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COMPOSITE CAP FOR MINE ROOF SUPPORTS
Karl Barail, Duisburg-Grossenbaum, and Wilhelm Wilkenloh, Duisburg-Wanheim, Germany, assignors to Rheinstahl Wanheim G.m.b.H., Duisberg-Wanheim, Germany

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The present invention relates to mine roof supports in general, and more particularly to improvements in caps or roof bars which form part of such mine roof supports. Still more particularly, the invention relates to composite caps for travelling multi-prop mine roof supports.

It is already known to provide the props of a travelling mine roof support with roof-engaging caps or roof bars which are articulately connected with the respective props and which often assume the form of comparatively thin elastically deformable strips made of spring steel or the like. It was found that such elastic strips cannot provide satisfactory supports for the mine roof because they yield when the props are extended so that the supporting action transmitted to the mine roof is highly localized and is felt only in the regions immediately adjacent to the upper ends of the props. Such highly localized transmission of stresses is undesirable and is even more pronounced if the mine roof is rough, i.e. if the mine roof consists of jagged rocks which have a mere point contact with the caps.

Accordingly, it is an important object of the present invention to provide an improved cap for mine roof supports which is constructed and assembled in such a way that it can support large areas of the mine roof even if the mine roof presents a rough and humpy surface.

Another object of the invention is to provide a composite cap of the just outlined characteristics which embodies all advantageous characteristics but is constructed in a way to avoid all drawbacks of elastically deformable caps.

A further object of the invention is to provide a composite cap for mine roof supports which is constructed and assembled in such a way that its component parts may be lifted, lowered and/or tilted with respect to each other whereby the cap is always ready to assume a shape best suited to support a large area of the mine roof.

A concomitant object of the invention is to provide a mine roof support of the travelling multi-prop type which embodies a composite cap of the above outlined characteristics.

With the above objects in view, the invention resides in the provision of a composite cap which comprises at least one pair of preferably rigid substantially plate-like roof-engaging members each of which is provided with a downwardly extending flange- or web-like connecting portion. The connecting portions are adjacent to each other and at least one thereof has an aperture which receives with certain play a coupling means which preferably assumes the form of a bolt and which is supported by the other connection portion so that the two portions are movable with respect to each other to the extent determined by the play of the coupling means in the aperture of apertures. According to another highly advantageous feature of our invention, each coupling means is associated with a biasing means which normally urges the connecting portions into face-to-face abutment with each other but which can yield sufficiently to permit movements of the connecting portions toward, away from, at an angle to and/or in planes substantially parallel with each other. In a mine roof support which comprises

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four props, the composite cap normally comprises four roof-engaging members and each roof-engaging member is articulately connected to the upper end of a prop.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method or operation, together with additional objects and advantages thereof, will be best understood from the following detailed description of a specific embodiment with reference to the accompanying drawings, in which:

FIG. 1 is a side elevational view of a travelling mine roof support comprising a composite cap which is constructed in accordance with our invention, certain portions of the mine roof support being broken away for the sake of clarity;

FIG. 2 is a top plan view of the mine roof support with certain parts omitted and with certain portions of the rear roof-engaging members broken away; and

FIG. 3 is a partly front elevational and partly transverse vertical sectional view of the mine roof support as seen in the direction of arrows from the line III—III of FIG. 2.

Referring now in greater detail to the drawings, there is shown a travelling multi-prop mine roof support which comprises two main sections A and B arranged side-by-side and secured to each other by a ground-contacting connecting plate 5. Each section comprises a pair of preferably hydraulically operated extensible and retractible pit props including a front prop 1 and a rear prop 1', and each prop is provided at its lower end with a concave socket which receives a spherical boss 3 or 3' respectively secured to a ground-contacting sole plate or runner 2 or 2'. The lower end portions of the props 1, 1' are respectively received in pair wise arranged annular guides or rings 4, 4' which are secured to the connecting plate 5 by means of bolts 6, 6'. The arrangement is such that the props and their sole plates are vertically reciprocable with respect to the connecting plate 5 in order to make sure that the sole plates may assume optimum positions on uneven mine floors. The leading sole plates 2 have upwardly extending from end portions 2a which are articulately connected to vertical bolts 8, and these bolts are slidable in apertures of brackets 9 and 10 respectively provided on a traverse 7 and on the front end portions 2a. The upwardly bent front end portions 5a of the trailing sole plates 2' are secured in similar fashion to vertically reciprocable bolts 8' which are slidably received in brackets 9' secured to the rear portion of the connecting plate 5 and in brackets 10' secured to the front end portions 5a.

It will be noted that the props 1, 1' are disposed at the four corners of an imaginary rectangle.

The above described component parts of the mine roof support and disclosed and claimed in the copending application Serial No. 155,109 of Wilhelm Wilkenloh and Karl Brauer, and these parts form no part of the present invention.

The invention resides in the provision of a composite cap which is mounted at the upper ends of the props 1 so that its elements are articulatable with respect to each other and with respect to the props. As shown in FIG. 1, the props 1, 1' respectively comprise spherical upper end portions 12, 12' which are received in concave sockets 12a, 12a' provided at the undersides of the respective plate-like roof-engaging members or roof bars 11, 11'. There are four roof-engaging members and, in accordance with our invention, these members are coupled to each other in a novel way so that they may move with respect to each other and that they may assume an infinite number of positions in order to properly engage the mine roof when the props 1, 1' are extended. In its

preferred form, each roof-engaging member assumes the form of a rather rigid plate whose roof-contacting upper side is of large area so as to provide a satisfactory support for a substantial portion of the mine roof. The two leading or front roof-engaging members 11 are provided with forwardly extending front shields 13 which are adjustably secured thereto by pivot pins 13a and by wedges 13b in a manner well known in this art. The purpose of the shields 13 is to support that portion of the mine roof which is located between the mine face and the mine roof support to prevent the material from dropping or caving in onto the customary horizontal conveyor which is advanced by the mine roof support whenever the latter is caused to move toward the mine face.

The rear ends of the trailing roof-engaging members 11' are articulately connected with rear shields 14 whose purpose is to prevent the filling from descending into the area occupied by the mine roof support.

The rear ends of the leading roof-engaging members 11 are provided with downwardly extending connecting portions in the form of flanges or webs 15 which are adjacent to similar connecting portions or flanges 15' providing on and extending downwardly from the front ends of the trailing roof-engaging members 11'. Each connecting portion 15 forms with the associated connecting portion 15' a pair, and these pairs are articulately connected to each other by coupling means in the form of elongated bolts 18 which extend with play through apertures here shown as elongated vertical slots 17 provided in the portions 15 and/or 15'. The bolts 18 mesh with nuts 18a and carry washers 20, 20a. Intermediate each washer 20 and the respective connecting portion 15, there is provided a helical spring 19 which serves as a means for biasing the outer side of the portion 15 into face-to-face abutment with the outer side of the associated portion 15'. The vertical slots 17, the bolts 18 and the springs 19 permit the leading roof-engaging members 11 to assume phantom-line positions 11p which are shown in FIG. 1, to move forwardly and away from the trailing roof-engaging members 11', to be tilted with respect to the trailing members 11' (see the phantom-line position 11r in FIG. 3), to descend below the level of the members 11' and/or to perform any combination or combinations of such relative movements. The trailing members 11' are articulatable in the same way. As soon as the stresses transmitted to the members 11, 11' are terminated, these members automatically return to positions in which the connecting portions 15 are in face-to-face abutment with the associated portions 15'. The portions 15, 15' may form integral flanges of or are welded or bolted to the respective roof-engaging members. The purpose of these connecting portions and of the bolts 18 is to articulately connect the roof-engaging members 11, 11' of the section A or B.

The mine roof support further comprises additional connecting means which are utilized for articulately coupling the leading roof-engaging members 11 to each other and for similarly coupling the trailing roof-engaging members 11' with each other. As shown in FIGS. 2 and 3, the members 11' are provided with angle irons each of which comprises a horizontal flange 16a' that is welded to the underside of the respective member 11' and a downwardly extending flange-like connecting portion 16b' which corresponds to and which performs the same function as a connecting portion 15 or 15'. The connecting portions 16b' are provided with vertically extending apertures or slots 17'. These slots receive a horizontal bolt 18' which carries washers 20', 20a' and mates with a nut 18a'. The bolt 18' cooperates with a resilient element in the form of a helical spring 19', the latter tending to bias the outer sides of the pairwise arranged connecting portions 16b' into face-to-face abutment with each other. The just described connections between the trailing roof-engaging members 11' and the analogous connections between the leading roof-engaging members 11 enable these members to pivot, to rise, to

descend or to be otherwise displaced with respect to each other to the extent determined by the length of the bolts 18', by the length of the slots 17', and by the elasticity of the springs 19'. The angle irons 16a, 16b of the leading roof-engaging members 11 are shown in FIGS. 1 and 2.

It will be readily understood that the connecting portions 15, 15' may be replaced by the portions 16, 16b' or vice versa. It will also be noted that the planes of connecting portions 16b, 16b' make right angles with the planes of the connecting portions 15, 15', i.e. that the connecting portions 15, 16b of a roof-engaging member 11 or the connecting portions 15', 16b' of a roof-engaging member 11' are perpendicular to each other. The connecting portions 15, 15' in the section A, the connecting portions 15, 15' in the section B, the connecting portions 16b, 16b and the connecting portions 16b', 16b' form four pairs of cooperating connecting portions which enable the composite cap to assume a shape best suited to conform to the configuration of the mine roof even if the exposed underside of the mine roof is exceptionally rough or humpy.

An important advantage of vertically extending apertures 17 and/or 17' is that they permit displacements of roof-engaging members 11 and/or 11' into different planes, e.g. the member 11 in the section A may rise above the level of the member 11 in the section B or the members 11'. This is of considerable importance when the mine roof exhibits fissures or cracks so that say the members 11, 11' in the section A must engage the mine roof at one side of the crack and that the members 11, 11' in the section B engage the mine roof at the other side of the crack. Despite its universal adjustability, the composite cap is sufficiently rigid when disengaged from the mine roof so as to prevent excessive oscillations of the props when the mine roof support advances toward the mine face.

It will be readily understood that the slots 17, 17' and the bolts 18, 18' constitute but one form of coupling means which may be utilized in the composite cap of our invention. For example, the slots may be replaced by suitable ways which may be combined with springs in order to bias the associated connecting portions of two adjacent roof-engaging members against each other. Furthermore, the slots 17, 17' may be replaced by circular or otherwise configured apertures which must receive the bolts with sufficient play to permit necessary articulation of the roof-engaging members.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims:

What is claimed as new and desired to be secured by Letters Patent is:

1. A composite cap for mine roof supports comprising, in combination, a pair of roof engaging members arranged adjacent to each other and having downwardly extending peripheral flanges facing each other; and connecting means connecting said peripheral facing flanges to each other for limited peripheral movement in direction of said peripheral flanges and for tilting movement with respect to each other, said connecting means including biasing means yieldably maintaining said peripheral facing flanges in resilient abutment with each other.

2. A composite cap as set forth in claim 1, wherein each of said flanges is formed with an aperture there-through, the aperture in one flange being substantially aligned with the aperture in the other flange facing said one flange, and said connecting means including bolt means extending with ample clearance through said

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aligned apertures for connecting said roof engaging members for limited peripheral movement in direction of said peripheral flanges, for tilting movement about the axis of said bolt means and for limited tilting movement about an axis transverse to that of said bolt means.

3. A composite cap as set forth in claim 2, wherein each of said apertures is an elongated downwardly extending aperture.

4. A composite cap as set forth in claim 3, wherein said bolt means has a pair of transversely extending end portions one of which engages the surface of one flange facing away from the other flange abutting against said one flange, and wherein said biasing means includes compression spring means about said bolt means between said other flange and the other of said transverse end portions of said bolt means.

5. A composite cap for mine roof supports as set forth in claim 4 in which each of said roof engaging members is in the form of a rigid plate having at least one downwardly extending flange.

6. A composite cap for mine roof supports comprising, in combination, two pairs of roof engaging members, each of said roof engaging members being in the form of a rigid substantially rectangular plate having each a pair of downwardly extending connecting portions substantially normal to the plate, one of the connecting portions of each member being arranged on one of the long sides and the other on one of the short sides of the rectangular plate, each of said connecting portions being formed with an elongated downwardly extending aperture therethrough, the roof engaging members in each pair being arranged with the connecting portions on the long sides thereof adjacent each other and with the apertures therethrough in substantial alignment and the two pairs of roof engaging members being arranged with the connecting portions on the short sides thereof adjacent each other and with the apertures therethrough substantially aligned with each other; a bolt extending through each of said aligned apertures, each bolt having a pair of transversely extending end portions one of which being in engagement with the surface of the respective connecting portion facing away from the connecting portion adjacent thereto and the other end portion being spaced from said adjacent connecting portion; and a compression coil spring about each bolt between the other transverse end portion thereof and the respective adjacent connecting portion.

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7. In a mine roof support, in combination, a composite cap including two pairs of roof engaging members, each of said roof engaging members being in the form of a rigid substantially rectangular plate having each a pair of downwardly extending connecting portions substantially normal to the plate and each of said members having a roof contacting upper side and an underside, one of the connecting portions of each member being arranged on one of the long sides and the other on one of the short sides of the rectangular plate, each of said connecting portions being formed with an elongated downwardly extending aperture therethrough, the roof engaging members in each pair being arranged with the connecting portions on the long sides thereof adjacent each other and with the apertures therethrough in substantial alignment and the two pairs of roof engaging members being arranged with the connecting portions on the short sides thereof adjacent each other and with the apertures therethrough substantially aligned with each other, a bolt extending through each of said aligned apertures, each bolt having a pair of transversely extending end portions one of which being in engagement with the surface of the respective connecting portion facing away from the connecting portion adjacent thereto and the other end portion being spaced from said adjacent connecting portion, and a compression coil spring about each bolt between the other transverse end portion thereof and the respective adjacent connecting portion; and a single mine prop for each of said roof engaging members, each of said props having an upper end portion articulated connected to the underside of the respective member and supporting the same.

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CHARLES E. O'CONNELL, *Primary Examiner.*

JACOB L. NACKENOFF, EARL J. WITMER,
Examiners.