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Strength Analysis of Steel Arch Support at Critical Loads

The main objectives in the improvement of underground coal mining are to establish effective means and methods of sustaining mining, cheaper to maintain them. Unsatisfactory state of mining complicates mine transport, air conditioning of cleaning and development faces, leads to an increase in the number of workers involved in work for the maintenance of mines. It ultimately reduces the technical and economic performance of the mine. Moreover, especially acute is a question of stability growth for in-seam workings, supported in weak surrounding rocks in the zone of influence of intensive second working. Therefore, the problem of maintaining mining is very important. In the native industry are used the following types of metal supports: arched, circular and trapezoidal compliant support, arched, circular and trapezoidal articulated rigid support.

Arch supports made of mine yielding special profile, which became widespread in the mines, made up of individual arches installed in mines at 0.5 - 1.2 m from each other, support ties (spacers) and reinforced concrete, wood or metal lattice tie bar, stacked in the spans between the arches.

In this paper, we perform strength analysis of the metal arch support for critical loads. At present, the relevance of this topic is not in doubt, because:
- It constantly increases the complexity of modern technical solutions;
- There is a need for optimization of the design for mass and size, and other parameters to improve the competitiveness of the product;
- Design is carried out in a short time;
- Often, there is no opportunity for costly products' field tests.

To perform strength analysis of steel arch support for critical loads the preference is given to program complex of automated systems "Compass 3D Version 13." In interface of this software product, we constructed a three-dimensional model of a metal arch support AP-27 that is easily conceivable and lucid. Further, the object of the investigation was studied by means of strength analysis of the computer program ARM FEM. To do this, build three-dimensional model of a metal arch support was prepared for the calculation. We specified fixation fields, set the matching surface and specified planes, which are under pressure of the rock. The last operation performed prior to calculation, is the generation of a finite elements (FE) of the grid, i.e., breakdown of details on the finite elements. It should be noted that from the quality of the FE mesh, which was generated on parts or assemblies, the accuracy of the strength calculation results is depended. After specifying all the factors affecting the metal arch support, we have made a static calculation. Simultaneously it was identified weaknesses in the roof supports in excess of the permissible loads. Thus, this result shows some safety factor for arch support within steady loads.