A cutting chain for mining apparatus which includes chain links with integral protruding bosses. Some of the bosses are laterally centered on the chain link bodies, and some of the bosses are laterally offset on the chain link bodies. Each boss terminates in a face that is obliquely disposed with respect to the direction of advance of the cutting chain. Each cutting chain link has a cutter bit receiving bore which extends from the oblique face into the chain link body.

7 Claims, 12 Drawing Figures
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CUTTING CHAIN LINK FORMED AS INTEGRAL ELEMENT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The instant invention relates to cutting chains and cutting chain links having integral bosses which support cutter bits in position to cut and break material as the cutting chain and the cutting chain links with cutter bits affixed to them are advanced into the material.

2. Description of the Prior Art

A number of chain links having a link body with an integral boss are found in the prior art. An integral boss centered laterally with respect to a link body is disclosed in U.S. Pat. No. 837,246. A chain link having an integral boss offset with respect to the link body is disclosed in U.S. Pat. No. 921,728. Furthermore, a chain link having a boss with opposed cutter bit recesses bored therein for respectively receiving bits for forward and reverse cutting of the chain is disclosed in U.S. Pat. No. 2,155,526.

An example of the use of a cutting chain on a mining machine can be found in U.S. Pat. No. 3,305,273. The mining apparatus disclosed in this patent includes as one means for cutting the material being mined, an endless sprocket driven cutting chain that is comprised of a plurality of cutting chain links, some of which support cutter bits.

The cutting chain links in the instant invention provide link bodies having improved integral bosses which can be easily machined to receive various types of cutter bits.

SUMMARY

The instant invention provides a cutting chain having cutting chain links, each of which includes a chain link body having an upwardly projecting boss and a face on the boss obliquely disposed with respect to the direction of advance of the link body.

A bore is formed in the boss to extend rearwardly from the oblique face into the chain link body. The bore receives a cutter bit for cutting and breaking material being mined by the cutting chain. In some cutting chain links of the instant invention, the boss is laterally offset with respect to the chain link body. In some other cutting chain links the boss is centered on the link body.

The cutting chain links having offset bosses have two faces on the boss such that one of the faces is obliquely disposed with respect to material being mined when the chain link is advanced by the cutting chain in one direction, and the second face is obliquely disposed with respect to material being mined when the chain link is oppositely advanced by the cutting chain.

It is an object of the instant invention to provide cutting chain links having link bodies with improved integral bosses projecting upwardly therefrom.

Another object of the instant invention is to provide integral bosses on link bodies which can be machined to receive various types of cutter bits.

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

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a cutting chain having three rows of cutting chain links.

FIG. 2 is a side elevational view of the cutting chain of FIG. 1.

FIG. 3 is a plan view of a cutting chain link blank having a centered boss before it is machined to include a cutter bit receiving bore.

FIG. 4 is a side elevational view of the chain link blank of FIG. 3.

FIG. 5 is a plan view of a cutting chain link blank having an offset boss before it is machined to include a cutter bit receiving bore.

FIG. 6 is a side elevational view of the chain link blank of FIG. 5.

FIG. 7 is a side elevational view of a cutting chain link having a centered boss machined to include a cutter bit receiving bore with one type of cutter bit positioned within the bore.

FIG. 8 is a side elevational view partially sectioned of a cutting chain link having an offset boss machined to include a cutter bit receiving bore in the oblique face with one type of cutter bit positioned within the bore.

FIG. 9 is a side elevational view of the cutting chain link shown in FIG. 8 machined to include a cutter bit receiving bore in the oblique face with one type of cutter bit positioned within the bore.

FIG. 10 is a side elevational view of a cutting chain link having a centered boss machined to include a cutter bit receiving bore with a second type of cutter bit positioned within the bore.

FIG. 11 is a side elevational view of a cutting chain link having an offset boss machined to include a cutter bit receiving bore in the oblique face with a second type of cutter bit positioned within the bore.

FIG. 12 is a side elevational view partially sectioned of the cutting chain link shown in FIG. 11 machined to include a cutter bit receiving bore in the oblique face with a second type of cutter bit positioned within the bore.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A cutting chain 10 adapted for mining materials, for example coal, is shown in FIGS. 1 and 2. Such cutting chains can also be used for mining other materials, as for example, iron ore. In the form shown, the chain 10 is intended to be used in a mining machine of the type disclosed in U.S. Pat. No. 3,305,273 in which it functions as a trim chain or clearance cutting chain, but it can also be adapted for use with other mining apparatus.

The cutting chain 10 comprises three types of cutting chain links 12, 14 and 16. The links 14 and 16 carry bits, which are advanced into the material being mined for cutting and breaking the material.

The cutter bits on the cutting chain 10 are laterally spaced so as to provide a cutting and breaking means across a predetermined width in the mined material. Lateral spacing of the cutter bits determines the width of the cut made by the cutting chain. As an example, in the aforementioned U.S. Pat. No. 3,305,273 the cutting chain bits are required to fill a gap in the cutter head between an intermediate section and an outer section of the rotary mining head. The cutting chain 10 comprises three parallel rows 22, 24 and 26 of chain links. In order to laterally distribute the cutter bits as required, some of the cutter bits in these rows must be laterally offset with respect to the links which carry them. The cutting chain links 16 which carry laterally
offset cutter bits have an offset portion which extends beyond the lateral dimension of the link body, as will be described below.

The cutting chain links 16 which carry offset cutter bits are located in the outside rows 22 and 26 of the cutting chain 10. These chain links 16 must be located in the outside rows 22 and 26 so that the offset portion of these links does not project toward an adjacent row of links, as would occur if the chain links 16 were located in the center row 24 of the cutting chain 10. In the outside rows 22 and 26 of the cutting chain 10, the offset portion of the chain links 16 can project toward the outside of the cutting chain 10, and hence away from an adjacent row of links. If the cutting chain were attempted to be assembled with the offset portions of the chain links 16 projecting toward an adjacent row of links, the offset portion would engage the links in the adjacent row before the chain links 16 having the offset portion were properly positioned laterally on the chain 10, and thus the cutting chain 10 could not be assembled. The links 16 in the two outside rows 22 and 26 of the instant cutting chain 10 having offset cutter bits must have their offset portions projecting in two different lateral directions. A projection of an offset portion in one lateral direction is necessary for positioning a link in one outside row 22 and a projection of an offset portion in another lateral direction is necessary for positioning a link in another outside row 26.

If chain links 16 having an offset portion are located in both outside rows 22 and 26 of the cutting chain 10, two positions for cutter bits on the chain 10 are established. It is possible to provide three more cutter bit positions on the instant cutting chain 10 by placing a link 14, having a cutter bit centered with respect to its longitudinal centerline, in each of the three rows 22, 24 and 26 of the cutting chain 10. Thus a total of five different lateral cutter bit positions are provided on the instant cutting chain 10. The cutting chain 10 could have cutter bits located in all five of the aforementioned lateral positions or in any lesser number, depending upon the lacing pattern of the cutting chain 10, and upon the material being cut.

The cutting chain 10 has some chain links 12 which do not carry cutter bits, as will be next described.

As mentioned above, there are three different types of chain links 12, 14 and 16 used in the cutting chain 10. There are chain links 12 that carry no cutter bits, chain links 14 which carry cutter bits laterally centered with respect to the link bodies, and chain links 16 which carry cutter bits laterally offset with respect to the link bodies. The distinguishing feature of these links is whether they carry a cutter bit, and if so, in what manner.

The cutting chain link 12 carries no cutter bit as seen in FIG. 1. Such a link has a generally elongated body, although its specific shape is not important. The chain link 12 can be located in any row 22, 24 and 26, and can travel in either direction along its longitudinal centerline in the instant cutting chain 10.

The second type of chain link 14 used in cutting chain 10 carries a cutter bit centered with respect to its longitudinal centerline. The cutting chain link 14 has an integral boss 30 projecting upwardly from a chain link body 32. The integral boss 30 projects upwardly a distance less than the height of the link body 32. This low projection prevents the boss 30 from rubbing against the material being cut by the chain 10. The integral boss 30 is laterally centered on the link body 32, and is within the lateral dimensions of the link body 32. FIGS. 3 and 4 illustrate the centered boss chain link 14 as a blank prior to being machined. The blank is formed by a forging operation, but it could also be produced by casting, flame cutting or other methods. The oblique face 34 on the boss is made flat by a milling operation, and the centered boss chain link 14 is subsequently machined to carry a cutter bit, as will be hereinafter described.

The third type of cutting chain link 16 used in the instant cutting chain 10 carries a cutter bit that is laterally offset. In the chain link 16, an integral boss 40 projects upwardly from a link body 42. The integral boss 40 terminates in oppositely disposed oblique faces 44 and 46 as shown in FIGS. 5 and 6. The boss 40 is offset to one side of and projects laterally beyond the lateral dimension of the link body 42. FIGS. 5 and 6 illustrate the offset boss chain link 16 as a blank prior to being machined. The blank is formed by a forging process, as is the blank for the centered boss link body 14.

One of the oblique faces 44 and 46 on the offset boss 40 is made flat by a milling operation, and the offset boss chain link 16 is subsequently machined to enable it to carry a cutter bit, as will be described below. The face to be milled flat and subsequently machined to receive a cutter bit is determined by deciding which face on the offset boss chain link 16 is to be advanced into the material to be cut.

If the offset boss chain link 16 has one oblique face 44 milled flat and subsequently machined to receive a cutter bit, it would be used in one outside row 22 of the cutting chain 10, whereas if the other oblique face 46 was milled flat and subsequently machined to receive a cutter bit, it would be used in the other outside row 26 of the chain 10.

The centered boss chain link blank 14 and the offset boss chain link blank 16 may be selectively machined in one of several different ways to receive one of a variety of cutter bits. The machining process determined by the type of cutter bit that is to be utilized.

If the same type of cutter bit is to be used in an offset boss chain link 16 and a centered boss chain link 14, the machining operations required on the two types of links are the same.

Two different types of cutter bits, and the machining operations required on the cutting chain links receiving these bits are shown in FIGS. 7–12. A cylindrical shank type cutter bit 50 is shown in FIGS. 7–9 and a plumb bob type cutter bit 52 is shown in FIGS. 10–12. FIG. 7 illustrates a centered boss chain link 14 machined to receive a cylindrical shank cutter bit 50. FIGS. 8 and 9 illustrate an offset boss chain link 16 machined to receive a cylindrical shank cutter bit 50. FIGS. 8 and 9 differ in that opposite faces 44 and 46 of the chain link boss 40 on the offset boss chain link 16 are machined to receive a cylindrical shank cutter bit 50.

The machining required for cutting chain links 14 and 16 to receive a cylindrical shank cutter bit 50 is as follows.

A cylindrical bit receiving bore 56 is formed in the centered boss chain link 14 by a drilling operation and a subsequent reaming operation. The bore 56 extends downwardly from the oblique face 34 through the boss...
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30 into the chain link body 32. A similar bore 58 is formed in the offset boss chain link 16. The bore 58 extends downwardly from the oblique face 44 through the boss 40 into the chain link body 42. As previously mentioned, either of the oblique faces 44 and 46 of the offset boss chain link 16 can be machined to receive a cutter bit.

The bores 56 and 58 of the respective centered and offset boss chain links 14 and 16 are cylindrical, and have a diameter slightly greater than, but closely fitting the diameter of the shank 60 of the cylindrical shank cutter bit 50.

A slot 64 is formed in the centered boss chain link 14 and a like slot 66 in the offset boss chain link 16 by a milling operation. The slots 64 and 66 extend laterally through the link bosses 30 and 40 and into the chain link bodies 32 and 42. The slots 64 and 66 are formed at the ends of the bores 56 and 58 in the centered boss and offset boss chain links 14 and 16.

In the centered boss chain link 14 the slot 64 extends inwardly through the boss 30 into the link body 32. In the offset boss chain link 16 the slot 66 extends inwardly through the boss 40 from the oblique face 46 opposite the oblique face 44. In FIG. 9 the offset boss chain link 16 is shown with a bore 58 in the other oblique face 46, and the slot 66 extends inwardly through the boss 40 from the oblique face 44.

The slots 64 and 66 are positioned in the centered boss and offset boss chain links 14 and 16 normal to the axis of the link bores 56 and 58.

The surface 70 in the slot 64 is in the centered boss chain link 14 is flame hardened to provide a seat for the end 74 of the cylindrical shank cutter bit 50. The cutter bit 50 has a cylindrical shank portion 60 which is received in the bore 56. The end 74 of the shank 60 is seated against the hardened seat 70 in the slot 64.

In the offset boss chain link 16 the surface 72 of the slot 66 is flame hardened to provide a seat for the end 74 of the cylindrical shank cutter bit 50. The shank portion 60 of the cylindrical shank cutter bit 50 is received in the bore 58 and the end 74 of the shank 60 is seated against the hardened surface 72 of the slot 66.

To prevent the cylindrical shank cutter bit 50 from moving longitudinally within the centered link and the offset link bores 56 and 58, a snap ring 76 is made to engage an annular groove 78 in the shank 60 of the cutter bit 50.

In addition to providing seats 70 and 72 in the chain link bodies 14 and 16 for the cylindrical shank cutter bit 50 the slots 64 and 66 permit dust to escape from the bores 56 and 58 and around the shank 60 of the aforementioned cutter bit 50.

FIG. 10 illustrates a plumb bob cutter bit 52 mounted in a centered boss chain link 14. FIGS. 11 and 12 illustrate a plumb bob cutter bit 52 mounted in an offset boss chain link 16. FIGS. 11 and 12 differ in that opposite faces 44 and 46 of the chain link boss 40 on the offset boss chain link 16 are machined to receive the plumb bob cutter bit 52.

The machining required for the chain links 14 and 16 to receive a plumb bob cutter bit 52 will next be described.

The oblique face 34 of the centered boss chain link 14 and one of the two oblique faces 44 and 46 of the offset boss chain link 16 are machined flat by means of a milling operation in the same manner as if the chain links 14 and 16 were being machined to receive a cylindrical shank cutter bit 50.

A cutter bit receiving bore 80 is formed in the centered boss chain link 14 by means of a drilling operation and a subsequent reaming operation. The bore 80 extends inwardly from the oblique face 34 through the boss 30 into the link body 32. The perimeter of the bore 80 in oblique face 34 of the centered boss chain link 14 is beveled by means of a drilling operation to form a seat 82 which engages an oppositely beveled surface or seat 84 on the plumb bob cutter bit 52 when its shank 86 is positioned within the bore 80.

A cutter bit receiving bore 90 is formed in the offset boss chain link 16 the same way as in the centered boss chain link 14. The bore 90 extends inwardly from the oblique face 44 through the boss 40 into the link body 42. In FIG. 12 the bore 90 is shown extending inwardly from the other oblique face 46. The perimeter of the bore 90 in one of the oblique faces 44 and 46 is beveled to form a seat 92 which engages an oppositely beveled surface or seat 94 on the plumb bob cutter bit 52 in the same manner as on the centered boss chain link 14.

The engagement of the seats 82 and 92 on the centered boss and offset boss chain links 14 and 16 prevents further movement into the respective chain link bores 80 and 90 by the plumb bob cutter bit 52.

An expandable collar 94 is mounted in a groove 96 on the shank 86 of the plumb bob cutter bit 52. The collar 94 is split 98 as is known in the art to allow the collar 94 to be compressed in the groove 96.

After the shank 86 is inserted in the centered boss chain link 14, the collar 94 expands to engage a groove 100 in the chain link body 14. The engagement of the collar 94 with the groove 100 prevents longitudinal movement of the plumb bob cutter bit 52 within the bore 80.

A groove 102 within the offset boss chain link 16 similar to the groove 100 in the centered boss chain link 14 engages the collar 94 to prevent longitudinal movement of the plumb bob cutter bit 52 within the bore 90.

Pulling the cutter bit 52 away from either the centered boss or offset boss links 14 and 16 causes the collar 94 to be compressed and permits removal of the cutter bit 52.

A cylindrical bore 106 is drilled in the centered boss chain link body 32. The bore 106 extends laterally through the link body 32 and intersects the end of bit receiving bore 80 in the link body 32. A similar bore 108 is drilled laterally through offset boss link body 42 and intersects the end of the bit receiving bore 90 in the link body 42. The bores 106 and 108 in the centered boss and offset boss chain links 14 and 16 permit dust to escape from the bit receiving bores 80 and 90 of the respective links. If the dust could not escape the plumb bob cutter bit 52 would become jammed in the bit receiving bores 80 and 90.

Connecting the cutting chain links 12, 14 and 16 together are chain pins 110. The chain links 12, 14 and 16 have circular chain pin receiving bores 112 drilled therein that extend transversely through the links 12, 14 and 16 at both ends thereof. The diameter of the bore 112 is slightly greater than the diameter of the chain pin 110, so that the pin 110 can be inserted into the bore 112.

As shown in FIG. 1, the cutting chain 10 contains three laterally spaced rows 22, 24 and 26 of cutting chain links 12, 14 and 16. The three rows are linked to-
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together by passing a chain pin 110 through the bores 112 so as to connect the front of the center row 24 links with the rear of the outer row 22 and 26 links, and the rear of the center row 24 links with the front of the outer row 22 and 26 links.

Various means may be employed to secure chain links 12, 14 and 16 to chain pins 110 and to maintain the links in spaced relationship. One suitable securing method is by using lock pins 114. Each link is provided with one or more circular lock pin holes 116 that extend downwardly from the top of the centered and the offset boss chain link bodies 32 and 42 into the chain pin bores 112. The lock pin holes 116 have a diameter slightly less than that of the circular lock pins 114. The lock pins 114 may be fluted for forced insertion into the lock pin holes 116. When so inserted and when the cutting chain links 12, 14 and 16 are properly positioned, the lock pin 114 rests in a groove (not shown) in the chain pin 100. The fit between the lock pin 114 and the groove permits the chain pin 110 to rotate.

The cutting chain links of this invention provide link bodies with improved integral bosses extending upwardly therefrom. The improved bosses can be machined to support various types of cutter bits. Further, the blank chain link bodies having offset bosses can be machined for use in either outside row of the cutting chain.

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 applicants, therefore, wish not to be restricted to the precise construction herein disclosed.

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

1. An integral cutting chain link formed as a unitary element to support a cutter bit in position to cut and break material as the cutting chain and the chain link with the cutter bit are advanced in the material, comprising: a chain link body with lateral bores that are substantially spaced from each other in the longitudinal direction of the chain link to receive pins for connecting the chain link to other chain links in an articulated assembly; a substantial portion of said chain link body being disposed between said lateral bores; a boss integral with the link body and projecting upwardly from said link body between said lateral bores; a face on said boss disposed obliquely with respect to the direction of advance of said link body; said boss being disposed behind said face and extending rearwardly therefrom to merge into the link body; a bore in said boss that opens in said face and extends downwardly from the face through the boss and into said link body between said lateral bores to receive a cutting bit that has a cylindrical shank with the cutting bit shank being supported at least in part in said bore in the chain link body that is disposed between said lateral bores; a seat adjacent said bore for engaging said cutter bit; and an access opening in said link body and providing communication with the end of said bore in the chain link body.

2. A cutting chain link as recited in claim 1, wherein said boss is centered with respect to the direction of advance of said link body; and said oblique face merges into said link body.

3. A cutting chain link as in claim 2, wherein said bit receiving bore is transversely centered with respect to said link body.

4. A cutting chain link as in claim 2, wherein said boss projects upwardly from said link body to a height that is less than the height of said link body.

5. An integral cutting chain link formed as a unitary element to support a cutter bit in position to cut and break material as the cutting chain and the chain link with the cutter bit are advanced in the material, comprising: a chain link body with lateral bores that are substantially spaced from each other in the longitudinal direction of the chain link to receive pins for connecting the chain link to other chain links in an articulated assembly, a substantial portion of said chain link body being disposed between said lateral bores; a boss integral with the link body and projecting upwardly from said link body between said lateral bores and laterally offset to one side of said link body; a face on said boss obliquely disposed with respect to the direction of advance of said link body; a cutter bit receiving bore extending downwardly from said oblique face through said boss, into said link body between said lateral bores to receive a cutting bit that has a cylindrical shank with the cutting bit shank being supported at least in part in said bore in the chain link body that is disposed between said lateral bores; a seat adjacent said bore providing a surface for engaging said cutter bit; and an access opening extending in said link body and providing communication with the end of said bore in the link body.

6. A cutting chain link as recited in claim 5, wherein said boss extends laterally beyond the lateral dimension of said link body; said cutter bit receiving bore is laterally offset in said chain link body to one side of said chain link body; and said oblique face merges into said link body.

7. A cutting chain link as recited in claim 5, wherein said boss projects upwardly from said link body to a height that is less than the height of said link body.

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