

July 17, 1934.

L. F. GERDETZ

1,967,116

CUTTER CHAIN

Filed June 13, 1932

2 Sheets-Sheet 1

Fig. 1.

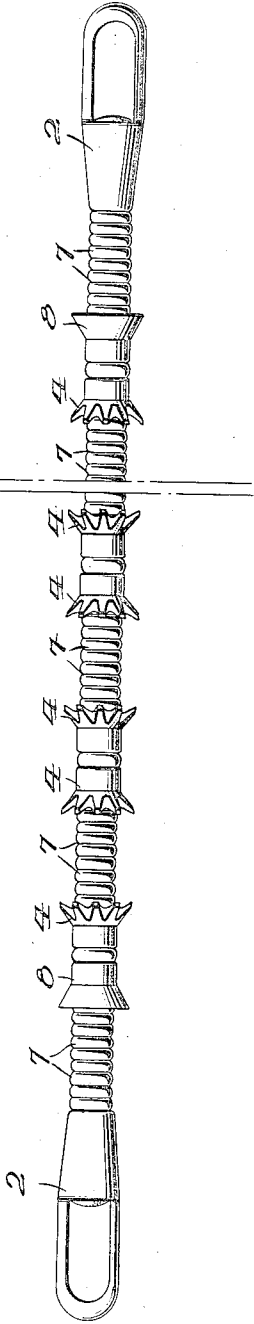


Fig. 2.

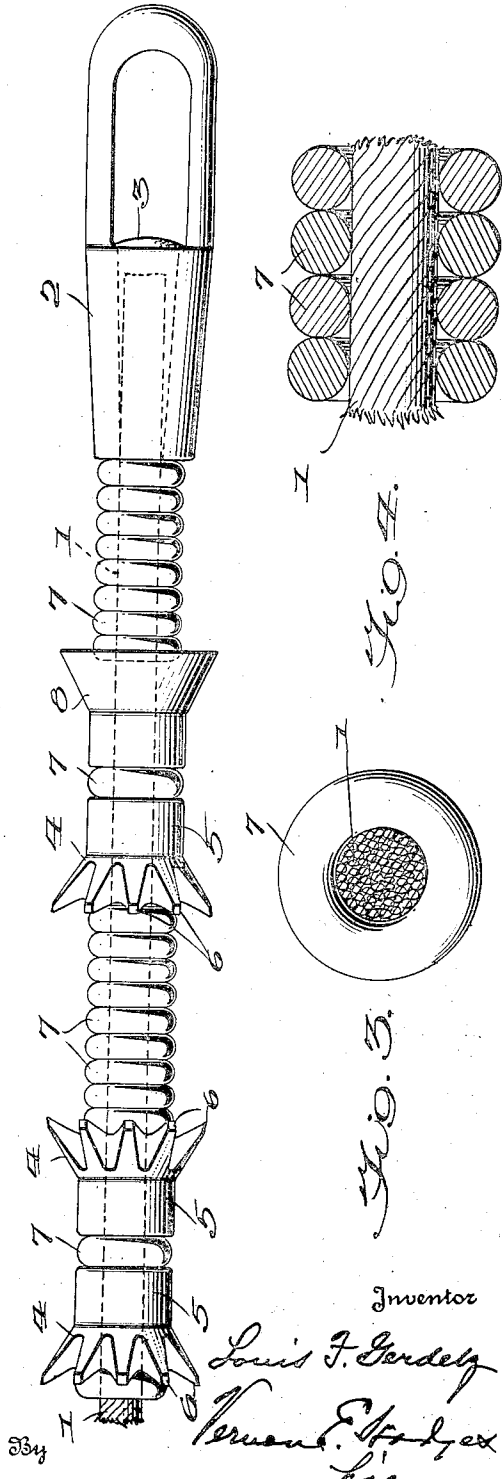


Fig. 4.

Fig. 5.

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2 Sheets-Sheet 2

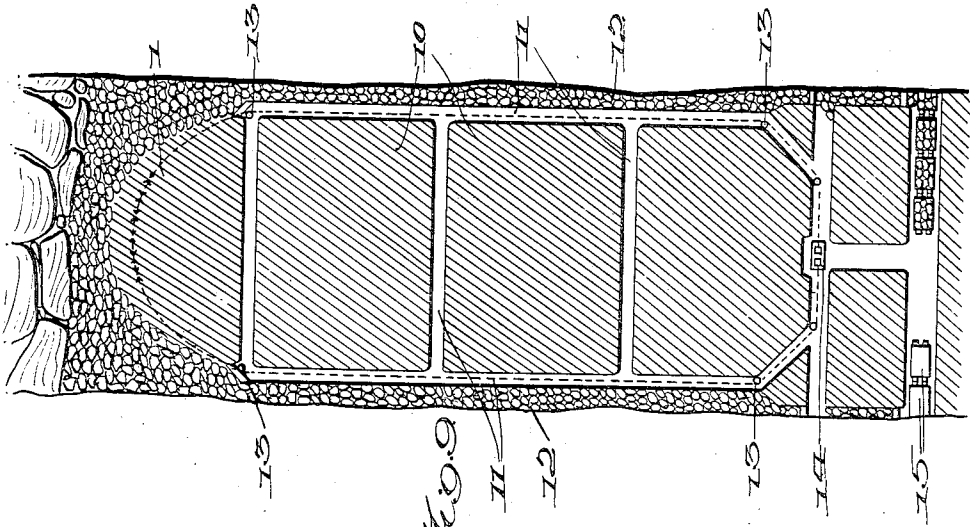


Fig. 6.

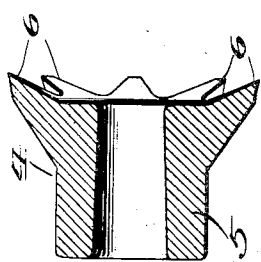


Fig. 9.

Fig. 8. a

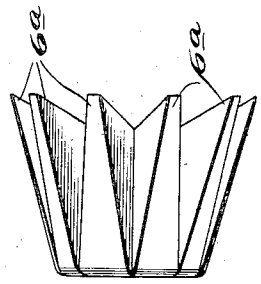


Fig. 5.

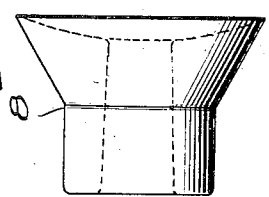
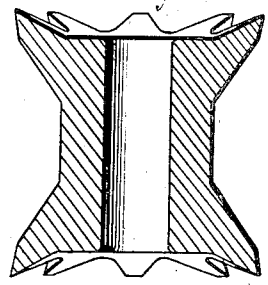
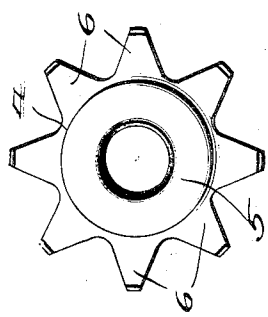


Fig. 7.

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UNITED STATES PATENT OFFICE

1,967,116

CUTTER CHAIN

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Application June 13, 1932, Serial No. 616,991

23 Claims. (Cl. 262—33)

This invention relates to a flexible cutter chain designed primarily for the cutting of coal by the process of undercutting a complete pillar by linear movement of the chain.

5 I am aware that it has heretofore been proposed to use a rope or cable with cutting tools thereon at spaced intervals but such a cutter chain would not be satisfactory because no practical way was proposed for holding the cutting tools at spaced
10 intervals on the cable.

My invention utilizes a cable or other flexible member on which the cutters are strung and spacing elements may also be sleeved over the cable between the cutters so as to keep them properly spaced apart and leaving the cutters free to
15 turn on the cable and also making it unnecessary to securely fasten the cutters to the cable which would be very impractical and also difficult. By means of a series of small spacer rings, the cutters may be properly spaced lengthwise of the cable
20 the desired distance and yet leaving the cable flexible enough to operate around a pillar in undercutting or overcutting the coal.

Another advantage in applying the cutters to
25 a cable in this manner is that when the cutters become dull and need to be sharpened, the chain may be completely detached and another substituted for it in order to permit the cutting operation to continue without serious interruption
30 while the cutting chain is taken out to sharpen the cutters. The removal of the cutters is very simple, it being necessary only to remove one of the end pieces and all of the cutters will slip off the cable merely by holding the opposite end up.

35 I propose to employ cutters of annular form provided with longitudinally arranged teeth at the periphery and preferably formed on central hubs, so that when the cutters are removed for sharpening, each cutter may be put into a die and the teeth swaged out and sharpened merely by
40 applying a few blows to one section of the die while the other section is held. This makes a very simple and convenient way of sharpening the cutters.

45 In the accompanying drawings,

Fig. 1 is a side elevation of a cutter chain embodying my improvements, with a portion of the chain broken away;

50 Fig. 2 is an enlarged side elevation of an end portion thereof;

Fig. 3 is a transverse sectional view showing the cable and spacing rings;

Fig. 4 is a partial longitudinal sectional view therethrough;

55 Fig. 5 is an end elevation of one of the cutters;

Fig. 6 is a longitudinal sectional view there-through;

Fig. 7 is a side elevation of one of the cutting and cleaning elements;

Fig. 8 is a similar view showing a slightly different form of cutter;

Fig. 8a is a sectional view showing a double cutter; and

Fig. 9 is a diagrammatic view of a portion of a mine showing the manner of using my flexible
65 cutter chain therein.

My flexible coal cutter chain utilizes a flexible cable designated by the numeral 1, which may be of the nature of a wire rope as shown, or a chain or other suitable flexible element which is
70 herein termed a cable. The opposite ends of this cable 1, are detachably secured to sockets 2 as by a poured metal filling 3, shown in Fig. 2. It is desirable to have the ends of the cable removably secured to the sockets 2 and the metal
75 filling provides an effective means for holding the ends in the sockets and yet permits easy removal of the ends from the sockets merely by melting the metal. The ends may be cut
80 off at the sockets and then the ends removed therefrom by melting the metal if desired. Any other suitable means may be used for attaching the ends of the cable, as by bending the ends back upon themselves and fastening them with
85 clamps.

The cutters are designated generally by the numeral 4. These cutters may be of various forms, such for instance as shown in Figs. 2, 5 and 6, wherein each cutter is provided with a hub 5 extending approximately throughout the
90 length of the cutter and peripheral teeth 6 extend radially from the hub at an acute angle to the axis of the cutter, as shown particularly in Fig. 6. The cutters are strung or slipped over the cable 1 where they are held in suitably spaced
95 relation by spacing rings 7, which are also slipped over the cable between the cutters. These rings hold the cutters in spaced relation but they permit flexing of the cable as is desired where it is operating around a pillar in undercutting
100 the coal. Instead of using separate spacer rings, a spiral may be employed as a spacer. But the rings or spiral should be round in cross section with no sharp corners on the inner sides so as to protect the cable and so as not to cut through
105 it. The ends of the openings through the cutters should be rounded off for the same reason. For cutting hard coal it may be desirable to have the cutters rather close together, in which event, the spacers may be omitted and the cutters placed
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in abutting relation. The hubs will be long enough to space the cutting teeth and yet provide flexibility between the cutters.

The opening through the hub of the cutter preferably should be smaller in diameter at the end having the cutting teeth than at the opposite end. The small end of the opening fits the cable while the larger end permits tilting of the cutter on the cable. This causes the cutter to dig in on its forward motion, and to tilt back on its backward motion, tending to sharpen its teeth.

The cutters may be turned in either direction desired. They are shown in Fig. 1 as arranged in pairs in opposed relation with a spacer ring 7 separating each pair of cutters, but they may all be turned in one direction in which event they would cut only in one direction of movement of the chain, whereas in the form shown, one set of cutters cuts when the chain is moved in one direction and the other set cuts when the chain is moved in the opposite direction. If desired, the cutters of the opposing sets may be arranged at opposite end portions of the chain.

The chain may be provided at intervals with suitable cleaner elements or cups 8, one of which is shown at each end of the chain in order to clean the cuttings out of the kerf as the chain moves lengthwise. This cleaning element or cup may be similar to one of the cutters, except that it has a continuous cutting rim instead of peripheral teeth as provided on the cutters.

The cutters and spacers are freely rotatable on the cable and as the cable moves lengthwise there is sufficient friction to cause a slight turning of the cutters, thus bringing the teeth successively into cutting action and producing uniform wear on the teeth. The cutters are held in place against endwise movement by the spacers and the sockets which are detachably secured to the opposite ends of the cable permitting either socket to be withdrawn and allowing all of the cutters to slide off merely by holding up the opposite end of the chain.

The cutters may thus be easily removed for sharpening or the substitution of new cutters. The construction of the cutters with radial teeth not only greatly extends the period of use of the cutter without reshaping, but it also enables the cutter to be sharpened by being placed in a die and by the application of a few strokes to one section of the die, which swages the teeth out into the proper shape, thus enabling them to be sharpened quickly and at small cost. The teeth may be sharpened by an abrading tool, if desired.

The shape of the cutters and arrangement and number of the teeth may be varied as found desirable and suitable for the purpose. I have shown in Fig. 8 another form which may be used wherein the teeth 6a extend throughout the length of the cutter and are thus longer than the teeth 6, but are otherwise similarly formed. Fig. 8a shows a double cutter having teeth at opposite ends like the form shown in Figs. 5 and 6, so that the one cutter cuts upon movement in either direction.

I have shown in Fig. 9 of the drawings a partial plan view of a portion of a coal mine illustrating the manner of using my improved cutter chain in undercutting or overcutting coal. The mine has the usual pillars 10 provided with side and intersecting man-ways 11, and chutes 12, along the sides thereof formed by cutting a breast into the seam of coal.

The cable is placed around a side of the pil-

lar and extends over suitable sheaves 13 directing it to a reciprocating engine or hoist 14 of well-known construction which works the cable back and forth and at the same time takes up the slack, thus causing the cable to cut its way into the coal either at the bottom or top of the pillar or midportion thereof, as desired. This operation may be continued until the cutter chain has cut its way through the pillar. As an undercut is made, the coal breaks down and rolls into and through the chutes 12, through which it finds its way to the cars 15. If the seam is at an incline as set forth in my companion application on a method of mining Serial No. 616,990, filed June 13, 1932, the coal will automatically flow down through the chutes and may be directed into the cars thus making it unnecessary for the removal of the coal by hand. This method of mining is claimed in my companion application. The cutter chain extends partway across a face of the pillar a distance that will allow a suitable reciprocation of it through the kerf a distance sufficient to discharge the cuttings from the kerf, and the sockets 2 may be connected to the ends of cables, such as wire rope which extend to the reciprocating engine. The cutter chain may be made up of a series of two or more cutter chains as above described, attached together by links, if this is desired, or it may be a single chain, sufficiently long to effectively accomplish the cutting action.

I claim:

1. A cutter chain comprising a flexible cable, cutters sleeved over the cable, spacers sleeved over the cable between the cutters and holding the cutters in spaced relation, and attachments secured to the opposite ends of the cable for preventing displacement of the cutters and spacers.

2. A cutter chain comprising a flexible cable, toothed cutters sleeved over the cable and freely rotatable thereon, spacers sleeved over the cable between the cutters for maintaining the cutters in spaced relation, and attachments secured to the opposite ends of the cable for preventing removal of the cutters and spacers therefrom.

3. A cutter chain comprising a flexible cable, cutters carried thereby at spaced intervals, and a plurality of spacer rings inserted over the cable between adjacent cutters and holding said cutters in spaced relation.

4. A cutter chain comprising a flexible cable, cutters carried thereby at spaced intervals, and a plurality of spacer rings inserted over the cable between adjacent cutters and holding said cutters in spaced relation, the spacer rings being movable relative to each other providing flexibility of the cables between the spaced cutters.

5. A cutter chain comprising a cable, sockets attached to opposite ends of the cable, means for detachably connecting at least one socket to the cable, a plurality of cutters inserted over the cable and freely rotatable thereon, and spacing rings separating cutters from each other and from the sockets.

6. A cutter chain comprising a cable, sockets attached to opposite ends of the cable, means for detachably connecting at least one socket to the cable, a plurality of cutters inserted over the cable and freely rotatable thereon, and spacing rings separating cutters from each other and from the sockets, the rings arranged between adjacent cutters being disconnected from each other and freely mounted on the cable providing for flexure of the cable between the cutters.

7. A cutter adapted to be applied to a cable of a cutter chain, and having a hub and provided with an opening therethrough for insertion over the cable, and a plurality of radially arranged cutting teeth carried by the hub and arranged circumferentially therearound, said teeth being positioned at one end of said hub and projecting lengthwise beyond the end of the hub.

8. A cutting device comprising a flexible cable, a plurality of cutting tools strung thereon, each of said cutting tools having a hub portion provided with an opening therethrough to receive the cable, the diameter of said opening at one end of the hub portion being greater than at the opposite end.

9. A cutting device comprising a flexible cable, a plurality of cutting tools strung thereon, each of said tools having a hub portion provided with a peripheral cutting edge at an end thereof, said hub portion having an opening therethrough to receive the cable, the diameter of the opening at the end of the hub having the cutting edge being smaller than at the opposite end to cause a tilting of the tool on the cable.

10. Cutting apparatus comprising power means, a flexible cable having opposite ends attached to said power means and actuated thereby, a series of cutting tools sleeved on the cable, and spacers on the cable separating the cutting tools from each other and permitting flexion of the cable.

11. Cutting apparatus comprising power means, a flexible cable having opposite ends attached to said power means and actuated thereby, a series of cutting tools loosely sleeved on the cable, and means sleeved on the cable for separating adjacent cutters from each other while permitting flexion of the cable within said means.

12. A cutter adapted to be secured to a cable having a hub portion and integral teeth arranged radially around said hub portion and turned in opposite directions longitudinally of the cutter for cutting action in both directions of reciprocation of the cable.

13. A cutter-chain comprising a flexible device, cutters loosely sleeved over said flexible device and having cutting edges turned in opposite directions for cutting action alternately upon rectilinear movement of the flexible device, and means for applying endwise pull alternately on opposite end portions of the flexible device.

14. Cutting apparatus comprising a power element, means actuated thereby, a cutting tool having a bore to receive the said means and being tiltable thereon, and means for preventing relative longitudinal movement between the cutting tool and the first said means.

15. Cutting apparatus comprising a power element, flexible means actuated thereby, and a cutting tool having a tapered bore to receive the flexible means and to enable the cutting tool to tilt on said means.

16. Cutting apparatus comprising a power element, flexible means actuated thereby, and a series of cutting tools on said flexible means and being tiltable thereon.

17. Cutting apparatus comprising a power element, flexible means actuated thereby, a series of cutting tools on said flexible means and being tiltable thereon, and means to hold the cutting tools in spaced relation with respect to each other.

18. Cutting apparatus comprising a power element, a flexible cable actuated thereby, a series of cutting tools on the cable and being tiltable thereon, and washers on the cable interposed between adjacent cutting tools and having bores of larger diameter than the cable to permit flexion of the cable within the washers.

19. A cutter-chain comprising a flexible device having attachments at opposite ends thereof, toothed cutters strung loosely on said flexible device between the attachments and freely rotatable thereon, and cleaner members strung loosely on the cable and having continuous peripheral edges.

20. In a cutter chain having a cable, a cutter mounted on the cable comprising a body portion having radially arranged cutting teeth positioned at an end of said body portion and projecting lengthwise beyond said end of the body portion.

21. In a cutter chain having a cable, a cutter mounted on the cable comprising a body portion having radially arranged cutting teeth positioned at an end of said body portion and projecting lengthwise beyond said end of the body portion, said teeth having straight sides to facilitate sharpening by swaging.

22. In a cutter chain having a cable, a cutter mounted on the cable comprising a body portion having radially arranged cutting teeth positioned at an end of said body portion and projecting lengthwise beyond said end of the body portion, the outer sides of said teeth extending inwardly from the cutting points of the teeth at substantial angles to lines drawn through the points of the teeth parallel with the axis of the cutter.

23. In a cutter chain having a cable, a cutter mounted on the cable comprising a body portion having a tapered cable receiving opening therethrough to permit tilting of the cutter on the cable, and having radially arranged cutting teeth.

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