

STRONG ANCHORING AND GROUTING SUPPORT STRUCTURE FOR CONTROLLING RED SHALE ROADWAY AND CONSTRUCTION METHOD THEREOF

Technical Field

This invention relates to a strong anchoring and grouting support structure for controlling a red shale roadway and a construction method thereof, belonging to the technical field of roadway support equipment in non-coal mines.

Background Art

In underground mining, roadways typically require support. Existing technologies primarily rely on anchor mesh for support. However, when the roof breaks, the main method is to increase the support density. Due to the soft roof, the anchoring force of anchor bolts and cables cannot be guaranteed, posing a risk of roof collapse and significant safety hazards. Therefore, the method of erecting U-shaped steel sheds is often used. The backplate and steel shed occupy the effective area of the roadway, requiring a larger roadway excavation cross-section, thus increasing the workload, resulting in high costs, slow progress, and the need for multiple repairs during the service period, severely restricting the safe and efficient mining of mineral resources. As mining continues, uneven stress on the roadway excavation becomes more prominent, and with traditional U-shaped steel supports, the roadway sides are prone to inward displacement, reducing support strength.

Summary of the Invention

The technical problem to be solved by the invention is to provide a strong anchoring and grouting support structure for controlling a red shale roadway and a construction method thereof, so as to solve the problems existing in the prior art.

The technical solution provided by the invention is as follows:

a strong anchoring and grouting support structure for controlling a red shale roadway, characterized in that: the structure comprises a reinforcing mesh, a reinforcing arch frame, and a concrete sprayed layer; the reinforcing mesh is provided on an inner surface of an arched roadway, and the concrete sprayed layer is provided on the reinforcing mesh; the reinforcing arch frame is supported on an outer surface of

the concrete sprayed layer;

the reinforcing arch frame comprises main rebars and auxiliary rebars; the main rebars have an inverted U-shaped structure and are provided at intervals along a roadway direction; the auxiliary rebars are provided circumferentially; the main rebars and the auxiliary rebars are fixedly bound together by iron wires;

a spacing between the main rebars is 210-310 mm, and a spacing between the auxiliary rebars is 310-410 mm;

the structure further comprises retaining piles; the retaining piles are provided on left and right sides of the roadway;

the structure further comprises hollow grouting anchor cables and steel flower pipes; the hollow grouting anchor cables are provided in a radial direction of a vault of the roadway; outer ends of the hollow grouting anchor cables are tightened and fastened onto the reinforcing arch frame by anchor plates and nuts; the steel flower pipes are provided in middle portions of horizontal two sides of the roadway, and outer ends thereof are tightened and fastened onto the reinforcing arch frame by anchor plates and nuts.

A construction method of the strong anchoring and grouting support structure for controlling a red shale roadway, comprising the following steps:

(1) excavating the roadway to a designed section, drilling holes for anchor bolts, installing the anchor bolts at an inter-row spacing of 500-800 mm, and laying a metal mesh;

(2) following closely behind a tunneling working face, excavating a rectangular groove for a reinforced-concrete retaining pile at a side wall on one side of an ore body, planting $\Phi 18$ – $\Phi 28$ longitudinal rebars and $\Phi 6$ – $\Phi 12$ transverse rebars in the groove and binding them, assembling construction formwork to form a casting mold box, and casting C30-grade concrete into the groove;

(3) spraying concrete on a surface of the roadway to form a concrete layer;

(4) erecting $\Phi 16$ – $\Phi 18$ main rebars at the roadway section, erecting $\Phi 10$ – $\Phi 12$ auxiliary rebars along a trend of the roadway; the spacing between the main rebars is 210–310 mm, the spacing between the auxiliary rebars is 310–410 mm; and binding

the main rebars and the auxiliary rebars with iron wires;

(5) drilling holes for grouting anchor cables; the drilling hole diameter is 20–24 mm and the hole depth is 5000–8000 mm; drilling grouting holes; the grouting hole diameter is 30–45 mm and the hole depth is 3000–4000 mm; inserting the grouting steel flower pipes, connecting a grouting pump, performing grouting using a grouting pump with a grouting pressure of 2–3 MPa, tightening the anchor plates and nuts at the outer ends of the steel flower pipes after completion of grouting, inserting the hollow grouting anchor cables into the grouting holes, tensioning the anchor cables, and performing grouting using a grouting pump with a grouting pressure of 7–10 MPa; tightening the anchor plates and nuts at the outer ends of the hollow grouting anchor cables after completion of grouting;

(6) cutting off exposed portions of the grouting pipes and the hollow grouting anchor cables, and spraying a concrete layer having a thickness of 210–310 mm on the roadway surface.

Compared with the prior art, the reinforcing mesh, reinforcing arch frame, and concrete sprayed layer of the invention form a continuous flexible support structure for the roadway arch. This structure is particularly suitable for red shale roadways, which are prone to fragmentation and exhibit water absorption and expansion characteristics. The arched structure provides a large deformation space, which can release the initial pressure from the surrounding rock. The top and side anchor cables, along with the grouting anchor pipes, improve the stability of the roof and sidewalls. Their synergistic effect maximizes the advantages of both, thereby enhancing the overall support performance.

Brief Description of the Drawings

FIG. 1 is a schematic diagram of the structure of the invention;

FIG. 2 is a schematic diagram of the structure of the invention (with retaining piles).

Specific Embodiment of the Invention

The invention will be further described below with reference to the accompanying drawings and specific embodiments.

Embodiment 1: as shown in FIG. 1 to FIG. 2, a strong anchoring and grouting support structure for controlling a red shale roadway, comprising a reinforcing mesh 1, a reinforcing arch frame 2, and a concrete sprayed layer 3; the reinforcing mesh 1 is provided on an inner surface of an arched roadway, and the concrete sprayed layer 3 is provided on the reinforcing mesh; the reinforcing arch frame 2 is supported on an outer surface of the concrete sprayed layer.

Preferably, the reinforcing arch frame 2 comprises main rebars and auxiliary rebars; the main rebars have an inverted U-shaped structure and are provided at intervals along a roadway direction; the auxiliary rebars are provided circumferentially; the main rebars and the auxiliary rebars are fixedly bound together by iron wires.

Preferably, a spacing between the main rebars is 210-310 mm, and a spacing between the auxiliary rebars is 310-410 mm.

Preferably, the strong anchoring and grouting support structure for controlling a red shale roadway mentioned hereinabove further comprises retaining piles 5; the retaining piles 5 are provided on left and right sides of the roadway.

The above description is merely a specific embodiment of the invention, but the scope of protection of the invention is not limited thereto. Any variations or substitutions that can be easily conceived by those skilled in the art within the scope of the technology disclosed in the invention should be included within the scope of protection of the invention. Therefore, the scope of protection of the invention should be determined by the scope of protection of the claims.