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(54) **EASILY REMOVABLE RECIPROCATING IMPACT HEAD WITH ANTI-ROTATION SLOT FOR MINING MACHINE**

(57) An easily removable reciprocating impact head with an anti-rotation slot for a mining machine comprises a reciprocating impact head device (2), wherein the reciprocating impact head device (2) comprises a reciprocating impact head (4), the reciprocating impact head (4) comprising reciprocating impact teeth (5) and a fixed seat (6), and also comprising a snap spring (7) or an elastic pin (8) or a locking pin (9). The reciprocating impact tooth (5) further comprises an impact tooth (16) and an impact tooth shoulder (17). The impact tooth (16) is arranged on an impact tooth insertion post (14) or an impact tooth insert (15), and the impact tooth shoulder (17) is arranged at the lower part of the impact tooth (16) or arranged at the end of the impact tooth insert (15). The reciprocating impact tooth (5) and the fixed seat (6) comprise a groove for arranging the snap spring (7) or the elastic pin (8) or the locking pin (9), and the snap spring (7) or the elastic pin (8) or the locking pin (9) is arranged in the groove so as to connect the fixed seat (6) and the reciprocating impact tooth (5). The snap spring (7) or the elastic pin (8) or the locking pin (9) is subjected to a rearward pulling force of the reciprocating impact motion. The impact tooth insertion post (14) is inserted into a tooth seat insert (11) or a tooth seat insertion post (12) is inserted into the impact tooth insert (15), the impact tooth shoulder (17)

closely mates with a tooth seat shoulder (13) to withstand the counterforce of reciprocating impact, and a slot-type anti-rotation structure is snap-fitted with a post-type anti-rotation structure to prevent the reciprocating impact teeth (5) from rotating.

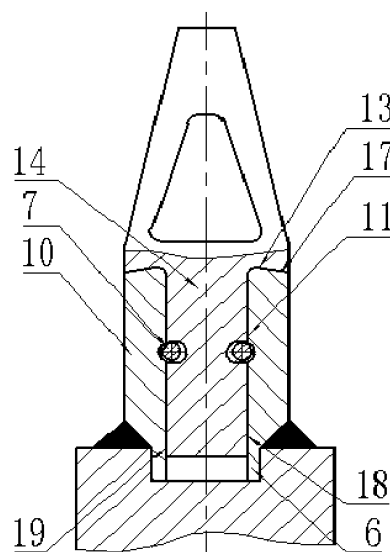


Fig.2

Description

Technical field

[0001] The invention relates to the field of mining machinery, in particular to an easily removable reciprocating impact head with an anti-rotation slot for a mining machine.

Background

[0002] The widely used mining machine is used for cutting materials of a coal wall or a rock wall or a compacted rock and the like, the coal wall or the rock wall or the compacted rock and the like are cut and milled in a rotating and inclined manner. In order to prevent the situation that cutting tooth is damaged too fast due to cutting and milling in a rotating and inclined manner, continuous rotation feeding is performed on the cutting tooth and the materials at an inclined angle which is smaller than 80 degrees, because the cutting tooth and the tooth seat are mostly connected in a relative rotating manner, and the cutting tooth and the tooth seat are in intermittent fit, the cutting intensity and the efficiency of the cutting tooth when the cutting tooth is used for cutting the materials are greatly reduced; besides, the cutting tooth is seriously damaged, and the lump material rate of the dropped materials is low, and the efficiency is low; the impact shovel of an impact coal planer is perpendicular to the materials to continuously plane and cut the materials, but because the chain is used for pulling the planing and cutting head to continuously and straightly plane and cut the materials, the cutting tooth continuously planes and cuts the inserted materials without intermittent; due to the continuous warming, the temperature of the planing and cutting tooth is difficult to lower, and the like, and the planing and cutting tooth is seriously damaged; in order to enhance the intensity of the planing and cutting tooth, the planing and cutting tooth is made into a large heavy shovel tooth which greatly improves the impact resistance, which enables that the energy consumption is high and the efficiency is lower during cutting; because the roller cutting tooth, the planing and cutting tooth or the mining cutting tooth does not make reciprocating movement, the structure and the performance and the like, for preventing the cutting tooth from being damaged by bidirectional force during reciprocating movement, are not formed on the roller cutting tooth, the planing and cutting tooth or the mining cutting tooth; the roller cutting tooth, the planing and cutting tooth or the mining cutting tooth and the like are connected through a bolt, a pin shaft and the like, the cutting impact force is easy to enable the pin shaft or the bolt to be cut and deformed, and the cut and deformed pin shaft or bolt is difficult to restore the original shape due to no self recovery elasticity, so that the cutting tooth is difficult to disassemble and exchange; in order to fundamentally overcome the defects of damage due to continuous warming, high energy consumption, low efficiency

and the like caused by the cutting manner without intermittent, the cutting manner is changed into a reciprocating impact intermittent cutting manner; in order to overcome the defect of no intermittent cutting of the cutting tooth, prolong the service life of the cutting tooth, and improve the production efficiency, the invention provides the easily removable reciprocating impact head with the anti-rotation slot for the mining machine.

Summary of the invention

[0003] The invention is realized through the following technical scheme: the easily removable reciprocating impact head with the anti-rotation insertion hole for the mining machine comprises a reciprocating impact head device and the like, wherein the reciprocating impact head device comprises a reciprocating impact head and the like, and the reciprocating impact head comprises reciprocating impact tooth and a fixed seat and the like, and also comprises snap springs or elastic pins or a locking pin and the like; the fixed seat comprises a tooth seat and the like, and the tooth seat comprises a tooth seat insert or a tooth seat insertion pillar and the like, and also comprises tooth seat shoulders and the like; the reciprocating impact tooth comprises an impact tooth insertion pillar or an impact tooth insert and the like, and also comprises an impact tooth and the impact tooth shoulders, wherein the impact tooth is arranged on the impact tooth insertion pillar or the impact tooth insert, the impact tooth shoulders are arranged at the lower part of the impact tooth or at the end part of the impact tooth insert and the like, and the reciprocating impact tooth and the fixed seat comprise a hole groove for arranging the snap springs or the elastic pins or the locking pin and the like, the snap springs or the elastic pins or the locking pin and the like are arranged in the hole groove so as to connect the fixed seat and the reciprocating impact tooth in a penetrating manner, and the snap springs or the elastic pins or the locking pin and the like withstand a rearward pulling force of the reciprocating impact movement. The snap springs or the elastic pins or the locking pin and the like prevent the reciprocating impact tooth from dropping from the fixed seat, the tooth seat insertion pillar and/or the impact tooth insertion pillar and the like comprise a pillar anti-rotation structure, the tooth seat insert and/or the impact tooth insert and the like comprise a hole anti-rotation structure, and the impact tooth insertion pillar is inserted into the tooth seat insert or the tooth seat insertion pillar is inserted into the impact tooth insert; the impact tooth shoulders are closely matched with the tooth seat shoulders to withstand the counterforce of reciprocating impact, and the hole anti-rotation structure is matched with the column anti-rotation structure to prevent the reciprocating impact tooth from rotating.

[0004] The hole bottom of the tooth seat insert and the bottom of the impact tooth insertion pillar are jointed, the bottom and the bottom hole of the impact tooth insertion pillar support the impact tooth for reciprocating impact,

and the tooth seat insert and the tooth seat shoulders are in integral connection.

[0005] The tooth seat shoulders and/or the impact tooth shoulders comprise the disassembly grooves and the like, and when the impact tooth which is damaged needs to be exchanged, the disassembly grooves are used for prying and pulling out the impact tooth insertion pillar from the tooth seat insert.

[0006] The snap springs comprise outer cambered surface snap springs and the like, the fixed seat comprises a tooth seat insert, outer cambered surface snap spring grooves of the fixed seat are formed in the tooth seat insert, and outer cambered surface snap spring deformation grooves corresponding to the outer cambered surface snap spring grooves are formed in the impact tooth insertion pillar; the outer cambered surface snap springs are arranged on the outer cambered surface snap spring deformation grooves, and the impact tooth insertion pillar is pushed into the tooth seat insert; the hole wall of the tooth seat insert compresses the outer cambered surface snap springs into the outer cambered surface snap spring deformation grooves; when the outer cambered surface snap springs are pushed into the outer cambered surface snap spring grooves of the fixed seat, the outer cambered surface snap springs extend outwards to be clamped into the outer cambered surface snap spring grooves of the fixed seat in a spring manner, and the impact tooth insertion pillar is snap-fitted with the tooth seat insert; the outer cambered surface snap springs prevent the impact tooth insertion pillar from dropping from the tooth seat insert, and the disassembly grooves are formed in the impact tooth insertion pillar and/or the tooth seat insert and the like, force which is larger than the deformation of the outer cambered surface snap springs is used for prying and/or pulling the impact tooth insertion pillar and the like through the disassembly grooves, and the impact tooth insertion pillar is moved outwards from the tooth seat insert so as to push the outer cambered surface snap springs into the outer cambered surface snap spring deformation grooves, so that the impact tooth insertion pillar is pulled out from the hole of the tooth seat insert.

[0007] The height of the cambered surface of each outer cambered surface snap spring groove is smaller than the radius of the outer cambered surface of each outer cambered surface snap spring, so that the situation that the outer cambered surface snap springs cannot be disassembled after entering the outer cambered surface snap spring grooves is avoided; the radius of the cambered surface of each outer cambered surface snap spring groove is greater than or equal to the radius of the outer cambered surface of each outer cambered surface snap spring, which is favorable for that the outer cambered surface snap springs are clamped into the outer cambered surface snap spring grooves, and is favorable for that the outer cambered surfaces of the outer cambered surface snap are jointed with the groove surfaces of the outer cambered surface snap spring grooves so

as to have a better dropping prevention effect.

[0008] The snap spring hole groove is arranged in the combined part of the tooth seat insert and the impact tooth insertion pillar, or the combined part of impact tooth insert and the tooth seat insertion pillar, the snap spring hole groove comprises the left snap spring hole groove, the right snap spring hole groove and the like; the snap springs comprise the cambered-head V-shaped opening snap spring, the cambered-head V-shaped opening snap spring comprises the left pin pillar and the right pin pillar and the like, the distance between the opening of the left pin pillar and the opening of the right pin pillar is larger than the distance between the left snap spring hole groove and the right snap spring hole groove, the left pin pillar and the right pin pillar of the cambered-head V-shaped opening snap spring correspondingly penetrate into the left snap spring hole groove and the right snap spring hole groove so as to prevent the tooth seat insert and the impact tooth insertion pillar from dropping, the left pin pillar generates elastic force towards the left, and the right pin pillar generates elastic force towards the right, so that the cambered-head V-shaped opening snap spring is prevented from dropping from the fixed seat and the reciprocating impact tooth.

[0009] The cambered head section groove is formed outside the tooth seat insert or outside the impact tooth insert and the like, the cambered-head V-shaped opening snap spring also comprises the cambered head section, the cambered head section is arranged in the cambered head section groove, the cambered head section groove protects the cambered head section, and the structure and the like for disassembling the cambered-head V-shaped snap spring are arranged between the cambered head section and the cambered head section groove.

[0010] The elastic pins comprise the elastic bayonets, wherein the elastic bayonets comprise the lock heads and the lock roots and the like, the elastomers are arranged behind the lock roots, and the lock heads are arranged at one end or two ends of the elastomers; the tooth seat is provided with the concave holes, and the tapered holes or the tapered groove or the keyhole and the like, which are matched with the concave holes, are correspondingly formed in the impact tooth insertion pillar; the lock heads are arranged in the tapered holes or in the tapered groove or in the keyhole and the like, the lock heads are tightly matched with the tapered holes, or the tapered groove or the keyhole and the like, the lock roots and the elastomers are arranged in the concave holes, and the lock roots and the concave holes are closely matched.

[0011] The elastic pins comprise the elastic bayonets and the like, the tooth seat is provided with the concave holes, and the stepped holes or the stepped groove or the keyhole and the like, which are matched with the concave holes, are correspondingly formed in the reciprocating impact tooth; the elastic bayonets are arranged in the large stepped holes and the concave holes or ar-

ranged in the large stepped groove or arranged in the keyhole or the concave holes and the like; the elastic bayonets comprise the lock heads and the lock roots, the elastomers are arranged behind the lock roots, the lock roots and the elastomers are arranged in the concave holes, and the lock heads are arranged in the large stepped holes or arranged in the large stepped groove or arranged in the keyhole and the like; when the reciprocating impact tooth is disassembled, the soldering rod of which the diameter is smaller than that of each stepped hole is used for pushing the lock heads into the concave holes from the small stepped holes, and the reciprocating impact tooth is disassembled.

[0012] The tooth seat insertion pillar comprises the transverse cambered surface pillar projection shoulders of the tooth seat, the impact tooth insert is correspondingly provided with the transverse cambered surface pillar groove shoulders of the impact tooth, the transverse cambered surface pillar projection shoulders of the tooth seat are snap-fitted with the transverse cambered surface pillar groove shoulders of the impact tooth to prevent the impact tooth from rotating and withstand the impact force.

[0013] The tooth seat comprises the hole anti-rotation structure and/or the hole anti-shaking structure and the like, and the impact tooth insertion pillar comprises the pillar anti-rotation structure and / or the pillar anti-shaking structure and the like, and the pillar-type anti-rotation structure and/or the pillar anti-shake structure and the like keep the reciprocating impact tooth vertically impacting the materials. When the hole anti-shaking structure is set into a shoulder cambered surface hole anti-shaking structure, the pillar anti-shaking structure is correspondingly provided with a shoulder cambered surface pillar anti-shaking structure; the shoulder cambered surface hole anti-shaking structure and the shoulder cambered surface column anti-shaking structure are snap-fitted; or, when the hole anti-shaking structure and the like are arranged to be a shoulder polygonal hole anti-shaking structure, the pillar anti-shaking structure is correspondingly provided with a polygonal pillar anti-shaking structure; the shoulder polygonal hole anti-shaking structure and the polygonal column anti-shaking structure are snap-fitted; or, when the hole anti-shaking structure and the like are arranged to be a tooth seat bottom hole anti-shaking structure, the pillar anti-shaking structure is correspondingly provided with an impact-tooth-insert pillar bottom anti-shaking structure, preventing the shake of the reciprocating impact tooth.

[0014] The tooth seat shoulders of which the tooth seat is tightly snap-fitted with the impact tooth insertion pillar form the anti-rotation shaking structure along with the impact tooth shoulders. The tooth seat insertion pillar is the transverse cambered surface pillar projection of the tooth seat, and the impact tooth insert is correspondingly the transverse cambered surface pillar groove of the impact tooth; the transverse cambered surface pillar projection of the tooth seat and the transverse cambered

surface pillar groove of the impact tooth are snap-fitted, preventing the reciprocating impact tooth from rotating. The bucking cambered surface between the transverse cambered surface pillar projection of the tooth seat and the transverse cambered surface pillar groove of the impact tooth faces to an object to be mined, so that the reacting force of reciprocating impact acts on the cambered surface; the cambered surface withstands large intensity of the reacting force so as to prevent the partial deformation on the snap-fitted surface of the cambered surface pillar projection and / or the cambered surface pillar groove and the like.

[0015] The snap springs comprise the elastic retaining ring for the hole, and the like, the elastic retaining ring groove for the hole is formed in the transverse cambered surface pillar groove of the impact tooth, and the projection blocking table matched with the elastic retaining ring groove for the hole is arranged on the transverse cambered surface pillar projection of the tooth seat; the elastic retaining ring for the hole is arranged at the snap-fitted end part of the elastic retaining ring groove for the hole and the projection blocking table; the outer edge of the elastic retaining ring for hole is larger than the snap-fitted line, and the inner edge of the elastic retaining ring for hole is smaller than the snap-fitted line. The elastic retaining ring for the hole prevents the transverse cambered surface pillar groove of the impact tooth from dropping from the transverse cambered surface pillar projection of tooth seat.

[0016] The impact tooth insertion pillar is the impact tooth insertion pillar with a round upper part and an arris-shaped lower part, and impact tooth insertion pillar with a round upper part and an arris-shaped lower part comprises an upper cylindrical body and a lower arris-shaped body, and the like; the tooth seat insert comprises the tooth seat insert with a round upper part and an arris-shaped lower part, and the tooth seat insert with a round upper part and an arris-shaped lower part comprises an upper cylinder hole, a lower arris-shaped groove and the like; the upper cylinder body is snap-fitted with the upper cylinder hole, and the inner snap spring or the elastic pins and the like are arranged in the snap-fitted space, so that the reciprocating impact tooth are firmly snap-fitted with the tooth seat together so as to prevent the reciprocating impact tooth from dropping; the lower arris-shaped body and the lower arris-shaped groove are tightly matched so as to prevent the reciprocating impact tooth from rotating and right the impact direction of the reciprocating impact tooth.

[0017] The pillar-type anti-rotation structure comprises a lower-cylinder upper-prism anti-rotation structure, or a square pillar-type anti-rotation structure, or a triangular pillar-type anti-rotation structure, or a polygonal pillar-type anti-rotation structure, or an upper-cylinder lower-prism anti-rotation structure, or a concave-convex bucking anti-rotation structure, or a ramp anti-rotation structure, and the like., and in split connection or in integral connection to the impact tooth insertion pillar.

[0018] The snap-fitted cambered surfaces between the tooth seat shoulders and the impact tooth shoulders face to the object to be mined, the reacting force of the reciprocating impact vertically acts on the cambered surface, and the cambered surface withstands large reacting force.

[0019] The blocker is arranged at the lower part of the impact tooth, the blocker is snap-fitted with the tooth seat to stop the dust, the water, or the material scraps and the like from entering the tooth seat insert or the combined part of the tooth seat shoulders, the impact tooth shoulders and the like to enable the impact direction of the reciprocating impact tooth to be inclined, and to prevent the dust, the water, the corrosive or the material scraps and the like from rusting the impact tooth insertion pillar, and the reciprocating impact tooth is righted.

[0020] Each reciprocating impact tooth comprises the tooth body, the alloy cutter head and the like, wherein the alloy cutter head is fixed on the tooth body, and the tooth body and the alloy cutter head are in split connection or in integral connection and the like. The tooth body and the alloy cutter head are fixed in an insertion hole manner, or a snapped groove manner, or a welding manner or a locking pin manner or a shoulder manner, and the like.

[0021] The sealing elements are arranged between the fixed seat and the reciprocating impact tooth and is arranged between the impact tooth shoulders and the tooth seat shoulders or between the impact tooth insertion pillar and the tooth seat insert, and the sealing elements prevent the water, the material, the dust or the corrosive and the like from entering a space between the tooth seat insert and the impact tooth insertion pillar.

[0022] The impact tooth insertion pillar, the impact tooth, the fixed seat, the impact rack and the like are provided with the circulating water passage or the unidirectional water passage and the like, the sealing elements are arranged at the jointed part of the tooth seat insert and the impact tooth insertion pillar, and the sealing elements prevent the water from being permeated into the tooth seat insert from the water passage; the circulating water passage comprise a water inlet passage and a water outlet passage, which are arranged in parallel and are communicated mutually at the upper part of the impact tooth; the water flows into the water inlet passage from the tooth seat and flows out from the water outlet passage, so that the temperature of the impact tooth is lowered.

[0023] The impact tooth is provided with the wear-reducing concave surface, and the wear-reducing concave surface reduces the direct contact area of the impact tooth and the materials, reduces the wear of the materials to the impact tooth, lowers the weight of the impact tooth, and reduces impact resistance.

[0024] The impact tooth comprise the material guiding surface which comprises the bevel material guiding surface, or the cambered material guiding surface, or the plane material guiding surface, or the curved surface

material guiding surface and the like, and when dropped materials are impacted, the material guiding surface smoothly guides out the materials.

[0025] The tooth seat shoulders are provided with the conical projection, the impact tooth shoulders are provided with the conical groove, the conical projection of the tooth seat shoulders and the conical groove of the impact tooth shoulders are closely snap-fitted to prevent dust, water, coal slime, corrosive or material scraps and the like from entering the tooth seat insert and protect the snap springs, or the elastic pins or the locking pin and the like from being polluted by the materials.

[0026] The positioning boss is arranged at the lower part of the tooth seat, the positioning concave hole which is snap-fitted with the positioning boss is formed in the impact rack, the positioning boss is inserted into the positioning concave hole to be positioned, and after the tooth seat is righted and welded, the tooth seat and the impact rack are firmly welded.

[0027] The positioning boss comprises a tapered positioning boss or a cylindrical positioning boss or a square positioning boss or a rectangular positioning boss or an elliptic positioning boss or a triangular positioning boss or a polygonal positioning boss and the like.

[0028] The inner hole snap spring grooves and the outer hole snap spring grooves are formed in the combined part of the tooth seat insert and the impact tooth insertion pillar or the combined part of the impact tooth insert and the like and the tooth seat insertion pillar, the inner snap springs are pressed into the inner hole snap spring grooves, the cambered-head V-shaped opening snap spring is inserted into the outer hole snap spring grooves, and the cambered-head V-shaped opening snap spring prevents the tooth head from rotating, and the cambered-head V-shaped opening snap springs are matched with the inner snap springs so as to jointly prevent the reciprocating impact tooth from dropping.

[0029] The impact tooth comprises a round head tooth or a flat head tooth or a taper head tooth or an emboli form tooth or a cutter head tooth or a bevel tooth or a multi-arrs tooth and the like.

[0030] The fixed seat comprises the impact rack, wherein the impact rack comprises the tapered impact rack, or the coal outlet hole impact rack, or the flat impact rack, or the cambered surface impact rack or the mushroom head impact rack, and the impact rack and the fixed seat are in split connection or integral connection.

[0031] The snap springs comprise inner snap springs or outer snap springs or outer cambered surface snap springs or cambered-head V-shaped opening snap springs or cambered-head clamping board opening ring snap springs or an electric retaining ring for the shaft, or an elastic retaining ring for the hole or a steel wire elastic retaining ring or a tapered pin elastic retaining ring and the like.

[0032] The snap springs comprise a spring steel snap spring, or an alloy steel snap spring, or a snap spring made of nylon materials, or a snap spring made of rubber

materials, or a snap spring made of plastic materials, or a snap spring made of bamboo materials, or a snap spring made of composite materials, and the like.

[0033] The transverse cambered pillar projection of the tooth seat comprises a cambered surface projection or an cambered surface projection or a rectangular projection or a triangular projection or a polygonal projection, or a column projection or a T-shaped projection or an cambered head T-shaped projection, and the like, the transverse cambered pillar groove of the impact tooth comprises a curved groove or an cambered surface groove or a rectangular groove or a triangular groove or a polygonal groove or a column groove or a T-shaped groove or an cambered head T-shaped groove and the like, and the transverse cambered pillar groove of the impact tooth comprises a through hole groove or a blind hole groove or a blocker groove and the like.

[0034] The wear-resistant stiffener or the wear-resistant alloy block and the like are arranged at the side part of the reciprocating impact tooth, and the wear-resistant stiffener or the wear-resistant alloy block and the like are welded to the side part of the reciprocating impact tooth so as to reduce the wear to the reciprocating impact tooth.

[0035] The front side part, or the rear side part or both side parts and the like of the reciprocating impact tooth are formed into cambered surfaces, and the cambered surfaces are single cambered surfaces or the combination of a plurality of cambered surfaces, and the cambered surfaces reduce the frictional resistance of the impact tooth body.

[0036] The tooth seat insertion pillar or the impact tooth insertion pillar and the like are provided with the tapered projection and the like, the tapered groove and the like are correspondingly formed in the impact tooth insert or the tooth seat insert and the like, the tapered projection is snap-fitted with the tapered groove, the reciprocating impact force acts on the jointed surfaces of the impact tooth shoulders and the tooth seat shoulders, and the tapered projection and the tapered groove are snap-fitted to jointly prevent the reciprocating impact tooth from dropping along with the snap springs.

[0037] The elastic pins comprises the expansion pin and the like, the expansion pin is arranged in the elastic pin hole groove of the reciprocating impact tooth and the fixed seat, the expansion pin is connected with the reciprocating impact tooth and the fixed seat in a penetrating manner, after the expansion pin is automatically sprung, the expansion pin is prevented from dropping from the hole groove, and the reciprocating impact tooth and the fixed seat are connected in a fastening manner.

[0038] The rounded transition is formed at the edges and corners of the reciprocating impact tooth, and the frictional resistance when the reciprocating impact tooth are in contact with the materials is reduced.

[0039] The reciprocating impact head device comprises a driving assembly and the like, the driving assembly comprises a hydraulic pressure driving assembly or a crank-connecting rod driving assembly or an air pressure

driving assembly or a magnetic force driving assembly and the like, wherein the driving assembly drives the reciprocating impact head to perform reciprocating impact.

[0040] The invention has the beneficial effects that:

[0041] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, has the following advantages:

(1) The reciprocating impact head changes the working principle and the structure that when the widely used mining machine is used for cutting the materials of the coal wall or the rock wall or the compacted rock and the like, the coal wall or the rock wall or the compacted rock and the like are cut and milled in a rotating and inclined manner, and the cutting tooth vertical impacts the materials in a reciprocating and intermittent manner, so that the cutting tooth and the tooth seat are fixedly connected for preventing rotation and/or preventing shaking; according to the reciprocating impact head, the cutting tooth and the tooth seat are in interference fit, so that when the cutting tooth cut the materials, the cutting intensity and the efficiency of the cutting tooth are greatly improved, the situation that the cutting tooth is seriously damaged is avoided, and the working principle that the impacted style coal planer adopts the chain to pull the planing and cutting head to continuously and straightly plane and cut the materials, and the planing and cutting tooth continuously plane and cut the inserted materials without intermittence, so that the planing and cutting tooth are seriously damaged because the temperature of the planing and cutting tooth is raised continuously, the temperature is difficult to lower, and the like, is changed; the reciprocating impact tooth are made into less than 1/2 of the planing and cutting tooth; compared with the planing and cutting tooth, the reciprocating impact tooth greatly reduce the impact resistance, so that the cut dropped materials are low in energy consumption and are high in efficiency; because the reciprocating impact working principle is different from that of the roller cutting tooth or the planing and cutting tooth or the mining cutting tooth which continuously cuts the materials, the reciprocating impact head has the structure, the performance and the like which prevent the cutting tooth from generating bidirectional force damage due to reciprocating movement, and overcome the defects that the impact tooth, such as the roller cutting tooth, the planing and cutting tooth or the mining cutting tooth, are connected through the bolt, the pin shaft and the like, the pin shaft, or the bolt and the like are easy to drop due to the vibration of the vibration force, the cutting impact force is easy to enable the pin shaft or the bolt to be cut and deformed, and the cut and deformed pin shaft or bolt is difficult to restore the original shape due to no self recovery elasticity, so that the cutting tooth are difficult to disassemble and exchange; the

snap springs or the elastic pins or the locking pin and the like, having elastic deformability, are used for connecting the fixed seat and the reciprocating impact tooth, so that the service life of the reciprocating impact head is greatly prolonged, and the production efficiency is improved.

(2) The snap springs or the elastic pins or the locking pin and the like are in limiting connection with the impact tooth insertion pillar and the tooth seat, so that the position of the impact tooth insertion pillar and the position of the tooth seat are mutually limited; the impact tooth is arranged at the upper part of the impact tooth insertion pillar, the impact tooth shoulders are arranged at the lower part of the impact tooth, the impact tooth shoulders and the tooth seat shoulders and the like are tightly matched to withstand the reciprocating impact force, the hole-type anti-rotation structure is snap-fitted with the pillar-type anti-rotation structure to prevent the reciprocating impact tooth during reciprocating movement from rotating, and the snap springs or the elastic pins or the locking pin and the like prevent the reciprocating impact tooth from dropping from the fixed seat; the driving assembly drives the reciprocating impact tooth to impact in a reciprocating manner, so that the impact tooth is perpendicular to the materials to drop materials in a reciprocating manner, and the damage of the impact tooth is greatly decreased.

(3) The hole bottom of the tooth seat insert is jointed to the bottom of the impact tooth insertion pillar, and the bottom of the impact tooth insertion pillar and the bottom hole support the impact tooth to perform reciprocating impact, so that the withstanding strength and the intensity of the impact tooth during reciprocating impact are enhanced.

(4) When the impact tooth which is damaged needs to be exchanged, the disassembly grooves are used for prying and pulling out the impact tooth insertion pillar from the tooth seat insert, so that the disassembling is simple and convenient, and the mounting is rapid and quick.

(5) The impact tooth shoulders are arranged around the impact tooth insertion pillar or the impact tooth shoulders are arranged around the impact tooth insertion pillar in a semi-surrounding manner, so that the support strength of the tooth seat to the impact tooth insertion pillar is greatly enhanced.

(6) The blocker is arranged at the lower part of the impact tooth so as to prevent the dust, the water, the coal slime or the material scraps and the like from entering the tooth seat insert, so that the snap springs or the elastic pins or the locking pin and the like are effectively protected from being polluted by the materials and the like.

(7) The snap springs or the elastic pins and the like are arranged in the combined part of the tooth seat insert and the impact tooth insertion pillar, so that the situation that the snap springs and the elastic

pins drop due to the outside force is avoided, the situation that the snap springs or the elastic pins and the like are rusted and damaged when being polluted by the dust, the water, the coal slime or the material scraps and the like, is avoided, and the situation that the impact tooth insertion pillar is difficult to disassemble after being polluted and rusted is avoided.

(8) One end of the lock heads is arranged on the tooth seat, and the other end of the lock heads is arranged on the impact tooth insertion pillar, so that the reciprocating impact tooth is prevented from dropping.

(9) The lock heads are arranged in the tapered holes or arranged in the tapered groove or arranged in the keyhole, the lock heads are tightly matched with the tapered holes or the tapered groove or the keyhole, the lock roots and the elastomers are arranged in the concave holes, and the lock roots are tightly matched with the concave holes, so that the lock heads and the lock roots enable the tooth seat and the reciprocating impact tooth to be tightly matched without shaking, and the defects that due to the shaking of the reciprocating impact tooth, the impact efficiency is low, the reciprocating impact head is easy to damage and the like are overcome.

(10) The lock roots and the elastomers are arranged in the concave holes, the lock heads are arranged in the large stepped holes or in the large stepped groove or in the keyhole, when the reciprocating impact tooth is disassembled, the soldering rod of which the diameter is smaller than that of the stepped holes is used for pushing the lock heads into the concave holes from the small stepped holes, so that the reciprocating impact tooth is convenient to disassemble, repair and maintain.

(11) The lock heads are provided with the tapered surface or the bevel surface and the like, which are arranged in the keyhole, the lock roots are arranged behind the tapered surface or the bevel surface, the elastomers are arranged behind the lock roots, and the lock roots, the elastomers, and the like are arranged in the concave holes, so that the function of preventing the reciprocating impact tooth from dropping from the tooth seat is played; when powerful external force acts on the tapered surface lock head or the bevel surface lock head, the tapered surface lock head or the bevel surface lock head is easy to stretch out and draw back from the keyhole, and the reciprocating impact tooth is convenient to disassemble and mount.

(12) According to the material discharge hole impact rack, the mining width is enlarged, the material discharging hole is favorable for smoothly discharging the materials impacted by the inner layer material tooth, the lump material rate of the impacted dropped materials is effectively protected, and the running characteristics and the economic value of the impacted dropped materials are improved.

(13) The limiting area of the clamping groove formed in the impact tooth insertion pillar and/or the tooth seat is large, so that the limiting degree is increased, the reciprocating impact tooth withstand a large cutting area, and the dispersal cutting force enables the snap springs not to be easy to damage.

(14) The shoulder arranged on the reciprocating impact tooth and/or the fixed seat has a definite width, the width of the shoulder enlarges the jointing and supporting area of the reciprocating impact tooth and the fixed seat, the reciprocating impact tooth is prevented from shaking relative to the tooth seat and the like, reciprocating impact tooth is firmly fixed, and the intensity of the axial impact force withstood by the reciprocating impact tooth is enhanced.

(15) The width of the shoulder enables the contact area of the reciprocating impact tooth and the fixed seat to be large, so that the local intensity withstood by the reciprocating impact tooth and the fixed seat is reduced, and the situation that the tooth seat and/or the impact tooth insertion pillar which are(is) locally damaged and deformed cannot be disassembled is avoided.

(16) The hole-type anti-rotation structure and/or the hole anti-shaking structure maintain(s) the reciprocating impact tooth to vertically impact the materials in a reciprocating manner, so that the snap springs or the elastic pins or the locking pin and the like are prevented from being impacted and cut.

(17) The pillar-type anti-rotation structure and/or the pillar anti-shaking structure maintain(s) the reciprocating impact tooth to vertically impact the materials in a reciprocating manner, so that the snap springs or the elastic pins or the locking pin and the like are prevented from being impacted and cut.

(18) The lower cylindrical body is snap-fitted with the lower cylindrical hole, and the inner snap springs or the elastic pins are arranged in the snap-fitted space, so that the reciprocating impact tooth is firmly snap-fitted with the tooth seat together so as to prevent the reciprocating impact tooth from dropping; the upper arris-shaped body and the upper arris-shaped groove are tightly matched so as to prevent the reciprocating impact tooth from rotating, and the impact direction of the reciprocating impact tooth is righted, and/or the material guiding direction of the material guiding surface of the reciprocating impact tooth is righted.

(19) The hole anti-shaking structure and the tooth seat are in split connection or in integral connection, so that the structure is simple and the intensity is large.

(20) The shoulder cambered surface hole anti-shaking structure is snap-fitted with the shoulder cambered pillar anti-shaking structure, or the shoulder polygonal hole anti-shaking structure is snap-fitted with the shoulder polygonal pillar anti-shaking structure, so that the reciprocating impact tooth is pre-

vented from shaking.

(21) The hole anti-rotation anti-shaking structure is matched with the pillar anti-rotation anti-shaking structure so as to prevent the reciprocating impact tooth from rotating and shaking on the fixed seat, so that the impact force and the intensity are improved, and the situation that the snap springs or the elastic pins or the locking pin and the like are cut is avoided.

(22) The snap-fitted surfaces of the tooth seat shoulders and the impact tooth shoulders face to the object to be mined, the reacting force of the reciprocating impact acts on the snap-fitted surfaces, and the intensity of the impact reacting force withstood by the snap-fitted surfaces is large.

(23) The blocker is arranged at the lower part of the impact tooth, the blocker is snap-fitted to the tooth seat to stop the dust, the water, the corrosive or the material scraps and the like from entering the tooth seat insert or the combined parts of the tooth seat shoulders and the impact tooth shoulders and the like to enable the impact direction of the reciprocating impact tooth to be inclined, the protection to the impact tooth insertion pillar is strengthened, and the intensity of righting the reciprocating impact tooth is enhanced.

(24) The alloy cutter head is fixed on the tooth body, and the tooth body and the alloy cutter head are in split connection or in integral connection, so that the impact resistance and the abrasive resistance of the reciprocating impact tooth are improved.

(25) The sealing elements are arranged at the jointed position of the hole bottom of the tooth seat insert and the bottom end of the impact tooth insertion pillar, and the sealing elements prevent water from being permeated into the tooth seat insert from the water passage.

(26) The water inlet passage and the water outlet passage are arranged in parallel and are mutually communicated at the upper part of the impact tooth, and the water flows in from the water inlet passage in the tooth seat and flows out of the water outlet passage, so that the temperature of the impact tooth is lowered.

(27) The wear-reducing concave surface reduces the direct contact area of the impact tooth and the materials, reduces the wear of the materials to the impact tooth, lowers the weight of the impact tooth, and reduces impact resistance.

(28) The bevel material guiding surface, or the cambered surface material guiding surface, or the plane material guiding surface, or the curved surface material guiding surface and the like smoothly guide out the materials when the dropped materials are impacted, and the frictional resistance of the impact tooth and the materials is reduced, so that the materials are smooth to fall and discharge.

(29) The sealing elements and the like are arranged between the fixed seat and the reciprocating impact

tooth, the sealing elements are arranged between the impact tooth shoulders and the tooth seat shoulders or is arranged between the impact tooth insertion pillar and the tooth seat insert, and the sealing elements prevent water, materials, dust or corrosive from entering the position between tooth seat insert and the impact tooth insertion pillar.

(30) The elastic pin hole groove is formed in the combined part of the tooth seat insert and the impact tooth insertion pillar, the distance between the openings of the cambered head V-shaped opening snap spring is greater than the distance between the left snap spring hole groove and the right snap spring hole groove, the left pin pillar and the right pin pillar of the cambered head V-shaped opening snap spring are correspondingly penetrated into the left snap spring hole groove and the right snap spring hole groove to prevent the tooth seat insert from be divorced from the impact tooth insertion pillar, the left pin pillar produces elastic force towards the left, and the right pin pillar produces elastic force towards the right, so that the cambered head V-shaped opening snap spring is prevented from dropping from the tooth seat; the structure greatly reduces the height of the tooth seat and the height of the impact tooth insertion pillar, reduces the length of damaged force arm of the reciprocating impact head, reduces material consumption and the weight of the reciprocating impact head, and reduces power consumption.

(31) The cambered head section is arranged in the cambered head section groove which protects the cambered head section, the cambered head section groove is arranged outside the tooth seat or outside the reciprocating impact tooth, and the structure for disassembling the cambered head V-shaped opening snap spring is arranged between the cambered head section and the cambered head section groove, so that the reciprocating impact tooth is convenient to disassemble and exchange.

(32) The upper cylindrical body and the upper cylindrical hole are snap-fitted, the inner snap springs or the elastic pins and the like are arranged in the snap-fitted part so as to enable the reciprocating impact tooth and the tooth seat to be firmly snap-fitted together to prevent the reciprocating impact tooth from dropping, the lower aris-shaped body and the lower aris-shaped groove are closely matched to prevent the reciprocating impact tooth from rotating, the impact direction of the reciprocating impact tooth and the material guiding direction of the material guiding surface of the reciprocating impact tooth are righted, the structure is easy to process and manufacture, and the sealing elements are conveniently arranged.

(33) The tooth seat shoulders are provided with the conical projection, the impact tooth shoulders are provided with the conical groove, the conical projection of the tooth seat shoulders and the conical groove of the impact tooth shoulders are closely

snap-fitted to prevent the dust, the water, the coal slime, the corrosive or the material scraps and the like from entering the tooth seat insert and protect the snap spring, or the elastic pins or the locking pin and the like from being polluted by the materials.

(34) The snap spring hole grooves, the elastic pin hole grooves and the like are formed in the combined part of the tooth seat insert and the impact tooth insertion pillar, the snap spring is pressed into the snap spring hole groove, the elastic pins which are inserted into the elastic pin hole grooves prevent the impact tooth from rotating, and the elastic pins and the snap springs are matched to jointly prevent the impact tooth from dropping.

(35) The positioning boss is arranged at the lower part of the tooth seat, the positioning concave hole which is snap-fitted with the positioning boss is arranged on the impact rack, the positioning boss is inserted into the positioning concave hole to be positioned, and after the tooth seat is righted and welded, the tooth seat and the impact rack are firmly welded.

(36) The transverse cambered pillar projection of the tooth seat and the transverse cambered pillar groove of the impact tooth are snap-fitted to prevent the reciprocating impact tooth from rotating, the snap-fitted cambered surface of the transverse cambered pillar projection of the tooth seat and the transverse cambered pillar groove of the impact tooth faces to the article to be milled, the reacting force of the reciprocating impact acts on the snap-fitted cambered surfaces and the snap-fitted surfaces of the impact tooth shoulders and the tooth seat shoulders, the intensity of the impact reacting force withstood by the snap-fitted surfaces is large, and the local deformation of the snap-fitted surface of the cambered pillar protrusion and/or the cambered pillar groove cannot be caused; the clamping groove of the transverse cambered pillar groove of the impact tooth is formed in the transverse cambered pillar groove of the impact tooth, the tooth seat protrusion clamping groove is formed in the tooth seat protrusion segment, the snap springs or the elastic pins are arranged in the tooth seat protrusion clamping groove, the snap springs or the elastic pins are locally protruded out of the tooth seat protrusion clamping groove, after the transverse cambered pillar projection of the tooth seat and the transverse cambered pillar groove of the impact tooth are snap-fitted, the snap springs or the elastic pins are positioned between the transverse cambered pillar projection of the tooth seat and the transverse cambered pillar groove of the impact tooth to prevent the reciprocating impact tooth from dropping from the tooth seat, and the snap springs or the elastic pins are snap-fitted in the transverse cambered pillar groove of the impact tooth and are free from impact and/or pollution.

(37) The outer cambered surface snap springs are

arranged on the outer cambered surface snap spring deformation grooves, the impact tooth insertion pillar is pushed into the tooth seat insert, and the hole wall of the tooth seat insert compresses the outer cambered surface snap springs into the outer cambered surface snap spring deformation grooves; when the outer cambered surface snap springs are pushed to the positions of the outer cambered surface snap spring grooves of the fixed seat, the outer cambered surface snap springs outwards springs and extends to be snapped into the outer cambered surface snap spring grooves of the fixed seat, and the outer cambered surface snap springs prevent the impact tooth insertion pillar from dropping from the tooth seat insert; when the impact tooth insertion pillar needs to be disassembled, the force greater than the deformation of the outer cambered surface snap springs is used for prying and pulling out the impact tooth insertion pillar through the disassembly grooves, the impact tooth insertion pillar is outwards moved from the tooth seat insert so as to push the outer cambered surface snap springs into the outer cambered surface snap spring deformation grooves, and therefore, the impact tooth insertion pillar is pulled out of the hole of the tooth seat insert; the outer cambered surface snap springs are arranged in the combined part of the tooth seat insert and the impact tooth insertion pillar, so that the outer cambered surface snap springs cannot be polluted and corroded.

(38) The height of the cambered surface of each outer cambered surface snap spring groove is smaller than the radius of the outer cambered surface of each outer cambered surface snap spring, the situation that the outer cambered surface snap spring grooves are too large so that the outer cambered surface snap springs are difficult to be pressed into the outer cambered surface snap spring deformation grooves is prevented, and the situation that the impact tooth insertion pillar cannot be disassembled is prevented; the radius of the cambered surface of each outer cambered surface snap spring groove is greater than or equal to the radius of the outer cambered surface of each outer cambered surface snap spring, which is favorable for that the outer cambered surface of each outer cambered surface snap spring and the cambered surface of each outer cambered surface snap spring groove are jointed.

(39) The elastic retaining ring for the hole is arranged at the snap-fitted end part of the elastic retaining ring groove for the hole and the projection blocking table, the outer edge of the elastic retaining ring for the hole is greater than the snap-fitted line, the inner edge of the elastic retaining ring for the hole is smaller than the snap-fitted line, the dust, the water, the coal slime, the corrosive or the material scraps and the like are prevented from entering the transverse cambered pillar groove of the impact tooth, the elastic retaining ring for the hole prevents the transverse

cambered pillar groove of the impact tooth from dropping from the transverse cambered pillar projection of the tooth seat, the elastic retaining ring for the hole is convenient to disassemble, and the impact tooth insertion pillar is convenient and quick to exchange.

(40) The transverse cambered pillar protrusion shoulder of the impact tooth and the transverse cambered pillar groove shoulders of the impact tooth are snap-fitted to prevent the impact tooth from rotating, so that the impact resistant stressed area is increased, and the capacity of the impact tooth for withstanding the impact force is improved.

(41) The wear-resistant stiffener or the wear-resistant alloy block is arranged at the side part of the reciprocating impact tooth, and the wear-resistant stiffener or the wear-resistant alloy block is welded to the side part of the reciprocating impact tooth so as to reduce the wear to the reciprocating impact tooth; when the impact materials of the impact tooth produce side force towards one side of the wear-resistant alloy block, the wear-resistant alloy block withstands the side force, and the damage to the reciprocating impact tooth is reduced.

(42) The front side part, or the rear side part or both side parts of the reciprocating impact tooth are formed into cambered surfaces, and the cambered surfaces are single cambered surfaces or the combination of a plurality of cambered surfaces, and the cambered surfaces reduce the frictional resistance of the impact tooth body.

(43) The tooth seat insertion pillar or the impact tooth insertion pillar is provided with the tapered projection, the tapered groove is correspondingly formed in the impact tooth insert or the tooth seat insert, the tapered projection is snap-fitted with the tapered groove, the reciprocating impact force acts on the jointed surfaces of the impact tooth shoulders and the tooth seat shoulders, and the tapered projection and the tapered groove are snap-fitted to jointly prevent the reciprocating impact tooth from dropping along with the snap springs.

(44) The expansion pin is arranged in the elastic pin hole grooves of the reciprocating impact tooth and the fixed seat, the expansion pin is connected with the reciprocating impact tooth and the fixed seat in a penetrating manner, after the elastic pins are automatically sprung, the expansion pin is prevented from dropping from the hole groove, and the reciprocating impact tooth and the fixed seat are connected in a fastening manner.

(45) The rounded transition is formed at the edges and corners of the reciprocating impact tooth, and the frictional resistance when the reciprocating impact tooth is in contact with the materials is reduced.

Description of the Drawings

[0042]

FIG. 1 is a structural schematic diagram of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 1;

FIG. 2 is a schematic diagram of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 1;

FIG. 3 is a schematic diagram of another impact head of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 1;

FIG. 4 is another structural schematic diagram of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 1;

FIG. 5 is a view of elastic pins of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 2;

FIG. 6 is a view of elastic bayonets of an impact head of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 2;

FIG. 7 is a schematic diagram of another manner of elastic bayonets of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 2;

FIG. 8 is a schematic diagram of stepped holes of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 3;

FIG. 9 is a main view of an impact rack of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 4;

FIG. 10 is a view of a blocker of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 5;

FIG. 11 is a main view of reciprocating impact tooth of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 6;

FIG. 12 is a main view of another impact tooth of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 6;

FIG. 13 is a schematic diagram of a circulating water passage of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 7;

FIG. 14 is a section view B-B in FIG. 13, according to the embodiment 7;

FIG. 15 is a schematic diagram of a single water passage of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining

machine, according to the embodiment 7;

FIG. 16 is a schematic diagram of an impact tooth insertion pillar of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 8;

FIG. 17 is a B view of FIG. 16, according to the embodiment 8;

FIG. 18 is a structural schematic diagram of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 9;

FIG. 19 is a structural schematic diagram of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 10;

FIG. 20 is another structural schematic diagram of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 10;

FIG. 21 is a structural schematic diagram of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 11;

FIG. 22 is an A-A view of FIG. 21, according to the embodiment 11;

FIG. 23 is a schematic diagram of a cambered-head V-shaped opening snap spring of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 11;

FIG. 24 is a schematic diagram of a material guiding surface of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 13;

FIG. 25 is a schematic diagram of a transverse cambered pillar groove of an impact tooth of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 14;

FIG. 26 is an A-A view in FIG. 25, according to the embodiment 14;

FIG. 27 is a schematic diagram of a snap-fitted line of a reciprocating impact head of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 14;

FIG. 28 is a schematic diagram of outer cambered surface snap springs of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 15;

FIG. 29 is a schematic diagram of transverse cambered pillar groove shoulders of an impact tooth of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 16;

FIG. 30 is a schematic diagram of a transverse cambered pillar projection of a tooth seat of an easily

removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 16;

FIG. 31 is a structural schematic diagram of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 17;

FIG. 32 is a structural schematic diagram of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 18;

FIG. 33 is a structural schematic diagram of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 19;

FIG. 34 is a structural schematic diagram of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 20;

FIG. 35 is a schematic diagram of a reciprocating impact tooth of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 20;

FIG. 36 is schematic diagrams of a tapered projection and a tapered groove of an easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 21;

FIG. 37 is a schematic diagram of an expansion pin of easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 22;

FIG. 38 is a left structural schematic diagram of an expansion pin of easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, according to the embodiment 22.

[0043] In figures: 1. Driving Assembly; 2. Reciprocating Impact Head Device; 3. Crank-connecting Rod Driving Assembly; 4. Reciprocating Impact Head; 5. Reciprocating Impact Tooth; 6. Fixed Seat; 7. Snap Spring; 8. Elastic Pin; 9. Locking Pin; 10. Tooth Seat; 11. Tooth Seat Insert; 12. Tooth Seat Insertion Pillar; 13. Tooth Seat Shoulder; 14. Impact Tooth Insertion Pillar; 15. Impact Tooth Insert; 16. Impact Tooth; 17. Impact Tooth Shoulder; 18. Pillar Anti-rotation Structure; 19. Hole Anti-rotation Structure; 20. Inner Hole Snap Spring Groove; 21. Outer Hole Snap Spring Groove; 22. Cambered-head V-shaped Opening Snap Spring; 23. Disassembly Groove; 24. Conical Projection; 25. Conical Groove; 26. Positioning Boss; 27. Impact Rack; 28. Positioning Concave Hole; 29. Elastic Bayonet; 30. Concave Hole; 31. Tapered Hole; 32. Lock Head; 33. Lock Root; 34. Elastomer; 35. Stepped Hole; 36. Blocker; 37. Tooth Body; 38. Alloy Cutter Head; 39. Circulating Water Passage; 40. Unidirectional Water Passage; 41. Seal Element; 42. Water Inlet Passage; 43. Water Outlet Passage; 44. Cambered Surface of Outer Cambered Surface Snap

Spring Groove; 45. Outer Cambered Surface of Outer Cambered Surface Snap Spring; 46. Snap Spring Hole Groove; 47. Left Snap Spring Hole Groove; 48. Right Snap Spring Hole Groove; 49. Left Pin Pillar; 50. Right Pin Pillar; 51. Cambered head Section Groove; 52. Cambered head Section; 53. Wear-reducing Concave Surface; 54. Material Guiding Surface; 55. Transverse Cambered Pillar Projection of Tooth seat; 56. Transverse Cambered Pillar Groove of Impact Tooth; 57. Cambered Surface; 58. Outer Cambered Surface Snap Spring Groove; 59. Outer Cambered Surface Snap Spring Deformation Groove; 60. Transverse Cambered Pillar Projection Shoulder of Tooth Seat; 61. Transverse Cambered Pillar Groove Shoulder of Impact Tooth; 62. Elastic Retaining Ring for Hole; 63. Elastic Retaining ring Groove for Hole; 64. Projection Blocking Table; 65. Snap-fitted Line; 66. Outer Cambered Surface Snap Spring; 67. Cambered-head Clamping Board Opening Ring Snap Spring; 68. Wear-resistant Alloy Block; 69. Wear-resistant Stiffener; 70. Rounded Transition; 71. Tapered Projection; 72. Tapered Groove; 73. Expansion Pin; 74. Elastic Pin Hole Groove.

Detailed description

[0044] The reciprocating impact head disclosed by the invention is further illustrated by combining accompanying drawings.

Embodiment 1

[0045] Figure 1 to Figure 4 are the easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 1. The reciprocating impact head 4 comprises a reciprocating impact tooth 7, a fixed seat 6 and the like, and also comprises snap springs 7 and the like; the tooth seat 10 comprises a tooth seat insert 11, and also comprises tooth seat shoulders 13; the reciprocating impact tooth 5 comprises an impact tooth insertion pillar and the like, and also comprises an impact tooth 16, impact tooth shoulders 17 and the like, the impact tooth 16 is arranged on the impact tooth insertion pillar 14, and the impact tooth shoulders 17 are arranged at the lower part of the impact tooth 16; the reciprocating impact tooth 5 and the fixed seat 6 comprise the hole grooves which are provided with the snap springs 7 and the like, wherein the snap springs 7 are arranged in the hole groove; the fixed seat 6 and the reciprocating impact tooth 5 are connected, the snap springs 7 withstand the rearward pulling force of reciprocating impact movement, and the snap springs 7 prevent the reciprocating impact tooth 5 from dropping out of the fixed seat 6; the tooth seat insertion pillar 12 and/or the impact tooth insertion pillar 14 comprise(s) a pillar-type anti-rotation structure 18 and the like; the tooth seat insert 11 and/or the impact tooth insert 15 comprise(s) a groove-type anti-rotation structure 19 and the like; the impact tooth insertion pillar 14 is inserted into

the tooth seat insert 11; the impact tooth shoulders 17 and the tooth seat shoulders 13 are closely snap-fitted to withstand reciprocating impact reacting force, and the groove-type anti-rotation structure 19 and the pillar-type anti-rotation structure 18 are snap-fitted to prevent the reciprocating impact tooth 5 from rotating.

[0046] The tooth seat 10 comprises the tooth seat insertion pillar 12 and the like or comprises the tooth seat shoulders 13 and the like; the reciprocating impact tooth 5 comprises the impact tooth insertion 15 and the like, and also comprises the impact tooth 16, the impact tooth shoulders 17 and the like, the impact tooth 16 is arranged on the impact tooth insert 15, and the impact tooth shoulders 17 are arranged at the end of the impact tooth insert 15; the reciprocating impact tooth 5 and the fixed seat 6 comprise the hole grooves which are provided with the snap springs 7, the snap springs 7 are arranged in the hole groove, the fixed seat 6 and the reciprocating impact tooth 5 are connected, the snap springs 7 withstand the backward pulling force of reciprocating impact movement, and the snap springs 7 prevent the reciprocating impact tooth 5 from dropping out of the fixed seat 6; the tooth seat insertion pillar 12 and/or the impact tooth insertion pillar 14 comprise(s) the pillar-type anti-rotation structure 18; the tooth seat insert 11 and/or the impact tooth insert 15 comprise(s) the groove-type anti-rotation structure 19; the tooth seat insertion pillar 12 is inserted into the impact tooth insert 15; the impact tooth shoulders 17 and the tooth seat shoulders 13 are closely matched to withstand the reciprocating impact reacting force; the groove-type anti-rotation structure 19 and the pillar-type anti-rotation structure 18 are snap-fitted to prevent the reciprocating impact tooth 5 from rotating.

[0047] Or the elastic pins 8 or the locking pin 9 and the like are used for preventing the reciprocating impact tooth 5 from dropping out of the fixed seat 6.

[0048] The inner hole snap spring grooves 20 or the outer hole snap spring grooves 21 are formed in the combined part of the impact tooth insert 15 and the tooth seat insertion pillar 12.

[0049] The hole bottom of the tooth seat insert 11 and the bottom of the impact tooth insertion pillar 14 are jointed, the bottom and the bottom hole of the impact tooth insertion pillar 14 support the impact tooth 16 for reciprocating impact, and the tooth seat insert 11 and the tooth seat shoulders 13 are in integral connection.

[0050] The tooth seat shoulders 13 and/or the impact tooth shoulders 17 comprise the disassembly grooves 23 and the like, and when the impact tooth 16 is damaged and needs replacement, the tooth seat insert 11 is used for prying and pulling out the impact tooth insertion pillar 14 through the disassembly grooves 23.

[0051] The positioning boss 26 may be arranged at the lower part of the fixed seat 6, the positioning concave hole 28 which is snap-fitted with the positioning boss 26 is arranged on the impact rack 27, the positioning boss 26 is inserted into the positioning concave hole 28 to be positioned, and after the tooth seat 10 is righted and welded,

the tooth seat 10 and the impact rack 27 are firmly welded.

[0052] The positioning boss 26 comprises the conical positioning boss 26, or the cylindrical positioning boss 26, or the square positioning boss 26, or the rectangular positioning boss 26, or oval positioning boss 26, or the triangular positioning boss 26, or the polygonal positioning boss 26, or the bevel positioning boss 26 and the like.

[0053] Or the fixed seat and the impact rack are in integral connection.

[0054] The snap-fitted surfaces of the tooth seat shoulders 13 and the impact tooth shoulders 17 face to the object to be mined, the reacting force of the reciprocating impact acts on the snap-fitted surfaces, and the intensity of the impact reacting force withstood by the snap-fitted surfaces is large.

[0055] The reciprocating impact head device 2 comprises the driving assembly 1, wherein the driving assembly 1 comprises the crank-connecting rod driving assembly 3 and the like, and the driving assembly 1 drives the reciprocating impact tooth 5 for performing reciprocating impact.

Embodiment 2

[0056] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 2 are shown in figure 5 to figure 7. The embodiment 2 is different from the embodiment 1: the elastic pins 8 comprise the elastic bayonets 29, the tooth seat 10 is provided with the concave holes 30, the impact tooth insertion pillar 14 is correspondingly provided with the tapered holes 31 matched with the concave holes 30, and the elastic bayonets 29 are arranged in the tapered holes 31 and the concave holes 30.

[0057] The impact tooth insertion pillar 14 can also be correspondingly provided with the tapered groove, or the pin hole and the like matched with the concave holes 30.

[0058] Or the elastic bayonets 29 are arranged in the tapered groove and the concave holes 30, or is arranged in the pin hole and the concave holes 30 and the like.

[0059] The elastic pins 8 comprise the elastic bayonets 29, wherein the elastic bayonets 29 comprise the lock heads 32 and the lock roots 33, the elastomers 34 are arranged at the back of the lock roots 33, and the lock heads 32 are arranged at one end or two ends of the elastomers 34; the tooth seat 10 is provided with the concave holes 30, the tapered holes 31 matched with the concave holes 30 are correspondingly formed in the impact tooth insertion pillar 14, the lock heads 32 are arranged in the tapered holes 31, the lock heads 32 and the tapered holes 31 are closely matched, the lock roots 33 and the elastomers 34 are arranged in the concave holes 30, and the lock roots 33 and the concave holes 30 are closely matched.

[0060] Or the lock heads 32 are arranged in the tapered groove or the keyhole and the like, the lock heads 32 are

closely matched with the tapered groove, or the keyhole and the like, the lock roots 33 and the elastomers 34 are arranged in the concave holes 30, and the lock roots 33 and the concave holes 30 are closely matched.

[0061] Other parts of the embodiment 2 are the same as the embodiment 1.

Embodiment 3

[0062] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 3 is shown in figure 8. The embodiment 3 is different from the embodiment 1: the elastic pins 8 comprise the elastic bayonets 29, the tooth seat 10 is provided with the concave holes 30, and the reciprocating impact tooth 5 is correspondingly provided with the stepped holes 35 matched with the concave holes 30; the elastic bayonets 29 are arranged in a large hole of the stepped holes 35 and the concave holes 30; the elastic bayonets 29 comprise the lock heads 32 and the lock roots 33, the elastomers 34 are arranged at the back of the lock roots 33, the lock roots 33 and the elastomers 34 are arranged in the concave holes 30, and the lock heads 32 are arranged in the large hole of the stepped holes 35; when the reciprocating impact tooth 5 is disassembled, the soldering rod which is smaller than the stepped holes 35 is used for pushing the lock heads 32 into the concave holes 30 from the small hole of the stepped holes 35, and the reciprocating impact tooth 5 is disassembled.

[0063] The reciprocating impact tooth 5 can also be correspondingly provided with the stepped groove or the keyhole and the like matched with the concave holes 30.

[0064] Other parts of the embodiment 3 are the same as the embodiment 1.

Embodiment 4

[0065] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 3 is shown in figure 9. The embodiment 4 is different from the embodiment 1: the fixed seat 6 comprises the impact rack 27, wherein the impact rack 27 comprises the tapered impact rack 27, or coal outlet hole impact rack 27, or the flat impact rack 27, or the cambered surface impact rack 27 or the mushroom head impact rack 27, and the impact rack 27 and the fixed seat 6 are in split connected or are in integral connection.

[0066] Other parts of the embodiment 4 are the same as the embodiment 1.

Embodiment 5

[0067] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 5 is shown in the figure 10. The embodiment 5 is different from the embod-

iment 1: the blocker 36 is arranged at the lower part of the impact tooth 16, the blocker 36 is snap-fitted on the tooth seat 10 to be used for preventing the dust, the water, or the material scraps and the like from entering the tooth seat insert 11 or the combined parts of the tooth seat shoulders 13 and the impact tooth shoulders 17 to enable the impact direction of the reciprocating impact tooth 5 to be inclined so as to prevent the dust, the water, corrosive or the material scraps and the like from corroding the impact tooth insertion pillar 14, and the reciprocating impact tooth 5 is righted.

[0068] Others of the embodiment 5 are the same as the embodiment 1.

Embodiment 6

[0069] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 6 is shown in the figure 11 to the figure 12. The embodiment 6 is different from the embodiment 1: the reciprocating impact tooth 5 comprises the tooth body 37 and the alloy cutter head 38, wherein the alloy cutter head 38 is fixed on the tooth body 37, the tooth body 37 and the alloy cutter head 38 can be in split connection, and the tooth body 37 and the alloy cutter head 38 can be fixed in an insertion hole manner, or a snap-fitted groove manner, or a welding manner, or a locking pin 9 manner, or a shoulder manner and the like.

[0070] Or the tooth body 37 and the alloy cutter head 38 can also be in integral connection.

[0071] Or the impact tooth 16 is a round head tooth, or a flat head tooth, or a tapered head tooth, or an emboli form tooth, or a cutter head tooth, or a bevel tooth, or a multi-arris tooth and the like.

[0072] Others of the embodiment 6 are the same as the embodiment 1.

Embodiment 7

[0073] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 7 is shown in the figure 13 to the figure 15. The embodiment 7 is different from the embodiment 1: the impact tooth insertion pillar 14, the impact tooth 16, the fixed seat 6 and the impact rack 27 are provided with the circulating water passage 39 and the like, the sealing elements 41 and the like are arranged at the joint of the tooth seat insert 11 and the impact tooth insertion pillar 14, the sealing elements 41 are used for preventing water from being permeated into the tooth seat insert 11 from the water passage, the circulating water passage 39 comprises the water inlet passage 42, the water outlet passage 43 and the like, the water inlet passage 42 and the water outlet passage 43 are arranged in parallel and are mutually communicated at the upper part of the impact tooth 16, and the water flows in from the water inlet passage 42 in the tooth seat

10 and flows out of the water outlet passage 43 so as to enable the impact tooth 16 to lower the temperature.

[0074] The impact tooth insertion pillar 14, the impact tooth 16, the fixed seat 6 and the impact rack 27 can also be provided with the unidirectional water passage 40.

[0075] Others of the embodiment 7 are the same as the embodiment 1.

Embodiment 8

[0076] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 8 is shown in the figure 16 to the figure 17. The embodiment 8 is different from the embodiment 1: the pillar-type anti-rotation structure 18 comprises the anti-rotation structure 18 with a round lower part and a prismatic upper part, or the square pillar-type anti-rotation structure 18, or the triangle pillar-type anti-rotation structure, or the polygonal pillar-type anti-rotation structure 18, or the anti-rotation structure 18 with a round upper part and a prismatic lower part, or the concave-convex snap-fitted anti-rotation structure, or the bayonet anti-rotation structure, or the ramp anti-rotation structure and the like, and the pillar-type anti-rotation structure 18 and the impact tooth insertion pillar 14 are in split connection or in integral connection.

[0077] Others of the embodiment 8 are the same as the embodiment 1.

Embodiment 9

[0078] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 9 is shown in the figure 18. The embodiment 9 is different from the embodiment 1: the sealing elements 41 are arranged between the fixed seat 6 and the reciprocating impact tooth caliper, the sealing elements 41 are arranged between the impact tooth shoulders 17 and the tooth seat shoulders, and the sealing elements 41 are used for preventing water, materials, dust or corrosive and the like from entering a position between the tooth seat insert 11 and the impact tooth insertion pillar 14.

[0079] Or the sealing elements 41 are also arranged between the impact tooth insertion pillar 14 and the tooth seat insert 11.

[0080] Others of the embodiment 9 are the same as the embodiment 1.

Embodiment 10

[0081] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 10 is shown in the figure 19 to the figure 20. The embodiment 10 is different from the embodiment 1: the pillar-type anti-rotation structure 18 comprises the anti-rotation structure 18 with a round upper part and a prismatic lower part; the impact

tooth insertion pillar 14 is the impact tooth insertion pillar 14 with a round upper part and an arris-shaped lower part, and impact tooth insertion pillar 14 with a round upper part and an arris-shaped lower part comprises an upper cylindrical body and a lower arris-shaped body; the tooth seat insert 11 comprises the tooth seat insert 11 with a round upper part and an arris-shaped lower part, and the tooth seat insert 11 with a round upper part and an arris-shaped lower part comprises an upper cylindrical hole and a lower arris-shaped groove; the upper cylindrical body and the upper cylindrical hole are snap-fitted, the inner snap springs or the elastic pins are arranged in the snap-fitted part so as to enable the reciprocating impact tooth 5 and the tooth seat 10 to be firmly snap-fitted together to prevent the reciprocating impact tooth 5 from dropping, the lower arris-shaped body and the lower arris-shaped groove are closely matched to prevent the reciprocating impact tooth 5 from rotating, and the impact direction of the reciprocating impact tooth 5 is righted.

[0082] Or the anti-rotation structure is the anti-rotation anti-shaking structure formed by the impact tooth shoulders 17 and the tooth seat shoulders 13 in which the tooth seat 10 and the impact tooth insertion pillar 14 are closely snap-fitted.

[0083] Other parts of the embodiment 10 are the same as the embodiment 1.

Embodiment 11

[0084] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 11 is shown in Figure 21 to Figure 23. The embodiment 11 is different from the embodiment 1: the snap spring hole grooves 46 and the like are arranged in the combined part of the tooth seat insert 11 and the impact tooth insertion pillar 14, and the snap spring hole grooves 46 comprises the left snap spring hole groove 47, the right snap spring hole groove 48 and the like; the snap springs 7 comprise the cambered-head V-shaped opening snap spring 22 and the like, the cambered-head V-shaped opening snap spring 22 comprises the left pin pillar 49 and the right pin pillar 50, the distance between the opening of the left pin pillar 49 and the opening of the right pin pillar 50 is larger than the distance between the left snap spring hole groove 47 and the right snap spring hole groove 48, the left pin pillar 49 and the right pin pillar 50 of the cambered-head V-shaped opening snap spring 22 are correspondingly penetrated into the left snap spring hole groove 47 and the right snap spring hole groove 48 so as to prevent the tooth seat insert 11 and the impact tooth insertion pillar 14 from dropping, the left pin pillar 49 produces elastic force towards the left, and the right pin pillar 50 produces elastic force towards the right, so that the cambered-head V-shaped opening snap spring 22 is prevented from dropping from the fixed seat 6 and the reciprocating impact tooth 5.

[0085] The cambered head section groove 51 and the like are formed outside the tooth seat insert 11 or outside the impact tooth insert 15, the cambered head V-shaped opening snap spring 22 also comprises the cambered head section 52 and the like, the cambered head section 52 is arranged in the cambered head section groove 51 and the like, the cambered head section groove 51 protects the cambered head section 52, and the structure for disassembling the cambered head V-shaped snap spring 22 is arranged between the cambered head section 52 and the cambered head section groove 51.

[0086] Chamferings are arranged at the top ends of the left pin pillar 49 and the right pin pillar 50, so that the elastic pins 8 are conveniently penetrated.

[0087] Other parts of the embodiment 11 are the same as the embodiment 1.

Embodiment 12

[0088] The embodiment 12 is different from the embodiment 1: the transverse cambered pillar projection 55 of the tooth seat and the transverse cambered pillar groove 56 of the impact tooth are snap-fitted, the snap spring hole grooves 46 are arranged in the joined part, and the snap spring hole grooves 46 comprise the left snap spring hole groove 47 and the right snap spring hole groove 48; the snap springs 7 comprise the cambered head V-shaped opening snap spring 22 which comprises the left pin pillar 49 and the right pin pillar 50, the distance between the opening of the left pin pillar 49 and the opening of the right pin pillar 50 is larger than the distance between the left snap spring hole groove 47 and the right snap spring hole groove 48, the left pin pillar 49 and the right pin pillar 50 of the cambered head V-shaped opening snap spring 22 are correspondingly penetrated into the left snap spring hole groove 47 and the right snap spring hole groove 48 so as to prevent the reciprocating impact tooth 5 from dropping from the fixed seat 6, the left pin pillar 49 produces the elastic force towards the left, and the right pin pillar 50 produces the elastic force towards the right, so that the cambered head V-shaped opening snap spring 22 is prevented from dropping from the tooth seat 10.

[0089] Other parts of the embodiment 12 are the same as the embodiment 1.

Embodiment 13

[0090] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 13 is shown in figure 24. The embodiment 13 is different from the embodiment 1: the impact tooth 16 is provided with the wear-reducing concave surface 53 and the like; the wear-reducing concave surface 53 reduces the direct contact area of the impact tooth 16 and the materials, reduces the wear of the materials to the impact tooth 16, lowers the weight of the impact tooth 16, and reduces impact resistance.

The impact tooth 16 comprises the material guiding surface 54 and the like, the material guiding surface 54 comprises the bevel material guiding surface 54, or the cambered material guiding surface 54, or the plane material guiding surface 54, or the curved surface material guiding surface 54 and the like, and when dropped materials are impacted, the material guiding surface 54 smoothly guides out the materials.

[0091] Other parts of the embodiment 13 are the same as the embodiment 1.

Embodiment 14

[0092] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 14 is shown in figure 25 to figure 27. The embodiment 14 is different from the embodiment 1: the tooth seat insertion pillar 12 is the transverse cambered pillar projection 55 of the tooth seat and the like, the impact tooth insert 15 is correspondingly the transverse cambered pillar groove 56 of the impact tooth and the like, the transverse cambered pillar projection 55 of the tooth seat and the transverse cambered pillar groove 56 of the impact tooth are snap-fitted to prevent the reciprocating impact tooth 5 from rotating, the snap-fitted cambered surface 57 of the transverse cambered pillar projection 55 of the tooth seat and the transverse cambered pillar groove 56 of the impact tooth faces to the object to be mind, the reacting force of the reciprocating impact acts on the cambered surface 57, the intensity of the impact reacting force withstood by the cambered surface 57 is large, and the local deformation of the snap-fitted surface of the cambered pillar protrusion and/or the cambered pillar groove cannot be caused.

[0093] The snap springs 7 comprise the elastic retaining ring 62 for the hole, the elastic retaining ring groove 63 for the hole is arranged on the transverse cambered pillar groove 56 of the impact tooth, the projection blocking table 64 matched with the elastic retaining ring groove 63 for the hole is arranged on the transverse cambered pillar projection 55 of the tooth seat, the elastic retaining ring 62 for the hole is arranged at the snap-fitted end part of the elastic retaining ring groove 63 for the hole and the projection blocking table 64, the outer edge of the elastic retaining ring 62 for the hole is larger than the snap-fitted line 65, the inner edge of the elastic retaining ring 62 for the hole is smaller than the snap-fitted line 65, and the elastic retaining ring 62 for the hole prevents the transverse cambered pillar groove 56 of the impact tooth from dropping from the transverse cambered pillar projection 55 of the tooth seat.

[0094] The snap spring 7 comprises the spring steel snap spring, or the alloy steel snap spring, or the snap spring made of nylon materials, or the snap spring made of rubber materials, or the snap spring made of plastic materials, or the snap spring made of bamboo materials, or the snap spring made of composite materials and the like.

[0095] Other parts of the embodiment 14 are the same as the embodiment 1.

Embodiment 15

[0096] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 15 is shown in figure 28. The embodiment 15 is different from the embodiment 1: the snap springs 7 comprise the outer cambered surface snap springs 66 and the like; the fixed seat 6 comprises the tooth seat insert 11 and the like, and the outer cambered surface snap spring grooves 58 of the fixed seat 6 and the like are arranged in the tooth seat insert 11; the outer cambered surface snap spring deformation grooves 59 corresponding to the outer cambered surface snap spring grooves 58 are formed in the impact tooth insertion pillar 14; the outer cambered surface snap springs 66 are arranged on the outer cambered surface snap spring deformation grooves 59, the impact tooth insertion pillar 14 is pushed into the tooth seat insert 11, and the hole wall of the tooth seat insert 11 compresses the outer cambered surface snap springs 66 into the outer cambered surface snap spring deformation grooves 59; when the outer cambered surface snap springs 66 are pushed to the positions of the outer cambered surface snap spring grooves 58 of the fixed seat 6, the outer cambered surface snap springs 66 outwards spring and extend to be snapped into the outer cambered surface snap spring grooves 58 of the fixed seat 6; the impact tooth insertion pillar 14 and the tooth seat insert 11 are snap-fitted, and the outer cambered surface snap springs 66 prevent the impact tooth insertion pillar 14 from dropping from the tooth seat insert 11; the disassembly grooves 23 are formed in the impact tooth insertion pillar 14 and/or the tooth seat insert, the force which is larger than the deformation of each outer cambered surface snap spring is used for prying and/or pulling out the impact tooth insertion pillar 14 through the disassembly grooves 23, the impact tooth insertion pillar 14 is outwards moved from the tooth seat insert 11 so as to push the outer cambered surface snap springs 66 into the outer cambered surface snap spring deformation grooves 59, and therefore, the impact tooth insertion pillar 14 is pulled out of the hole of the tooth seat insert 11.

[0097] The height of the cambered surface 44 of each outer cambered surface snap spring groove is smaller than the radius of the outer cambered surface 45 of each outer cambered surface snap spring, and the situation that the outer cambered surface snap springs 66 enter the outer cambered surface snap spring grooves 58 so that the outer cambered surface snap springs 66 cannot be disassembled is prevented; the radius of the cambered surface 44 of each outer cambered surface snap spring groove is greater than or equal to the radius of the outer cambered surface 45 of each outer cambered surface snap spring, which is favorable for the outer cambered surface snap springs 66 to be snapped into the

outer cambered surface snap spring grooves 58, and is favorable for the outer cambered surface 45 of each outer cambered surface snap spring to be jointed with the groove surface of each outer cambered surface snap spring groove 58 so as to have a better anti-drop effect.

[0098] Other parts of the embodiment 15 are the same as the embodiment 1.

Embodiment 16

[0099] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 16 are shown in the Figure 29 to the Figure 30. The embodiment 16 is different from the embodiment 1: the tooth seat insertion pillar 12 comprises the transverse cambered pillar projection shoulders 60 of the tooth seat, the impact tooth insert 11 is correspondingly provided with the transverse cambered pillar groove shoulders 61 of the impact tooth, the transverse cambered pillar projection shoulders 60 of the tooth seat are snap-fitted with the transverse cambered pillar groove shoulders 61 of the impact tooth to prevent the impact tooth 16 from rotating and withstand the impact force.

[0100] Other parts of the embodiment 16 are the same as the embodiment 1.

Embodiment 17

[0101] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 17 are shown in figure 31. The embodiment 17 is different from the embodiment 1: the inner hole snap spring grooves 20 and the outer hole snap spring grooves 21 are formed in the combined part of the tooth seat insert 11 and the impact tooth insertion pillar 14, the outer cambered surface snap springs 66 are pressed into the inner hole snap spring grooves 20, the cambered head V-shaped opening snap spring 22 is inserted into the outer hole snap spring grooves 21, the cambered head V-shaped opening snap spring 22 prevents the impact tooth insertion pillar 14 from rotating, and the cambered head V-shaped opening snap springs 22 and the outer cambered surface snap springs 66 are matched to jointly prevent the reciprocating impact tooth 5 from dropping.

[0102] Other parts of the embodiment 17 are the same as the embodiment 1.

Embodiment 18

[0103] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 18 are shown in the figure 32. The embodiment 18 is different from the embodiment 1: the tooth seat shoulders 13 are provided with the conical projection 24, the impact tooth shoulders 17 are correspondingly provided with the conical groove 25,

the conical projection 24 of the tooth seat shoulders 13 and the conical groove 25 of the impact tooth shoulders 17 are closely snap-fitted to prevent the dust, the water, the coal slime, the corrosive or the material scraps and the like from entering the tooth seat insert 11 and protect the snap springs 7 from being polluted by the materials.

[0104] Other parts of the embodiment 18 are the same as the embodiment 1.

Embodiment 19

[0105] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 19 are shown in the Figure 33. The embodiment 19 is different from the embodiment 1: the snap springs 7 are the cambered-head clip board opening ring snap spring 67 which is arranged in the combined part of the tooth seat insert 11 and the impact tooth insertion pillar 14, and the cambered-head clip board opening ring snap spring 67 stops the impact tooth insertion pillar 14 from dropping from the tooth seat insert 11.

[0106] The inner snap springs, the outer snap springs, or the outer cambered surface snap springs, or the cambered head V-shaped opening snap springs 22, or the retaining ring for the shaft, or the elastic retaining ring 62 for the hole, or the steel wire elastic retaining ring, or the tapered pin elastic retaining ring and the like are arranged in the combined part of the tooth seat insert 11 and the impact tooth insertion pillar 14.

[0107] Others of the embodiment 19 are the same as the embodiment 1.

Embodiment 20

[0108] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 20 are shown in the Figure 34 to the Figure 35. The embodiment 20 is different from the embodiment 1: the wear-resistant stiffener 69 or the wear-resistant alloy block 68 is arranged at the side part of the reciprocating impact tooth 5, and the wear-resistant stiffener 69 or the wear-resistant alloy block 68 is welded to the side part of the reciprocating impact tooth 5 so as to reduce the wear to the reciprocating impact tooth 5.

[0109] The cambered surface 57 is formed at the front side part, or the rear side part, or the two side parts of the reciprocating impact tooth 5, the cambered surface 57 is the single cambered surface 57 or the combination of a plurality of cambered surfaces 57, and the cambered surface 57 reduces the frictional resistance of an impact tooth body.

[0110] The rounded transition 70 is formed at the edges and corners of the reciprocating impact tooth 5, and the frictional resistance when the reciprocating impact tooth 5 is in contact with the materials is reduced.

[0111] Others of the embodiment 20 are the same as

the embodiment 1.

Embodiment 21

[0112] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 21 is shown in the figure 36. The embodiment 21 is different from the embodiment 1: the tooth seat insertion pillar 12 or the impact tooth insertion pillar 14 is provided with the tapered projection 71, the tapered groove 72 is correspondingly formed in the impact tooth insert 15 or the tooth seat insert 11, the tapered projection 71 and the tapered groove 72 are snap-fitted, the reciprocating impact force acts on the jointed surface of the impact tooth shoulders 17 and the tooth seat shoulders 13, and the tapered projection 71 and the tapered groove 72, which are snap-fitted, and the snap springs 7 jointly prevent the reciprocating impact tooth 5 from dropping.

[0113] Others of the embodiment 21 are the same as the embodiment 1.

Embodiment 22

[0114] The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, illustrated in the embodiment 22 is shown in the figure 37 to the figure 38. The embodiment 22 is different from the embodiment 1: the elastic pins 8 comprise the expansion pin 73 which is arranged in the elastic pin hole groove 74 of the reciprocating impact tooth 5 and the fixed seat 6, the expansion pin 73 is connected with the reciprocating impact tooth 5 and the fixed seat 6 in a penetrating manner, after the elastic pins 8 are automatically sprung, the expansion pin 73 is prevented from dropping from the hole groove, and the reciprocating impact tooth 5 and the fixed seat 6 are connected in a fastening manner. Others of the embodiment 22 are the same as the embodiment 1.

Claims

1. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine, **characterized by** comprising a reciprocating impact head device, wherein the reciprocating impact head device comprises a reciprocating impact head, the reciprocating impact head comprises a reciprocating impact tooth and a fixed seat, and also comprises snap springs or elastic pins or locking pins; the fixed seat comprises a tooth seat, the tooth seat comprises a tooth seat insert or a tooth seat insertion pillar, and also comprises tooth seat shoulders; the reciprocating impact tooth comprises an impact tooth insertion pillar or an impact tooth insert, and also comprise an impact tooth and impact tooth shoulders, wherein the impact tooth is arranged on the impact

tooth insertion pillar or the impact tooth insert, the impact tooth shoulders are arranged at the lower part of the impact tooth or at the end part of the impact tooth insert, and the reciprocating impact tooth and the fixed seat comprise hole grooves in which the snap springs or the elastic pins or the locking pins are arranged, the snap springs or the elastic pins or the locking pins are arranged in the hole grooves so as to connect the fixed seat and the reciprocating impact tooth in a penetrating manner, and the snap springs or the elastic pins or the locking pins withstand a rearward pulling force of the reciprocating impact motion. The snap springs or the elastic pins or the locking pins prevent the reciprocating impact tooth from dropping from the fixed seat, the tooth seat insertion pillar and/or the impact tooth insertion pillar comprise(s) a pillar anti-rotation structure, the tooth seat insert and/or the impact tooth insert comprise(s) a hole anti-rotation structure, and the impact tooth insertion pillar is inserted into the tooth seat insert or the tooth seat insertion pillar is inserted into the impact tooth insert; the impact tooth shoulders and the tooth seat shoulders are closely snap-fitted to withstand the reacting force of reciprocating impact, and the hole anti-rotation structure is snap-fitted with the pillar anti-rotation structure to prevent the reciprocating impact tooth from rotating.

2. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the hole bottom of the tooth seat insert is jointed with the bottom of the impact tooth insertion pillar, the bottom of the impact tooth insertion pillar and a bottom hole support the reciprocating impact of the impact tooth, and the tooth seat insert and the tooth seat shoulders are in integral connection.
3. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the tooth seat shoulders and/or the impact tooth shoulders comprise disassembly grooves, when the impact tooth is damaged and needs to be exchanged, the disassembly grooves are used for prying and pulling the impact tooth insertion pillar from the tooth seat insert.
4. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** each snap spring comprises an outer cambered surface snap spring, the fixed seat comprises a tooth seat insert, outer cambered surface snap spring grooves of the fixed seat are formed in the tooth seat insert, and outer cambered surface snap spring deformation grooves corresponding to the outer cambered surface snap spring grooves are formed in the impact tooth insertion pillar; the outer cambered surface snap springs

are arranged on the outer cambered surface snap spring deformation grooves, and the impact tooth insertion pillar is pushed into the tooth seat insert; the hole wall of the tooth seat insert compresses the outer cambered surface snap springs into the outer cambered surface snap spring deformation grooves; when the outer cambered surface snap springs are pushed into the positions of the outer cambered surface snap spring grooves of the fixed seat, the outer cambered surface snap springs spring and extend outwards to be clamped into the outer cambered surface snap spring grooves of the fixed seat, and the impact tooth insertion pillar is snap-fitted with the tooth seat insert; the outer cambered surface snap springs prevent the impact tooth insertion pillar from dropping from the tooth seat insert, and the disassembly grooves are formed in the impact tooth insertion pillar and/or the tooth seat insert, force which is larger than the deformation of the outer cambered surface snap springs is used for prying and/or pulling the impact tooth insertion pillar through the disassembly grooves, and the impact tooth insertion pillar is moved outwards from the tooth seat insert so as to push the outer cambered surface snap springs into the outer cambered surface snap spring deformation grooves, so that the impact tooth insertion pillar is pulled out from the hole of the tooth seat insert.

5. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the snap spring hole grooves are formed in the combined part of the tooth seat insert and the impact tooth insertion pillar or the combined part of the impact tooth insert and the tooth seat insertion pillar, each snap spring hole groove comprises a left snap spring hole groove and a right snap spring hole groove, and each snap spring comprises a cambered head V-shaped opening snap spring which comprises a left pin pillar and a right pin pillar, wherein the distance between the openings of the left pin pillar and the right pin pillar is larger than that between the left snap spring hole groove and the right snap spring hole groove, and the left pin pillar and the right pin pillar of the cambered head V-shaped opening snap spring penetrate through the left snap spring hole groove and the right snap spring hole groove correspondingly so as to prevent the tooth seat insert and the impact tooth insertion pillar from being divorced or prevent the impact tooth insert and the tooth seat insertion pillar from dropping, the left pin pillar generates elastic force towards the left, and the right pin pillar generates elastic force towards the right so as to prevent the cambered head V-shaped opening snap springs from dropping from the fixed seat and the reciprocating impact tooth.

6. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the cambered head section grooves are formed in the outside of the tooth seat insert or the outside of the impact tooth insert, and each cambered head V-shaped opening snap spring also comprises an cambered head section which is arranged in each cambered head section groove, the cambered head section grooves protect the cambered head section, and a structure for disassembling the cambered head V-shaped opening snap springs is arranged between the cambered head section and the cambered head section groove.
7. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** each elastic pin comprises an elastic bayonet which comprises a lock head and a lock root, wherein elastomers are arranged at the rear parts of the lock roots, the lock heads are arranged at one ends or both ends of the elastomers, concave holes are formed in the tooth seat, and tapered holes or tapered grooves or keyholes, which are matched with the concave holes are correspondingly formed in the impact tooth insertion pillar; the lock heads are arranged in the tapered holes or arranged in the tapered grooves or arranged in the keyholes, the lock heads are tightly matched with the tapered holes or the tapered grooves or the keyholes, the lock roots and the elastomers are arranged in the concave holes, and the lock roots are tightly matched with the concave holes.
8. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** each elastic pin comprises the elastic bayonet, the tooth seat is provided with the concave holes, the stepped holes or the stepped grooves or the keyholes, which are matched with the concave holes are correspondingly formed in the reciprocating impact tooth, and the elastic bayonets are arranged in a large stepped holes and the concave holes or are arranged in large stepped grooves or the concave holes or are arranged in the keyholes and the concave holes; each elastic bayonet comprises the lock head and the lock root, wherein the elastomers are arranged at the rear parts of the lock roots, the lock roots and the elastomers are arranged in the concave holes, the lock heads are arranged in the large stepped holes or in the large stepped grooves or in the keyholes, when the reciprocating impact tooth is disassembled, a soldering rod of which the diameter is smaller than that of the stepped holes is used for pushing the lock heads into the concave holes from the small stepped holes so as to disassemble the reciprocating impact tooth.
9. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the tooth seat insertion pillar comprises transverse cambered pillar projection shoulders of the tooth seat, the impact tooth insert is correspondingly provided with the transverse cambered pillar groove shoulders of the impact tooth, and the transverse cambered pillar projection shoulders of the impact tooth are snap-fitted with the transverse cambered pillar groove shoulders of the impact tooth so as to prevent the impact tooth from rotating and to withstand the impact force.
10. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the tooth seat comprises a hole anti-rotation structure and/or a hole anti-shaking structure, the impact tooth insertion pillar comprises a pillar anti-rotation structure and/or a pillar anti-shaking structure, and the pillar anti-rotation structure and/or the pillar anti-shaking structure maintain (s) that the reciprocating impact tooth vertically impacts materials, when the hole anti-shaking structure is formed to be in the shoulder cambered surface hole anti-shape structure, the pillar anti-shaking structure is correspondingly provided with the shoulder cambered surface pillar anti-shaking structure, and the shoulder cambered surface hole anti-shaking structure is snap-fitted with the shoulder cambered surface pillar anti-shaking structure; or when the hole anti-shaking structure is arranged to be a shoulder polygonal hole anti-shaking structure, the pillar anti-shaking structure is correspondingly provided with a polygonal pillar anti-shaking structure, and the shoulder polygonal hole anti-shaking structure is snap-fitted with the polygonal pillar anti-shaking structure; or when the hole anti-shaking structure is arranged to be in a tooth seat bottom hole anti-shaking structure, the pillar anti-shaking structure is correspondingly provided with a bottom anti-shaking structure of the impact tooth insertion pillar so as to prevent the reciprocating impact tooth from shaking.
11. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the tooth seat shoulders of which the tooth seat is tightly snap-fitted with the impact tooth insertion pillar forms an anti-rotation shaking structure along with the impact tooth shoulders.
12. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the tooth seat insertion pillar is the transverse cambered pillar pro-

jection of the tooth seat, the impact tooth insert is the transverse cambered pillar groove of the impact tooth correspondingly, the transverse cambered pillar projection of the tooth seat is snap-fitted with the transverse cambered pillar grooves of the impact tooth so as to prevent the reciprocating impact tooth from rotating, and the transverse cambered pillar projection of the tooth seat is snap-with the transverse cambered pillar grooves of the impact tooth, so that an cambered surface faces to an object to be mined; the reacting force of the reciprocating impact acts on the cambered surface, the cambered surface withstands large intensity of the reacting force of the impact without enabling the local surface of the snap-fitted surface of the cambered surface pillar projection and/or the cambered surface pillar groove to be deformed.

13. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the snap spring comprises an elastic retaining ring for the hole, the elastic retaining ring groove for the hole is formed in the transverse cambered pillar grooves of the impact tooth, a projection blocking table matched with the elastic retaining ring groove for the hole is arranged on the transverse cambered pillar projection of the tooth seat, the elastic retaining ring for the hole is arranged at the snap-fitted end part of the elastic retaining ring groove for the hole and the projection blocking table, the outer edge of the elastic retaining ring for the hole is larger than the snap-fitted line, the inner edge of the elastic retaining ring for the hole is smaller than the snap-fitted line, and the elastic retaining ring for the hole prevents the transverse cambered pillar groove of the impact tooth from dropping from the transverse cambered pillar projection of the tooth seat.
14. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the impact tooth insertion pillar comprises an impact tooth insertion pillar with an upper circular part and a lower rhombic part, wherein the impact tooth insertion pillar with the upper circular part and the lower rhombic part comprises an upper cylindrical body and a lower rhombic body; the tooth seat insert comprises a tooth seat insert with an upper circular part and a lower rhombic part, wherein the tooth seat insert with the upper circular part and the lower rhombic part comprises an upper cylindrical hole and a lower rhombic groove; the upper cylindrical body is snap-fitted with the upper cylindrical hole, and inner snap springs or elastic pins are arranged in the snap-fitted space, so that the reciprocating impact tooth is firmly snap-fitted with the tooth seat together so as to prevent the reciprocating impact tooth from dropping; the lower

rhombic body and the lower rhombic groove are tightly matched so as to prevent the reciprocating impact tooth from rotating, and the impact direction of the reciprocating impact tooth is righted.

15. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the pillar anti-rotation structure comprises an anti-rotation structure with a lower circular part and an upper prismatic part, or a square pillar anti-rotation structure, or a triangular pillar anti-rotation structure, or a polygonal pillar anti-rotation structure, or an anti-rotation structure with an upper circular part and a lower prismatic part, or a concavo-convex snap-fitted anti-rotation structure, or a locking pin anti-rotation structure, or a sloping table anti-rotation structure, and the pillar anti-rotation structure and the impact tooth insertion pillar are in split connection or in integral connection.
16. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the snap-fitted surfaces of the tooth seat shoulders and the impact tooth shoulders face to the object to be mined, the reacting force of the reciprocating impact acts on the snap-fitted surfaces, and the snap-fitted surfaces withstand large intensity of the reacting force of the impact.
17. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** a blocker is arranged at the lower part of the impact tooth, the blocker is snap-fitted with the tooth seat to be used for stopping dust, water or material scraps from entering the tooth seat insert or entering combined parts of the tooth seat shoulders and the impact tooth shoulders to enable the impact direction of the reciprocating impact tooth to be inclined and preventing the dust, the water, a corrosive or the material scraps from corroding the impact tooth insertion pillar, and the reciprocating impact tooth is righted.
18. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the reciprocating impact tooth comprises a tooth body, and an alloy cutter head, wherein the alloy cutter head is fixed on the tooth body, and the tooth body and the alloy cutter head are in split connection or in integral connection; the tooth body and the alloy cutter head are fixed in an insertion hole manner, or a buckling groove manner, or a welding manner, or a locking pin manner or a shoulder manner.
19. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine

of claim 1, **characterized in that** sealing elements are arranged between the fixed seat and the reciprocating impact tooth and is arranged between the impact tooth shoulders and the tooth seat shoulders or between the impact tooth insertion pillar and the tooth seat insert, and the sealing elements prevent the water, the material, the dust or the corrosive from entering a space between the tooth seat insert and the impact tooth insertion pillar.

20. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the fixed seat comprises an impact rack, wherein an impact tooth insertion pillar, the impact tooth, the fixed seat and the impact rack are provided with a circulating water passage or an unidirectional water passage, the sealing elements are arranged at the jointed part of the tooth seat insert and the impact tooth insertion pillar, the sealing elements prevent water from being permeated into the tooth seat insert from the water passage, and the circulating water passage comprises a water inlet passage and a water outlet passage which are arranged in parallel and are communicated mutually at the upper part of the impact tooth; the water flows into the water inlet passage from the tooth seat and flows out from the water outlet passage, so that the temperature of the impact tooth is lowered.
21. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the impact tooth is provided with a wear-reducing concave surface which decreases the direct contact area of the impact tooth with the materials, reduces the wear of the materials on the impact tooth, lowers the weight of the impact tooth and reduces the impact resistance.
22. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the impact tooth comprises a material guiding surface which comprises a bevel material guiding surface or a cambered surface material guiding surface or a plane material guiding surface or a curved surface material guiding surface, and when the dropped materials are impacted, the material guiding surface smoothly guides out the materials.
23. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** each tooth seat shoulder is provided with a conical projection, each impact tooth shoulder is provided with a conical groove, the conical projections of the tooth seat shoulders are tightly snap-fitted with the conical grooves of the impact tooth shoulders so as to pre-

vent the dust, the water, coal slime, the corrosive or the material scraps from entering the tooth seat insert and prevent the snap springs, or the elastic pins, or the locking pins from being polluted by the materials.

24. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** a positioning boss is arranged at the lower part of the fixed seat, a positioning concave hole which is snap-fitted with the positioning boss is formed in the impact rack, the positioning boss is inserted into the positioning concave hole to be positioned, and after the tooth seat is righted and welded, the tooth seat and the impact rack are firmly welded.
25. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 24, **characterized in that** the positioning boss comprises a tapered positioning boss or a cylindrical positioning boss or a square positioning boss or a rectangular positioning boss or an elliptic positioning boss or a triangular positioning boss or a polygonal positioning boss.
26. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** inner hole snap spring grooves and outer hole snap spring grooves are formed in the combined part of the tooth seat insert and the impact tooth insertion pillar, and the combined part of the impact tooth insert and the tooth seat insertion pillar, the outer cambered surface snap springs are pressed in the inner hole snap spring grooves, cambered head V-shaped opening snap springs are inserted into the outer hole snap spring grooves, the cambered head V-shaped opening snap springs prevent the impact tooth insertion pillar from rotating, and the cambered head V-shaped opening snap springs and the outer cambered surface snap springs are matched to jointly prevent the reciprocating impact tooth from dropping.
27. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the impact tooth comprises a circular head tooth, or a flat head tooth, or a tapered head tooth, or an emboliform tooth, or a cutter head tooth, or a bevel tooth or a multi-arris tooth.
28. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the fixed seat comprises an impact rack which comprises a tapered impact rack or a coal discharge hole impact rack or

a flat impact rack or an cambered surface plate type impact rack or a mushroom head impact rack, and the impact rack and the fixed seat are in split connection or in integral connection.

29. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 4, **characterized in that** the height of the cambered surface of the outer cambered surface snap spring groove is smaller than the radius of the outer cambered surface of each outer cambered surface snap spring, so that the situation that the outer cambered surface snap springs enter the outer cambered surface snap spring grooves so that the outer cambered surface snap springs cannot be disassembled is avoided; the radius of the cambered surface of each outer cambered surface snap spring groove is greater than or equal to the radius of the outer cambered surface of each outer cambered surface snap spring, which is favorable for the outer cambered surface snap springs to be clamped in the outer cambered surface snap spring grooves, and is favorable for the outer cambered surfaces of the outer cambered surface snap springs to be jointed with the groove surfaces of the outer cambered surface snap spring grooves, so that a better dropping prevention function is played.
30. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** each snap spring comprises an inner snap spring or an outer snap spring or an outer cambered surface snap spring or an cambered head V-shaped opening snap spring or a cambered head clamping board opening ring snap spring or an elastic retaining ring for a shaft, or an elastic retaining ring for the hole, or a steel wire elastic retaining ring or a tapered pin elastic retaining ring.
31. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** each snap spring comprises a snap spring made of spring steel, or a snap spring made of alloy steel, or a snap spring made of nylon materials, or a snap spring made of a rubber material, or a snap spring made of a plastic material, or a snap spring made of a bamboo material, or a snap spring made of a composite material.
32. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 12, **characterized in that** the transverse cambered pillar projection of the tooth seat comprises a cambered surface projection or an cambered surface projection or a rectangular projection or a triangular projection or a polygonal projection, or a column projection or a T-shaped projection or an

cambered head T-shaped projection, the transverse cambered pillar groove of the impact tooth comprises a curved groove or an cambered surface groove or a rectangular groove or a triangular groove or a polygonal groove or a column groove or a T-shaped groove or a cambered head T-shaped groove, and the transverse cambered pillar groove of the impact tooth comprises a through hole groove or a blind hole groove or a blocker groove.

33. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** a wear-resistant stiffener or a wear-resistant alloy block is arranged at the side part of the reciprocating impact tooth, and the wear-resistant stiffener or the wear-resistant alloy block is welded to the side part of the reciprocating impact tooth, so that the wear to the reciprocating impact tooth is reduced.
34. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the front side part, or the rear side part or both side parts of the reciprocating impact tooth are formed into cambered surfaces, and the cambered surfaces are single cambered surfaces or the combination of a plurality of cambered surfaces, and the cambered surfaces reduce the frictional resistance of the impact tooth body.
35. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the tooth seat insertion pillar or the impact tooth insertion pillar is provided with a tapered projection, the tapered groove is correspondingly formed in the impact tooth insert or the tooth seat insert, the tapered projection is snap-fitted with the tapered groove, the reciprocating impact force acts on the jointed surface of the impact tooth shoulders and the tooth seat shoulders, and the tapered projection is snap-fitted with the tapered groove so as to jointly prevent the reciprocating impact tooth from dropping along with the snap spring.
36. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the elastic pin comprises an expansion pin which is arranged in an elastic pin hole groove of the reciprocating impact tooth and the fixed seat, the expansion pin is connected with the reciprocating impact tooth and the fixed seat in a penetrating manner, and after the expansion pin is automatically sprung, the expansion pin is prevented from dropping from the hole grooves, so that the reciprocating impact tooth is tightly connected with the fixed seat.

37. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the edges and the corners of the reciprocating impact tooth are in rounded transition, so that the frictional resistance when the reciprocating impact tooth is in contact with the materials is reduced.

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38. The easily removable reciprocating impact head with an anti-rotation insertion hole for a mining machine of claim 1, **characterized in that** the reciprocating impact head device comprises a driving assembly which comprises a hydraulic pressure driving assembly or a crank-connecting rod driving assembly or an air pressure driving assembly or a magnetic force driving assembly, wherein the driving assembly drives the reciprocating impact head to perform reciprocating impact.

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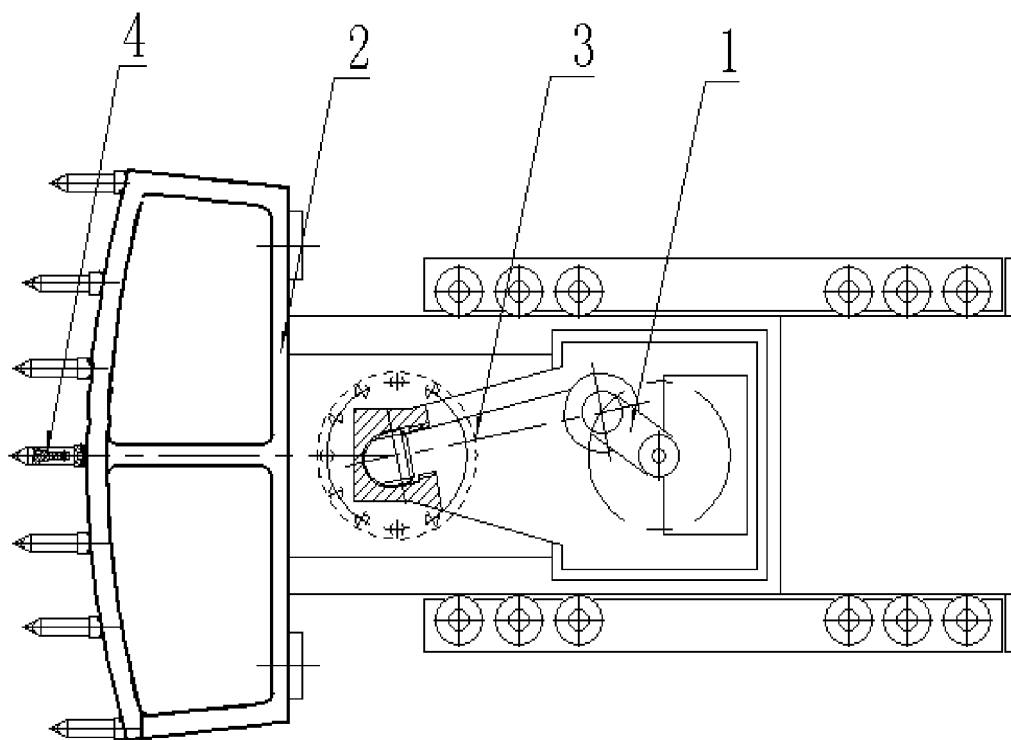


Fig.1

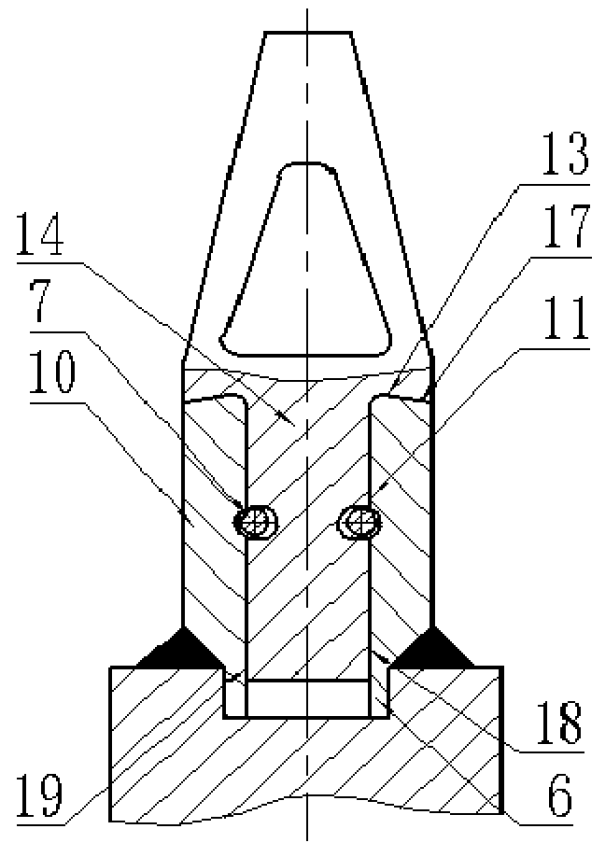


Fig.2

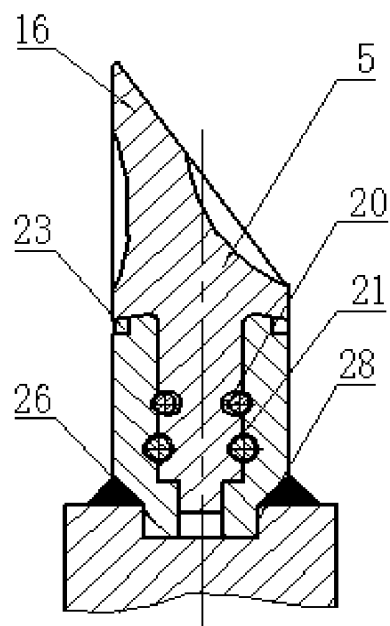


Fig.3

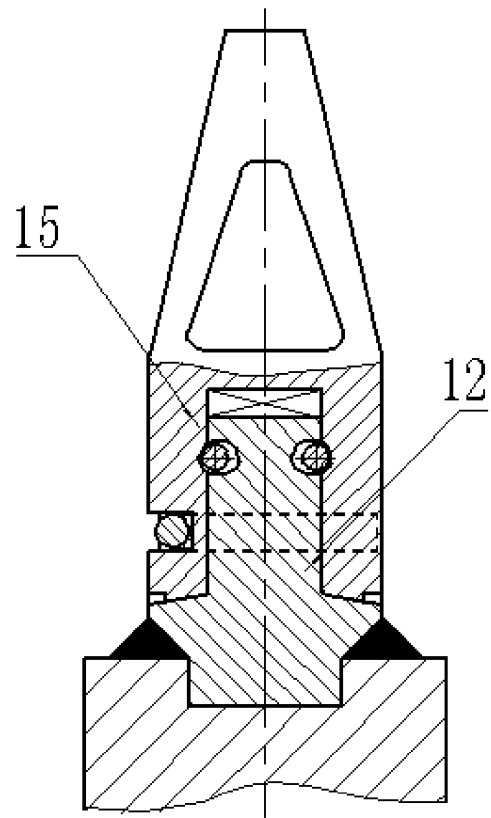


Fig.4

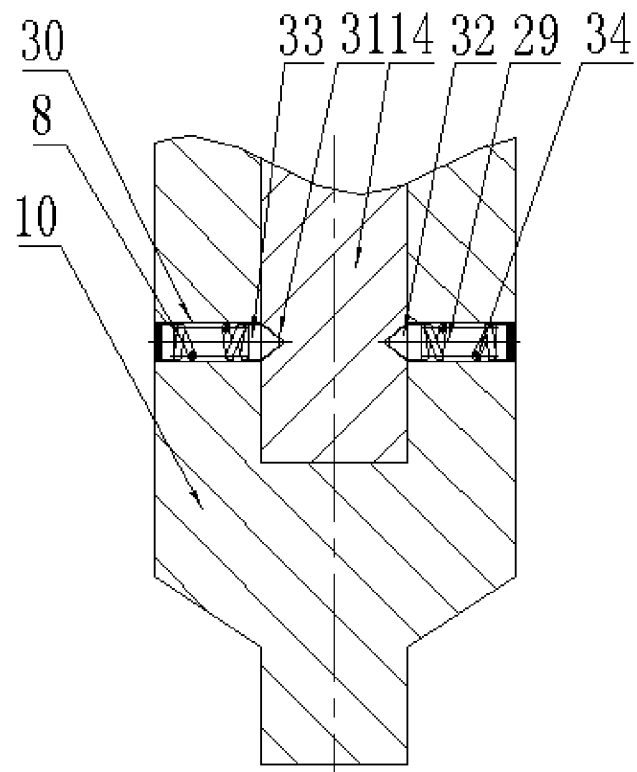


Fig.5

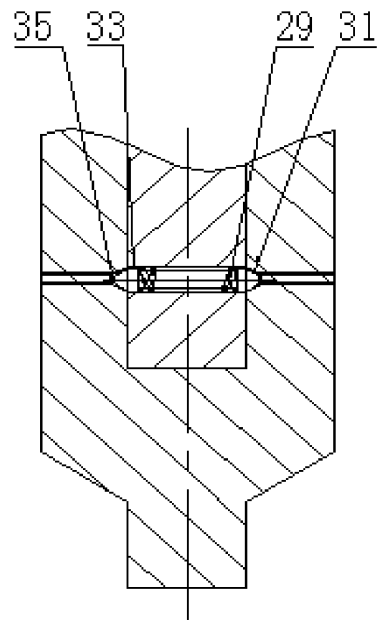


Fig.6

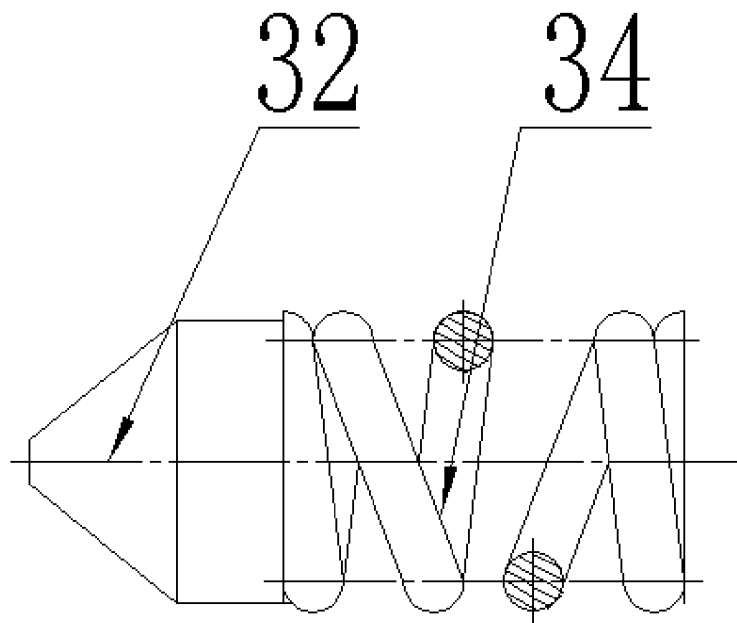


Fig.7

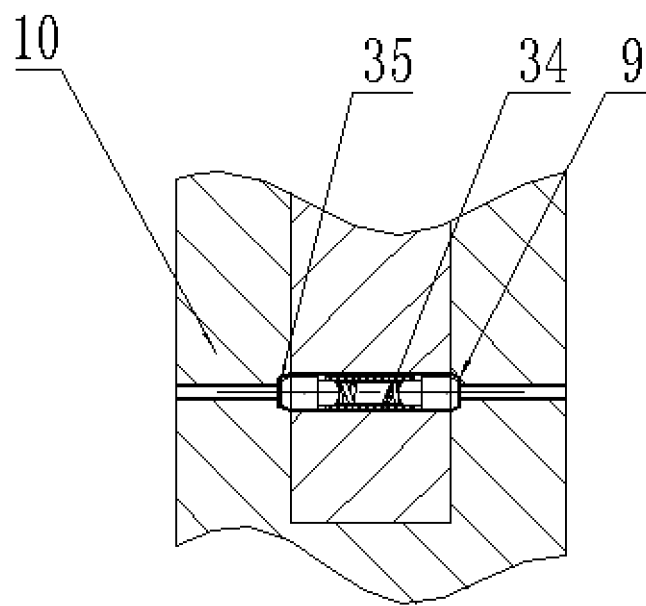


Fig.8

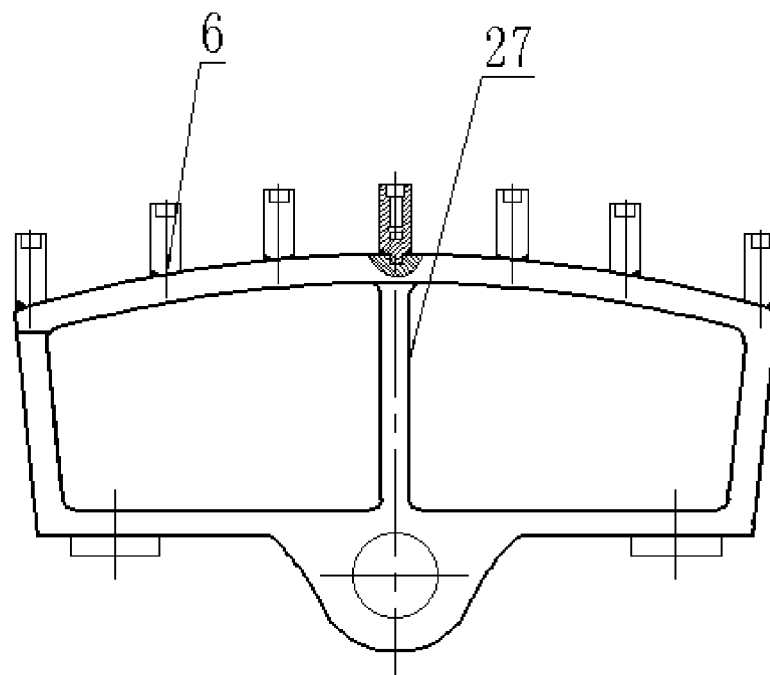


Fig.9

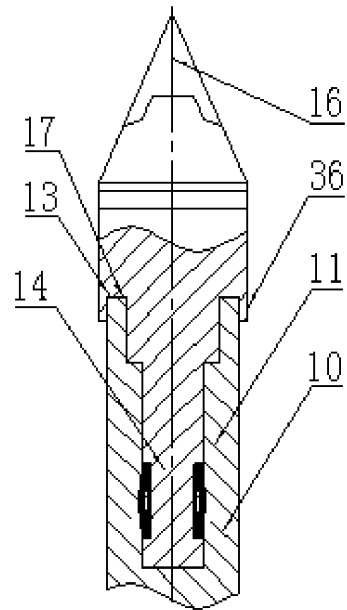


Fig.10

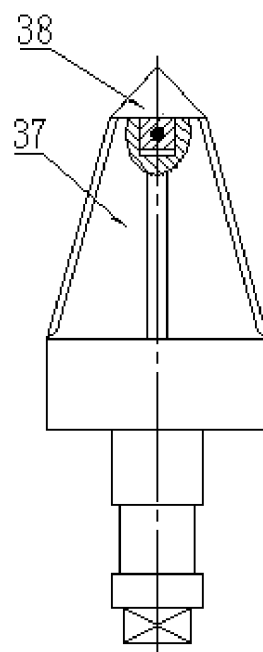


Fig.11

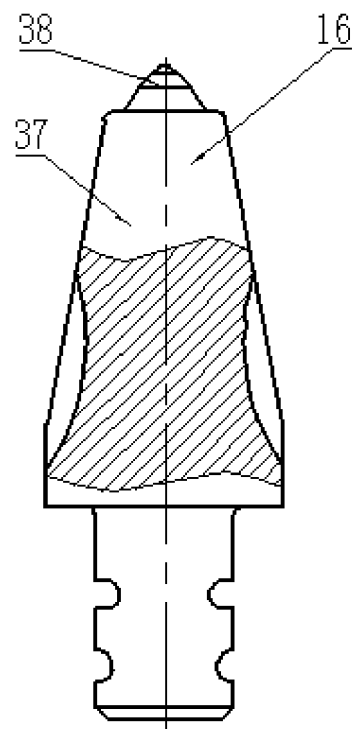


Fig.12

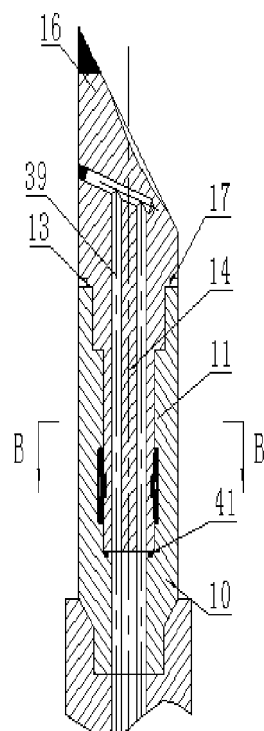


Fig.13

B-B 42 43

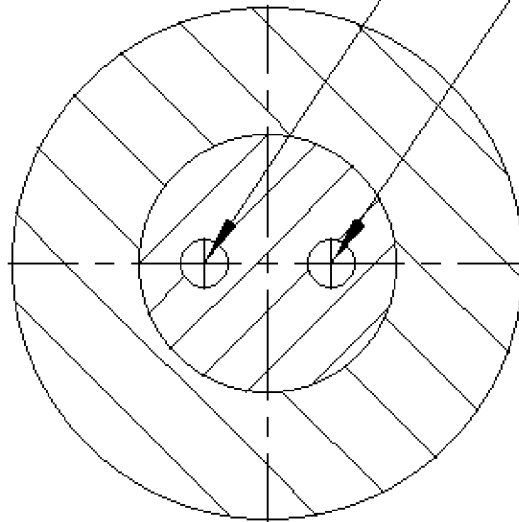


Fig.14

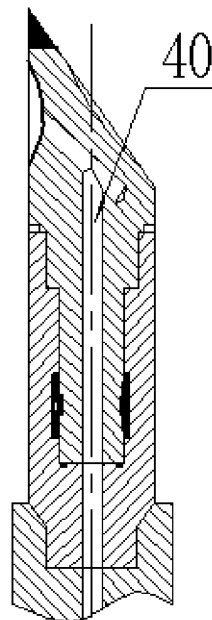


Fig.15

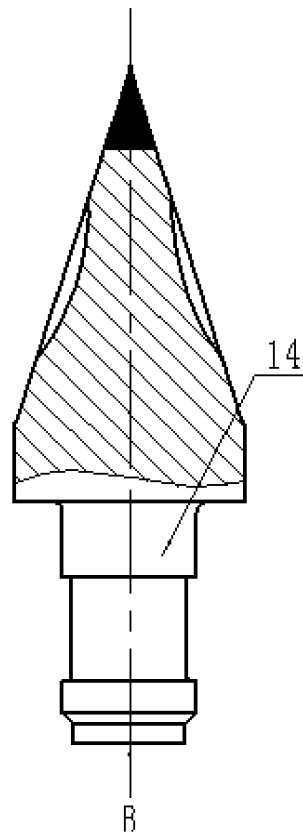


Fig.16

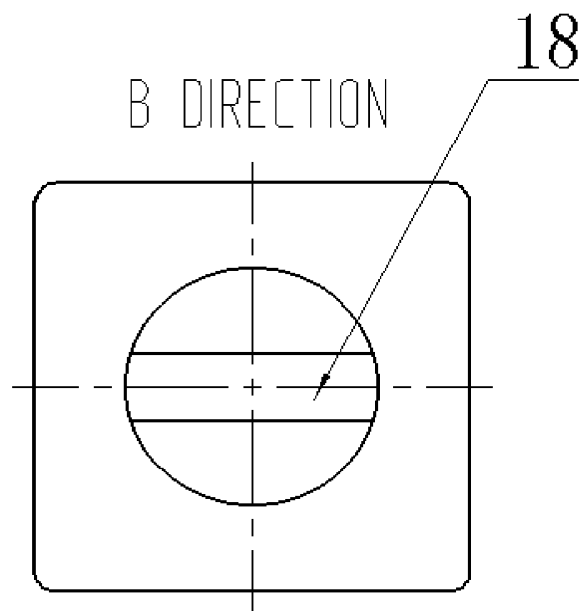


Fig.17

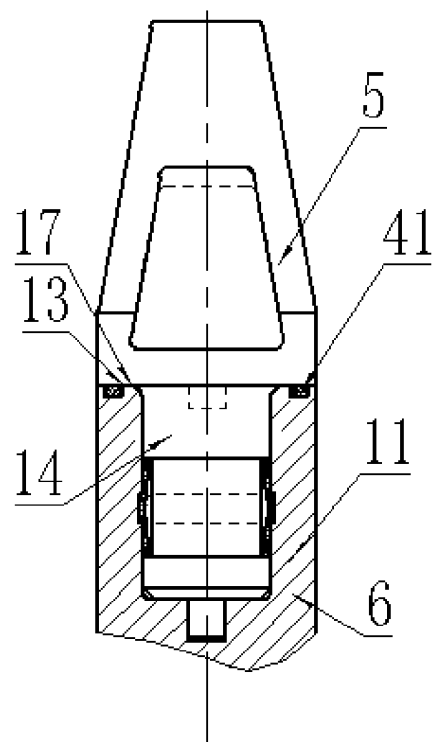


Fig.18

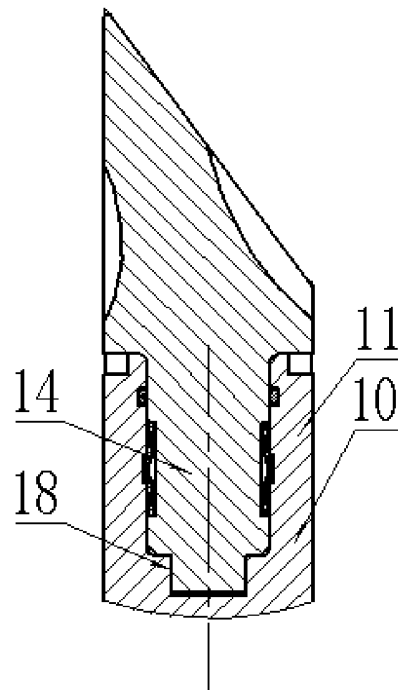


Fig.19

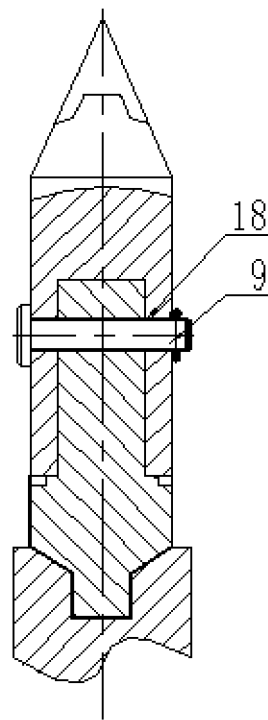


Fig.20

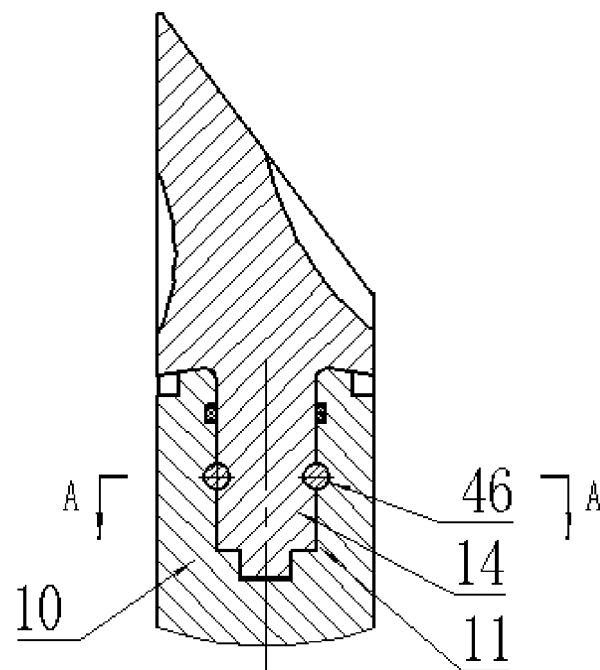


Fig.21

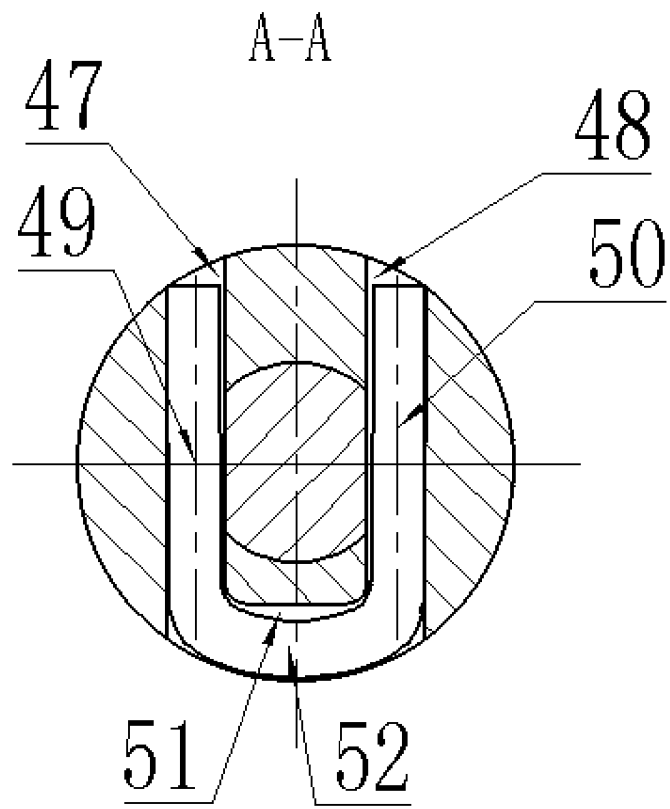


Fig.22

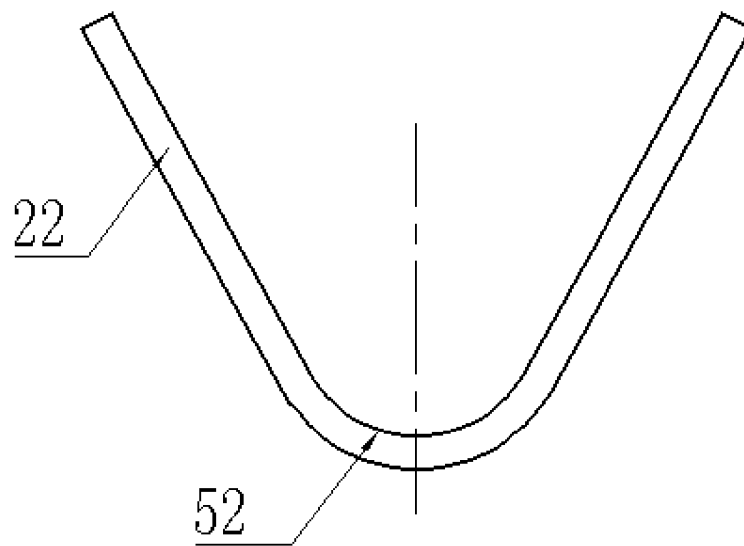


Fig.23

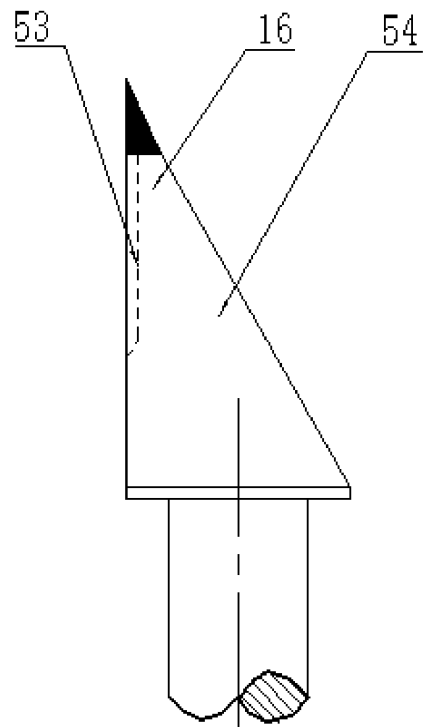


Fig.24

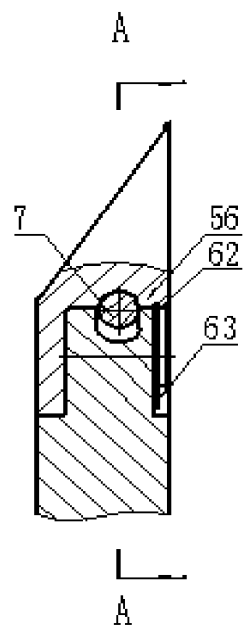


Fig.25

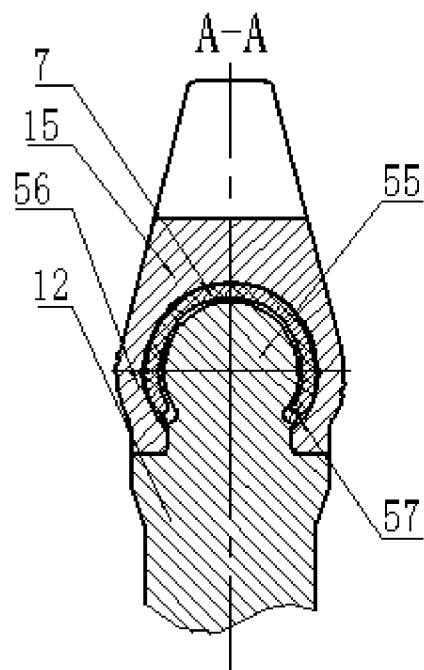


Fig.26

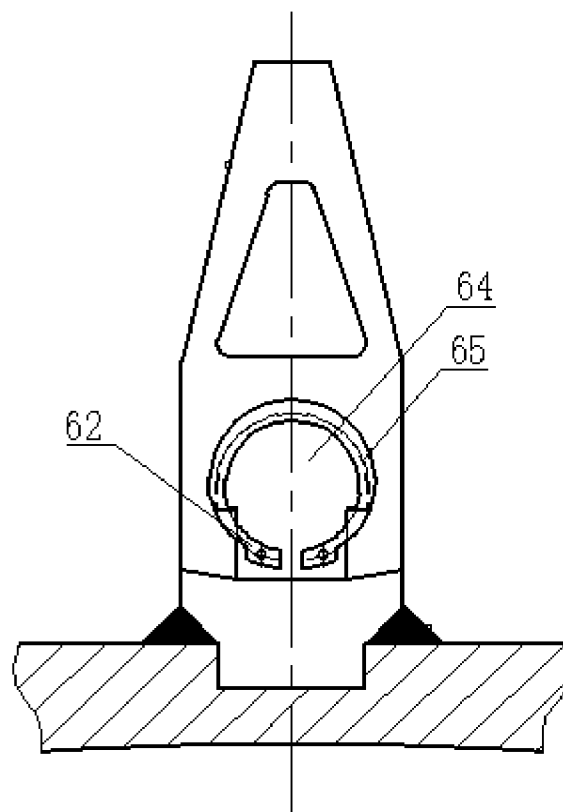


Fig.27

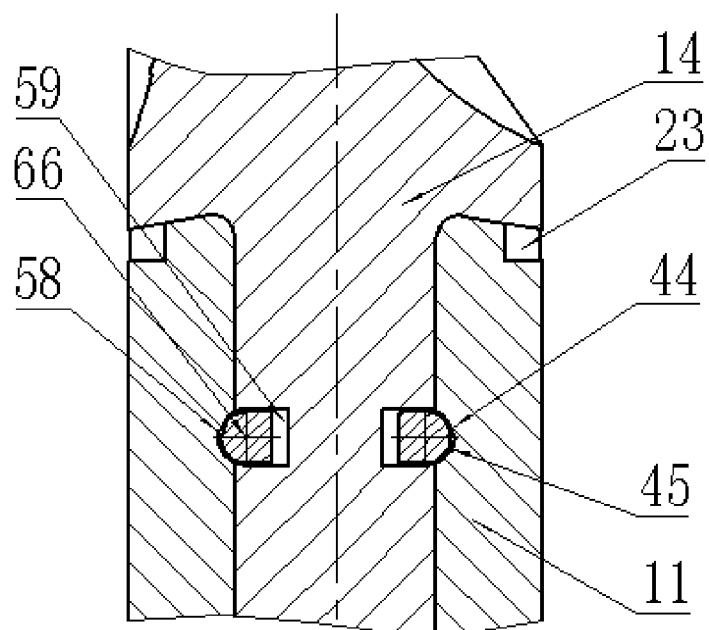


Fig.28

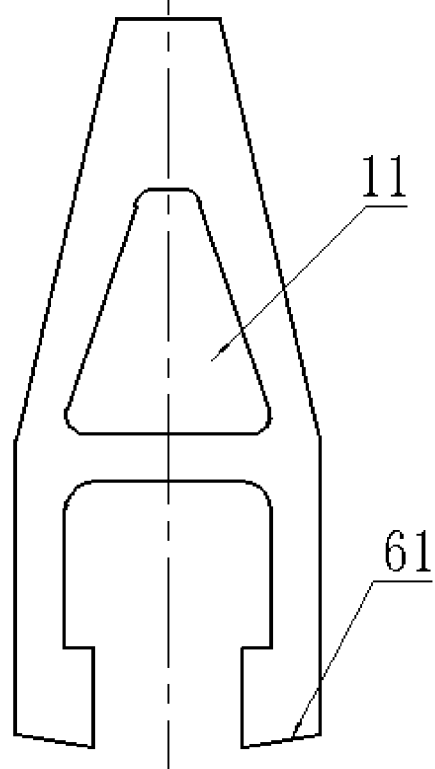


Fig.29

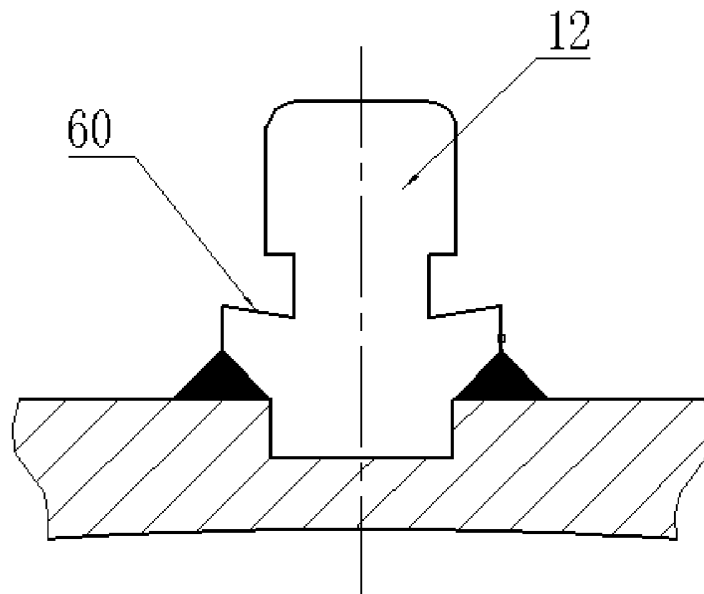


Fig.30

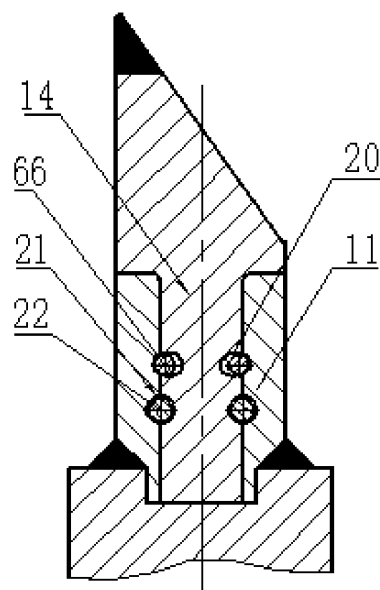


Fig.31

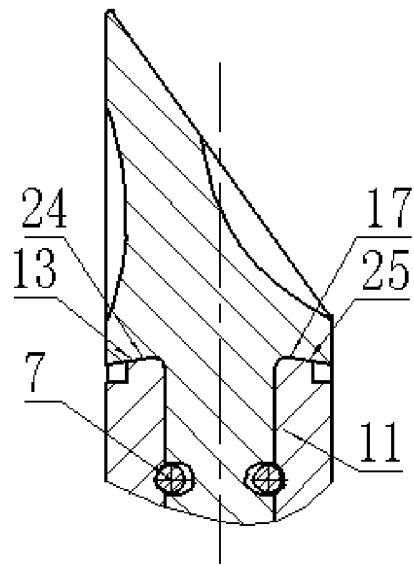


Fig.32

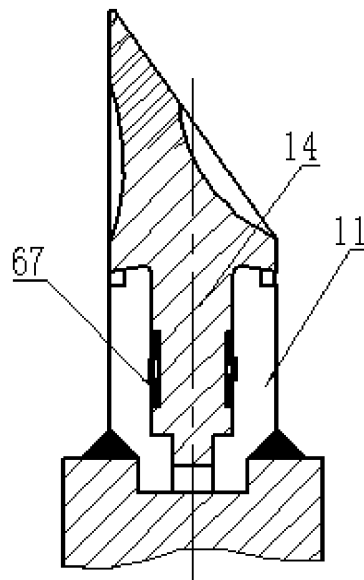


Fig.33

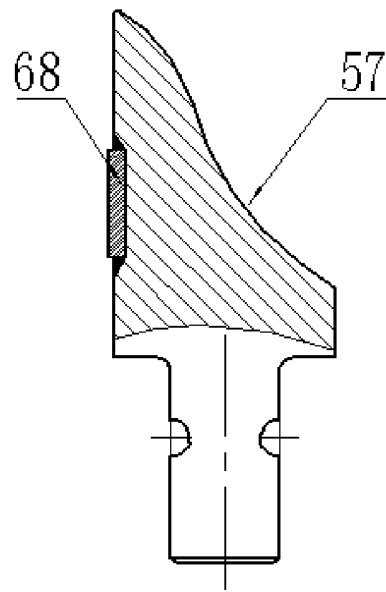


Fig.34

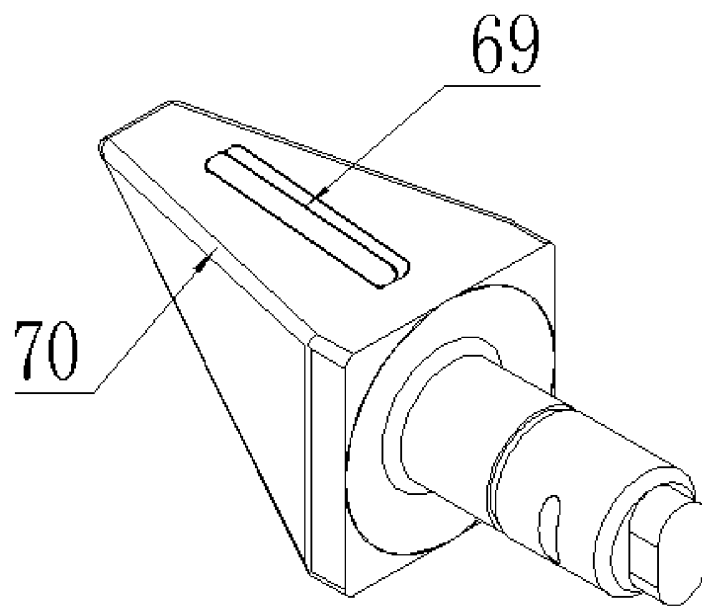


Fig.35

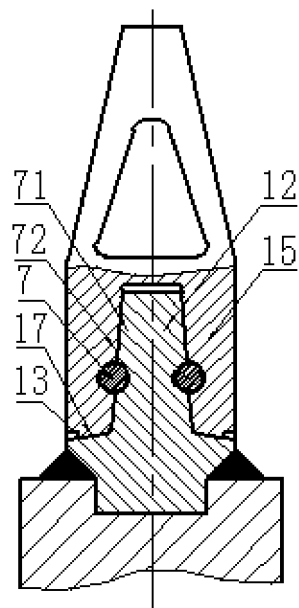


Fig.36

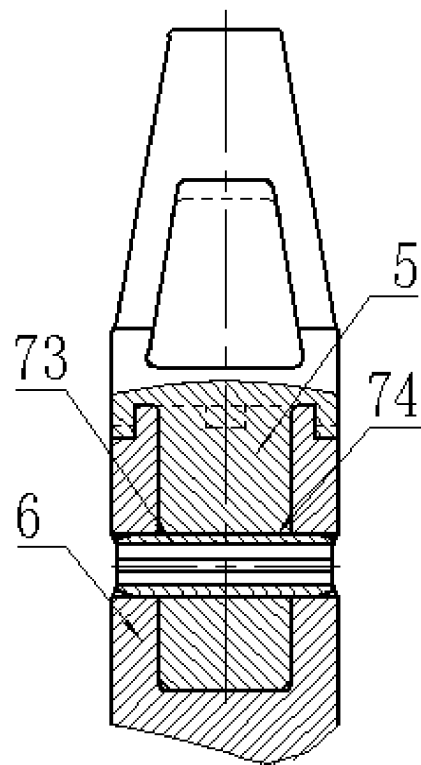


Fig.37

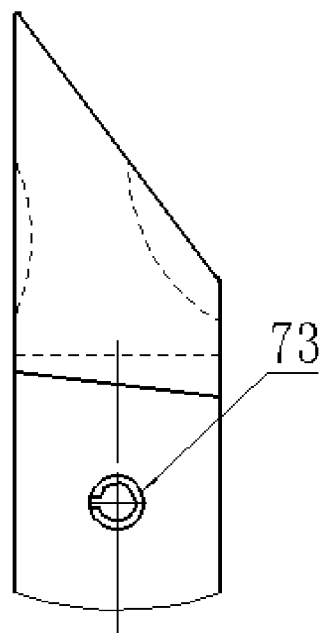


Fig.38

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2014/000009

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: E21C; E21D; E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

VEN, CNABS, CPRSABS: strik+, impact+, shock+, break+, percuss+, min+, reciproc+, to-and-fro

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 1163980 A (SHANXI MINING COLLEGE) 05 November 1997 (05.11.1997) claims 1-12, and figures 1-14	1-38
A	CN 202125295 U (LIU, Suhua) 25 January 2012 (25.01.2012) the whole document	1-38
A	CN 201363149 Y (GABBARD BEIJING SCI&TECHNOLOGY DEV CO LTD) 16 December 2009 (16.12.2009) the whole document	1-38
A	CN 2476642 Y (JAMUSI COAL MINE MACHINERY FAC) 13 February 2002 (13.02.2002) the whole document	1-38
A	US 5131476 A (PERCUSSION DRILLING INC.) 21 July 1992 (21.07.1992) the whole document	1-38

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
20 March 2014 (20.03.2014)

Date of mailing of the international search report
03 April 2014 (03.04.2014)

Name and mailing address of the ISA
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No. 6, Xitucheng Road, Jimenqiao
Haidian District, Beijing 100088, China
Facsimile No. (86-10) 62019451

Authorized officer
CHEN, Gang
Telephone No. (86-10) 62085154

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/CN2014/000009

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 1163980 A	05.11.1997	None	
CN 202125295 U	25.01.2012	None	
CN 201363149 Y	16.12.2009	None	
CN 2476642 Y	13.02.2002	None	
US 5131476 A	21.07.1992	None	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2014/000009

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A. CLASSIFICATION OF SUBJECT MATTER

E21C 27/12 (2006.01) i

E21C 27/14 (2006.01) i