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(54) ROOF MAT STRUCTURE FOR USE IN MINE WORKINGS

(71) I, KARL MARIA GROETSCHEL, a citizen of West Germany of, Montsalvatstrasse 1A, 8000 Munchen 40, West Germany do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to a mat for supporting the roof of an underground mine working.

According to the invention there is provided a roof mat structure for use in application against the under surface of a mine roof comprising a plurality of strip-like portions of matting material of mesh form arranged in successive laterally off-set but proximate relation, and lengths of fastening strip securing adjacent margins of the portions of matting material together and each length of fastening strip comprising a longitudinally extending base and laterally spaced staple pins projecting from the base and interlocked with said margins.

The invention will now be described, by way of example, with reference to the accompanying drawings wherein:-

Figure 1 shows in side elevation apparatus laying a safety mat;

Figure 2 is a plan view of the mat and apparatus shown in Figure 1; and

Figure 3 is a view in the direction of the arrow III of Figure 1.

There is shown in the accompanying drawings a drum 2 mounted on a coal cutting machine of which the base 1 is guided along a track 1*b* which extends parallel to a coal face K. A strip 3 of wire mesh roof matting material has a stored portion coiled on the drum 2. After the leading end of an extended portion of the matting 3 has been securely clamped to the roof, the matting is automatically payed out to increase the length of the extended portion as the coal cutting machine advances in the direction of the arrow P. As shown in Figure 2, the matting is payed out from the drum in a direction which extends upwardly towards the coal face K and at right angles thereto as viewed in plan.

The necessary diversion into a direction parallel with the coal face is achieved by conducting the matting strip over a suitably angled deflector 10.

The deflector 10 is a component part of a mat-applicator device which is supported by a leaf spring 7. The leaf spring 7 is supported in a vertically adjustable manner on a telescopic prop 12, 13 which is likewise mounted on the coal cutting machine 1. The vertical position of element 12 of this prop can be adjusted in conformity and automatically with the vertical position of the cutting cylinder 1*a* of the coal cutting machine.

As illustrated, a portion 3*a* of the extended length of roof matting 3 is shown as already having been payed out past the deflector 10 and is held stationary by being firmly applied to the roof at a suitable distance from said deflector by the forepoled portion of the roof supporting superstructure 20 of a roof support unit, for example that disclosed in my prior British Patent 1,168,792. Another portion 3*b* of the matting still occupies the span between the drum 2 and the deflector 10.

As will be observed from Figure 2, a marginal region 3*c* of the roof matting portion 3*a* which is undergoing application to the roof overlaps the marginal region 4*a* of the previously layed roof matting strip 4 which is already part of the overall safety mat cover for the whole of the supported length of the working. The marginal region 4*a* is that marginal region of the previously layed matting which is nearest to the coal face and the region 3*c* is that marginal region of the matting portion 3*a* undergoing application which is remote from the coal

face K. The extended portions 3 and 4 of matting are applied to the underside of the roof in successive, parallel but laterally off-set paths of travel of the coal cutting machine carrying with it the coiled stored portion of the matting.

A guide plate 38, shown in Figure 2, has a downwardly angled forward end portion 38*a* arranged on the applicator means in such a way as to extend beneath the outer edge of the marginal zone 4*a* of matting when the applicator means is advanced, to lift this marginal region to the required level. It will be understood that, prior to approach of the applicator means, the marginal region 4*a* may have sagged downwardly relative to the remainder of the length of matting 4. The required level of the marginal region 4*a* adjacent to the applicator means is a level at which the marginal region 4*a* can conveniently be connected to the marginal region 3*c*.

During the mat-laying process, a fastening strip 30 is applied to the matting portions 3 and 4 to fasten these together. In the particular example illustrated in the accompanying drawings, the fastening strip comprises a chain shown most clearly in Figure 4. Each link of this chain is formed of a length of wire bent to provide a cross portion 30*e*, two integral side portions, 30*f*, 30*g*, extending lengthwise of the strip parallel to each other and connected to projecting elements 30*a* by integral loops 30*h* through which the junctions of elements 30*e* and 30*g* of one adjacent link pass. The opposite free end portions of each length of wire constitute the rectilinear projecting elements 30*a* which form two rows, one along each margin of the chain. The side portions 30*f* and 30*g* of all of the lengths of wire and the loops 30*h* collectively form a base of the fastening strip extending along its entire length. A coiled supply of the fastening strip is contained in a cassette 33 which is removably mounted on the coal cutting machine 1.

A leading end portion of the fastening strip 30 is fastened to a corresponding end portion of the roof matting which has been clamped to roof of the mine working. As the coal cutting machine 1 moves along the coal face K, the fastening strip 30 is drawn from the cassette 33 over a guide pulley 34 mounted on the applicator means below the roof matting portion 3*a* and from the pulley 34 to the zone of overlap between the roof matting portions 3 and 4 which are to be fastened together. In the portion of the fastening strip which extends from the cassette 33 to the pulley 34, the projecting elements 30*a* extend transversely of the plane of the base means of the strip. The path along which the fastening strip 30 travels from the pulley 34 is inclined at an acute angle of a few degrees to the matting portions 3 and 4 so that there is a gradual meshing or interengagement of the projecting elements 30*a* through openings of the roof matting portions 3 and 4 until the projecting elements have almost completely penetrated through the roof matting. The optimum feed angle depends on the length of the projecting elements 30*a* which in turn depends on the mesh size of the roof matting.

A very low feed angle is of greater importance in association with foil-covered matting material because it is advantageous with regard to piercing of the foil material that the points of the fastening elements should impinge as nearly as possible at right angles to the plane of the matting material. The piercing of any such foil material may be facilitated by perforating the marginal regions of such roof matting material by means of spiked rollers prior to feeding the matting material to the applicator device. On the other hand, if non-mesh non-textured fastening strip is employed, formed, for example, from imperforate material, the foil covering along the marginal regions of the roof matting strips may be dispensed with since the fastening strip in these regions will overlap the marginal regions of the matting.

The next step of the method involves the mechanised deforming, i.e. bending over of the projecting elements 30*a* which penetrate through the roof matting portions 3 and 4 in the overlap region so that these projecting elements will firmly interlock with the roof matting portions and secure these together depending on circumstances (form of the roof matting material, design of fastening elements, and condition of the roof). This may be done in a particularly simple manner in the regions which are directly engaged by the roof bars of the forepoled support units by the applied roof bar pressure. Thus, a fastening strip may incorporate a comparatively large number of projecting elements or other fastening elements (e.g. 200 and more per metre of length) and this ensures that a minimum number of effective, i.e. interlocked, individual fastenings will be established sufficient for the mat and working as a whole.

In the embodiment shown in the accompanying drawings, a device 35 for deforming, i.e. turning over and pressing down, the projecting elements 30*a* into the operative, i.e. interlocked, fastening configuration is provided. This device is secured to the applicator means 10, 12 and it comprises a pair of jaws 36, 37 defining a tapering passageway in the direction along which the fastening strip passes relative to the jaws. One of the jaws, 36, is effective above the junction zone of the roof matting portions

and the other, 37, beneath said zone. The lower jaw 37 is mounted on a rearwardly situated bar 14 (see Figure 2) of the mat applicator device. The upper jaw 36 consists of a looped strip of steel secured to the same bar 14 and looped around the deflector 10 in such spaced relation therewith as to permit unobstructed passage of the roof matting 3. The portion of the matting undergoing application to the roof passes over the deflector 10 and beneath the underface of the upper jaw 36 and beneath the adjacent margin 4*a* of the previously applied matting which will lie beneath the underface of jaw 36. The fastening strip enters the space between the upper and lower jaws at the lefthand end of the lower jaw in a region about mid-way between the ends of the upper jaw. All three layers, namely the overlapping portions of the matting and the fastener strip therebeneath pass out of the shallow exit at the righthand ends of the jaws, as viewed in Figure 1. The device 35 sweeps, during travel of the coal cutting machine 1, over both the upper and lower sides of the marginal regions 3*c*, 4*a* (considered collectively) of the roof matting portions 3 and 4 which are overlapped on their underside by the fastening strip 30 and which are progressively penetrated by the projecting elements 30*a* of the fastening strip. The projecting elements 30*a* are successively received between the jaws 36, 37, penetrate through the matting and are turned down into an operative fastening, i.e. interlocked, position. This device 35 turns the projecting elements down mainly along the direction of travel of the machine and in this position a satisfactory securement can be quite readily produced, provided all of the elements concerned in the fastening operation (3*c*, 4*a*, 30) are sufficiently firmly compressed and the roof matting as well as the fastening strip has a suitable structure and material composition.

If, having regard to a given roof matting material, it should be desirable that the projecting elements 30*a* are splayed laterally outwardly to a greater extent, this can be achieved by a deforming means comprising a wedge (not shown) arranged on the underside of the top jaw 36. Such wedge would have its side elements engaged by the inner sides of projecting elements 30*a* to splay these elements outwardly until they pass beneath the wedge. The projecting elements will, however, normally be turned in the opposite direction, i.e. laterally inwardly. This can be ensured by providing on the upper jaw 36 a deforming device comprising a plate having a slot bounded by edges tapering towards each other in the direction of feed of the fastening strip and deflecting the projecting elements 30*a* laterally inwardly until they pass beyond the narrow end of the slot. Both matting portions and the fastening strip would pass beneath this plate, which may be close to the lower jaw 37 and serve also to press the matting portions downward closely against each other and the fastening strip.

In the fastening strip comprised by the coil contained in the cassette 33, the projecting elements 30*a* are each preferably inclined at an angle slightly exceeding 90° to the adjacent cross portion 30*e*. Thus, the strip as a whole has the form of a channel with slightly divergent sides and can be coiled up conveniently.

In the particular fastening strip illustrated, the projecting elements 30*a* each have the form of a pin. Alternatively, the projecting elements may be formed as hooks or tapered teeth.

In place of a fastening strip in the form of a chain, there may be used a fastening strip which comprises a grid or screen-like arrangement of intersecting wires which are bonded together. In the particular example of roof matting illustrated, marginal portions of adjacent lengths of matting are overlapped. Alternatively, overlapping of the lengths of matting may be avoided and the lengths connected to each other by a fastening strip which engages the adjacent marginal portions. For example, the fastening strip may have two rows of projecting elements, the elements of one row may be interlocked with a marginal portion of one strip of matting and the elements of the other row interlocked with a marginal portion of the adjacent strip of matting.

A method of applying a roof mat structure and apparatus for use in the method are described and claimed in my co-pending application 32171/77 (Serial No. 1592193) and a fastener strip for use in the method as described and claimed in my co-pending application 7944382. (Serial No.)

WHAT I CLAIM IS:-

1. A roof mat structure for use in application against the under surface of a mine roof comprising a plurality of strip-like portions of matting material of mesh form arranged in successive laterally off-set but proximate relation and lengths of fastening strip securing adjacent margins of the portions of matting material together and each length of fastening strip comprising a longitudinally extending base and laterally spaced staple pins projecting therefrom and interlocked with said margins.

2. A roof mat structure according to Claim 1 wherein said adjacent margins of the portions of matting material are overlapped with each other and each staple pin penetrates through both of the adjacent portions of matting material.

3. A roof mat structure according to Claim 2 wherein some staple pins of the

fastening strip are interlocked with the margin of one of the portions of matting material and other staple pins of the fastening strip are interlocked with the margin of the other portion of matting material.

4. A roof mat structure according to any preceding claim wherein the fastening strip is in the form of a chain.

5. A roof mat structure according to any one of Claims 1, 2 and 3 wherein the fastening strip comprises a grid arrangement of intersecting wires which are bonded together.

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1592194 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

FIG 1

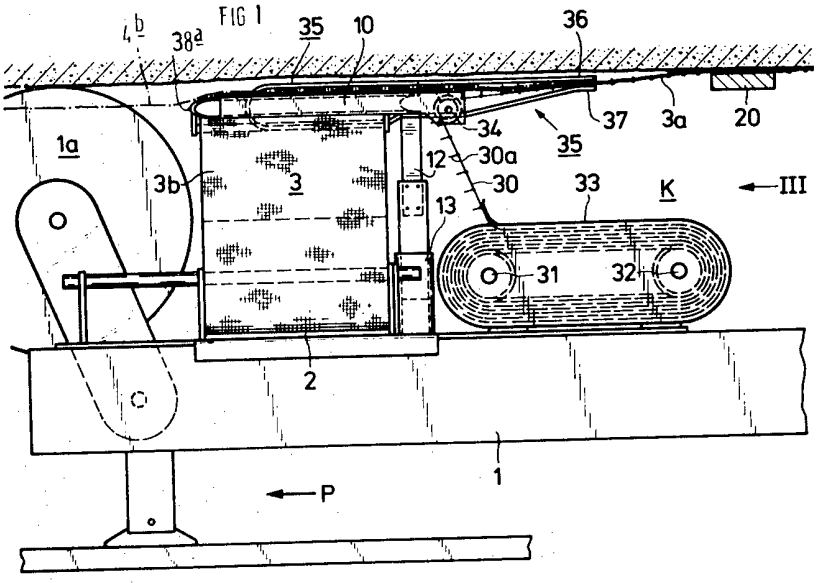


FIG 2

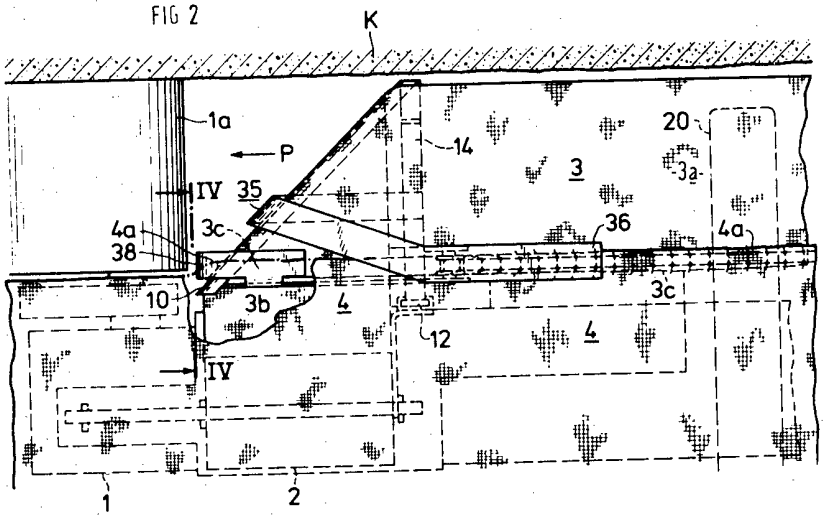


Fig. 3

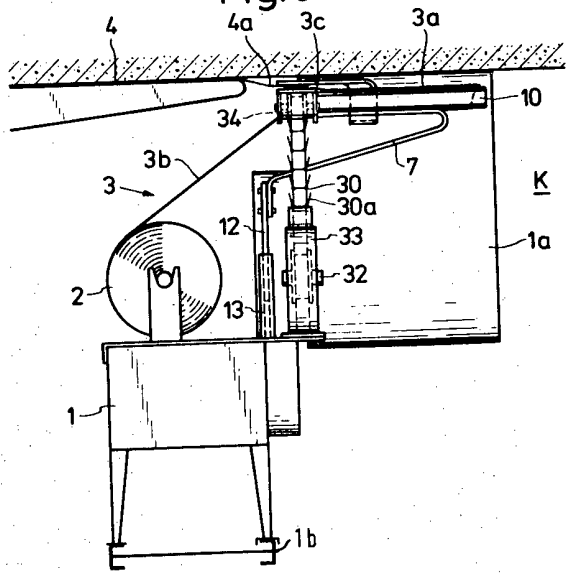
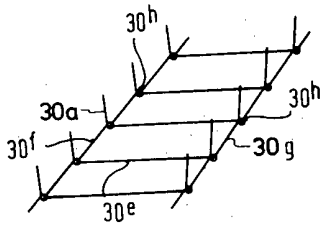

4
4a
3c
3a
10
34
3b
3
7
K
30
30a
12
33
1a
32
2
13
1
1b

Fig. 4


30h
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