

[Scope of Claims]**[Claim 1]**

Entry arm which are inserted into the several entry holes at the horizontal, vertical and horizontal directions equipped with several pulleys diagonal directions at the end of the insertion direction in the wire-saw excavation apparatus which excavates the target surface using the wire-saw to be installed at the several entry holes depending on the cutting section consisting of multi-directional lines including the horizontal, vertical and horizontal lines on the rock target surface

Excavation method of cutting the target surface at once by connecting the wires wired to the pulleys mounted in each direction at the end of the entry arm to each driving unit in each direction

[Claim 2]

Excavating apparatus characterized by cutting the rock without reciprocal interference owing since each wire wired to each pulley at the horizontal, vertical and horizontal direction, mounted in the entry arm in Claim 1 rotates in different directions

[Claim 3]

Excavation apparatus characterized by formation of the support frame fixing the entry arm by crossover of the first frame placed at direction 1 and the second frame placed at direction 2 and responding to multidirectional cutting lines including horizontal, vertical and horizontal lines

[Claim 4]

In Claim 3,

Wire-saw excavation apparatus characterized in that the form consisting of a frame on the outside of the support frame is polygonal, circular, oval or arched

[Claim 5]

The tunnel excavation method using the wire-saw excavation apparatus including:

- (a) Drilling step where the several entry holes are drilled along the cutting section on the target surface of the rock
- (b) Insertion step of inserting into insertion holes the above entry arms where the insertion unit where the wire-saw is wired to match with the cutting line in the above cutting section and has the cross sectional area less than the above entry arm at the insertion opposite direction of the above entry arms
- (c) Support frame installation step of preparing the support frame which has the matrix structure corresponding to the above cutting section by crossing the first frame placed at the direction 1 and the second frame placed at the direction 2 and the insertion holes are formed to insert the above entry unit and installing the support frame to insert the above entry unit into the above entry hole
- (d) Step of operating the driving roller where a part of the above wire-saw is winded and cutting the rock at the location for the wire-saw to cut

[Claim 6]

In Claim 5,

The excavation method using the wire-saw excavation apparatus characterized in that the wiresaws are wired in horizontal lines, vertical lines and diagonal lines of the cutting section, the rock corresponding to the horizontal, vertical and diagonal lines of the above cutting section is cut at once owing to operation of the driving roller wired to the wire-saw

[Claim 7]

In Claim 6,

The tunnel exaction method using the wire-saw excavation apparatus characterized in that at least one pulley is wired to an end of the entry arm in the insertion direction,

the rock corresponding to the horizontal, vertical and diagonal lines of the above cutting section is cut at once owing to operation of the driving roller after wiring the wire-saw to the driving roller in each direction including the horizontal, vertical and diagonal lines of the above cutting section

[Claim 8] In

Claim 5,

the method of excavating a tunnel using a wire-saw excavation apparatus characterized in that a several entry holes are drilled only in the edge of the cutting section in Step (a) above.

[Claim 9]

In Claim 5, the method of tunnel exaction using the wire-saw excavation apparatus

which performs the Steps (a) through (d) by selecting the cutting lines as the horizontal, vertical and diagonal lines in Step (b)

after performing Step (b) through (d) by selecting one out lines in each direction including the cutting lines as the horizontal, vertical and diagonal lines in Step (b)

[Claim 10]

In Claim 5,

The tunnel excavation method using the wire-saw excavation apparatus with "0" or 2 base entry holes at the cutting section above

Where the several entry holes with cutting lines are called as "Coupling entry holes" and the entry holes with odd number of the above cutting lines are called as "Base entry holes"

[Claim 11] In Claim 10, the method of excavating a tunnel using a wire-saw excavation apparatus

with single line