Sept. 1, 1953 K. GERLACH 2,650,475

MINE SUPPORTING STRUCTURE

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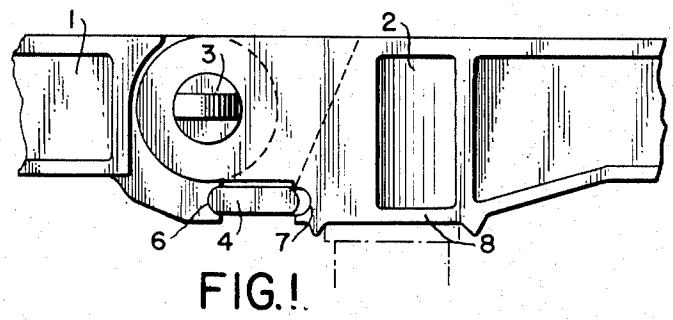


FIG. 1.

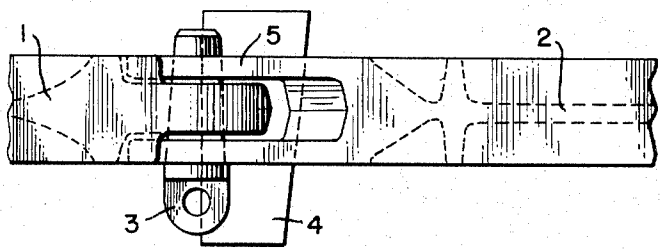


FIG. 2.

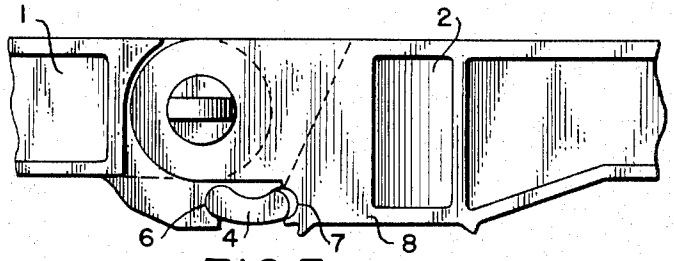


FIG. 3.

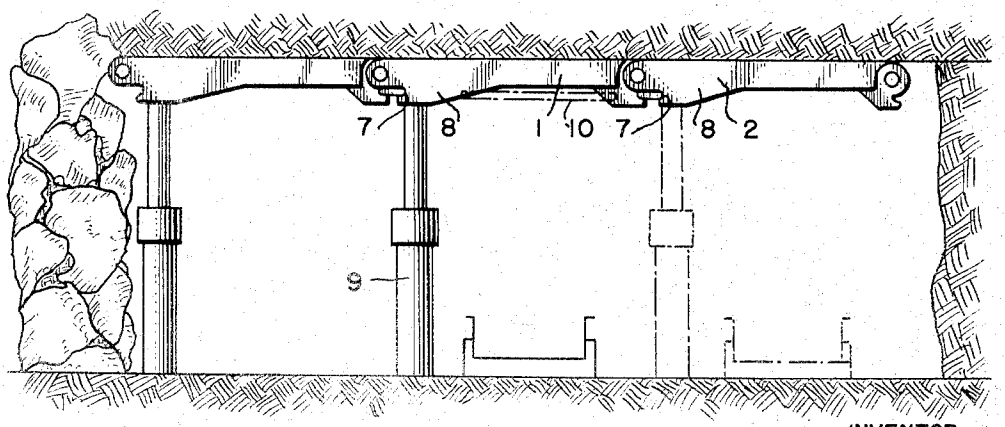


FIG. 4.

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MINE SUPPORTING STRUCTURE

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1 Claim. (Cl. 61—45)

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The invention relates to a mine supporting structure of metal props and girders for mines which are being worked, in which structure the girders are movably connected at their adjoining ends. The individual iron girders are constructed in the shape of short profiles or sections which are at first connected with the preceding girders to be freely supported thereby and which, as the working progresses, are supported by one or more props. Since in that type of mine filling construction the girders are at first installed to be freely supporting, their joints, by means of which they are movably connected, are exposed to considerable mountain-pressure which is effective on the long lever arms of the freely supported girders.

In this connection it is known to effect the shifting of the girders by means of a tensioning device which swings them into the desired position and retains them there until they are released during the further robbing of the mine. In these known mine supporting constructions an endeavor was made to provide the tensioning arrangement with its abutments as far as possible from the joint bolts in order to provide favorable leverage conditions for the joints and the tensioning device. This, however, entailed the disadvantage that in the installation of the girders they could no longer be brought in over the link or joint bolts because the distance between the joints and the abutments of the tensioning devices was too great. It was, therefore, necessary to provide special auxiliary link or joint axles around which the girders were swung when being installed. Aside from these disadvantages, and despite providing a large distance between joint bolts and abutments of the tensioning devices it was necessary to reinforce the profiles of the girders in the vicinity of the joints, both at the bottom and at the top. As a result of the increase of the cross section of the girders in the region of the joints a further disadvantage resulted in that the girders could no longer be brought to bear against the roof along their full lengths.

The invention relates to a mine supporting structure using props and girders in which the abutting ends of the girders are connected with one another in a manner to be movable around a pivot joint and under the control of a tensioning device, and it is the purpose of the invention to eliminate all disadvantages of the known mine supporting structures of this type. In accordance with the invention this is substantially achieved in that the abutments for the

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tensioning and locking means are arranged outside of the cross section of the girder profile, particularly at the under-side of the girders in the form of rigid extensions. This makes it possible to make the lever arms relatively large with respect to the effective forces, while, at the same time forming that portion of the joint of the girders which is disposed below the profile relatively small in size, thus permitting the supporting prop to be installed closely adjacent the joint. It is, moreover, possible to construct the joint, the abutments and the tensioning arrangement as strong as the loads require, because the construction proposed in accordance with the invention affords considerable liberties with respect to the dimensioning of these parts.

In accordance with the invention the tightening of the tensioning and locking arrangement is advantageously arranged in the direction of the axles of the girders, which makes it possible to keep the space requirement for the arrangement of the abutments of the tensioning and locking device as small as possible. As a whole, the tensioning means can be arranged in accordance with the invention substantially in the manner of a pair of tongs or cutting nippers. Furthermore, it is advantageous in accordance with the invention to construct the joints of the girders in such a manner that the abutments of the tensioning means are arranged away from the interengaging ends of the girders and provided with full cross sectional planes so that the cross key is not subject to flexure. It is furthermore advantageous in accordance with the invention to arrange the tensioning means with its abutments so far away from the cross section of the profile that the girder is allowed to swing around the joint possibly as much as 90°. The tensioning means can then be formed particularly advantageously as a cross key and the connecting planes of the cross key and of its abutments may be spherically shaped to insure full contact of the cross key in any angular position of the girders. This form of construction simultaneously insures against the cross key falling out.

In accordance with the invention it is also possible to design the cross key in such a manner, as to shape and dimensions, that it acts as a safety or deforming element against overloading of the girders. On the other hand, it is also possible to provide a special plastic or elastic deforming element in the region of the abutments of the tensioning means.

It is still a further essential proposal in ac-

cordance with the invention to take into account the particular kind and distribution of the loads to which the profiles of the beams are exposed in a mine supporting structure for working mines such as is the subject of the invention. The fundamental proposal of the invention is to form the girders substantially as bodies of equally distributed strength. That can be achieved, for example, in that the abutment is formed as a reinforcing enlargement of the profile cross section at the end which adjoins the intersection in the region of greatest stress of the brace profiles. This enlargement decreases gradually to the normal profile cross section of the beams. In accordance with the invention the girders with joints and abutments can furthermore be produced as unitary structures produced by pressing, forging or casting, and, for example also out of aluminum or corresponding other light metal alloys. On the other hand, embodiments of the invention are possible in which the construction is by means of welding together separate parts.

Other advantageous particulars in accordance with the invention are shown in the drawings which illustrate examples of the invention and in which:

Fig. 1 is a girder connection for mine supporting structures in accordance with the invention in side elevation;

Fig. 2 is a plan view of the structure according to Fig. 1;

Fig. 3 illustrates a further embodiment of the invention, and

Fig. 4 shows a mine filling structure including two props and three girders.

In accordance with Figs. 1 and 2 the girders 1 and 2 are connected with one another for swinging movement around the joint bolt or trunnion 3 and are under the control of a tensioning and locking device 4 in the form of a cross key or wedge. The end of the girder 2 engages the end of girder 1 in the manner of a fork 5 as shown (Fig. 2).

Fig. 1 reveals that the cross wedge 4 and its abutments 6 and 7 at the ends of girders 1 and 2, respectively, are arranged outside of the profile of the cross section of the girders 1 and 2 and below the joint 3. The contact surfaces between cross wedge 4 always makes a complete contact with the abutments 6 and 7, even when the girder 2 is in different angular positions with respect to girder 1. This insures simultaneously against disengagement of the cross wedge. The upper side of the girders 1 and 2, on the other hand is formed to be continuous and is thus disposed in a plane. It should be noted that the joint bolt or pin 3 is positioned laterally of the girders and substantially in lateral alignment with the neutral plane of the girders.

The abutments 6 and 7 and the wedge 4 are arranged so far away from the profile cross section of the girders 1 and 2 that the girders 1 and 2 can pivot around the joint 3 to the extent of an angle as great as 90°. Thus, it is possible in the installation to first hang the girder 2 onto beam 1, whereupon it is swung into a horizontal position and finally it can be retained in the desired position by the insertion of the cross wedge 4. The tightening of the cross wedge 4 is effective in the direction of the longitudinal axes of the girders 1 and 2 and encounters also exteriorly of the fork 5 at the abutment 7 full and continuous engagement planes so that it is not exposed to bending stress in the direction of its longitudinal axis. As a whole the joint in accordance with the invention is formed in the manner of a pair of cutting nippers, and besides the advantages already mentioned it is also possible to shape the cross wedge 4 as to form and dimensions in a manner that it acts as a safety or deforming element, i. e. in a manner that it is already deformed as a result of the mountain pressure before girders 1 and 2 are taxed beyond the strength of their profile cross sections. For this purpose the cross wedge 4 may have a rounded shape, such as shown particularly in Fig. 3. It is possible, on the other hand, to insert a particular plastic or elastic deforming element in the region of the abutments 6 and 7.

As a whole, the drawings show, particularly in Fig. 4 that in a mine supporting structure in accordance with the invention the joint connection of the girders may not only be formed with advantageous lever arms and strong individual parts to meet the requirements as to loads, but provides also for a particularly compact form of construction, so that the supporting prop 9 for the freely carried girder 2 can be disposed in the immediate proximity of the joint bolt 3. Since, however, the counter moments in the area of this support are especially great, a further important feature of the invention provides for the abutment 7 at the end of the girders which adjoin the overlaps to rise into a reinforcing enlargement 8 of the profile cross section of the beams which substantially strengthens the girders in the vicinity of the prop to withstand the moments arising there. The reenforcement 8 gradually decreases to the normal profile cross section. In this manner it is possible in accordance with the invention to form the girders with respect to the moments encountered in a manner that they approximate bodies of approximately evenly distributed strength. It is also possible to provide the girder 1 (Fig. 4) which is exposed to the greatest loads with an additional reinforcement 10 which is shown in dotted lines.

As shown in the drawings the girders with the joint portions and abutments consist advantageously of a unitary conformation which can be produced by forging, pressing or casting, particularly also out of light metals, but it is also possible to produce them in the form of a welded structure.

The possibilities of the invention are, however, not exhausted by the embodiments described, although the fundamental concept of providing the abutments for the tensioning and locking means for a pivoted girder connection below the pivot point can be realized in other desirable forms. Furthermore, the concept of the invention to especially reenforce the cross section of the girders in the region of the greatest moments of strain by a special concentration of material at the bottom side of the girders and thus to form the girders approximately as bodies of equally distributed strength is of independent significance and may be employed independently of the formation of the connection joint on which the invention is based, particularly in all mine filling constructions where freely carrying girders are at first supported at only one side by means of a prop.

Having now described my invention with reference to the embodiments illustrated, what I claim is:

A mine roof supporting structure comprising generally longitudinally aligned girders, each girder comprising a first projecting element at

one end thereof, spaced projecting elements at the other end thereof, said girders being pivotally interconnected with said first projecting elements of each girder being received between said spaced projecting elements of an adjacent girder by a pin positioned laterally thereof and substantially in lateral alignment with the neutral plane of said girders, each of said girders having a depending projection adjacent its points of pivotal connection to adjacent girders and presenting abutments facing corresponding abutments on said adjacent girders, and wedges

in wedging engagement with the facing abutments of said girders and extending transversely of said girders.

KARL GERLACH.

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