided for gripping the rail stem in the area of their short lever arm. The longer lever arms are each swivel-mounted on a tension member (18) hinged to a housing

(12) of the adjacent block assembly (2). Each of the two crossbars (15) is connected to the adjacent part of the welding set (4) or (5) by an axial expanding cylinder (19) running in the direction of the upsetting cylinders (3).

As is particularly apparent in Fig. 1, a common plane of symmetry (20) running perpendicular to the swivelling axes (14) of the clamping jaws (16) is provided for the clamping jaws (16) and the tension members (18) connected to a block assembly (2) near the centre in relation to the height of the clamping dies (17) or the height of the rail. In the welding set (1) the secondary circuit is integrated into a electrical system by known methods in order to transform the welding current to low voltage and the high strength of current required. As high temperatures are caused both by converting the current and by the process itself the welding set is cooled. An extensive cooling system, further details of which have not been provided, has therefore been incorporated. The welding set (1) is suspended from a twin-armed telescopic crane mounted on a welding machine. The energy supply is provided by a generator located in the welding machine and a hydraulic pump. A control panel (21) is provided in order to start the various operating cycles.

The flash butt welding set (1) is centred over the rail ends (7) to be welded by means of said telescopic crane on the welding machine, and the two clamping jaws (16) are in opened position through the abutting of the two expanding cylinders (19) and the clamping dies (6) of the welding set components (4), (5) (see lower half in Fig. 2). After the welding set (1) is placed on the rail head the two expanding cylinders (19) are

abutted, which causes the clamping dies (17) to grip the rail stem. At the same time both of the clamping cylinders, of which no further details are provided, connected to the lever system (8), are moved so that the clamp electrodes (6) on the welding set components (4) or (5), grip the rail stem. The clamping of the two rail ends (7) ensures precise centring in relation to height and direction.

It is then subjected to pressure from the four upsetting cylinders (3) in accordance with the arrows shown in Fig. 1 resulting in relative motion of the two block assemblies (2) and the two sets of clamping jaws (16) towards each other. The shape of the clamping jaws (16) in the form of a knee lever automatically results in the clamping dies (17) gripping the rail stem very tightly. The tensile load to be applied to both rail ends (7) as well as the clamping dies (6) of the welding set components (4), (5) is also applied through the clamping dies (17) of the clamping jaws (16). As soon as the two rail ends (7) are at an appropriate distance from each other an arc is formed to produce the energy required for welding. If the rail ends have reached the correct welding temperature as laid down in the welding specification the four upsetting cylinders (3) are moved under increased pressure to start the so-called upset stroke. In this way the rail ends which have been heated to welding temperature are pressed together to form a weld joint. As the very high force of this upset stroke is applied using a system of clamping dies (6) on the block assemblies (2) which consists of a common structural unit and the clamping jaws (16) connected to it, their synchronous operation is guaranteed without the necessity of costly control equipment.

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It is then subjected to pressure from the four upsetting cylinders (3) in accordance with the arrows shown in Fig. 1 resulting in relative motion of the two block assemblies (2) and the two sets of clamping jaws (16) towards each other. The shape of the clamping jaws (16) in the form of a knee lever automatically results in the clamping dies (17) gripping the rail stem very tightly. The tensile load to be applied to both rail ends (7) as well as the clamping dies (6) of the welding set components (4), (5) is also applied through the clamping dies (17) of the clamping jaws (16). As soon as the two rail ends (7) are at an appropriate distance from each other an arc is formed to produce the energy required for welding. If the rail ends have reached the correct welding temperature as laid down in the welding specification the four upsetting cylinders (3) are moved under increased pressure to start the so-called upset stroke. In this way the rail ends which have been heated to welding temperature are pressed together to form a weld joint. As the very high force of this upset stroke is applied using a system of clamping dies (6) on the block assemblies (2) which consists of a common structural unit and the clamping jaws (16) connected to it, their synchronous operation is guaranteed without the necessity of costly control equipment.

The force of the upset stroke continues to be applied to the rails after an appropriate cooling period until a suitable stability under load is achieved in the weld joint while by starting both shearing cylinders (9) the upset shearing device (10) is moved longitudinally to remove the upset. After the weld joint has cooled sufficiently the upsetting cylinders (3) are depressurised and after opening the clamping, pressure and expanding cylinders (11), (19) connected to the welding set components (4), (5) and the resulting opening of the clamping dies (6) and (17) both block assemblies (2) are moved longitudinally to home position in the opposite direction to the arrows shown in Fig. 1.

The clamping mechanisms (22) as shown in Fig. 3 and 4 are designed as pinch-type grippers (25), (26) which can be swivelled towards each other about an axis (23) running along the length of the upsetting cylinder (3) and gripping both sides of a rail (24). These are connected to each other at their top ends by coupling links (27) and can be swivelled by means of a vertical clamping cylinder (28) from a clamped position indicated by unbroken lines to an open position indicated by dot-dash lines (Fig. 4). The two grippers (25) and (26) are swivel-mounted on the adjacent block (2) at their bottom ends by tension members (29). The connection between the tension members (29) and the grippers (25), (26) is designed in such a way that only a slight turn of the tension members (29) about an axis running along their length is needed to carry out the opening movement. The bottom ends of the grippers (25), (26) are provided with clamping dies (30) to grip the rail stem.

At the same time as the clamping dies (6) located on the block assemblies (2) are set down to carry out the welding, the clamping dies (30) of the clamping mechanisms (22) are also

being pressed on to the rail stem by putting the clamping cylinder (28) under pressure to carry out the closing movement. Finally, the two rail ends are welded together by abutting the upsetting cylinders (3) in the manner previously described.

The claims defining the invention are as follows:

1. A mobile flash butt welding set for butt welding rail ends, the welding set comprising: two block assemblies which can be moved towards each other by means of upsetting cylinders along their length, each block assembly including two components which can be swivelled towards each other in a pinching movement and clamp electrodes for gripping the rail ends, characterized in that each block assembly is connected to clamping mechanisms provided to grip a respective rail therebetween, the clamping mechanisms connected to one block assembly being separted from the clamping mechanisms connected to the other block assembly along the length of the upsetting cylinders.

2. A welding set as claimed in claim 1, characterised in that the clamping mechanisms connected to each block assembly include two lever-type clamping jaws which can swivel about a swivelling axis and are connected to each other by a crossbar, the clamping jaws being situated opposite each other crosswise in relation to the length of the respective upsetting cylinder and are connected at their ends farthest away from the swivelling axes to a tension member swivel-mounted on a housing of the adjacent respective block assembly.

3. A welding set as claimed in claim 1 or 2, characterised in that the two movable block assemblies are connected to each other by a total of four upsetting cylinders running parallel to each other and aligned to a common horizontal datum.

4. A welding set as claimed in claim 2, characterised in that the crossbar connecting the two clamping jaws is connected to the respective block assembly adjacent to the clamping jaws by an expanding cylinder running parallel to and alongside the upsetting cylinders.

5. A welding set a claimed in claim 4, characterised in that an expanding cylinder is symmetrically aligned to a longitudinal centre line of the welding set and above the upsetting cylinders.

6. A welding set as claimed in any one of claims 2, 4 or 5, characterised in that each clamping mechanism is provided with a clamping die connected to a respective clamping jaw, the clamping dies gripping the rails at opposite sides, and in that a common plane of symmetry for the clamping jaws and the

tension members connected to a respective block assembly, which runs perpendicular to the swivelling axes of the clamping jaws, is aligned approximately

centrally in relation to the height of the clamping dies or the height of the rail.

7. A welding set as claimed in claim 6, characterised in that the tension members are swivel-mounted on the housing of the relative block assembly both about an axis running the length of the upsetting cylinder and about an axis perpendicular to this and running vertically.

8. A welding set as claimed in any one of claims 1 to 7, characterised in that one block assembly is connected to an upset shearing device which can be moved along the length of the upsetting cylinders by two shearing cylinders and pressure cylinders connected to it are swivel-mounted on the housing of the assembly block.

9. A welding set as claimed in claim 1, characterised in that pinch-type grippers which can be swivelled towards each other about an axis running along the length of the upsetting cylinder and pressed on to both sides of the rails are provided with clamping mechanisms connected to a block assembly, the grippers being connected to each other in the area above the axis by a vertical clamping cylinder running perpendicular to the length of the upsetting cylinder and to the block assembly by means of tension members.

10. A mobile flash butt welding set substantially as hereinbefore described with reference to any one of the embodiments as shown in the accompanying drawings.

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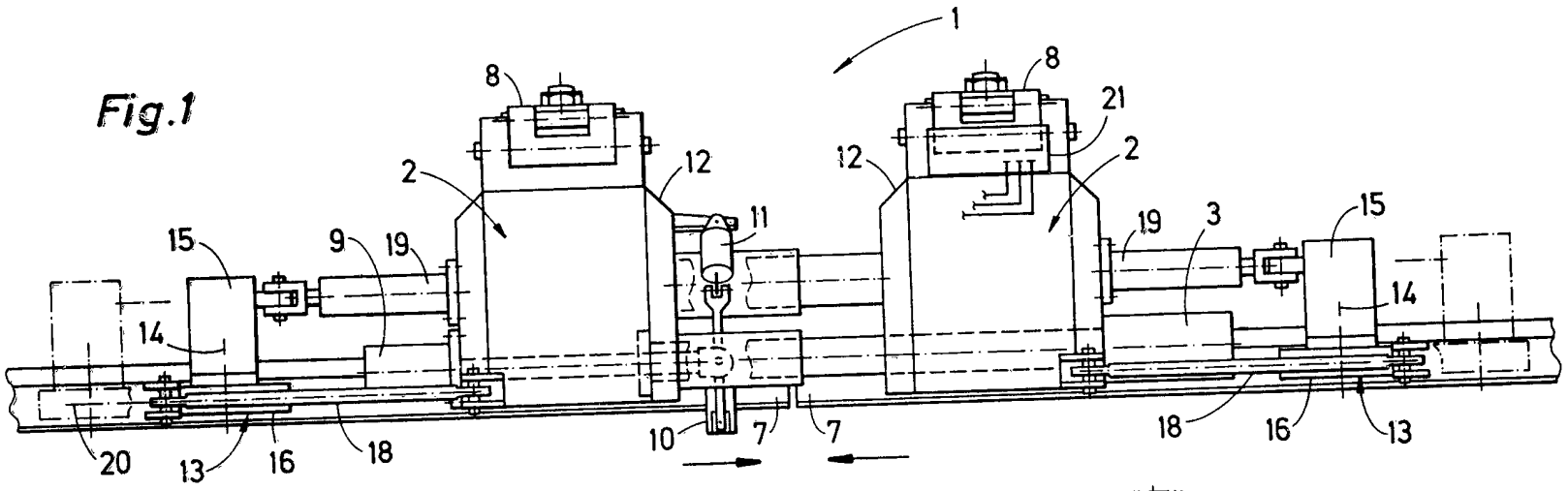
ABSTRACT

A mobile flash butt welding set (1) with two block assemblies (2) which can be moved towards each other by horizontally acting upsetting cylinders (3). The block assemblies (2) each include two clamp-type components (4, 5) which can be swivelled towards each other, with clamp electrodes (6) to be placed at the rail ends (7). Each block assembly (2) is connected to clamping mechanisms (13) separated from it along the length of the upsetting cylinder (3) which are provided for gripping both sides of the rail (7).

Fig.1



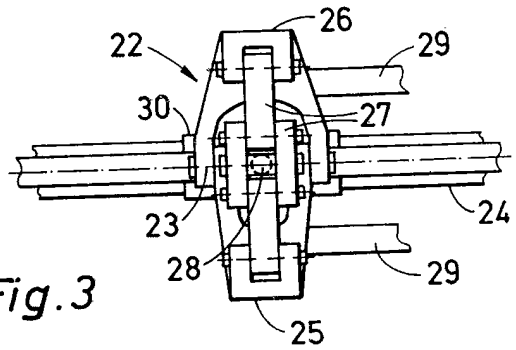


Fig.3

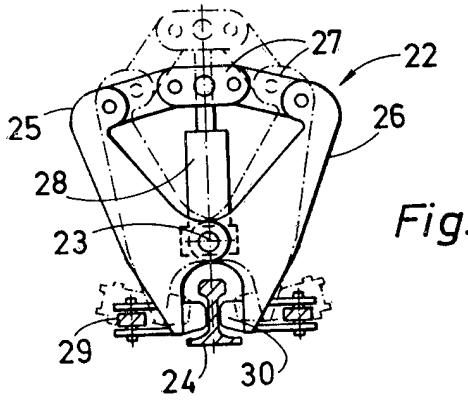


Fig.4

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Fig.2