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SIDE BENDING CUTTER CHAIN

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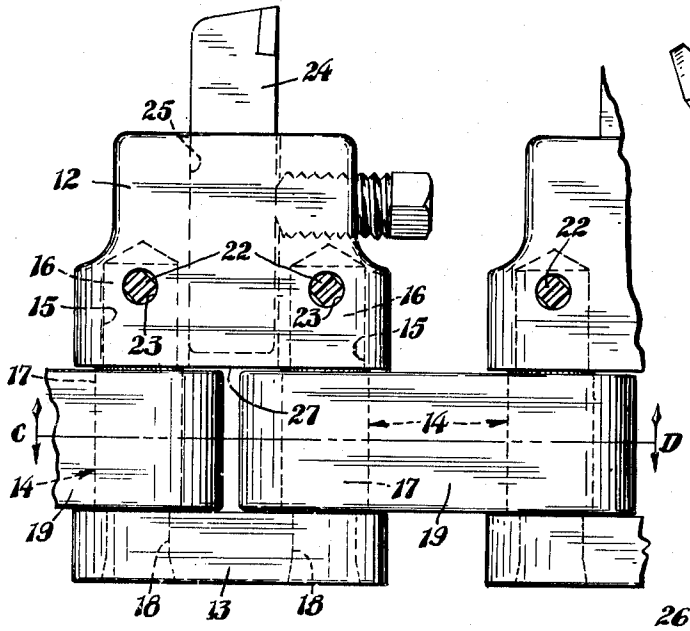


Fig. 1.

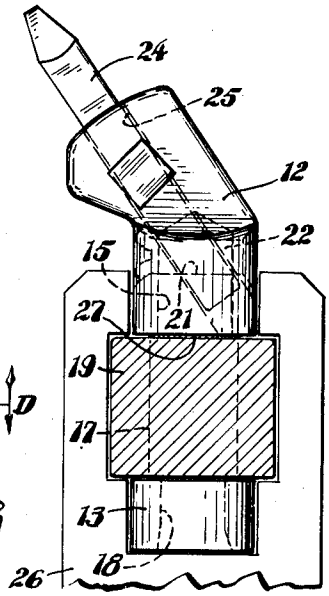


Fig. 2.

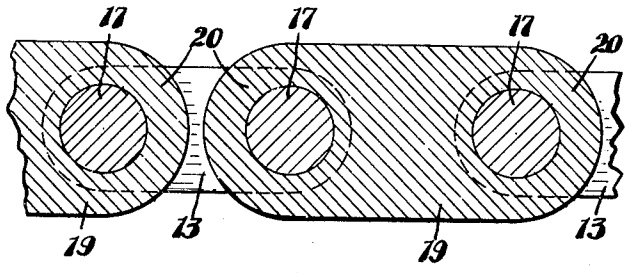


Fig. 3.

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SIDE BENDING CUTTER CHAIN

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3 Claims. (Cl. 262—33)

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This invention relates to mining machine chains and particularly to a coal cutting chain articulated to flex about a closed orbit in a plane at right angles to the direction of the cutting progress.

A prime objective is to provide a detachable bit block lug which will be unaffected by friction and wear, and therefore re-usable with the renewal elements which do wear out through friction, thereby reducing the cost of maintaining and replacing such chains.

A further object is to provide an arrangement whereby clean and accurately broached bit sockets for standard full sized bits may be formed in the bit blocks of such side bending chains.

A further object is to provide for all parts of the chain to be made of steel bars or steel drop forgings, obviating the use of any castings, which are objectionable for the severe service requirement for many reasons.

A further object is to provide for more accurate and at the same time more economical machining and sizing of the chain parts.

A further object is to provide in the parts that are hardened to resist wear, means to obviate distortion and secure greater strength in the parts, by novel pre-assembled heat treating, with subsequent dis-assembling of the parts.

A further object is to provide that such chains will operate on sprockets and in guideways presently in use for side bending chains which heretofore have had to be made of castings by reason of the shape of their links.

A further object is to provide for quick replacement of any parts of the chain which may break while in service.

A further object is to provide for my chain to have greatest strength possible together with shortest possible pitch, whereby more bits may be working, and the chain may flex around small sprockets and idlers.

These and other objectives will be apparent from the following description and the drawings, in which:

Fig. 1 is a side elevation of links of my improved chain,

Fig. 2 is an end elevation of the chain of Fig. 1,

Fig. 3 is a cross section of Fig. 1 taken on line C—D.

For clarity in understanding the drawings the terms upper and lower will be used in the following description and claims in referring to the elements of the chain as they appear in the drawings, it being understood that in the actual mounting and operation of the chain in the mining machine these terms may not actually be applicable.

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In previously-known "side-bending" chains, each bit block has a link head and a link base portion connected together by an integral central narrow web or stem in the middle of the link. The link head has a socket therein for receiving a ½" x 1" x 4" bit and is provided with a screw for securing the bit. The central web frequently becomes broken in service. Aligned bores are formed in the link base and head portions, and hardened pins of ¾" diameter steel are supported in those bores by a drive-fit tolerance intended to prevent axial or rotary movement of the pins, which it does not always do. Connecting links swivel on those pins. These connecting links are of 2 inch width compared with 1½" width of the link base portions so that a quarter-inch projection of the connecting links beyond each side of the bit-carrying link-base portions will serve as guide ribs traveling in a corresponding groove in an associated guideway to retain the chain therein. The connecting links at their ends are formed to a much reduced radius whereby they will clear the central web portions of the bit-carrying links as the links swivel.

Such chains must bend sharply around small sprockets and idlers and must therefore be of very short pitch, this of course also meeting an objective of having as many bits working in the chain as possible. The present chains to be replaced are 4¾" pitch, with bit block centers 1⅞" and connecting link centers 2⅞". The "McKinlay" type entry driving machines for which these chains are used are specially built and it would not be practicable to change the above mentioned chain pitch, which would necessitate not only new and different sprockets and idlers but also expensive dismantling of the machine. It is also highly desirable to hold the chain dimensions for operation in the existing guideways of these machines. The chain is driven by sprockets having teeth straddling the connecting links and engaging the rounded ends of bit-carrying links.

In Fig. 1 it will be seen that my improved bit block is formed of two parts, a drop forged detachable bit block head 12 and a base portion 13 having integrally formed with it a pair of bearing pins 14. The head portion 12 has a flat base 27 and is bored at 15 to snugly receive the ⅞" diameter upper ends 16 of pins 14, the central or bearing portion 17 of the pins being one inch diameter, their lower ends of ¾" diameter and being swelled by heavy pressure into taper-reamed apertures 18 of base portion 13, whereby portion 13 and pins 14 become a solid integral structure.

It will immediately be seen that the necessity for a central web or stem connecting my bit block head 12 to my link base 13 has been obviated. And I may now form my connecting links 19 with full end radius, so that the ends of adjacent connecting links 19 barely clear each other, instead of having their ends of greatly reduced radius to clear a central web structure. This permits the links to have greater cross sectional area 20. It also permits a full one inch diameter bearing instead of only ¾ inch.

Intersecting the axes of pins 14 are apertures 21 to provide for rivets 22 passing through aligned apertures 23 in block head 12. A stainless steel split rivet 22 will provide non corrosive and quick means to detachably fasten block head 12 to the pins 14. In service the block head 12 sustains no wearing or friction, so that whenever the chain bearings become worn it will be necessary only to replace the connecting links 19 and base portions 13 which carry new bearing pins. The drop forged block head 12 is the most expensive element since it requires more machining, also tapping, and must be pre-drilled with an aperture through which successive broaches are pulled in order to form the rectangular bit socket 25 which will hold a standard size carbide tipped bit 24.

By reference to Fig. 2 it will now be understood why it has not heretofore been possible to make these side bending chains other than by casting their links. The bit sockets which must be disposed in angular planes to cut chain clearance may be readily sand cored into cast links, while with drop forged links predrilling for and pulling broaches through the solid forging would seriously cut through the central web of the previously-known link described above. Those familiar with the art will understand the need for forgings in this severe service application, finer more dense grain structure, certified close tolerances as to carbon and alloying elements, complete freedom from hidden air holes in the metal. In Fig. 1 bit socket 25 is broached.

Such chains are subjected to extreme frictional wear by reason of abrasive impurities encountered in cutting coal, therefore it is desirable to have extremely hard bearing surfaces such as pack hardening to provide a brittle-hard case. However under stress any link aperture that is case hardened is subject to "case-cracking." The inside wall of such aperture will, after undergoing severe service involving shocks, be found to have visible case cracks. This is because the core must be low in carbon as .15, and the soft and ductile core will yield under shocks, thereby permitting the hard case to crack. Such cracks soon penetrate the core, resulting in complete fracture.

To obviate this, also to hold pins 14 against distortion when quenched, which would certainly throw them out of alignment with apertures 15 of the link heads, my novel links permit a unique yet very simple procedure. During the entire heat treating process pins 14 are retained in apertures 15 by wires passing through rivet apertures 21, 23. This will of course insure holding alignment, the parts being separated only after complete heat treatment. Also, since apertures 18 of base portion 13 as well as apertures 15 of the head portion 12 are completely filled by reason of pins 14 being in them, when the structure is heated in pots of carbon, these aperture inner surfaces will not be saturated with carbon, consequently when quenched they will not be glass hard as will the exposed bearing surface of the pins 14.

I claim:

1. In a mining machine cutter chain articulated for traveling about a closed orbit in a plane at right angles to the direction of cutting progress, a link structure comprising a base portion of rectangular cross section having parallel apertures adjacent its opposite ends and said ends rounded radially of the axes of said apertures, upstanding bearing pins having end portions of reduced diameter supported immovably in said apertures by reason of being pressure expanded therein, the middle portion of said pins being case hardened to provide a bearing for a connected link to swivel upon, a lug provided with a socket and with parallel bores aligned with said apertures, the opposite end portions of said pins being supported in said parallel bores, and rivets passing through said lug and through said pins near their upper ends for detachably securing said lug to said pins.

2. In a mining machine cutter chain articulated for traveling about a closed orbit in a plane at right angles to the direction of cutting progress, a link structure including an upper socketed lug and a detachable lower base portion having upstanding bearing pins, means for detachably associating the lug and the base portion including apertures in said lug for receiving said bearing pins, further apertures in said lug, and locking elements supported in said further apertures for securing said pins in said lug.

3. For use in a mining machine chain articulated for travelling about a closed orbit in a plane at right angles to the direction of cutter-bar progress, a two-part chain link including an upper, elongated body having a flat base surface, said body being formed with a socket of rectangular cross section extending through said body and opening through said base surface, the axis of said socket lying in a plane perpendicular to said base surface but said axis being inclined in said plane at an acute angle with respect to said base surface, said body further being formed with a pair of spaced, parallel apertures opening through said base surface with their axes perpendicular to said base surface, said apertures extending into said body at points near the opposite ends of said body, and a lower base element comprising an elongated body of rectangular cross section, a pair of generally cylindrical pins having their lower ends rigidly and immovably carried by said lower element, the upper ends of said pins being detachably secured respectively in said upper body parallel apertures and spacing said lower element from said upper body, the intermediate portions of said pins being located in the space between said lower element and said upper body to provide bearing surfaces for adjacent connecting links to swivel upon, the opposite ends of said upper body and of said lower element being symmetrically rounded upon radii of said pins to provide surfaces for propulsion by sprocket teeth spaced apart to straddle such connecting links.

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