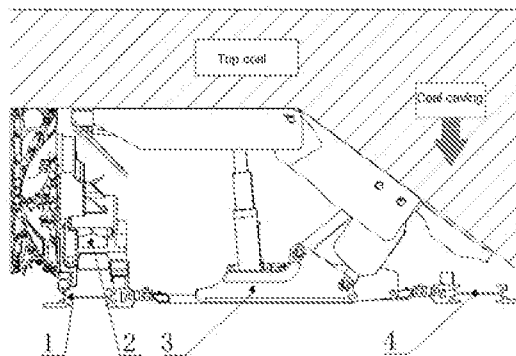


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**drs. C.M.A. Quintelier te La Hulpe**54 **NON-TEACHING MEMORIZING COAL CAVING SYSTEM WITH TOP-COAL CAVING HYDRAULIC SUPPORTS IN INTELLIGENT COMPREHENSIVELY-MECHANIZED TOP COAL CAVING FACE**

57 In the field of the mining, a non-teaching memorizing coal caving system with top-coal caving hydraulic supports on in an intelligent comprehensively-mechanized top coal caving face. The system includes a front scraper conveyor, an electric traction shearer, the top-coal caving hydraulic supports, and a rear scraper conveyor; the top-coal caving hydraulic supports are located on a coal wall of a coal seam; coal caving ends of the top-coal caving hydraulic supports are provided with the rear scraper conveyor, and rear portions of the top-coal caving hydraulic supports are provided with the electric traction shearer, the front scraper conveyor is arranged below the electric traction shearer; a plurality of coal caving quadrant regions are divided along an advancing direction of the working face of the coal wall of the coal seam, and a coal caving sequence of the plurality of coal caving quadrant regions is set.



**NON-TEACHING MEMORIZING COAL CAVING SYSTEM WITH TOP-COAL  
CAVING HYDRAULIC SUPPORTS IN INTELLIGENT COMPREHENSIVELY-  
MECHANIZED TOP COAL CAVING FACE**

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**TECHNICAL FIELD**

[ 0001] The present disclosure relates to a non-teaching memorizing coal caving system with top-coal caving hydraulic supports in an intelligent comprehensively-mechanized top coal caving face, and belongs to the field of the mining of the top coal in the coal seam on the intelligent working face under the coal mine.

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**BACKGROUND**

[ 0002] In the working face for the intelligent comprehensively-mechanized caving under the coal mine, the top-coal caving hydraulic supports act as the main supports and coal mining equipment under the coal mine, and thus the grads of their automation and intelligence determine the support performance of the working face under the coal mine and the coal mining efficiency. During the process of top-coal mining on the working face for the comprehensively-mechanized caving under the coal mine, the top-coal caving is conducted by the top-coal caving hydraulic supports through the tail beams of the supports and the inserting plate, specifically, the amount of caved top coal is controlled by controlling the angles of the tail beams of the top-coal caving hydraulic supports and the expansion magnitude of the inserting plate. The coal blocks put down by the top-coal caving hydraulic supports fall into the rear scraper conveyor, and are transported out by the rear scraper conveyor.

[ 0003] As an ancient coal mining method, the top-coal caving mining method is a low-energy-consumption coal mining method, in which a winning working face is arranged at the bottom of the coal seam, and the coal caving is conducted in the rear by the action of mine pressure or by the advancement with the working face with the aid of the manual loosening. The comprehensively-mechanized top-coal caving mining method includes several methods, which are as follows: (1) a pre-mining top layered mining method, that is, arranging a common long wall winning working face in the coal seam along the top plate, and then arranging a working face for a top-coal caving along the bottom plate for winning to cave the top coals in the upper portion of the bottom layer; (2) a one-time entire thickness comprehensively-mechanized top coal caving mining method, that is, arranging a mining working face for a top-coal caving along the bottom plate, caving, when the mining working face advances for a certain distance, the top coals in the upper portion, and mining the coal seam in the entire thickness at one time; and (3) a layered comprehensively-mechanized top-coal caving mining method, that is, dividing, for an extremely thick coal seam, the thickness

of the coal seam into a plurality of sections, and adopting the top-coal caving shearer process for winning from top to bottom in layers. According to sequence and times of the coal caving, and coal caving amounts by the top-coal caving hydraulic supports, the coal caving manner of the working face for the top-coal caving can be categorized into the following manners: (1) caving coals by the sequence for a single round, in which the supports of the working face are arranged and numbered by the sequence, and the coal caving is conducted from the first support to the last support, each of which ends until the gangues are caved; (2) caving coals in equal amounts by the sequence for a plurality of rounds, in which the coal caving is conducted by the sequence by the working face supports, each of which caves 1/2-1/3 of the top coals, and the next round of the coal caving is to be conducted after one round ends, thereby repeating 2-3 rounds until the top coals are completely caved; (3) caving coals at equal intervals in equal amounts for a plurality of rounds, in which the coals caved from the coal caving opening is firstly the coals caved by the supports with an odd support number, where the coal caving is conducted sequentially according to the number from small to large, and then the coals caved by the supports with an even support number, where the coal caving is conducted sequentially according to the number from small to large, 1/2-1/3 of the top coals are caved each time, thereby repeating 2-3 rounds until the top coals are completely caved; and (4) caving coals at equal intervals for a single round, in which the top coals above a plurality of supports with an odd number are caved firstly, and then the top coals above a plurality of supports with an even number are caved. The above coal caving manners can cause large losses of coals, and cause gangues to be easily mixed in the caved coals, which requires high operating level of workers. Moreover, it is difficult to control the amount of coal caving by each support, and the coal caving time is long, and thus the coal caving mining efficiency is low.

[ 0004] However, most of the domestic coal mines still rely on manual manners to install the above coal caving manners according to the experience of operators of the top-coal caving hydraulic supports to manually operate and control the coal caving. Due to the complex working conditions and environment of the comprehensively-mechanized caving working face under the coal mine and the great differences in the experience of operators, it is difficult to meet the requirements of accurate coal caving, that is, of the shorter coal caving time and no impurity of gangues in the caved coals. Moreover, with the rapid development of industrial intelligence, intelligence is integrated into coal mining in the coal industry. At present, automation and intelligence of the top-coal caving hydraulic supports are required by the working face for the intelligent comprehensively-mechanized caving, and the top-coal caving hydraulic supports are required to finish the work of top-coal caving automatically or autonomously, so as to further improve the coal caving mining efficiency. Therefore, as the core equipment of the coal caving in the intelligent comprehensively-mechanized top coal caving face, the working process of top-coal

caving by top-coal caving hydraulic supports needs to be automated and intelligent.

### SUMMARY

5 [ 0005] In view of the above problems, the present disclosure provides a non-teaching memorizing coal caving system with top-coal caving hydraulic supports in an intelligent comprehensively-mechanized top coal caving face.

[ 0006] The following technical solutions are adopted in the present disclosure.

10 [ 0007] The non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face provided by the present disclosure includes a front scraper conveyor, an electric traction shearer, the top-coal caving hydraulic supports, and a rear scraper conveyor; the top-coal caving hydraulic supports are located on a coal wall of a coal seam; coal caving ends of the top-coal caving hydraulic supports are provided with the rear scraper conveyor, and rear portions of the top-coal caving hydraulic supports are provided with the electric traction shearer, the front scraper conveyor is arranged  
15 below the electric traction shearer; a plurality of coal caving quadrant regions are divided along an advancing direction of the working face of the coal wall of the coal seam, and a coal caving sequence of the plurality of coal caving quadrant regions is set; the working face for the comprehensively-mechanized caving for one cut is formed by the plurality of coal caving quadrant regions.

20 [ 0008] The non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face provided by the present disclosure is characterized in that: the coal caving quadrant regions are divided into 20 quadrant regions; the coal caving is conducted cyclically over the 20 quadrant regions of the working face for the comprehensively-mechanized caving by the top-coal caving hydraulic supports.  
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[ 0009] In the non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face provided by the present disclosure, the 20 quadrant regions are sequentially quadrant #1 to quadrant #20, and quadrant #1 to quadrant #20 are arranged in a stepped shape;

30 [ 0010] Quadrants divided in a first layer from a starting end of the coal seam to a rear end of the coal seam along the advancing direction of the working face of the coal wall of the coal seam are quadrant #1, quadrant #6, quadrant #11, and quadrant #16;

[ 0011] Quadrants divided in a second layer from the starting end of the coal seam to the rear end of the coal seam are quadrant 2#, quadrant #7, quadrant #12, and quadrant #17;

35 [ 0012] Quadrants divided in a third layer from the starting end of the coal seam to the rear end

of the coal seam are quadrant #3, quadrant #8, quadrant #13, and quadrant #18;

[ 0013] Quadrants divided in a fourth layer from the starting end of the coal seam to the rear end of the coal seam are quadrant #4, quadrant #9, quadrant #14, and quadrant #19;

[ 0014] Quadrants divided in a fifth layer from the starting end of the coal seam to the rear end of the coal seam are quadrant #5, quadrant #10, quadrant #15, and quadrant #20.

[ 0015] In the non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face provided by the present disclosure, the top-coal caving hydraulic supports located in each of the quadrants are sequentially numbered.

[ 0016] In the non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face provided by the present disclosure, a division rule for a quadrant is as follows.

[ 0017] The quadrant has  $M = N / 20$  hydraulic supports according to  $N$  top-coal caving hydraulic supports on the working face of the coal wall of the coal seam;

[ 0018] If  $M$  is a decimal, that is, not an integer,  $M$  is rounded;  $M$  is re-taken the largest integer not greater than the floating-point number  $M$ , then the quadrant with an odd quadrant serial number has  $M$  hydraulic supports, and the quadrant with an even quadrant number has  $M+1$  hydraulic supports, and according to sequence of the quadrant serial number from small to large, the top-coal caving hydraulic supports are allocated to the quadrants.

[ 0019] In the non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face provided by the present disclosure, according to the 20 quadrant regions of the working face for the comprehensively-mechanized caving, the top-coal caving hydraulic supports operate as follows.

[ 0020] (1) The top-coal caving hydraulic supports are started, and a parameter configuration table for the non-teaching top-coal caving hydraulic supports of the shearer is initialized;

[ 0021] (2) A data table of current 20 quadrant regions is read;

[ 0022] (3) Coal caving operations are conducted sequentially from quadrant #1 to quadrant #20 of the working face for the comprehensively-mechanized caving by top-coal caving hydraulic supports after reading data;

[ 0023] (4) Coal caving is started from the top-coal caving hydraulic supports with an initial serial number in quadrant #1, quadrant #6, quadrant #11, and quadrant #16 of the first layer of the working face for the comprehensively-mechanized caving in a previous cut;

[ 0024] Coal caving is started from the top-coal caving hydraulic supports with an initial serial number in quadrant #3, quadrant #8, quadrant #13, and quadrant #18 of the second layer;

[ 0025] Coal caving is started from the top-coal caving hydraulic supports with an initial serial

number in quadrant #4, quadrant #9, quadrant #14, and quadrant #19 of the third layer;

[ 0026] Coal caving is started from the top-coal caving hydraulic supports with an initial serial number in quadrant #5, quadrant #10, quadrant #15, and quadrant #20 of the fourth layer;

[ 0027] When any top-coal caving hydraulic support in the current quadrant is abnormal during the coal caving process of the cut quadrant in step (4), a data group for the current quadrant is corrected and the data are memorized, and then a data group for next cut is updated and covered;

[ 0028] Step (4) to step (5) are repeated, coal caving is conducted by the top-coal hydraulic supports sorted by serial numbers in each of the quadrants from quadrant #1 to quadrant #20 until the coal caving from quadrant #1 to quadrant #20 for the current cut is finished.

[ 0029] In the non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face provided by the present disclosure: after all rounds of the coal caving in the 20 quadrants for the current cut are finished, the next cut is entered and data of data groups of the 20 quadrants for the previous cut are memorized to conduct coal caving on the top coal, and polled coal caving statistics of the previous cut are used as a basis for controlling a polled coal caving process for a new cut.

[ 0030] In the non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face by the present disclosure, the data of the quadrant data groups include a feed number of coal caving of the working face, a number of rounds of coal caving, a starting time of coal caving, an ending time of coal caving, a duration of coal caving, and a current and frequency parameter of the rear scraper conveyor; and a coal caving parameter configuration table of coal caving for a coal caving process in the 20 quadrants for the next cut is produced according to the data of the quadrant data groups.

[ 0031] Beneficial effects

[ 0032] In the non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face provided by the present disclosure, the coal caving parameters for the previous top-coal caving can be memorized and the coal caving parameters for the next top-coal caving can be autonomously corrected by the hydraulic supports of the present disclosure, thereby realizing the autonomous controlling of the top-coal caving by the hydraulic supports, and improving the performance of the autonomous controlling of the hydraulic supports.

[ 0033] The non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face provided by the present disclosure reduces a failure rate of a device for caving top coals with hydraulic supports, increases an operating rate of the device for caving the top coals with hydraulic supports, and thereby improving the production safety and production efficiency.

[ 0034] In the non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face provided by the present disclosure, during the process of top-coal caving by the hydraulic supports, manual teaching to control the hydraulic supports for coal caving is not required, which greatly reduces the manual intervention rate, reduces the workload of maintenance personnel, reduces the labor intensity of the staff, and thereby improving the working conditions of the staff.

[ 0035] The non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face provided by the present disclosure improves the intelligent level of hydraulic supports, and lays the foundation for the construction of the working face for the intelligent comprehensively-mechanized caving.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

[ 0036] FIG. 1 illustrates a schematic diagram of a coal caving by top-coal caving hydraulic supports in an intelligent comprehensively-mechanized top coal caving face according to the present disclosure.

[ 0037] FIG. 2 illustrates a schematic diagram of an advancing direction and a coal flow direction of the working face for the intelligent comprehensively-mechanized caving according to the present disclosure.

[ 0038] FIG. 3 illustrates a schematic diagram of a time-series ladder coal caving in the quadrant intervals in the intelligent comprehensively-mechanized top coal caving face according to the present disclosure.

[ 0039] FIG. 4 illustrates a non-teaching memorizing coal caving system with top-coal caving hydraulic supports in an intelligent comprehensively-mechanized top coal caving face and a flow chart of the method thereof according to the present disclosure.

[ 0040] In the drawings: 1. Front scraper conveyor, 2. Electric traction shearer, 3. Top-coal caving hydraulic supports, 4. Rear scraper conveyor.

### **DETAILED DESCRIPTION OF THE EMBODIMENTS**

[ 0041] In order to make the objective and technical solutions in the embodiments of the present disclosure clearer, the technical solutions in the embodiments of the present disclosure will be described clearly and completely below with reference to the accompanying drawings of the embodiments of the present disclosure. It is apparent that the described embodiments are some, but not all, embodiments of the present disclosure. Based on the described embodiments of the present disclosure, all other embodiments obtained by those of ordinary skill in the art without creative efforts fall within the protection scope of the present disclosure.

[ 0042] The present disclosure provides a non-teaching memorizing coal caving system with top-coal caving hydraulic supports in an intelligent comprehensively-mechanized top coal caving face and the method thereof. With the advancement of the working face, the coal caving is conducted cyclically over the 20 quadrant regions of the working face for the comprehensively-mechanized caving by the top-coal caving hydraulic supports, and is divided into 20 groups of data, and each quadrant corresponds to a group of data. In the group of coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face, the top-coal caving hydraulic supports in the corresponding quadrant interval are polled, and the hydraulic support coal caving system reads the data group corresponding to this interval to automatically operate the top-coal caving without manual teaching of the hydraulic support caving, thereby realizing the intelligent coal caving operation by the top-coal caving hydraulic supports.

[ 0043] As shown by the following table, the coal caving parameter configuration table of coal caving for the non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face provided by the present disclosure, in the present disclosure, a data group is made for each quadrant in each feed in the intelligent comprehensively-mechanized top coal caving face under the coal mine. The data group includes a feed number of the working face, whether the support at the starting end is provided, a number of rounds of coal caving, a starting time of coal caving, an ending time of coal caving, a duration of coal caving, and a current and frequency parameter of the rear scraper conveyor. The parameter "m-n data group" in the coal caving table represents the data group of the "n-th cut m-th quadrant", which represents a certain cut and a certain quadrant where the hydraulic supports are located in path at a time, and then the parameter of this data group is read and top-coal caving is conducted according to this group of parameter in the non-teaching memorizing coal caving system with coal caving hydraulic supports. The data of each column (#1-#20 quadrants) in this configuration table can be illustrated and edited by a spreadsheet and a curve graph, and the data generated by dragging and editing the curve can be regulated, and the curve editing and table data can be linked in both directions.

Coal caving parameter configuration table of coal caving for the non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face

Feed number				.....		.....
Quadrant number	First cut	Second cut	Third cut	.....	n-th cut	.....

1	1-1 data group	1-2 data group	1-3 data group	.....	1-n data group	.....
2	2-1 data group	2-2 data group	2-3 data group	.....	2-n data group	.....
3	3-1 data group	3-2 data group	3-3 data group	.....	3-n data group	.....
.....	.....	.....	.....	.....	m-n data group	.....
18	18-1 data group	18-2 data group	18-3 data group	.....	18-n data group	.....
19	19-1 data group	19-2 data group	19-3 data group	.....	19-n data group	.....
20	20-1 data group	20-2 data group	20-3 data group	.....	20-n data group	.....

[ 0044] FIGS. 1 to 2 illustrate the coal caving by the top-coal caving hydraulic supports in an intelligent comprehensively-mechanized top coal caving face, the coal flow transportation direction of its coal flow on the rear scraper conveyor and the advancing direction of the working face for the comprehensively-mechanized caving provided by the present disclosure. In an intelligent comprehensively-mechanized top coal caving face, the electric traction shearer 2 walks on the front scraper conveyor 1 to cut the coal wall, and the coals cut off are transported to the transfer loader through the front scraper conveyor 1 and are transported out in the coal flow direction of the transfer loader. The top-coal caving is conducted by the top-coal caving hydraulic supports 3 in the intelligent comprehensively-mechanized top coal caving face, the caved coals are transported to the transfer loader through the rear scraper conveyor 4, and transported out in the coal flow direction of the transfer loader. During the process, if the sum of the coal caving amount of all top-coal caving hydraulic supports on the working face is too large, the operating load of the rear scraper conveyor 4 will be so large that the machine will stop or the electrical components will be damaged; if the sum of the coal caving amount of all top-coal caving hydraulic supports on the working face is too small, the operating load of the rear scraper conveyor 4 will be too small and a large amount of driving power energy will be wasted. Therefore, it is necessary to provide a non-teaching memorizing method for top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face, so as to make the top-coal caving hydraulic supports robotized and intelligent.

[ 0045] FIG. 3 illustrates a schematic diagram of a time-series ladder coal caving in the 20

quadrant intervals in the intelligent comprehensively-mechanized top coal caving face according to the present disclosure. In the present disclosure, all of the top-coal caving hydraulic supports on the working face for coal caving under the coal mine are divided into 20 quadrant intervals according to the polled coal caving operation sequence and time of hydraulic supports. The top-coal caving is conducted in a polled cycle within 20 quadrant intervals by the top-coal caving hydraulic supports in the sequence of quadrant #1 to quadrant #20 from small to large in the advancing direction of the working face. Assuming that the polled coal caving is started with the starting end of the working face in the  $i$ -th cut by the hydraulic supports, and the 20 quadrants of the working face for the comprehensively-mechanized caving are divided according to the polled coal caving operation sequence and time of hydraulic supports. The division rule is as follows: assuming that the working face is provided with  $N$  top-coal caving hydraulic supports in total, each quadrant is provided with  $M = N / 20$  hydraulic supports. If  $M$  is a decimal (not an integer),  $K$  takes the largest integer not greater than  $M$ , a quadrant with an odd quadrant serial number is provided with  $K$  hydraulic supports, and a quadrant with an even quadrant serial number is provided with  $K+1$  hydraulic supports. According to a sequence of the quadrant serial numbers from small to large, the top-coal caving hydraulic supports are assigned to the quadrants.  $i$  is the feed serial number, and the serial numbers "I, II, ..." in each quadrant in the figure are the hydraulic support numbers in each quadrant. The first round of coal caving refers to the coal caving by the  $I$ -th hydraulic supports in each quadrant. The second round of coal caving refers to the coal caving by the  $II$ -th hydraulic supports in each quadrant, and so on. During the process of top-coal caving by polling all top-coal caving hydraulic supports on the working face for the comprehensively-mechanized caving. When polling a hydraulic support in a certain quadrant for a certain cut (such as the  $i$ -th cut,  $j$ -th quadrant) for coal caving, the hydraulic support coal caving system executes the data of the  $j-i$  data group for coal caving according to Table One of the coal caving parameter configuration table of coal caving for the non-teaching memorizing coal caving system with the top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face.

[ 0046] FIG. 4 illustrates a non-teaching memorizing coal caving system with the top-coal caving hydraulic supports in the intelligent comprehensively-mechanized top coal caving face and the method thereof provided by the present disclosure. When the coal caving is initiated by the top-coal caving hydraulic supports on the working face for the comprehensively-mechanized caving, firstly, according to the top-coal geological data of the working face for the comprehensively-mechanized caving in the coal mine geographic information system, the parameters are configured for the coal caving parameter configuration table of coal caving for the non-teaching memorizing coal caving system with top-coal caving hydraulic supports in the intelligent comprehensively-

mechanized top coal caving face. The coal caving is initiated by the hydraulic supports, and the coal caving parameter configuration table of coal caving for non-teaching coal caving is initialized by the coal caving system. The data in the data groups of the 20 quadrants for the  $n$ -th ( $n=1,2,3,\dots$ ) cut on the working face are read firstly. After the data are read, then the coal caving is started to be conducted. The first round of coal caving is firstly conducted in each quadrant, that is, the coal caving is conducted by the  $I$ -th hydraulic supports in each quadrant. The coal caving is conducted sequentially on the top coal of the  $n$ -th cut from quadrant #1 until the first round of coal caving in quadrant #20 is ended to finish the coal caving for this cut. During the process of the first round of coal caving in #1 quadrant to #20 quadrant for this cut, if the operating parameters for the coal caving by the hydraulic supports in a certain quadrant (such as # $m$  quadrant) are abnormal, for example, the load of the rear scraper conveyor is too large or too small, the coal caving is to be continued after the parameters are adjusted and corrected according to the specific working conditions, and the corrected data in the quadrant data group ( $m$ - $n$  data group) are memorized, and at the same time, the corrected data group is transmitted to the data group ( $m$ - $(n+1)$ ) for the quadrant corresponding to the next cut for updating and covering, so as to avoid the similar abnormal coal caving operation by the hydraulic supports in the quadrant corresponding to the next cut ( $(n+1)$ -th cut). After the first round of coal caving in the 20 quadrants for the current cut ( $n$ -th cut) is ended, the second round of coal caving by hydraulic supports in the 20 quadrants will be conducted, that is, the coal caving by the  $II$ -th hydraulic supports in each quadrant will be conducted, *mutatis mutandis*, each round of coal caving is conducted until the coal caving by all hydraulic supports for this cut is ended. After all rounds of the coal caving in the 20 quadrants for the current cut ( $n$ -th cut) are finished, the next cut ( $(n+1)$ -th cut) is entered and the data of data groups of the 20 quadrants for the previous cut ( $n$ -th cut) are memorized to conduct coal caving on the top coal. The polled coal caving statistics of the previous cut are used as a basis for controlling a polled coal caving process for a new cut. The memorized data include a feed number of coal caving of the working face, a number of rounds of coal caving, a starting time of coal caving, an ending time of coal caving, a duration of coal caving, and a current and frequency parameter of the rear scraper conveyor. In this way, the data during coal caving process can be extracted automatically without teaching, and a coal caving parameter configuration table of coal caving for a coal caving process in the 20 quadrants for the next cut is produced, which can be edited or corrected manually. After being saved and reviewed, the table is transferred to the hydraulic support coal caving system for automatic coal caving by the hydraulic supports, or this coal caving parameter configuration table of coal caving is uploaded to the remote centralized controlling center for manual coal caving.

[ 0047] The above descriptions are merely preferred specific implementations of the present

disclosure, but the protection scope of the present disclosure is not limited thereto. Any changes or substitutions that can be easily conceived by those skilled in the art within the technical scope disclosed by the present disclosure shall be covered within the protection scope of the present disclosure. Therefore, the protection scope of the present disclosure should be subject to the protection scope of the claims.

## CONCLUSIES

1. Niet-lerend, memoriserend steenkoolwinningsysteem met hydraulische steunen voor steenkoolwinning in de bovenlaag in een intelligent, uitvoerig gemechaniseerde speleologische snede voor steenkoolwinning, waarbij het steenkoolwinningsysteem een voorschrappertransportband, een snijmachine met elektrische tractie, de hydraulische steunen voor steenkoolwinning in de bovenlaag en een achterschrapertransportband bevat; de hydraulische steunen voor steenkoolwinning in de bovenlaag bevinden zich op een kolenwand van een kolenlaag; de steenkoolwinningsuiteinden van de hydraulische steunen voor steenkoolwinning in de bovenlaag zijn voorzien van achterschrapertransportband en de achterste delen van de hydraulische steunen voor steenkoolwinning in de bovenlaag zijn voorzien van de snijmachine met elektrische tractie en de voorschrappertransportband bevindt zich onder de snijmachine met elektrische tractie;

gekenmerkt doordat:

er een veelvoud van kwadrantgebieden voor steenkoolwinning is verdeeld langs een voortschrijdende richting van het werkoppervlak van de kolenwand van de kolenlaag, en er een steenkoolwinningvolgorde van het veelvoud van kwadrantgebieden voor steenkoolwinning is ingesteld; het werkoppervlak voor de uitvoering gemechaniseerde steenkoolwinning voor één snede wordt gevormd door het veelvoud van kwadrantgebieden voor steenkoolwinning.

2. Niet-lerend, memoriserend steenkoolwinningsysteem met hydraulische steunen voor steenkoolwinning in de bovenlaag in een intelligent, uitvoerig gemechaniseerde speleologische snede voor steenkoolwinning volgens conclusie 1, gekenmerkt doordat de kwadrantgebieden voor steenkoolwinning zijn opgedeeld in 20 kwadrantgebieden; de steenkoolwinning door de hydraulische steunen voor steenkoolwinning in de bovenlaag cyclisch wordt uitgevoerd over de 20 kwadrantgebieden van het werkoppervlak voor de uitvoerig gemechaniseerde steenkoolwinning.

3. Niet-lerend, memoriserend steenkoolwinningsysteem met hydraulische steunen voor steenkoolwinning in de bovenlaag in een intelligent, uitvoerig gemechaniseerde speleologische snede voor steenkoolwinning volgens conclusie 2, gekenmerkt doordat: de 20 kwadrantgebieden achtereenvolgens kwadrant #1 tot kwadrant #20 zijn en kwadrant #1 tot kwadrant #20 zijn gerangschikt in een getrapte vorm;

de kwadranten verdeeld in een eerste laag vanaf een beginpunt van de kolenlaag tot een achtereinde van de kolenlaag langs de voortschrijdende richting van het werkoppervlak van de kolenwand van

de kolenlaag, kwadrant #1, kwadrant #6, kwadrant #11 en kwadrant #16 zijn;

de kwadranten verdeeld in een tweede laag vanaf een beginpunt van de kolenlaag tot het achtereinde van de kolenlaag, kwadrant #2, kwadrant #7, kwadrant #12 en kwadrant #17 zijn;

5 de kwadranten verdeeld in een derde laag vanaf een beginpunt van de kolenlaag tot het achtereinde van de kolenlaag, kwadrant #3, kwadrant #8, kwadrant #13 en kwadrant #18 zijn;

de kwadranten verdeeld in een vierde laag vanaf een beginpunt van de kolenlaag tot het achtereinde van de kolenlaag, kwadrant #4, kwadrant #9, kwadrant #14 en kwadrant #19 zijn;

de kwadranten verdeeld in een vijfde laag vanaf een beginpunt van de kolenlaag tot het achtereinde van de kolenlaag, kwadrant #5, kwadrant #10, kwadrant #15 en kwadrant #20 zijn;

10

4. Niet-lerend, memoriserend steenkoolwinningsysteem met hydraulische steunen voor steenkoolwinning in de bovenlaag in een intelligent, uitvoerig gemechaniseerde speleologische snede voor steenkoolwinning volgens conclusie 3, gekenmerkt doordat de hydraulische steunen voor steenkoolwinning in de bovenlaag, die zich in elk van de kwadranten bevinden, 15 achtereenvolgens zijn genummerd.

5. Niet-lerend, memoriserend steenkoolwinningsysteem met hydraulische steunen voor steenkoolwinning in de bovenlaag in een intelligent, uitvoerig gemechaniseerde speleologische snede voor steenkoolwinning volgens conclusie 3, gekenmerkt doordat: een verdelingsregel voor 20 een kwadrant is dat:

het kwadrant  $M = N / 20$  hydraulische steunen heeft volgens  $N$  hydraulische steunen voor steenkoolwinning in de bovenlaag op het werkoppervlak van de kolenwand van de kolenlaag; waarbij, indien  $M$  een decimaal getal is en geen geheel getal,  $M$  wordt afgerond, dit wil zeggen dat de afgeronde  $M+1$  wordt genomen voor de hydraulische steunen in het kwadrant.

25

6. Niet-lerend, memoriserend steenkoolwinningsysteem met hydraulische steunen voor steenkoolwinning in de bovenlaag in een intelligent, uitvoerig gemechaniseerde speleologische snede voor steenkoolwinning volgens conclusies 1 tot en met 5, gekenmerkt doordat volgens de 20 kwadrantgebieden van het werkoppervlak voor de uitvoerig gemechaniseerde steenkoolwinning, de hydraulische steunen voor steenkoolwinning in de bovenlaag als volgt 30 werken:

(1) het starten van de hydraulische steunen voor steenkoolwinning in de bovenlaag en het initialiseren van een parameterconfiguratietabel voor de niet-onderwijzende hydraulische steunen voor steenkoolwinning in de bovenlaag van de snijmachine;

35 (2) het lezen van een gegevenstabel van de huidige 20 kwadrantgebieden;

(3) het uitvoeren, na het lezen van de gegevens, van steenkoolwinnings door de hydraulische steunen voor steenkoolwinning in de bovenlaag, achtereenvolgens van kwadrant #1 tot kwadrant #20 van het werkoppervlak voor de uitvoerig gemechaniseerde steenkoolwinning;

5 (4) het starten van de steenkoolwinning vanaf de bovenste hydraulische steunen voor de steenkoolwinning met een eerste volgnummer in kwadrant #1, kwadrant #6, kwadrant #11 en kwadrant #16 van de eerste laag van het werkvlak voor de volledig gemechaniseerde winning en de speleologische snede;

10 het starten van de steenkoolwinning vanaf de bovenste hydraulische steunen voor de steenkoolwinning met een eerste volgnummer in kwadrant #3, kwadrant #8, kwadrant #13 en kwadrant #18 van de tweede laag;

het starten van de steenkoolwinning vanaf de bovenste hydraulische steunen voor de steenkoolwinning met een eerste volgnummer in kwadrant #4, kwadrant #9, kwadrant #14 en kwadrant #19 van de derde laag; en

15 het starten van de steenkoolwinning vanaf de bovenste hydraulische steunen voor de steenkoolwinning met een eerste volgnummer in kwadrant #5, kwadrant #10, kwadrant #15 en kwadrant #20 van de vierde laag;

(5) het corrigeren van een gegevensgroep voor het huidige kwadrant en het opslaan van de gegevens, wanneer een hydraulische steun voor de steenkoolwinning van de bovenste laag in het huidige kwadrant abnormaal is tijdens de steenkoolwinning van het afgesneden kwadrant in stap  
20 (4), en vervolgens het bijwerken en afdekken van een gegevensgroep voor de volgende snede; en  
(6) herhalen van stap (4) tot en met stap (5), uitvoeren van steenkoolwinnings door de bovenste hydraulische steunen voor kolen gesorteerd op serienummers in elk van de kwadranten van kwadrant #1 tot kwadrant #20 totdat de steenkoolwinnings van kwadrant #1 tot kwadrant #20 voor de huidige snede zijn voltooid.

25 7. Niet-lerend, memoriserend steenkoolwinningsysteem met hydraulische steunen voor steenkoolwinning in de bovenlaag in een intelligent, uitvoerig gemechaniseerde speleologische snede voor steenkoolwinning volgens conclusie 6, gekenmerkt doordat het invoeren, nadat alle rondes van steenkoolwinnings in de 20 kwadranten voor de huidige snede zijn beëindigd, van de  
30 volgende snede en het memoriseren van gegevens van de gegevensgroepen van de 20 kwadranten voor de vorige snede voor de steenkoolwinning van de bovenste steenkoollaag en het gebruiken van statistieken van de vorige snede voor het sturen van een proces voor de steenkoolwinning van de bovenste laag voor een nieuwe snede.

35 8. Niet-lerend, memoriserend steenkoolwinningsysteem met hydraulische steunen voor

5 steenkoolwinning in de bovenlaag in een intelligent, uitvoerig gemechaniseerde speleologische snede voor steenkoolwinning volgens conclusie 6, gekenmerkt doordat de gegevens van de gegevensgroepen van de kwadranten een aanvoernummer voor de steenkoolwinning van het werkvlak omvatten, een aantal rondes van de steenkoolwinning, een begintijd van de steenkoolwinning, een eindtijd van de steenkoolwinning, een duur van de steenkoolwinning en een stroom en frequentieparameter van de achterste schraperband; en een parameterconfiguratietabel van de steenkoolwinning voor een winningsproces van steenkool in de 20 kwadranten voor de volgende snede volgens de gegevens van de gegevensgroepen van de kwadranten wordt geproduceerd.

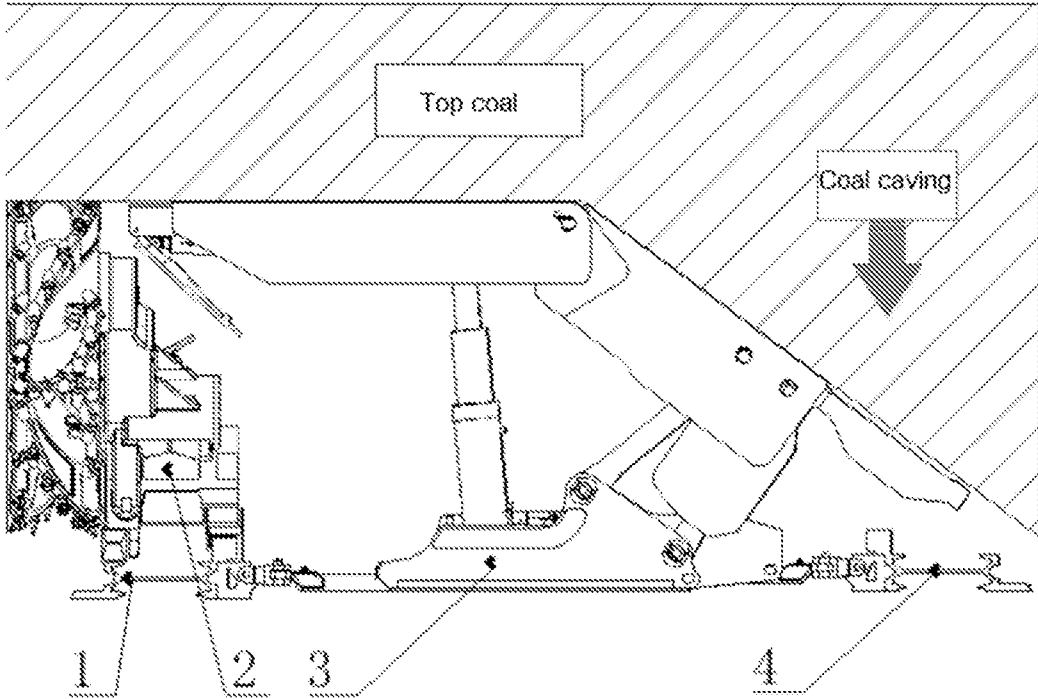


FIG.1

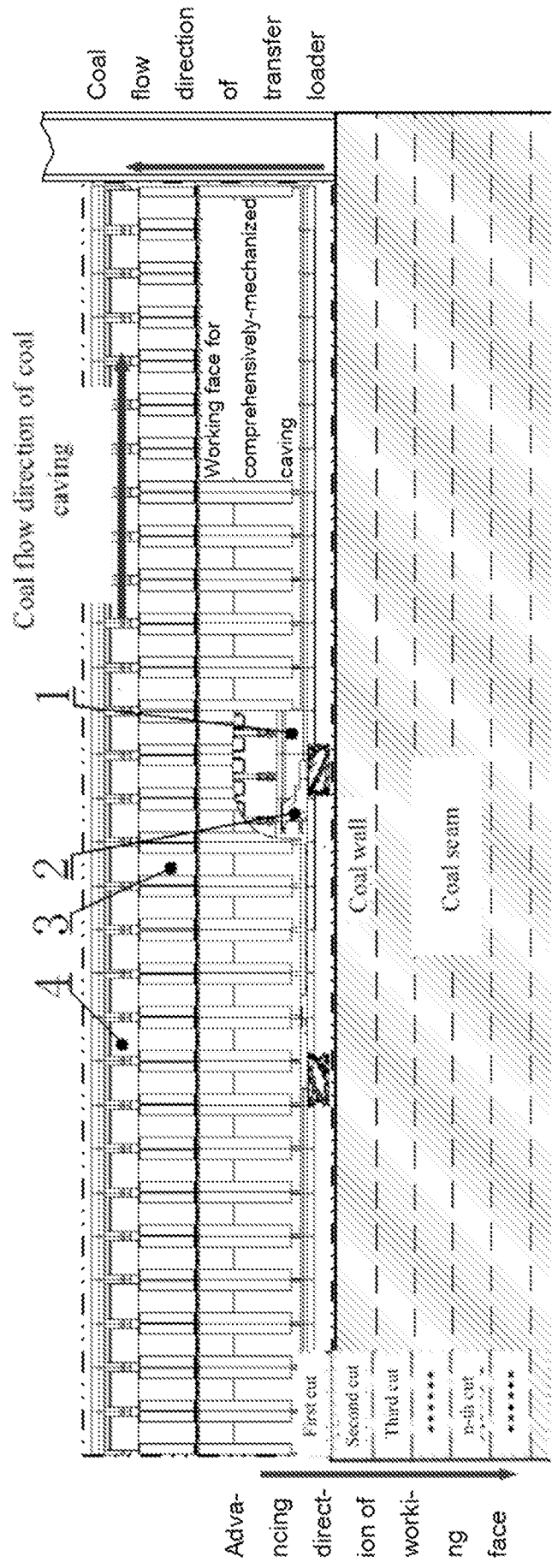


FIG.2

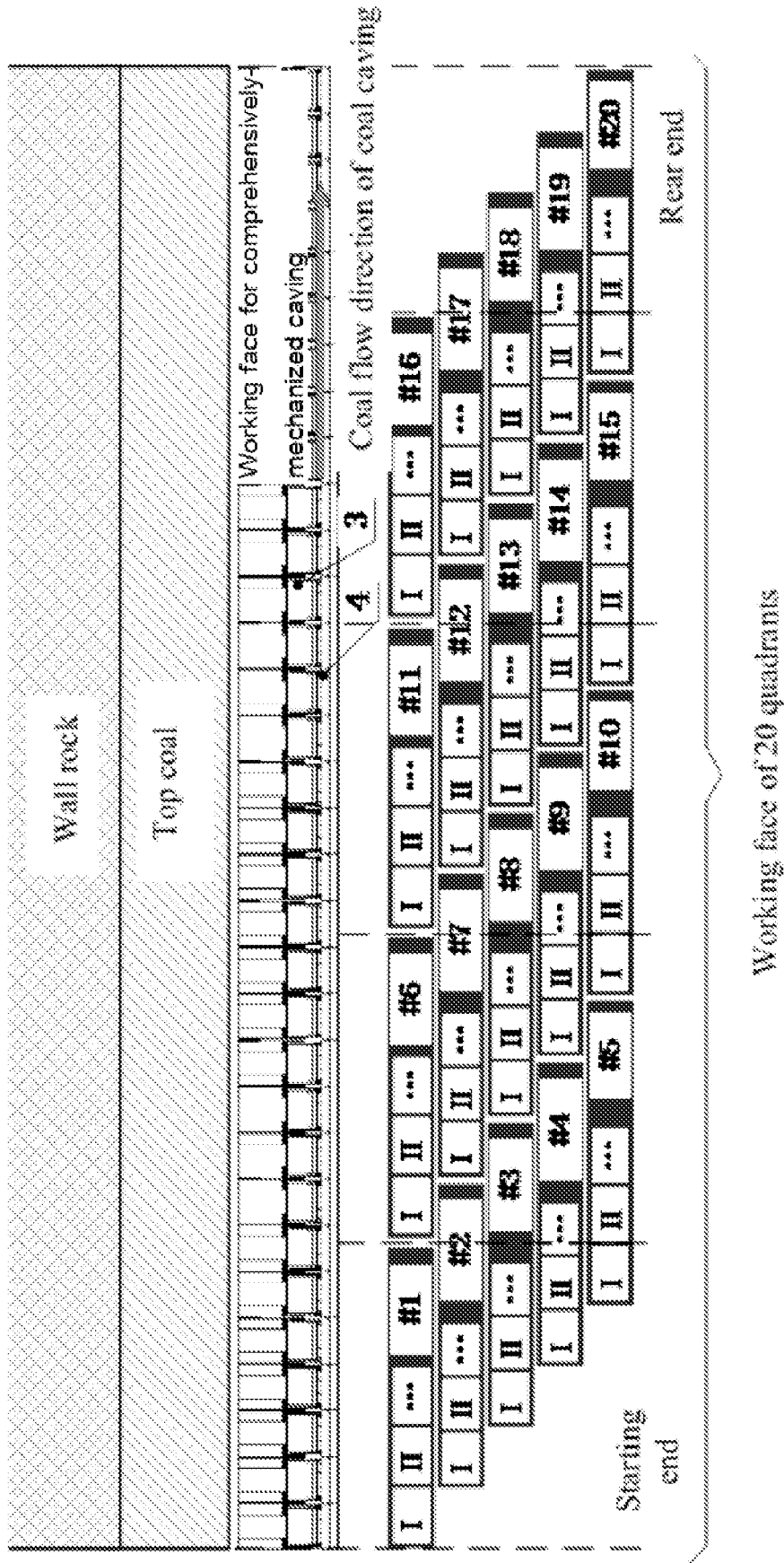


FIG.3

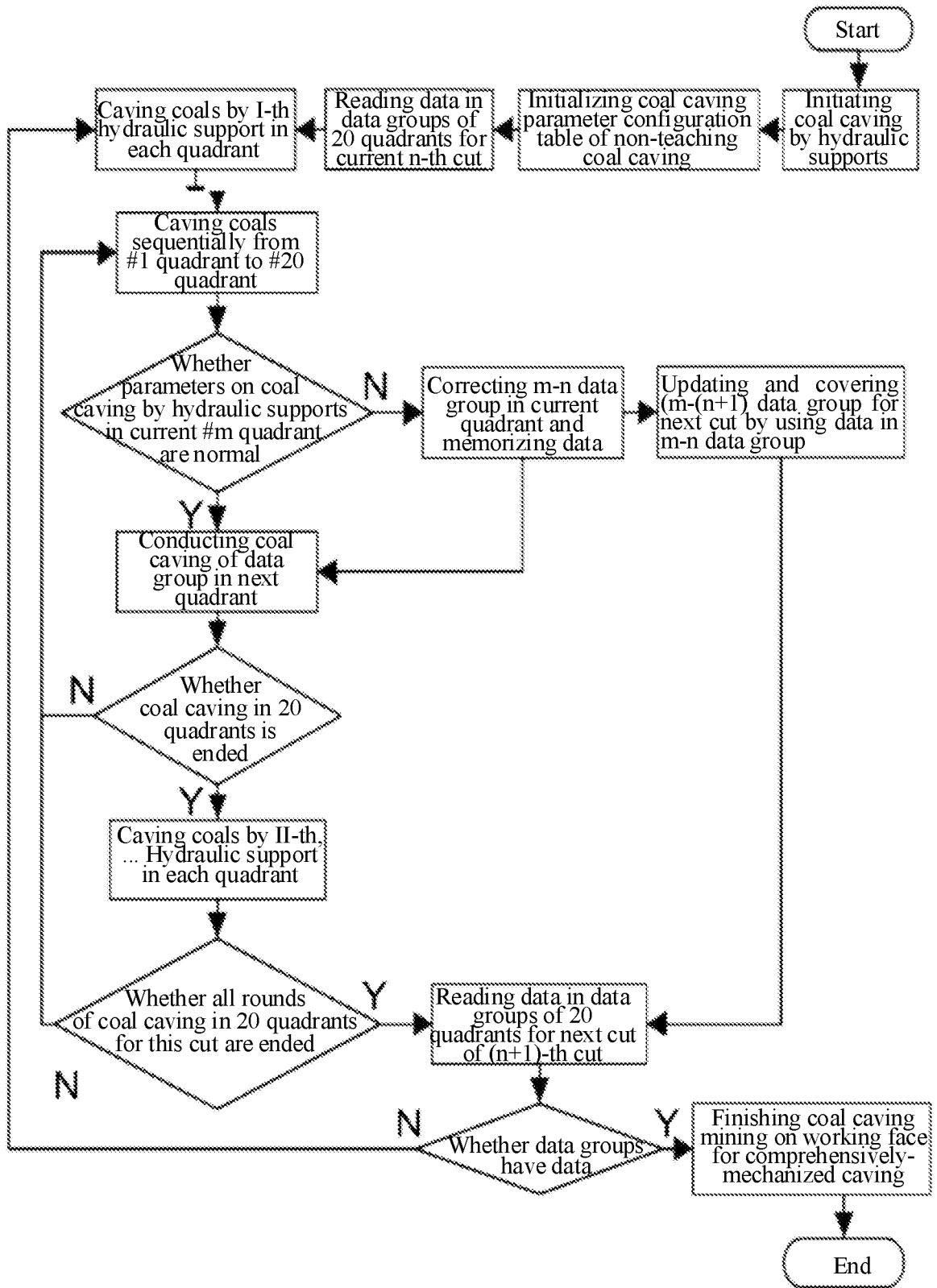


FIG.4