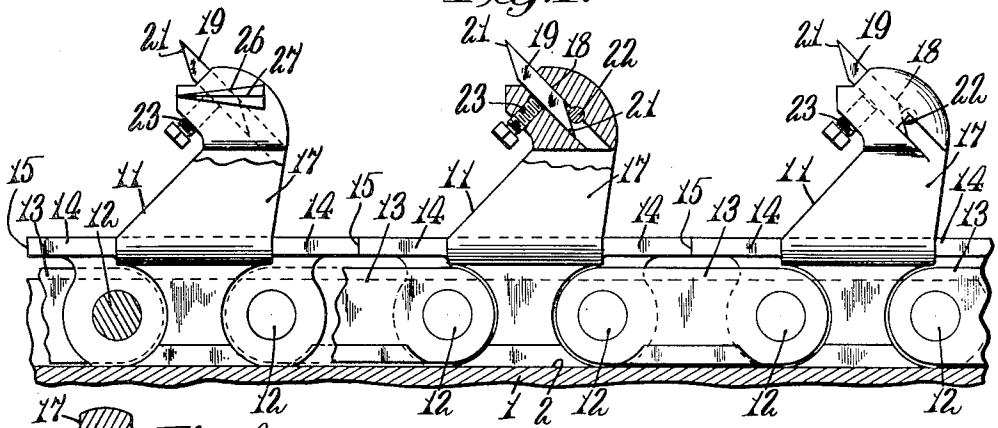
Oct. 20, 1936. J. F. JOY 2,057,684

KERF FORMING METHOD AND APPARATUS

Filed June 21, 1934 3 Sheets-Sheet 1

Fig. 1.



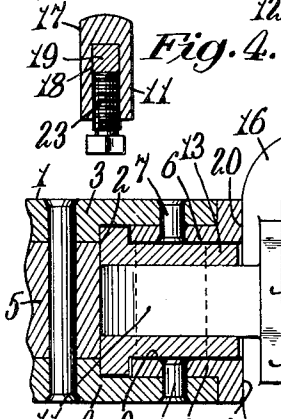


Fig. 4.

Fig. 2.

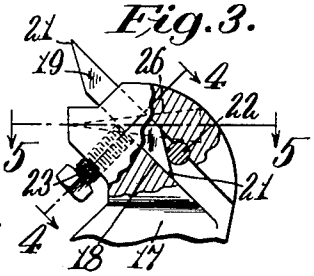


Fig. 3.

Fig. 5.

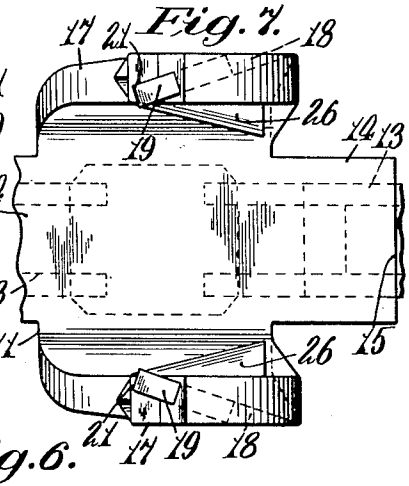


Fig. 7.

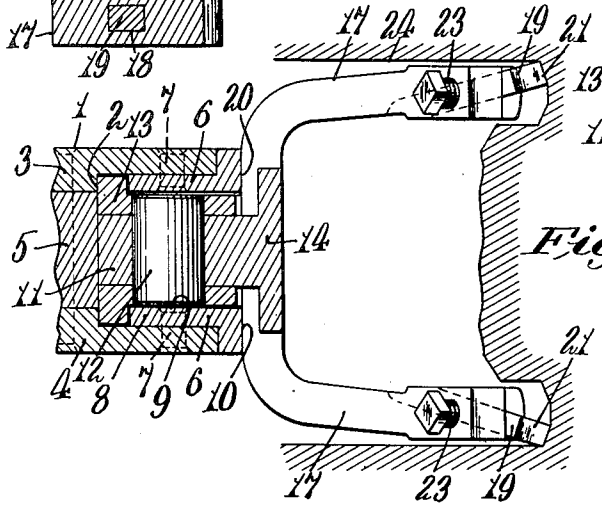


Fig. 6.

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Fig. 8.

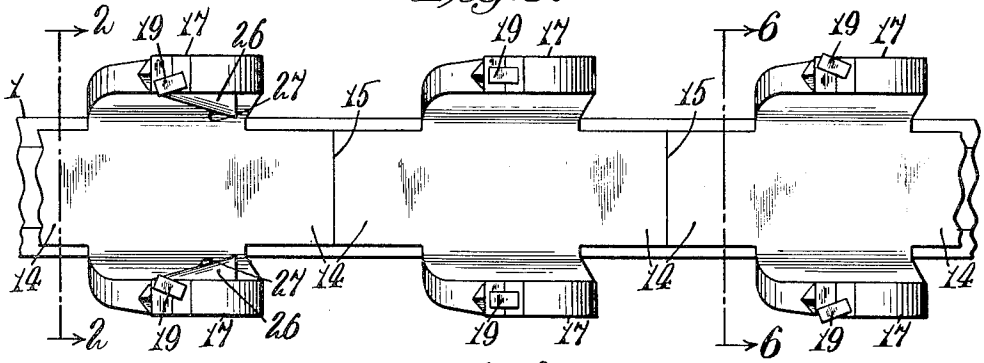


Fig. 9.

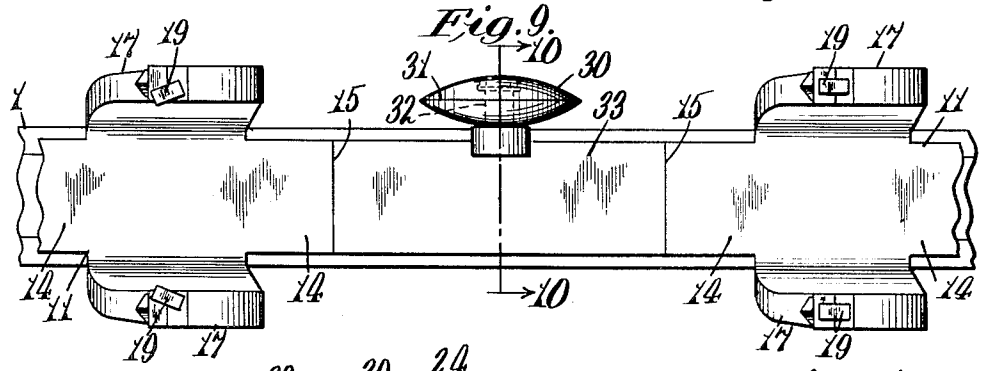


Fig. 10.

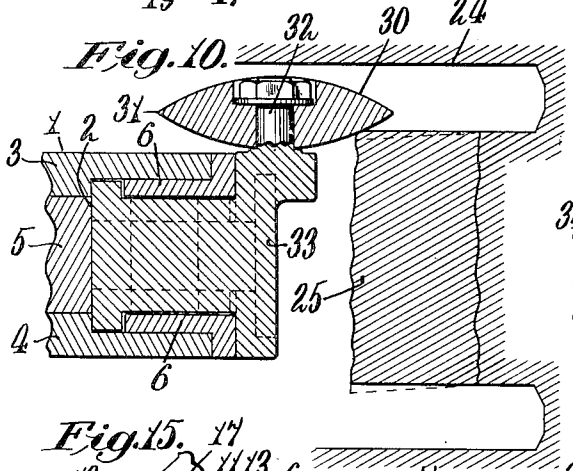


Fig. 11.

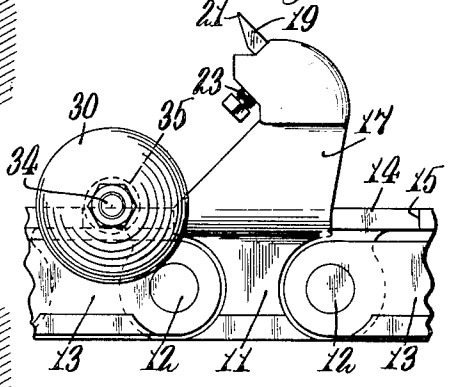
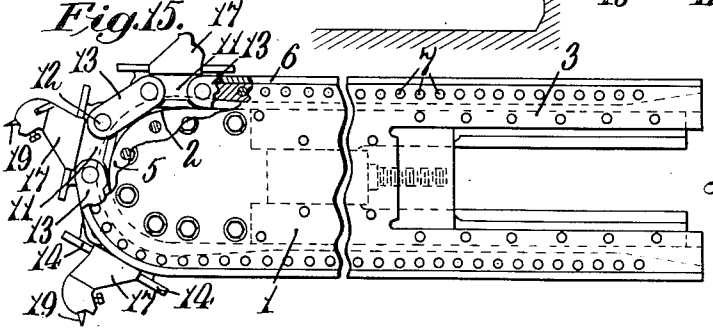


Fig. 15.



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KERF FORMING METHOD AND APPARATUS

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Fig. 12.

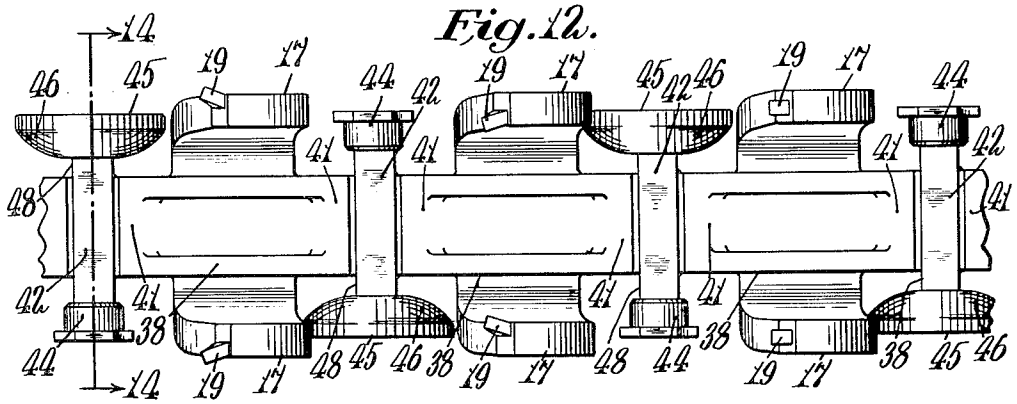
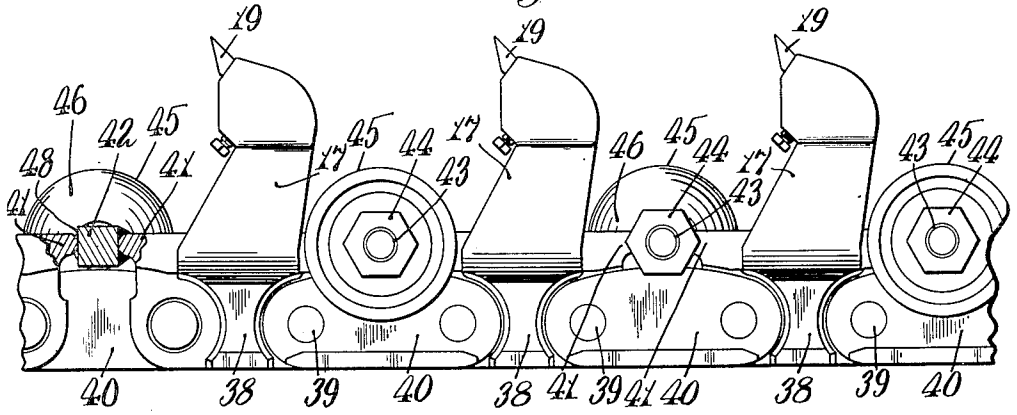


Fig. 13.



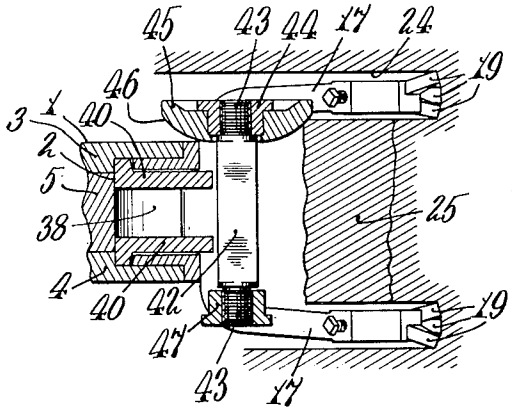


Fig. 14.

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UNITED STATES PATENT OFFICE

2,057,684

KERF-FORMING METHOD AND APPARATUS

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Application June 21, 1934, Serial No. 731,711

27 Claims. (Cl. 262—33)

This invention relates to improvements in kerf-forming methods and apparatus, and with respect to the latter, in improvements in mining machine cutter chains and cutter bars, as commonly used for kerf-forming purposes; and more particularly to the kerf-forming portions of the chain and the wearing parts of the cutter bar guideway through which the cutter chain is operated.

In a mining machine cutter chain of the conventional form whereby a relatively wide kerf is cut in the coal vein, one of the chief objections arising out of the use of such wide kerf-forming means is that of the fineness of the cuttings due to the removal by the cutting means of all the coal between the outer walls of the kerf. These fine cuttings are in the form of fine slack coal, which has a relatively low market value as compared with coarser sizes of coal. Another objection to the conventional form of cutter bar is the relatively rapid wear of the guideways through which the cutter chain travels about the margin of the cutter bar.

The primary object of the present invention is to provide an improved kerf forming means for forming a relatively wide kerf, such as is formed by the conventional form of cutter chain, through the forming of two relatively narrow kerfs or slots in parallel relation, whose outer walls shall be spaced by the width of the finished wide kerf, and breaking away, as cutting progresses, the portion of the coal intermediate the narrow kerfs or slots. Another object is to provide improved cutting means for forming a relatively wide kerf while at the same time producing a large amount of commercially valuable coal of substantial coarseness in comparison to the cuttings produced by a conventional kerf cutter. Another object is to provide an improved kerf-forming means for cutting narrow slots or kerfs in parallel relation in the coal, and having associated therewith improved breaking means for breaking away the coal intermediate the parallel kerfs or slots. Yet another object is to provide an improved cutter chain having a parallel series of cutting means whereby parallel kerfs or slots are cut simultaneously in the coal vein. Still another object is to provide an improved cutter chain link and bit mounting for a mining machine cutter chain. A further object is to provide an improved cutter bit holder particularly designed to use with a cutter chain of the above character. A further object is to provide, in a cutter chain of the above character, improved core breaker means for breaking away the coal between the parallel slots cut by the cutter chain. Another object is to provide an improved cutter chain of the core forming type, with which the improved breaker means is associated, and having improved cutting means and a common chain portion for actuating the cutting means and the core breaker means. Still another object is to provide an improved cutter chain guiding cutter bar having improved guiding means whereby the wear of the cutter bar is reduced to a minimum while providing substantial bearing surfaces for the chain. A further object is to provide an improved method of forming a relatively wide kerf by the forming of parallel narrow kerfs and at intervals breaking down the core of material between the parallel kerfs. These and other objects of the invention will, however, hereinafter more fully appear.

In the accompanying drawings there are shown, for purposes of illustration, several forms which the invention may assume in practice.

In these drawings,—

Fig. 1 is a plan view of one illustrative embodiment of the improved cutter chain.

Fig. 2 is a cross sectional view taken substantially on line 2—2 of Fig. 8, with parts broken away.

Fig. 3 is an enlarged detail sectional view of the improved cutter bit mounting.

Fig. 4 is a detail sectional view taken on line 4—4 of Fig. 3.

Fig. 5 is a detail sectional view taken on line 5—5 of Fig. 3 and showing one of the core breaker means.

Fig. 6 is a cross sectional view taken substantially on line 6—6 of Fig. 8.

Fig. 7 is a fragmentary elevational view of one of the chain blocks.

Fig. 8 is a side elevational view of the cutter chain shown in Fig. 1.

Fig. 9 is a view similar to Fig. 8, showing a modified form of core breaker means.

Fig. 10 is a cross sectional view taken substantially on line 10—10 of Fig. 9.

Fig. 11 is a plan view of a portion of the improved cutter chain, showing still another form of core breaker means.

Fig. 12 is a side elevational view of a further modified form of cutter chain.

Fig. 13 is a plan view of the cutter chain shown in Fig. 12.

Fig. 14 is a cross sectional view taken on line 14—14 of Fig. 12.

Fig. 15 is a plan view, with parts broken away in section, showing the improved cutter chain and its associated cutter bar.

The several forms of the improved cutter chain as shown in Fig. 15, are guided about the margin of a plane cutter bar 1 having formed about its outer edge a chain guiding groove 2 and composed of top and bottom plates 3 and 4 secured, as by rivets, to a central bar member 5. The improved wear means associated with the chain guiding groove is in the form of wear strips 6, 6, herein in the form of angle members, secured, as by rivets 7, to the plates 3 and 4 of the cutter bar. The longer flanges 8 of these angle members are arranged parallel with the inner faces of the bar plates and form at their inner sides plane bearing surfaces 9 with which the cutter chain engages. The shorter flanges of the angle members project outwardly about the outer edge of the bar plates and provide outer plane bearing surfaces 10 with which the links of the improved cutter chain engage, as hereinafter described.

Now referring to the illustrative embodiment of the improved cutter chain shown in Figs. 1 to 8, inclusive, it will be noted that the chain is of the endless type, comprising a series of links connected together and mounted in the cutter bar guideway for orbital movement about the margin of the cutter bar. This improved chain comprises a series of bit blocks 11 pivotally connected by transverse pivot pins 12 to strap links 13. Each bit block is provided with front and rear ledge or shelf portions 14, 14 providing plane end abutment surfaces 15; and these abutment surfaces on the different bit blocks are engageable with one another in the manner shown, during movement of the cutter chain along the side portions of the cutter bar guideway, but swing relatively apart as the cutter chain moves about the semi-circular end of the cutter bar guideway; these ledges being provided so that the series of bit blocks abuttingly engage one another during movement of the cutter chain along the sides of the cutter bar. Each bit block 11 is provided with a portion 16 of U-shaped form, the arms 17, 17 of which each have a socket 18 for receiving a cutter bit 19. As illustrated, these arms are spaced equally with respect to a plane parallel with the outer plane surfaces of the cutter bar, midway between the latter, and the inner surface of this U-shaped portion is provided with plane surfaces 20 engaging the outer surfaces 10 of the angle wear members 6 of the cutter bar, thereby to provide the increased bearing surface for the cutter chain.

In this instance, the cutter bit is of rectangular cross section and is provided with cutting points 21, 21 at its ends so that the bit may be reversed in its socket when one point wears out, thereby to present a sharp point. Secured within the bit block and traversing the bit socket is a pin 22, with which the inner end of the cutter bit engages, and this pin limits inward movement of the bit and positions the same within the bit socket. A setscrew 23 threaded within the bit block and engageable with the bit is utilized to secure the bit rigidly in position within its socket. The different bit blocks have the bit sockets 18 arranged in different angular positions to enable lacing of the bit points so that a narrow kerf 24, sufficient to clear the sides of the arms 17, is cut by the bits. The parallel series of cutter bits carried by the arms at the opposite sides of the cutter chain cooperate to form narrow kerfs or slots 24 in parallel relation, thereby to form therebetween, as the cutter bar is fed into the coal, a core 25. As this core is cut by the parallel series of cutters, it is broken away by wedge-shaped core breakers 26 secured at intervals to the inner sides of certain ones of the arms of certain of the bit blocks. These core breakers act as wedges and have sharp inclined surfaces 27 for cutting into the sides of and breaking away the core, in the manner shown in Fig. 2. In a preferred form, one bit block out of every four is provided with these core breakers 26, although it will be evident that many more or less may be provided, as desired or as the rate of penetration of the kerf cutters in the coal may make necessary.

In the modified form of construction shown in Fig. 9, the core breakers 26 may be omitted or, if desired, they may be supplemented by means of core breakers 30. These core breakers are in the form of rotary wedge discs having curved inner sides 31, and of generally elliptical cross section; and each of these rotatable core breakers is journaled on a stub shaft 32 secured to a chain block 33 pivotally connected to adjacent bit blocks. The rotary core breakers may be rotatably mounted intermediate the bit blocks, all on the upper side or all on the lower side, or may be arranged alternately on the upper and lower sides of the chain. As the parallel kerfs or slots are cut out by the cutter chain to form a core, the rotary core breakers 30 engage the side of the core, in the manner shown in Fig. 10, to break the core away as cutting progresses.

In the modified form of construction shown in Fig. 11, the rotary core breakers 30 are mounted on shafts 34 supported within lugs 35 formed integral with the front ledge 14 of the bit block 11. In this form of the invention, these rotary core breakers act in a manner identical to that described above in the form of the invention shown in Figs. 9 and 10.

In the further modified form of construction shown in Figs. 12, 13, and 14, it will be noted that the chain link and bit block structure is substantially the same as that shown in Figs. 1 and 8. The rotary wedge discs and their mountings are, however, in this instance, somewhat modified. In this form of the invention, a series of bit blocks 38 are pivotally connected by transverse pivot pins 39 to strap links 40. Each bit block is provided with front and rear ledge or shelf portions 41, 41, and the front ledge of each block has secured thereto, as by welding, a transverse shaft 42 having a central portion of square cross section and oppositely projecting threaded portions 43. As shown in Fig. 14, one of the threaded projections has threaded thereon a bearing and retaining bushing 44 on which is journaled a rotary wedge disc 45 having a curved inner wedging surface 46. A similar retaining and bearing bushing 47 is threaded on the opposite projection, but the rotary disc in this instance is omitted. These rotary discs alternate on opposite sides of the bit blocks so that one acts with a wedging action in one direction and the next succeeding disc with a wedging action in the opposite direction and respectively on the opposite sides of the core cut by the parallel series of kerf cutters, thereby to break down the core as cutting progresses. The square portions of the disc supporting shaft each have a front plane surface 48 which engages a similar surface on the rear shelf portion of the adjacent bit block, and these abutting surfaces correspond to the end abutting surfaces 15 of the shelf portions 14, 14

of the forms of the invention above described. Otherwise, the form of the invention is similar to the other forms of the invention, and the parallel kerf cutters and core breakers act on the coal in a similar manner.

In the various forms of the invention, when the cutter bar is moved edgewise relative to the coal vein, the parallel series of cutters carried by the series of bit blocks cooperate to form narrow slots or kerfs in parallel relation, thereby to form a core between the outer faces of the slots; and as this core is so formed it is broken away in relatively large lumps by the core breakers carried by the cutter chain. Also, in all forms of the invention, the core breakers act to engage and break down the core as cutting progresses. These and other uses and advantages of the improved cutter chain will be clearly apparent to those skilled in the art.

While in this application there are specifically described several forms which the invention may assume in practice, it will be understood that these forms are shown for purposes of illustration and that the invention may be further modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a cutter chain, a series of chain blocks pivotally connected together and each having a U-shaped portion the arms of which are spaced apart to provide a core receiving opening, each arm carrying a cutter bit, said bits being arranged on said arms to cut parallel spaced apart kerfs to form a core received in said opening.

2. In a cutter chain, a series of pivotally connected chain elements forming an endless chain and carrying spaced series of cutting devices for simultaneously cutting out spaced apart narrow parallel slots of substantial depth in the material to be mined to form a relatively wide core therebetween.

3. In a cutter chain, a series of pivotally connected chain elements forming an endless chain and carrying spaced series of cutting devices for simultaneously cutting out spaced apart narrow parallel slots of substantial depth in the material to be mined to form a relatively wide core therebetween, and means associated with the cutting means for breaking down relatively large sections of the core between the slots as cutting progresses.

4. In a cutter chain, a bit block having a U-shaped portion the arms of which are spaced apart to provide a core receiving opening, each arm carrying a cutter, said cutters being arranged on said arms to cut parallel spaced apart kerfs to form a core received in said opening.

5. In combination, a cutter bar, and a cutter chain guided on the margin of said bar and carrying parallel series of cutters arranged simultaneously to form spaced apart narrow slots of substantial depth in the material to be mined to form a relatively wide core therebetween.

6. In combination, a cutter bar, a cutter chain guided on the margin of said bar and carrying parallel series of cutters operative simultaneously to form spaced apart narrow slots of substantial depth in the material to be mined to form a relatively wide core therebetween, and means carried by said cutter chain for breaking away sections of the core between said slots as cutting progresses.

7. In a cutter chain, a series of pivotally connected chain elements each carrying at each of its opposite sides a cutter, said cutters cooperating simultaneously to form spaced apart narrow parallel slots of substantial depth in the material to be mined to form a relatively wide core therebetween.

8. In a cutter chain, a bit block having a U-shaped portion the arms of which each carry a cutter, and core breaker means formed on the inner sides of the arms of the bit block.

9. In a cutter chain, a bit block having a U-shaped portion the arms of which each carry a cutter, and rotary breaker means mounted on said bit block.

10. In combination, a cutter bar having a chain guideway about its edge, angle wear members having flanges to form wearing surfaces on the inner sides of the chain guideway and about the outer edge of the bar, and a cutter chain guided in said guideway and having cutter supporting elements of U-shape in planes transverse to the path of chain travel, the arms of which elements carry cutters and the bases of the arms engaging the wear member flanges at the outer edge of the bar.

11. A bit block having a U-shaped portion each arm of which carries a cutter, and wedge shaped core breaker means formed on the inner sides of said arms.

12. The method of forming a wide kerf in coal or other material, including the simultaneous formation of spaced, parallel, elongated narrow kerfs of substantial depth and of substantially the same depth throughout their length to form an elongated relatively wide core of substantially uniform cross section and periodically exerting laterally on the core between said narrow kerfs a wedging action at points along the core length.

13. The method of forming a wide kerf in coal or other material, including the simultaneous formation of spaced, parallel, elongated narrow kerfs of substantial depth and of substantially the same depth throughout their length to form an elongated relatively wide core of substantially uniform cross section and periodically exerting, as the core between said narrow kerfs is substantially severed from the adjacent mass, a wedging action on said core at points along the length of said core.

14. In a core cutting cutter chain, a series of chain blocks pivotally connected together, cutter supports on said chain blocks, and cutters carried by said cutter supports and arranged thereon to cut parallel kerfs spaced apart and of substantial depth, to form a relatively wide core therebetween, said cutter supports being spaced apart laterally on the chain to form an opening therebetween for receiving the core.

15. In a core cutting cutter chain, a series of chain blocks pivotally connected together, cutter supports on said chain blocks, cutters carried by said cutter supports and arranged thereon to cut parallel kerfs spaced apart and of substantial depth, to form a relatively wide core therebetween, said cutter supports being spaced apart laterally on the chain to form an opening therebetween for receiving the core, and means carried by the chain blocks and movable therewith for breaking down portions of the core as cutting progresses.

16. In an endless chain kerf cutting means for mining purposes, series of cutters for simultaneously cutting spaced apart parallel kerfs of substantial depth in the material to be mined to form a relatively wide core therebetween, and

means mounted on and movable with the kerf cutting means for periodically exerting a breaking down pressure to the core at points along the length of the latter as cutting progresses.

17. In an endless chain kerf cutting means for mining purposes, series of cutters carried by said endless chain for simultaneously cutting spaced apart parallel kerfs of substantial depth in the material to be mined to form a relatively wide core therebetween, and means carried by said endless chain for engaging the sides of the core to break down sections of the core as cutting progresses.

18. In an endless chain kerf cutting means for mining purposes, a single endless cutting means having parallel series of cutters respectively carried at the opposite sides thereof for simultaneously cutting relatively narrow spaced apart parallel kerfs of substantial depth in the material to be mined to form a relatively wide core therebetween.

19. In an endless chain kerf cutting means for mining purposes, an endless chain, parallel series of cutters carried respectively at the opposite sides of said chain for cutting simultaneously spaced apart parallel kerfs of substantial depth in the material to be mined to form a relatively wide core therebetween, and cutter supporting means carried by said chain and by which said series of cutters are carried, said supporting means being spaced to form an opening therebetween for receiving the core as cutting progresses.

20. In an endless chain kerf cutting means for mining purposes, parallel series of cutters carried respectively at the opposite sides of the cutting means for simultaneously cutting spaced apart parallel kerfs of substantial depth in the material to be mined to form a relatively wide core therebetween, and core breakers carried by the chain for periodically applying a breaking down pressure to the opposite sides of the core for breaking down sections of the core as cutting progresses.

21. In an endless chain kerf cutting means for mining purposes, an endless chain, parallel series of cutters carried respectively at the opposite sides of said chain for cutting simultaneously spaced apart parallel kerfs of substantial depth in the material to be mined to form a relatively wide core therebetween, cutter supporting means carried by said chain and by which said series of cutters are carried, said supporting means being spaced to form an opening therebetween for receiving the core as cutting progresses, and core breakers carried by said chain for breaking down sections of the core as cutting progresses.

22. In a cutter chain, a series of chain blocks pivotally connected together and each having a U-shaped cutter support portion, the side arms of said portions being spaced apart to provide a core opening therebetween, and cutters carried by the arms of said portions for cutting parallel kerfs to form a core received in the space between said side arms.

23. In a cutter chain, a series of chain blocks pivotally connected together and each having a U-shaped cutter support portion, the side arms of said portions being spaced apart to provide a core opening therebetween, cutters carried by the arms of said portions for cutting parallel kerfs to form a core received in the space between said side arms, and means carried by the chain for breaking off sections of the core as cutting progresses.

24. The method of forming a wide kerf having a straight inner wall in coal or other materials including the simultaneous formation of straight, spaced apart, parallel narrow kerfs of substantial length and depth and periodically exerting laterally on the material between said narrow kerfs a wedging action.

25. The method of forming a wide kerf having a straight inner wall in coal or other material including the simultaneous formation of straight, spaced, parallel narrow kerfs of substantial length and depth and periodically exerting, as the material between said elongated narrow kerfs is substantially separated from the adjacent mass, a wedging action on the material.

26. In an endless chain kerf cutting means for mining purposes, series of cutters for simultaneously cutting spaced-apart parallel kerfs of substantial depth in the material to be mined to form a relatively wide core therebetween, and wedge-shaped core breaker means mounted on and movable with the kerf cutting means for periodically exerting a breaking-down pressure on the opposite sides of the core at points along the length of the latter as cutting progresses.

27. In an endless chain kerf cutting means for mining purposes, series of cutters for simultaneously cutting spaced-apart parallel kerfs of substantial depth in the material to be mined to form a relatively wide core therebetween, and core breaking rollers mounted on said endless chain kerf cutting means and movable therewith for periodically exerting a breaking down pressure on the opposite sides of the core at points along the length of the latter as cutting progresses.

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