Aug. 8, 1939. F. L. FULKE 2,168,794

MINING CHAIN CUTTER

Filed July 1, 1933

Fig. 1.

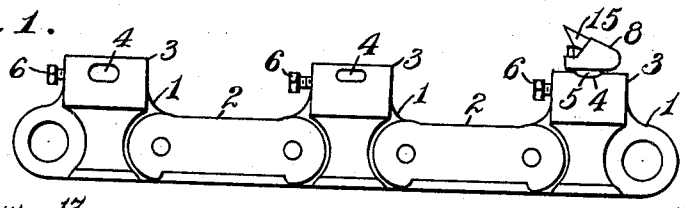

Fig. 2.

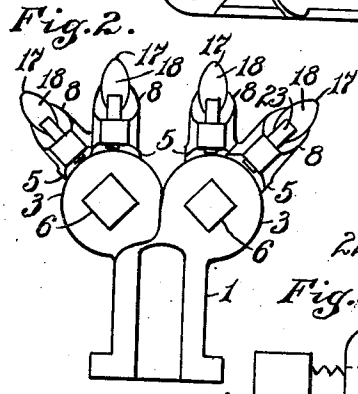

Fig. 5.

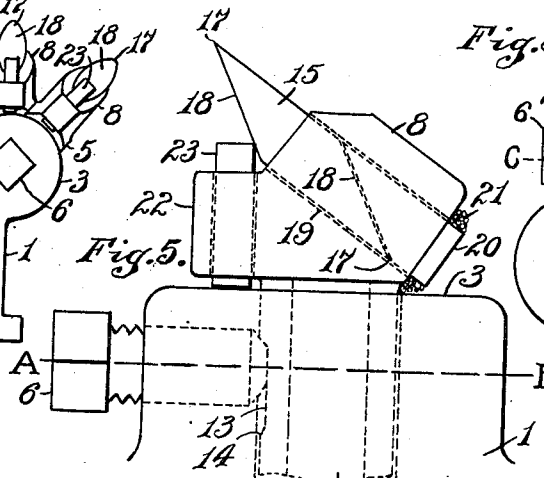

Fig. 3.

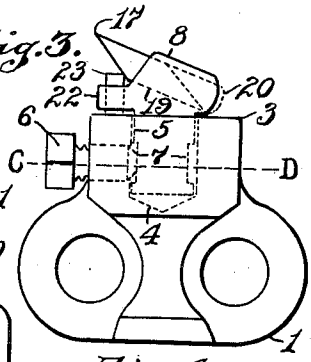

Fig. 4.

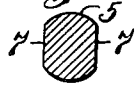

Fig. 6

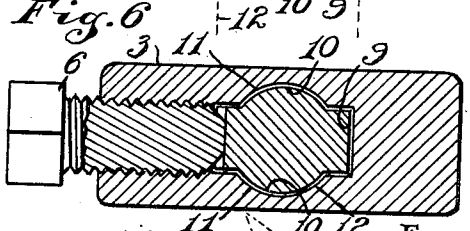

Fig. 9.

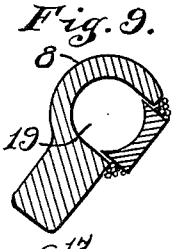

Fig. 7.

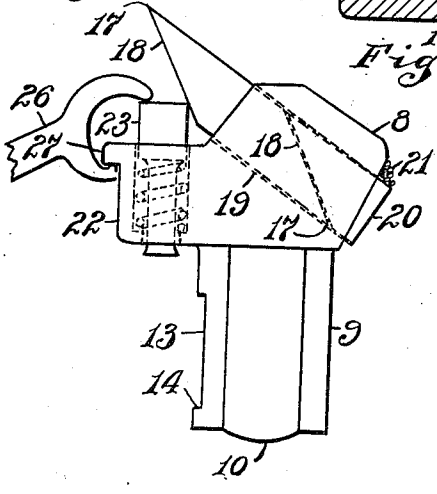

Fig. 8.

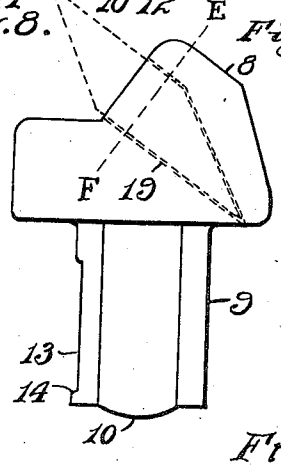

Fig. 10.

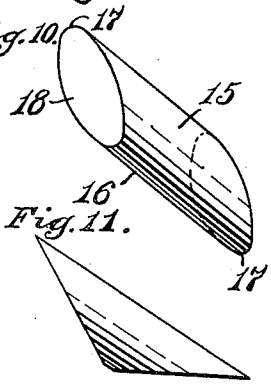

Fig. 11.

INVENTOR.
Frank L. Fulke;

BY
Hood & Hahn.
ATTORNEYS

Patented Aug. 8, 1939

2,168,794

UNITED STATES PATENT OFFICE

2,168,794

MINING CHAIN CUTTER

Frank L. Fulke, Terre Haute, Ind., assignor to Frank Prox Company, Terre Haute, Ind., a corporation of Indiana

Application July 1, 1933, Serial No. 678,555

14 Claims. (Cl. 262—33)

This present invention relates to certain new and useful improvements in cutter bits and carriers therefor, adapted to use in coal mining machines for the cutting of kerfs.

An especial object of this invention is to provide cutter bits of improved design adapted to plural usage without resharpening.

A further object is to provide improved holding devices for the bits.

A further object is to provide improved links to cooperate with my improved holding devices.

Other objects and the means whereby I attain these objects are fully set forth in the following specification and illustrated in the accompanying drawing of which:

Fig. 1 is a side elevation of a section of chain illustrating a preferred embodiment of my invention;

Fig. 2 is an end elevation of the chain shown in Fig. 1 illustrating how successive links in the chain support bits at different angles on a plane at right angles to the length of the chain for the purpose of producing a kerf of desired width;

Fig. 3 is a detail showing one of the bit supporting links illustrated in Fig. 1;

Fig. 4 is a cross section on line C—D of the bit holder stem illustrated in Fig. 3;

Fig. 5 is a side elevation of my bit holder adapted for use in links formed with broached apertures for using ordinary mine bits of rectangular cross section;

Fig. 6 is a cross section of the structure illustrated in Fig. 5 on line A, B;

Fig. 7 illustrates a modification of my bit locking element employing a spring;

Fig. 8 illustrates how I may partially form the bit receiving aperture in the process of drop forging my holder, and subsequently complete the formation of the aperture by welding;

Fig. 9 is a cross sectional view of Fig. 8 on line E, F showing how I may form a wall of my bit aperture;

Fig. 10 illustrates my preferred form of bit segmented from a round bar by parallel equidistant diagonal slices;

Fig. 11 illustrates a modified bit produced by rotating the bar through 180 degrees after each alternate diagonal slice.

In Fig. 1, bit supporting links 1 are suitably connected as by strap links 2 to form a cutter chain. The links 1 have projecting heads 3 offset laterally from the medial plane of the chain as clearly shown in Fig. 2. Round apertures 4 are drilled in these heads for receiving the round shank 5 of my improved bit holders 8. A set screw 6 takes through a wall of the aperture 4 and engages the holder shank 5 at a flattened portion 7 to secure the holder firmly against displacement from the aperture 4, and it will be seen that by engagement with the flattened portion 7 the set screw will also secure the holder against rotation in the aperture. It is sometimes necessary to cause the cutter chain to cut while it is propelled in a direction opposite the normal direction and this necessitates turning all the bits in the chain through 180 degrees. While this may be readily done with ordinary mine bits by withdrawing them from their sockets and reinserting them I am not aware that any satisfactory provision has ever been made for reversing plural armed bits secured in holders attached to the links. I readily accomplish this by loosening the screw 6, rotating the shank 5 through 180 degrees and tightening the screw, it being understood that there are two of the flattened portions 7 formed oppositely on the shank. It will be seen that this operation can be performed swiftly and easily without removing the shanks 5 from the apertures 4 in the links or disengaging my bit from its seat in the holder.

The round apertures 4 of successive links 1 in the chain are drilled at varying angles in a plane at right angles to the length of the chain so as to position the bits of successive links in spiral relation to provide for cutting a kerf of suitable width to clear the chain and its supporting guides, as is clearly illustrated in Fig. 2. By this method I am able to form my cutter chain with links made from a single die or pattern, it being understood that the link 1 may be turned end for end to position its offset head 3 on the opposite side of the chain. Fig. 2 clearly shows how the bits are grouped substantially radially about lines parallel to but offset laterally from the medial plane of the chain. By this method I attain economies and advantages not hithereto obtainable.

In Fig. 5, my bit holder 8 is preferably formed as an integral drop forging and is provided with an integral solid shank 9 having walls adaptable to conform to the walls of link aperture 12 as in Fig. 6, and on opposite sides of this shank are longitudinally extending enlargements 10, round in contour and of a slightly less radius than round walls 11 of aperture 12 formed in links of the type adapted to use ordinary mine bits of rectangular cross section. Most cutter chains in current use are composed of drop forged links of this type in which aperture 12 is formed by first drilling a relatively large hole and enlarging

this hole by broaching to receive a bit of rectangular section. In this way I attain a prime object of the invention in providing a bit holder suitable for cooperation with chains in current use of sufficient strength to resist breaking. I am aware of Patent 1,795,804 to Cartlidge showing a reinforcing rib formed on one of a pair of shank elements but my construction provides much greater strength because of the characteristics of its solid shank. It must be realized that the problem is to provide utmost strength in a bit holder under the imposed limitation of size of the small aperture in links adapted to use mine bits formed from ½ x 1" bar steel. Such bits break off frequently at the outer end of the bit aperture and it is an object of my invention to overcome the tendency toward breakage at or adjacent that point. In my holder I provide a solid shank completely filling the bit aperture and thereby provide for the first time the greatest strength obtainable under the limitations of the problem. An additional desirable object that I attain by forming longitudinal ribs **10** of part-cylindrical cross-section at opposite sides of my bit holder shank **9** is that under the pressure of screw **6** the rounded ribs of my shank will engage solidly with a wedgelike action against the corresponding rounded portions **11** of the aperture, thus preventing any lateral motion in operation, as would be encountered were my shank of purely rectangular section, by reason of the considerable clearance necessary between the dimensions of the shank and the aperture.

In Fig. 5 I show on the front face of solid shank **9** of my bit holder **8** a recess **13** constituting a reduction in thickness of the shank and defining a shoulder **14** underlying the nose of the screw **6** and at a suitable distance below it for the purpose of preventing displacement of the bit holder should the screw **6** loosen slightly during operation and also to serve as a stop to limit the slide of shank **9** in aperture **12** in cooperation with my method of locking or unlocking the bit relative to my holder as will now be made clear.

In Fig. 10 bit **15** has a round body **16** and cutting points **17** formed at its opposite ends. Its flat front and rear faces **18** are of oval outline and are parallel to each other and oblique to the longitudinal body of the bit. I form this bit readily by advancing a bar of round steel through a cutting apparatus and slicing the bar diagonally at uniform intervals on parallel lines. In Fig. 5 my bit holder **8** is formed with a socket **19** accommodating the body of my bit with one of its ends projecting forward and upwardly from the socket in position to cut. The side walls of the socket are formed to closely embrace the body of my bit by drilling entirely through the head of my holder and plugging the rear end of the bore with plug **20**. I may elect to employ a bit formed in the manner described from square steel bars, or oval bars, or diamond section bars, and in either of these cases I may form the walls of the socket by broaching, it being understood that I propose to drill or broach entirely through the head of my bit holder since I have found this to be the practicable way to form the socket to insure a closely fitting relation between the bit and the socket walls. The plug **20** is similar in form to an end of my bit whether of round, square, oval, or diamond section, and it is inserted in the socket **19** from the rear with its forward obliquely flat face adaptable to receive in wedge-like manner the rear oblique flat end face **18** of the bit, and the plug **20** is then permanently made part of the holder as by welding at **21**. It should now be evident that my bit **15** inserted in aperture **19** is firmly engaged and supported to resist any tendency toward displacement or rotation that it may encounter in operation. There is substantially no stress, other than vibration, encountered in operation which might tend to move the bit longitudinally forward out of the socket **19** as all stresses encountered tend to lock or drive and wedge the bit more securely into the socket. In order to prevent any possibility of accidental withdrawal of the bit I provide means to block any forward longitudinal movement of the bit in its socket. A forwardly extended portion **22** of my holder is provided, by drilling, with a substantially vertical opening adapted to receive slidably therein a round plunger **23**. This plunger is slightly burred at its opposite ends after insertion in the holder to prevent accidental removal and the length of the plunger is substantially greater than that of the opening in which it slides. Now considering Fig. 5, if I loosen screw **6** and slide the holder shank **9** outwardly in aperture **12** the limiting stop **14** will engage the screw. At this point plunger **23** may slide downwardly to a position whereby its upper end will be entirely clear of the path required for the bit to be withdrawn from its aperture **19**, and the bit may then be withdrawn readily and turned end for end for a second usage or else replaced by a new bit. When the bit has been reinserted in the aperture it is automatically locked against removal by simply pushing the holder to cause shank **9** to slide inwardly in aperture **12** whereupon the lower end of plunger **23** will come in contact with the top of the link causing the plunger to slide upwardly to engage the front face **18** of the bit which, being inclined angularly forward, will cause a rearward thrust on the bit. In this way I provide for automatically locking and unlocking the bit.

Fig. 7 illustrates a modification in which I employ a spring to exert a constant upward pressure on plunger **23** to maintain it in bit locking position, and I provide a releasing tool **26** cooperating with projection **27** whereby the plunger may be conveniently depressed to unlock the bit.

Figs. 8 and 9 show a modification of my method of forming the socket **19** to provide that the contour of its walls and rear end face shall coincide closely with the adjacent surfaces of my bit. In this case I preferably form the bit socket **19** so far as possible in the process of drop forging the holder as may be understood from Fig. 8. A projection on the forging die will form the depression bounded by dotted lines, and it will only be necessary to weld a cover plate in place as illustrated in Fig. 9 to form a side wall to complete the socket. I may also form this side wall by building it up with metal by arc-welding against a copper block shaped like my bit inserted in the partially formed socket as will be readily understood by those familiar with arc-welding.

I may provide an outlet for the exit of dirt accumulating in the bit recess in my holder by drilling a small hole in the wall of the holder communicating with the rear extremity of the bit recess.

I claim as my invention:

1. A bit holder having a head and a shank, a plural armed bit seated in a recess in the head with an arm projecting outwardly therefrom in position to cut, and a plunger operable in the holder to engage the projecting arm for pre-

venting the displacement of the bit from its recess.

2. A bit holder having a head and means for securing the holder to a mining chain link, a plural armed bit seated in a recess in the head with an arm projecting outwardly therefrom in position to cut, and means movable under the influence of a spring to cooperate with the projecting arm to prevent displacement of the bit from its recess.

3. A bit holder, a plural armed bit seated in the holder with one arm projecting forwardly and upwardly in cutting position with the said arm presenting a flat front face inclining slightly downwardly and rearwardly from the cutting point, and a member carried by said holder and slidable upwardly to engage the said front face to block exit of the bit from its seat.

4. A bit holder having a shank, a bit seated in the holder and disposed at a substantial angle to the axis of said shank, and a plunger operable in the holder in a line substantially parallel to the axis of said shank to engage the bit.

5. A bit holder associated with a link, a bit seated in the holder, and a plunger associated with the holder and cooperating with the exposed end of said bit to lock the bit therein, said bit extending into a position axially beyond the adjacent end of said plunger.

6. A coal cutting chain comprising bit carrying links, bit holding mechanism comprising a bit embraced in a seating element detachably carried by a link and presenting forwardly of the seating element a forwardly and upwardly inclined bit face terminating in a cutting point, an abutting element in advance of the said bit face and spring means associated with one of said elements for locking the bit between the seating element and the abutting element.

7. In combination with a mining chain link, bit holding mechanism comprising a seating member detachably supported in a socket formed in the link, a double ended bit embraced by the seating member with its front arm upwardly and outwardly inclined and terminating in a cutting point, an abutting member in advance of said arm and spring means associated with one of said members for bringing the abutting member and the said arm into engagement to lock the bit in the seating member.

8. A mining chain link, a bit embraced in a seating element detachably associated with the link, an abutting element in advance of the bit and spring means for shifting one of said elements to lock the bit securely against displacement between the two said elements.

9. A bit holder having a head and a shank, a plural-armed bit seated in a recess in the head with an arm projecting outwardly therefrom in position to cut, and a plunger operable in the holder and engaging the bit upon movement of the holder shank into a shank socket provided therefor.

10. In a device of the class described, a bit holder comprising a shank and a head, a socket formed in said head and having its axis disposed at an obtuse angle to the axis of said shank, a plural-armed bit having one arm disposed in said socket and having another arm projecting therefrom, said head being further formed with a bore having its axis angularly related to the axis of said socket, a blocking element reciprocably received in said bore and formed with a reduced stem, and a coiled spring surrounding said stem and urging said element into blocking engagement with the projecting arm of said bit.

11. The combination with a mining machine chain link formed with a shank-receiving socket, of a bit holder comprising a shank reciprocably engageable in said link socket and a head, said holder head being disposed at all times entirely outside said link socket, said head being formed with a socket having its axis disposed at an obtuse angle to the axis of said shank, a plural-armed bit having one arm disposed in said head socket and having another arm projecting therefrom, said head being further formed with a bore having its axis angularly related to the axis of said head socket, and a blocking element axially reciprocably received in said bore and freely removable therefrom in an axial direction when said bit is not positioned in said head socket and said shank is not seated in said link socket, said blocking element engaging with the surface of said link as said shank is entered in said link socket, and being movable, by seating movement of said shank, into blocking engagement with the projecting arm of said bit when said bit is seated in said head socket.

12. In a device of the class described, a bit holder comprising a shank and a head, a socket formed in said head and having its axis disposed at an obtuse angle to the axis of said shank, a plural-armed bit having one arm disposed in said socket and having another arm projecting therefrom, said head being further formed with a bore having its axis angularly related to the axis of said socket, and a blocking element reciprocably received in said bore and movable into and out of blocking engagement with the projecting arm of said bit.

13. The combination with a mining machine chain link formed with a shank-receiving socket, of a bit holder comprising a shank reciprocably engageable in said link socket and a head, said holder head being disposed at all times entirely outside said link socket, said head being formed with a socket having its axis disposed at an obtuse angle to the axis of said shank, a plural-armed bit having one arm disposed in said head socket and having another arm projecting therefrom, said head being further formed with a bore having its axis angularly related to the axis of said head socket, and a blocking element reciprocably received in said bore, said element engaging with the surface of said link as said shank is entered in said link socket, and being movable, by seating movement of said shank, into blocking engagement with the projecting arm of said bit.

14. In a device of the class described, a bit holder comprising a shank and a head, a socket formed in said head and having its axis disposed at an obtuse angle to the axis of said shank, a plural-armed bit having one arm disposed in said socket and having another arm projecting therefrom, said head being further formed with a bore having its axis angularly related to the axis of said socket, and a blocking element axially reciprocably received in said bore and freely removable therefrom in an axial direction when said bit is not positioned in said socket, but movable into blocking engagement with the projecting arm of said bit when said bit is seated in said socket.

FRANK L. FULKE.