Jan. 26, 1937. R. K. JEFFREY 2,068,985

CUTTER MECHANISM

Filed May 10, 1935

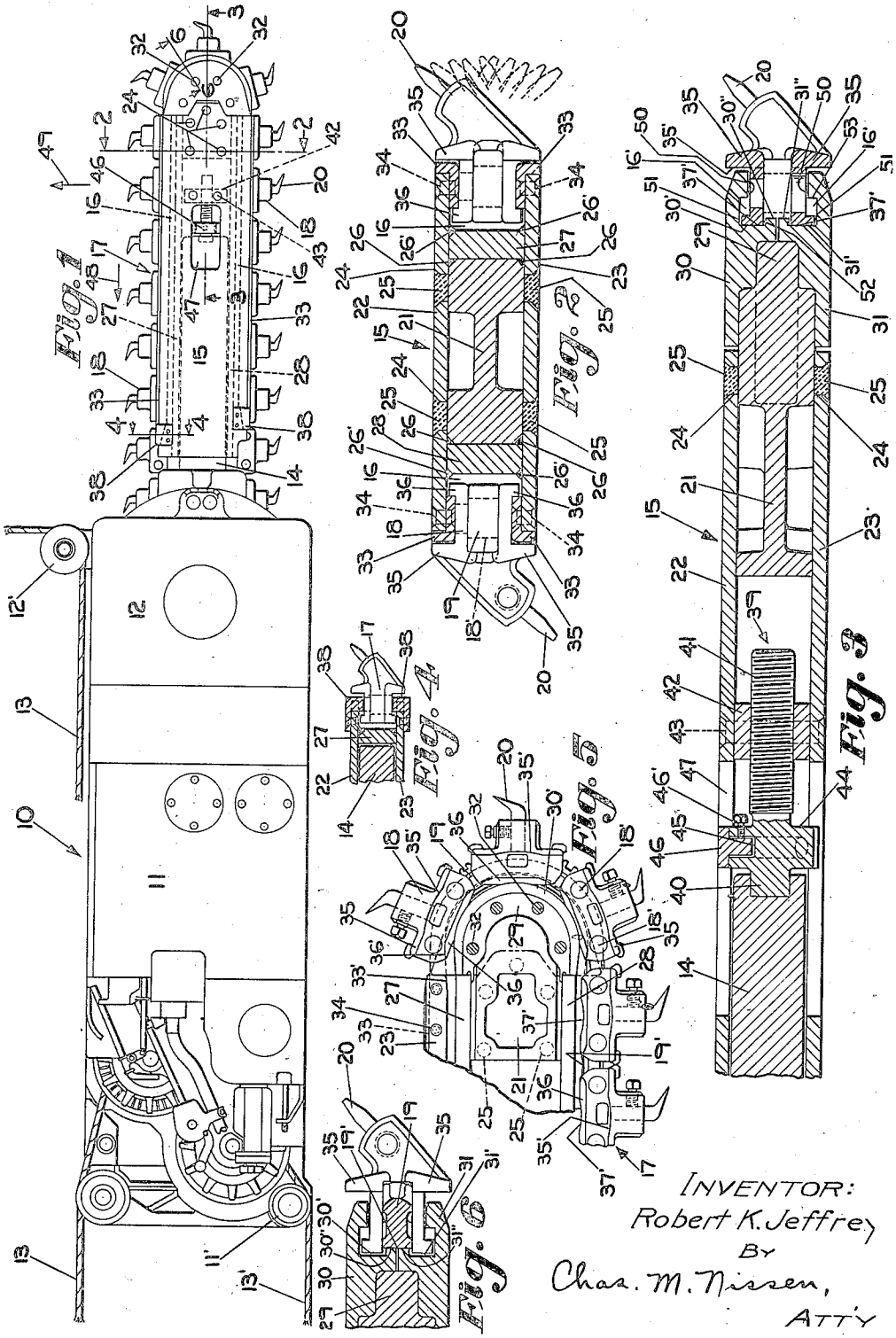


Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

INVENTOR:
Robert K. Jeffrey
BY
Chas. M. Nissen,
ATT'Y

Patented Jan. 26, 1937 2,068,985

UNITED STATES PATENT OFFICE

2,068,985

CUTTER MECHANISM

Robert K. Jeffrey, Columbus, Ohio, assignor to The Jeffrey Manufacturing Company, a corporation of Ohio

Application May 10, 1935, Serial No. 20,825
In Great Britain August 27, 1934

12 Claims. (Cl. 262—33)

One object of the invention is to provide a cutter bar for a kerf-cutting mining machine, which cutter bar is of extremely simple and rugged construction, built up or fabricated from steel plates by a process of welding.

Another object of the invention is to provide a new cutter chain and cutter bar which provide a maximum bearing surface therebetween adjacent the free or head end of said cutter bar where the cutter chain changes its direction of travel.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawing,

Fig. 1 is a plan view of a mining machine including the cutter mechanism comprising my invention;

Fig. 2 is a lateral elevational sectional view on the line 2—2 of Fig. 1;

Fig. 3 is a longitudinal elevational sectional view on the line 3—3 of Fig. 1;

Fig. 4 is a sectional view of a detail taken on the line 4—4 of Fig. 1;

Fig. 5 is an enlarged detail plan view showing the head end of the cutter bar and cutter chain with the cutter bar top plate removed and the cutter chain cut short; and

Fig. 6 is a sectional view on the line 6—6 of Fig. 1.

Referring to Fig. 1 of the drawing, there is seen a mining machine, particularly of the type adapted for cutting kerfs in a coal mine, comprising a body portion 10 which carries a motor 11 and has a head section 12. Adjacent the rear portion of the body 10 there is provided complete control mechanisms including a pair of winding drums to which are attached draft cables 13 for conveying the machine about a mine room and performing various kerf-cutting operations. Said mining machine may in general follow the form disclosed in full detail in the application of Robert K. Jeffrey and Lewis E. Mitchell for a Mining machine, Serial No. 716,160, filed March 17, 1934.

Projecting forwardly from the head section 12 of the machine is a post 14 adapted to support a cutter bar 15 in sliding relation. The cutter bar 15 is provided with a circumferential groove or track 16 within which is adapted to travel a continuous cutter chain 17 formed of alternate bit carrying links 18 and connecting links 19 pivotally connected by pins 18'. Appropriate cutter bits 20 are carried by the bit carrying links 18. It is obvious that as the cutter chain 17 progresses around the cutter bar 15 it may be directed to cut a kerf in a mine room in a manner described in complete detail in the aforementioned application.

Attention is particularly directed to Figs. 2, 3, and 4 of the drawing which illustrate the important construction of the cutter bar of my invention. This cutter bar is preferably built up or fabricated from steel plates, such as rolled plates, most of which are of simple and standard form, which are integrally connected as by welding, and preferably by electric welding, to form a rigid and thus a strong, but light weight construction.

The mining machine illustrated in Fig. 1 is of the "Shortwall" type with the feed rope 13 reeved around the pulley 12' and the retarding rope 13' associated with the pulley 11' in a well-known manner, to effect feeding movement of the kerf-cutter transversely of itself. It should be understood, however, that the cutter bar structure may also be used in longwall mining machines or other types of mining machines.

The cutter bar illustrated in the accompanying drawing comprises a head plate or block 21 which may be a casting or forging and which is preferably H-shaped in cross-section, as shown in Fig. 2 which is a view taken on the line 2—2 of Fig. 1 looking in the direction of the arrows. Elongated approximately rectangular plates 22 and 23 are welded to the upper and lower parallel faces of the head block 21 and a pair of side plates 27 and 28 each equal in length to the plates 22 and 23, are welded to the head block 21 and to the plates 22 and 23 so as to occupy spaced-apart parallel positions as shown in Figs. 1 and 2.

The welding together of the plates 22, 23, the head block 21, and the side plates 27 and 28 may be effected in various ways. For instance, the edges of the head plate or block 21 may be chamfered and welded at 26, 26 to the longitudinally extending side plates 27 and 28 in such relation to the head block 21 as to occupy predetermined positions with respect to the plates 22 and 23 when the latter are assembled.

Each of the cutter bar plates 22 and 23 is provided with five holes 24, as shown in Fig. 1. These holes may be drilled and counter-sunk as shown in Figs. 2 and 3. To effect the welding of the plates 22 and 23 to the head block 21, the latter may be connected to one terminal of an electric welding apparatus, and the welding rod of said apparatus melted by contacting the same with said head plate 21 at the holes 24 thereby

forming head rivets 25, 25 one in each of the holes 24. It will thus be seen that the plates 22 and 23 may be rigidly connected to the head block 21 so as to be in spaced parallel relation and in predetermined positions with respect to the head block 21, as illustrated in Figs. 1 and 3.

It is preferred to connect the side plates 27 and 28 to the cutter bar plates 22 and 23 throughout their entire lengths. This may be done by chamfering the edges of the plates 27 and 28 at their outer edges and then effecting welding of the side plates 27 and 28 at 26', 26' to the plates 22 and 23, as illustrated in Fig. 2. If desired the side plates 27, 28 may first be welded at 26, 26 to the head plate 21 followed by welding at 26', 26' of the plates 22 and 23 to the side plates 27 and 28, and finally welding the plates 22 and 23 to the head plate 21 by means of the welding rivets 25, 25.

It should be particularly noted that when the head block 21, side plates 27, 28, and cutter bar plates 22 and 23 are assembled by welding in proper relation to each other, the rear inner surfaces of the side plates 27 and 28 are in position to slide along the vertical side walls of the post 14. In other words, the side plates 27 and 28 cooperate with the spaced-apart parallel plates 22, 23 to provide a guide for the adjustment of the cutter bar in length, along the supporting post 14. The outer surfaces of the side plates 27 and 28 cooperate with the laterally projecting portions of the plates 22 and 23 to form a U-shaped guideway 16 for the endless cutter chain 17.

By reason of the complete absence of rivet holes in the side plates 22 and 23, the side plates may be located by welding closer to the outer edges of the plates 22 and 23 than would be possible if the plates 27 and 28 were riveted to the plates 22 and 23. Consequently, wider spacing between the side plates 27 and 28 enables the post 14 to be widened and the plates 27 and 28 to be made of ample thickness while maintaining sufficient space to form the guideways 16.

The outer end portion of the head block 21 is semi-circular as viewed in plan in Fig. 5. The outer curved section of the head plate or block 21 is provided with upper and lower guide plates 30 and 31 respectively, preferably composed of hardened steel. These upper and lower guide plates 30 and 31 are shown in Figs. 1 and 5 connected by rivets 32 to the outer semi-circular portion 29 of the head block 21. The plates 30 and 31 may be renewed when worn, by removing the rivets 32, and then riveting new guides to the semi-circular portion 29 of the head block 21.

The guide plates 30 and 31 are semi-circular at their outer ends and are provided with semi-circular guideways 16', 16' which at their rear ends are in alinement with the forward ends of the guideways 16, 16. The bottoms of the guideways 16', 16' form arcuate surfaces along which the chain links may slide while the chain is traveling around the outer end of the cutter bar. In other words, the bottoms of the guideways 16' provide large bearing areas for the cutter chain as it slides around the head end of the cutter bar 15.

As shown in Fig. 5, the bit holder links 18 are each provided with laterally projecting flanges or gibs 36 which are adapted to move along the guideways 16, 16 at the outer sides of the side plates 27 and 28 and along the guideways 16' at the outer end portion of the cutter bar. These gibs 36 are provided with arcuate surfaces 37' having a curved configuration similar to that of the arcuate surfaces 30', 31' at the bottoms of the guideways 16'. It is thus evident that over a substantial portion of the area of the arcuate surfaces 30' and 31' there is a sliding contact between the bit carrying links 18 and the plates 30 and 31.

The intermediate links 19 which connect the bit holding links 18 are each provided with arcuate surfaces 19' which are adapted to co-operate with the arcuate surfaces 30'' and 31'' on the adjacent inner arcuate web portions of the plates 30 and 31 respectively. As shown in Figs. 3 and 6 the bottoms of the guideways 16' are each U-shaped in cross-section and semi-circular as viewed in plan. Consequently the bottom or inner central portion of both the connecting links 19 and the bottom central portions of the side plates of the bit holding links 18 have arcuate surfaces adapted to make sliding contact with the semi-circular tracks 30'' and 31'' and 30' and 31' of the plates 30 and 31. The sliding contact between the curved surfaces 19', 37' and the bottoms of the guideways 16' will therefore be extended over a considerable area at the outer end of the cutter bar as the cutter chain slides around the same. This distribution of the contact area between the chain and the plates 30, 31 reduces to a minimum the wear on both the cutter bar plates 30 and 31 and on the bottoms of the links of the cutter chain. Inasmuch as the curved surfaces 19' and 37' at the bottoms of the chain links are elongated in the direction of the travel of the chain, undesirable tilting of the links on axes extending transversely of the cutter bar, will be avoided. In other words, the area of sliding contact between the cutter chain links and the arcuate guiding surfaces at the outer end of the cutter bar is so distributed as to maintain a continuous and efficient path of cutting travel for the cutter bits 20 during operation of the mining machine.

Adjacent the edges of the cutter bar plates 22 and 23 are attached by means of removable rivets 34, wear plates 33 which are L-shaped in cross-section, as shown in Fig. 2. The wear plates 33 are adapted to make an inter-locking fit with the gibs 36 and the outwardly extending flanges 35 of the bit holding links 18. The wear plates 33 are located between the guide shoes 38, 38 and the outer ends of the plates 22, 23. The sides of the bit carrying links fit the inner edges of the wear plates 33 and the outer flanges 35 so closely that the bottoms of the chain links do not contact with the outer surfaces of the side plates 27 and 28, but instead the thrust during feed of the chain cutter is taken by the flanges 35 bearing on the outer surfaces of the wear plates 33. That is to say, when the chain cutter is traveling in the direction of the arrow 48 of Fig. 1 and the chain cutter is being fed in the direction of the arrow 49, the feeding thrust will be taken by the outer surfaces of the wear plates 33.

It is desirable to stagger the cutter bits 20 in fan-shaped relation as illustrated in Fig. 2 so as to secure the cutting of a wide kerf affording ample clearance for feeding movement of the cutter bar. When the cutter bits 20 are located in such positions as those shown in full lines in Fig. 2, there is a tendency during feeding movement in the direction of the arrow 49 of Fig. 1, for tilting movements of the bit holding links to be effected on an axis parallel to the path of travel of the chain cutter, but this tendency is effectively resisted by the interlocking relation between the gibs 36, the flanges 35, and the surfaces of the wear plates 33 at the sides the cutter chain comes in contact with.

While at the sides of the cutter bar the flanges 35 slide along the wear strips 33 and the bottoms of the chain links do not engage the adjacent surfaces of the plates 27 and 28, a reverse arrangement is made at the outer semi-circular portion of the cutter bar. In other words, at the head end of the cutter bar the flanges 35 of the bit carrying links 18 are held out of contact with the guide plates 30 and 31, and to assure this the bottoms of the flanges 35 are cut away at 35' along arcuate lines, as shown in Fig. 5.

Near the rear end of the cutter bar the plates 22 and 23 are provided with guide shoes 38, 38, as shown in Figs. 1 and 4, to provide tapered guideways leading to the side grooves 16, 16 of the cutter bar. This provision is made to assure proper entry of the gibs 36 of the bit carrying links 18 into the side grooves 16 so that the gibs 36 and flanges 35 will fit over the wear strips 33, as shown in Fig. 2. The gibs 36 are beveled at both ends as indicated at 36' in Fig. 5, to cooperate with the guide shoes 38, 38. Such beveling at 36' also facilitates entry of the gibs 36 along the beveled ends 33' into the guideways 16 back to the wear strips 33.

It should also be noted that when the ropes 13, 13' are arranged to effect sumping of the kerf-cutter into a mine vein lengthwise of the cutter bar preparatory to shortwall operations, the rather close fit between the sides of the bit carrying links and the inner walls of the guideways 16', 16' will prevent tilting of those cutter bits which are inclined to the greatest angle relative to the plane of the cutter bar. The sides of the bit carrying links will bear against the inner spaced-apart parallel walls 50, 50 which are semi-circular in configuration and parallel to the planes which extend through the upper and lower surfaces of the cutter bar. The gibs 36 bear against the spaced-apart parallel walls 51, 51 which are also semi-circular and concentric with the curved walls 50. The inner edges of the side plates of the bit carrying links bear against the walls 52 which are also semi-circular and concentric with the curved walls 50.

It will thus be seen that the side plates of the bit carrying links are extended laterally and outwardly at their lower inner ends to form the gibs 36. The side plates of the bit carrying links together with the gibs 36 ride in arcuate spaced-apart grooves which are in vertical alinement as viewed in Fig. 3. The gibs 36 are also movable along parallel spaced-apart grooves which are of sufficient dimensions to afford freedom of movement of the elongated gibs 36 while the chain passes around the curved outer end of the cutter bar.

By comparing Figs. 2 and 3, it will be seen that the chain makes an interlocking connection with the cutter bar both at the sides or edges of the chain and at the outer curved end thereof, and tilting of those cutter bits which are located at the maximum angle, as shown in full lines in Figs. 2 and 3, is effectively prevented not only at the sides or edges of the cutter bar but also at the outer curved end thereof. The guides 38 lead the chain into interlocking connection with the L-shaped wear strips 33, as shown in Figs. 1 and 2, and from the outer ends of the wear strips 33 the chain is led into a guideway 16' into interlocking relation with the head sections 30, 31. After moving through a semi-circle the chain again goes into interlocking relation with the leading side of the cutter bar, as shown in Fig. 2. By observing the relationship between the grooves of the guideways 16' it will be seen that the cylindrical grooves at 30', 31' are at right angles to the spaced-apart parallel grooves 51, 51 and the latter are in parallel relation to the semi-ring surfaces 50, 50. Furthermore, although the laterally extending flanges 35 of the bit holding links bear against the outer surfaces of the wear strips 33 along the leading and trailing edges of the cutter bar they are held out of contact with the cutter bar, as shown at 35' in Fig. 3, when the cutter chain is traveling around the curved end of the cutter bar.

For the purpose of adjusting the slack in the cutter chain 17 a screw-threaded shaft 39 is screw-threaded through an opening in the block 42 which is riveted between the plates 22 and 23, as shown in Figs. 1 and 3. If desired the block 42 may be welded to the plates 22 and 23 in a manner similar to the welding of the head block 21 to the plates 22 and 23.

The shaft 39 is provided with a head 40 fitting a cylindrical opening in the outer end of the post 14. Between the threaded portion 41 of the shaft 39 and the head 40 thereof is located a wheel 44 having radially spaced-apart recesses 45. When the wheel 44 is turned in one direction or the other, the length of the cutter bar may be adjusted, after which a U-shaped locking device 46 having a central pin may be inserted in the opening 47 of the top plate 22. The pin of the locking device 46 will fit any one of the radial holes in the wheel 44 so as to lock the shaft 39 against rotation after it has once been actuated to effect adjustment of the slack in the cutter chain. When the locking device 46 is removed, a tool may be inserted in one of the radial openings to effect turning of the screw 41. Instead of depending upon frictional contact between the locking device 46 and the top plate 22, a set screw 46' may be provided to hold the locking device 46 securely connected to the wheel 44, as shown in Fig. 3.

In view of the foregoing disclosure of an embodiment of my invention, it is evident that a mining machine cutter bar may be constructed so as to be very strong and still relatively light in weight. The cost of construction is materially reduced because the cutter bar may be readily built up from rolled steel plates most of which are of standard shape. Consequently the weight of the cutter bar is reduced to a minimum while its strength is increased and the cost of construction reduced.

It should also be noted that the surfaces which receive the most wear are located on pates 30, 31, and 33, all of which are removable and therefore renewable. While the relation between the cutter chain and the wear strips 33 is for efficient operation during feeding movement in the direction of the arrow 48 of Fig. 1, the relation between the chain and the outer semi-circular guideways is for efficient entry of the cutter bits into their cutting paths of travel while changing direction or moving arcuately. That is to say, the particular arrangement at the outer end of the cutter bar is especially for the purpose of not only reducing the wear to a minimum, but also to secure efficient initial operation of each cutter bit as it enters its cutting path of travel and moves arcuately to the leading side or edge of the cutter bar.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims

hereto appended, and I therefore wish not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of my invention, what I desire to secure by Letters Patent of the United States is:

1. In a mining machine, the combination with a cutter bar, of a cutter chain, said cutter bar having chain receiving guideways adjacent each side thereof and a head portion forming a curved guideway with an arcuate bearing surface adjacent the inner wall thereof, said cutter chain comprising bit carrying links and connecting links, the bit carrying links having bearing flanges which contact with the outside edges of the cutter bar adjacent the longitudinal sides thereof, and having outwardly extending gibs having arcuate bottom surfaces which contact with said arcuate bearing surface of the head portion of said cutter bar, and said connecting links also having arcuate bottom surfaces which contact with said arcuate bearing surface of the head portion of said cutter bar.

2. In a mining machine, the combination with a cutter bar, of a cutter chain, said cutter bar having chain receiving guideways adjacent each side thereof and a head portion forming a curved guideway with an arcuate bearing surface adjacent the inner wall thereof, said cutter chain comprising connected bit carrying links and connecting links, the bit carrying links having bearing flanges which contact with the outside edges of the cutter bar adjacent the longitudinal sides thereof, and having retaining gibs with arcuate bottom surfaces which contact with said arcuate bearing surface of the head portion of said cutter bar.

3. In a mining machine, the combination with a cutter bar, of a cutter chain, said cutter bar having a curved end with curved bearing surfaces, one of which is on a central arcuate boss of said curved end and a pair of which are on each side of said boss, said cutter chain having bit carrying links with arcuate bottom surfaces which ride on said pair of surfaces and connecting links with arcuate bottom surfaces which ride on said one surface on the central arcuate boss.

4. A cutter bar for a mining machine comprising spaced top and bottom plates, longitudinal side plates positioned between said top and bottom plates, a head plate positioned between said top and bottom plates, and between said side plates and located at one end of said cutter bar, all of said plates being welded together to provide a rigid cutter bar.

5. In a mining machine, the combination with a cutter bar, of a cutter chain, said cutter bar forming a longitudinal guideway adjacent its side edges for said cutter chain, gibs on said cutter chain adapted to travel in said guideway, retaining means adjacent said guideway co-operating with said gibs to hold said cutter chain on said cutter bar, and a removable guide shoe adjacent the point of entry of said chain gibs into said guideway for guiding said gibs thereinto, said shoe having a tapering guideway leading to said cutter bar guideway.

6. In a mining machine, the combination with a cutter bar having a curved outer end, of semi-cylindrical grooves spaced apart within the outer semi-circular portion of said cutter bar, a cutter chain comprising cutter carrying links and connecting links, said cutter carrying links having spaced-apart side portions adapted to ride along said semi-cylindrical grooves while said connecting links travel along the space between said grooves, and means for guiding the cutter chain along the sides of the cutter bar.

7. In a mining machine, the combination with a support, of a cutter bar comprising spaced-apart parallel plates welded to spaced-apart elongated strips to form a socket fitting over said support, a head block welded between the outer ends of said plates and having a semi-circular portion projecting therefrom, a pair of guide plates removably secured to the semi-circular portion of said head block, and means affording guideways for cutter chains along the sides and outer end of said cutter bar.

8. In a mining machine, the combination with an elongated support, of a cutter bar comprising spaced-apart parallel plates welded to spaced-apart parallel strips to form a socket fitting said support, a cutter chain, interlocking guideway connections between said cutter chain and said cutter bar, a stationary nut secured to said plates to occupy a position between the same, means connected to said support and screw-threaded through said nut to adjust the slack of the cutter chain, and means associated with an opening in one of said plates for holding the slack adjusting mechanism in adjusted position.

9. In a mining machine, the combination with a cutter bar having a head with spaced arcuate bearing surfaces of different radii, of a cutter chain having interconnected bit carrying links and connecting links, both of said links having arcuate bearing surfaces which contact the head bearing surfaces as said links move around said head.

10. In a mining machine, the combination with a cutter bar having a head with spaced arcuate bearing surfaces of different radii, of a cutter chain comprising interconnected bit carrying links and connecting links, arcuate bearing surfaces formed on each of said types of links, one type of link contacting a bearing surface of one radius and the other type of link contacting a bearing surface of the other radius as they move around said head.

11. In a mining machine, the combination with a support, of a cutter bar comprising spaced-apart parallel plates rigidly attached to spaced-apart elongated strips to form a socket fitting over said support, a head block rigidly attached between the outer ends of said plates and having an arcuate portion projecting therefrom, and a pair of guide plates removably secured to said arcuate portion and forming an arcuate guideway having bearing surfaces of different radii.

12. A cutter bar comprising an elongated body portion and a head portion at one end, said head portion including a pair of plates providing spaced apart arcuate bearing surfaces with an arcuate boss between them, said boss having an arcuate bearing surface.

ROBERT K. JEFFREY.