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BARS FOR SUPPORTING THE ROOF IN MINES AND FOR LIKE PURPOSES

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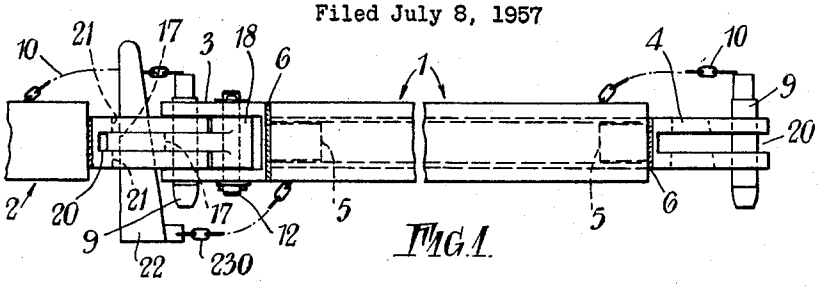


FIG. 1.

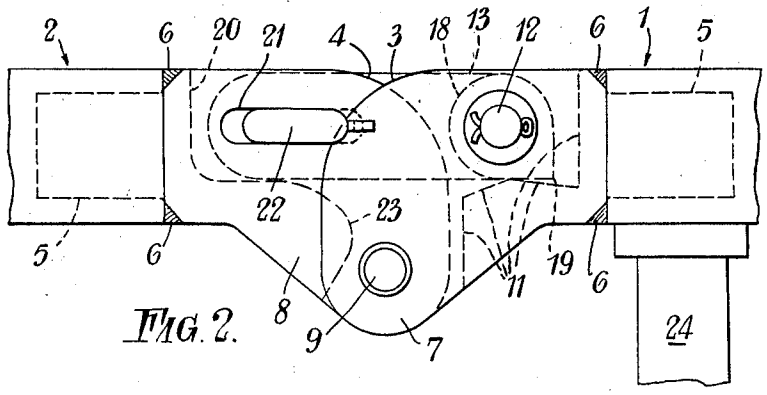


FIG. 2.

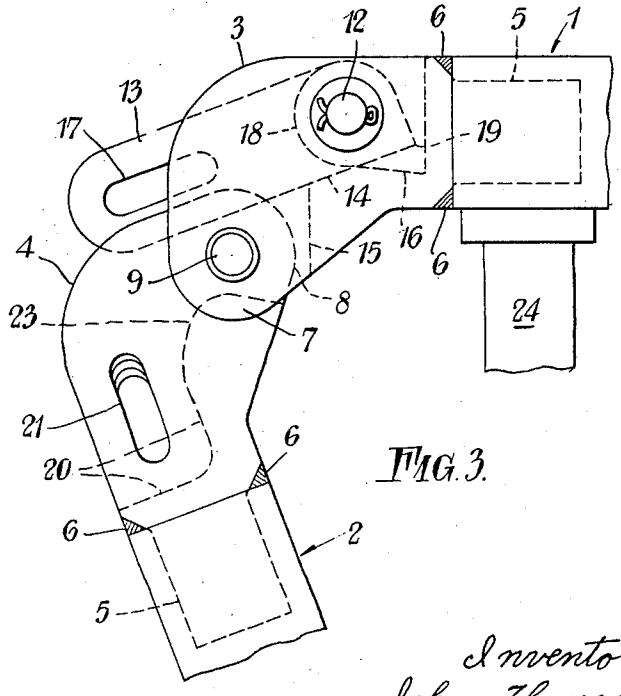


FIG. 3.

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BARS FOR SUPPORTING THE ROOF IN MINES AND FOR LIKE PURPOSES

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6 Claims. (Cl. 287—99)

This invention concerns bars which are used in substantially horizontal position, in conjunction with upstanding props or the like which bear them, for the purpose of supporting the roof in mines and for similar purposes. It is concerned with that kind of bar which is rigidly provided with a bifurcated joint part at one end and at the other end with a co-related joint part, i.e. adapted to fit into the bifurcated joint part of an adjoining similar bar, the joint parts of the bar first-mentioned being constructed for pivotal connection of the bar to adjoining bars and for the connection thereof to such bars to be made rigid by wedges engaged in mating slots or apertures in the respective joint parts.

An object of the present invention is to provide an improved construction enabling effective support of a mine or like roof to be obtained, while being adaptable in a desirable way to the restricted space and other conditions met with in mines and similar locations.

Another object of the invention is to provide a bar wherein the joint parts are constructed for pivotal connection with adjacent similar bars on an axis which is offset, with relation to the general run of the bar, on the side of the bar opposite to that to which the load is applied, and the bifurcated joint part has a coupling link pivotally mounted within the bifurcation, while the other joint part of the bar is recessed to receive a similar link of an adjoining similar bar, the pivotal axis of the link first-mentioned being disposed on the opposite side of the longitudinal center line of the bar to the axis first-mentioned and this link and said other joint part being slotted or otherwise apertured for engagement by the appropriate wedges.

In order to enable the invention to be readily understood, one embodiment thereof by way of example is illustrated in the accompanying drawing, in which:

Figure 1 is a plan view showing the bar partly broken away and depicting its connection with an adjacent bar shown fragmentally,

Figure 2 a fragmentary view in elevation on a larger scale than Figure 1 illustrating a completed joint between bars, and

Figure 3 a similar view to indicate one position of the bars at the start of making joint or after joint has been released.

The bars shown in the drawings are intended for supporting the roof in coal mines. In Figure 1, the bar is marked **1** and an adjacent bar is marked **2**. The bar **1** is a straight bar of box section and the joint parts **3**, **4** are plugged into the box at its ends as shown dotted at **5** and made rigid with the box part of the bar by welding, as at **6**, after known-manner, see also Figures 2 and 3.

According to this invention the bar, comprising the box part and the joint parts **3**, **4** rigid therewith, is enlarged to one side (i.e. the side opposite to side which takes the load from the mine roof) at the joint parts. The enlargements are incorporated in the joint parts **3**, **4** and

their outline is shown in Figures 2 and 3 wherein they are respectively marked **7**, **8**.

Both joint parts of the bar **1** are not, of course, shown in Figures 2 and 3. Only the one **3** is illustrated. The other one **4**, however, is similar to the joint part shown applied in these figures to what has been termed above the adjacent bar **2**.

The enlargements **7**, **8** are holed on an axis offset from the general run of the bar for connection with adjacent similar roof bars by removable pivot pins **9**. Each bar would suitably have such a pivot pin anchored to it by a short chain **10** (Figure 1) or it may be captive in an adjacent joint part.

The joint part hereinbefore referred to as the bifurcated joint part is the one marked **3**. As will be understood from Figure 1, this joint part is relatively widely bifurcated by vertically slotting it, the nature of the slotting within the bifurcation being further indicated by the dotted line **11** in Figure 2. This slotting is extended inwardly along the bar on the side of the bar opposite to the adjacent enlargement **7**, and in this extended slot part is the pivot **12** of a short coupling link **13**. The latter normally rests at a slight inclination outwardly and downwardly on a shallow chamfer **14** between the inner side **15** of the vertical slot and the bottom **16** of the extended slot part as shown in Figure 3. In the normal position, the link extends outwardly for a short distance from the vertical slot as also shown in Figure 3. Towards its outer or non-pivotal end, which is rounded semi-circularly, it is formed with a slot **17** which may be parallel-sided as shown or slightly widened from its outer to its inner extremity. The tail of the link **13** at the pivot is bossed at **18** and the bossing squared-off at **19** to form a stop for engagement with the bottom **16** of the extended slot part which is slightly inclined, inwardly and downwardly of the bar, with respect to the longitudinal center line of the bar.

The joint part hereinbefore referred to as the other joint part is the one marked **4**. It is disposed at the other end of the bar and is recessed at **20** to receive, with slight clearance, the major part of the coupling link **13** of an adjoining similar bar and the recess extends inwardly along the bar for a fair distance on the opposite side of the bar to the adjacent enlargement as will be understood from Figures 2 and 3. The sides of the recess are formed with parallel-sided slots **21** disposed parallel to the center line of the bar. These slots are for mating with the slot **17** of the coupling link **13** of an adjoining similar bar. The ordinary form of wedge used with bars of the kind described, can be employed in the present invention for insertion in the mating slots of adjoining bars. Such a wedge, shown at **22**, would suitably be anchored to each bar by a short chain **230** (Figure 1). When joint is made with an adjoining bar, the two pivot pins **9**, **12** and the wedge **22** lie substantially at the angular points of an inverted isosceles triangle having its apex at the pivotal axis between the two bars (cf. Figure 2). Suitably, the slot **17** in the coupling link and the slots **21** in the joint part **4** at the other end of the bar are longer than the effective width of the wedge, so that the latter bears on the outer end of the coupling-link slot **17** and the outer end of the slots **21** in the recessed joint part **4**. In the latter, the recess **20** is continued outwardly by curving it round in front of the pivot pin hole of such joint part, as shown at **23** in Figures 2 and 3, to provide a cam surface for the purpose of guiding the coupling link **13** of an adjoining similar bar automatically into position when joint is made between bars. It will be realised that it is important that the slotting and recessing of the two joint parts of the bar should be such that the coupling link **13** on one joint part **3** of the bar may rest

in a suitable position to be picked up by the shaped recess **20, 23** in the other joint part **4** of a companion similar bar, as the latter is swung up on its pivot **9** from a position such as is shown in Figure 3, and thereby carried automatically into position for insertion of the wedge.

It may be observed that the design of the joint parts of the bar thus described, is such that when two of the bars are substantially horizontally supported at each side of the joint between them, as by props such as **24** in a coal mine, the joint has only a limited downward deflection before locking and assuming rigidity to resist roof movements. However, either bar may pivot freely downwards when the support or prop for that bar is absent or removed and the wedge **22** is removed or is not in place as will be understood from Figure 3. Thus, free downward pivoting from the horizontal of a bar can be effected at either forward or face end or goaf end of a bar in place in a coal mine working. Moreover, the construction allows a bar to be connected to a bar already in use by raising it substantially vertically from below, or slightly back (as in Figure 3), and inserting the appropriate pivot pin **9**. In this operation, the surface **15** within the bifurcation of the joint part **3** of the last-mentioned bar may serve as a rest for the tip of the companion joint part **8** of the other bar (cf. Figure 3) so as to facilitate alignment of the holes in the joint parts to receive the pin **9**, or in other words it assists in effecting the pinning at **9**. The bar thus pinned may then be left hanging until required for use. The bar of the invention also provides a high initial resistance to deflection when the bar is loaded unsupported except for its connection cantilever fashion to an adjoining supported bar because the effect of placing the upper half of the bar in tension by the load above is transmitted directly through the joint mechanism to the supported bar. An amount of travel can be allowed to the wedge to permit of a limited upwards or downwards movement of a bar to follow reasonable irregularities of the roof. In this connection, the inclined part **16** of the surface **11** aforesaid cooperates with the stop surface **19** of the coupling link **13** to define a limit of upward swing of a bar pivotally connected to a bar already in position at the roof. If a forward bar, previously used cantilever fashion connected to a supported bar, is in turn supported by a prop on advance of the coal face, the tapered wedge may be withdrawn to allow flexibility in the joint for efficient tight setting of the props, a slight play being possible between the end of the recessed joint part **4** and the bottom wall part **15** of the vertical slot in the companion joint part **3** of the supported bar. When a support (prop) at the goaf side of a mine working and the wedge at the joint there are withdrawn, a bar thus released of its support will swing freely downwards to a vertical position and can be removed on removal of the pivot pin of the bar, so that this bar is completely freed. Though the bar described is of what is termed "non-reversible" type, i.e. can only be used one way up in a roof, it can be made in steel of reasonably small proportions and thus be not unduly heavy, though of sufficient capacity for roof supporting purposes in coal mines and similar situations. In addition, the free pivoting of the bar possible on assembly or release of the bar in or from working position provides for considerable convenience in the restricted spaces of, and operating conditions in, coal or other mines.

It will be understood that the invention is not restricted to the particular construction of bar above described and illustrated in the drawing. For example, it is not essential that the bar be of box section between the joint parts **3, 4** because this part of the bar could be of H or any other suitable section; also the joint parts referred to may be made integral with the remainder of the bar, instead of making them separately and welding them in position on the bar.

I claim:

1. A bar for supporting the roof in a mine, said bar comprising a bifurcated joint part at one end and a co-related joint part at the other end, said joint parts both being holed for reception of respective pins to provide pivotal connection of the bar with adjoining similar bars on axes which are offset on the side of said bar opposite to that to which the load is applied, and a coupling link captive within the bifurcation of said bifurcated joint part and pivotal on a fixed axis which is disposed on the opposite side of the longitudinal center line of said bar to the first-mentioned axes, said co-related joint part being formed with a recess to receive between the sides of the recess the free end of the similar coupling link of an adjoining similar bar already in position at the roof, and the free end of the first-mentioned coupling link and said co-related joint part having respective wedge apertures for reception of wedges for rigidising the connection of the bar with adjoining similar bars having similarly apertured link and joint parts, said bifurcated joint part having within the bifurcation a surface on which the coupling link within the bifurcation can normally rest at a slight inclination outwardly and downwardly of such joint part and said co-related joint part having within its said recess a cam surface co-operative with the said similar coupling link of said adjoining similar bar in such a manner that, when the bar is pivotally connected at said co-related joint part to said adjoining similar bar at a respective pin aforesaid and is raised from a depending position, said cam surface moves against the coupling link of said adjoining similar bar and raises it about its fixed pivotal axis to facilitate alignment of the respective wedge apertures of this link and said co-related joint part to receive a wedge.

2. A bar according to claim 1, wherein the bifurcation of the bifurcated joint part of said bar has a substantially vertically disposed surface within it which, when said bar is in position in a roof, is operative as a bearing or rest surface for the co-related joint part of a similar bar in a manner to assist pivotal connection of the bar in depending position with that first-mentioned by a pin.

3. A bar according to claim 1, wherein the bifurcation of the bifurcated joint part of the bar has within it a surface which is slightly inclined inwardly and downwardly and the tail end of the coupling link pivotally mounted within the bifurcation has a stop surface co-operative with the surface first mentioned to define an upward limit of pivoting of an adjoining similar bar on said bar.

4. An articulated joint for mine roof bars, comprising a bifurcated joint part on one end of a first bar and a co-related joint part on one end of a second and similar bar, said joint parts both being holed for reception of a pin to provide pivotal connection between said bars on an axis which is offset on the side of the bars opposite to that to which the load is applied, and a coupling link captive within the bifurcation of said bifurcated joint part and pivotal on a fixed axis which is disposed on the opposite side of the longitudinal center line of said first bar to the first mentioned axis, said co-related joint part being formed to engage within said bifurcated joint part and to co-operate laterally with the free end of said coupling link, this free end and the co-related joint part having alignable apertures for reception of a wedge for rigidising the joint, said bifurcated joint part having within the bifurcation a surface on which said coupling link can rest at a slight inclination outwardly and downwardly of such joint part and the co-related joint part having a cam surface co-operative with said coupling link in such a manner that when said first bar is in position up at the roof and pivotal connection between the two bars has been effected by said pin, the raising of the second bar from a depending position causes said cam surface to move against said coupling link and raise it about its fixed pivotal axis to facilitate alignment of said alignable apertures for reception of said wedge.

5. An articulated joint for mine roof bars according to

claim 4, wherein the bifurcation of the bifurcated joint part of the first bar has a substantially vertically disposed surface within it operative as a bearing or rest surface for the co-related joint part of a similar bar in a manner to assist pivotal connection of the latter bar in depending position with said first bar by a pin.

6. An articulated joint for mine roof bars according to claim 4, wherein the bifurcation of the bifurcated joint part of the first bar has within it a surface which is slightly inclined inwardly and downwardly and the tail end of the

coupling link pivotally mounted within said bifurcation has a stop surface co-operative with the surface first mentioned to define an upward limit of pivoting of the second bar on the first bar.

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