April 29, 1958 A. L. BARRETT 2,832,579

MINING MACHINE BIT TIP PATTERNS

Original Filed Sept. 11, 1952 5 Sheets-Sheet 1

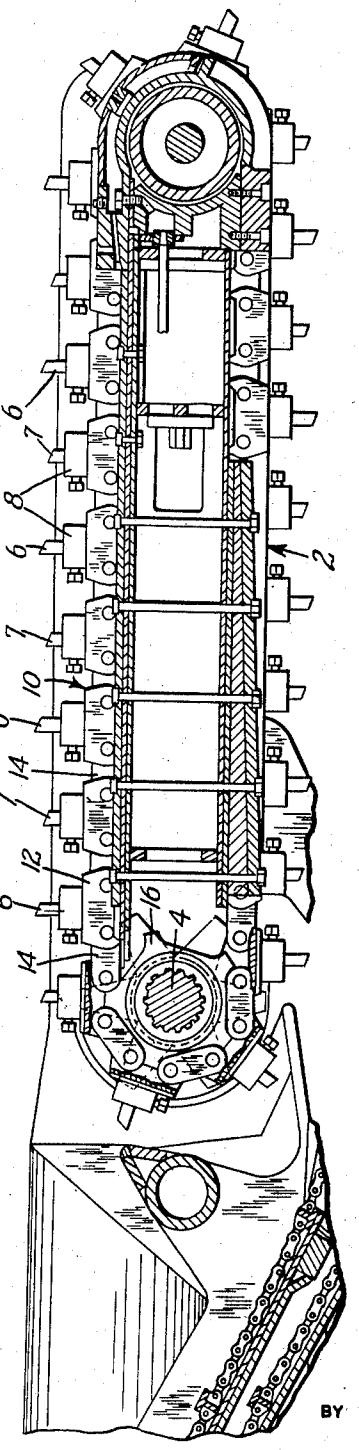


FIG. 1.

INVENTOR:
ARTHUR L. BARRETT
BY John F. Schmidt
ATTORNEY

April 29, 1958 A. L. BARRETT 2,832,579

MINING MACHINE BIT TIP PATTERNS

Original Filed Sept. 11, 1952 5 Sheets-Sheet 2

FIG. 2.

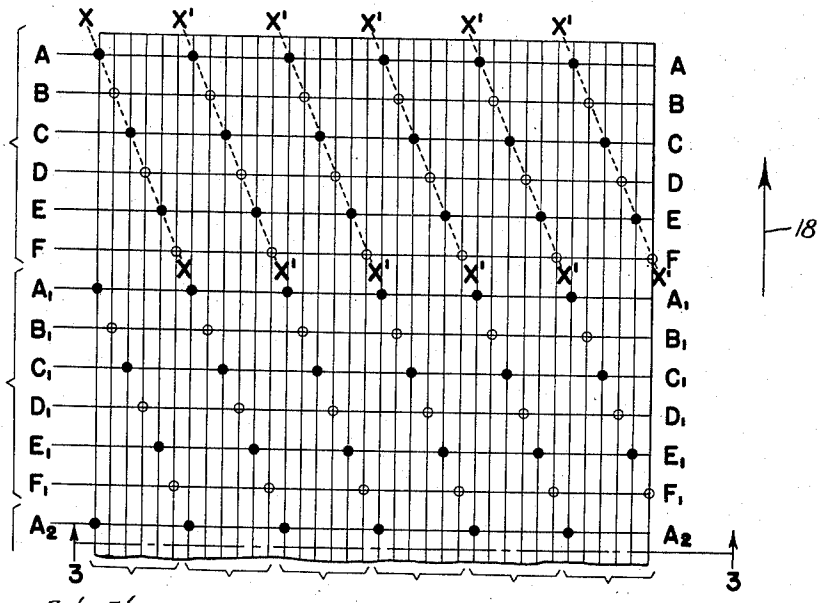


FIG. 3.

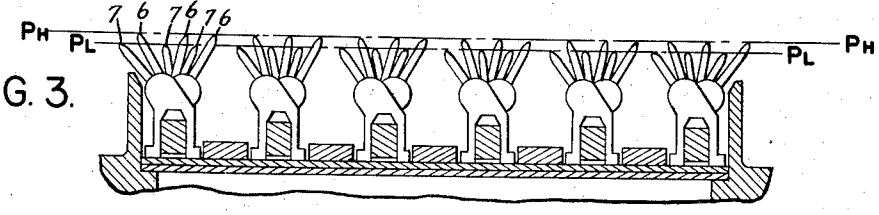
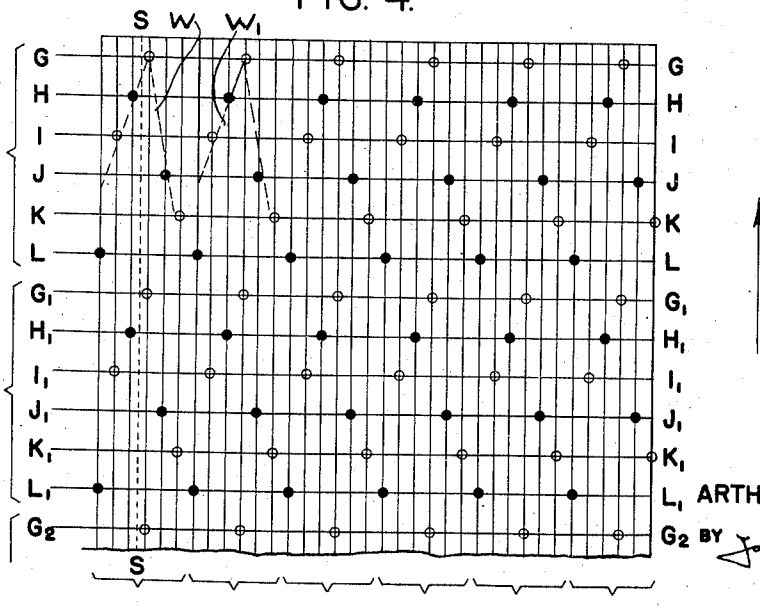


FIG. 4.



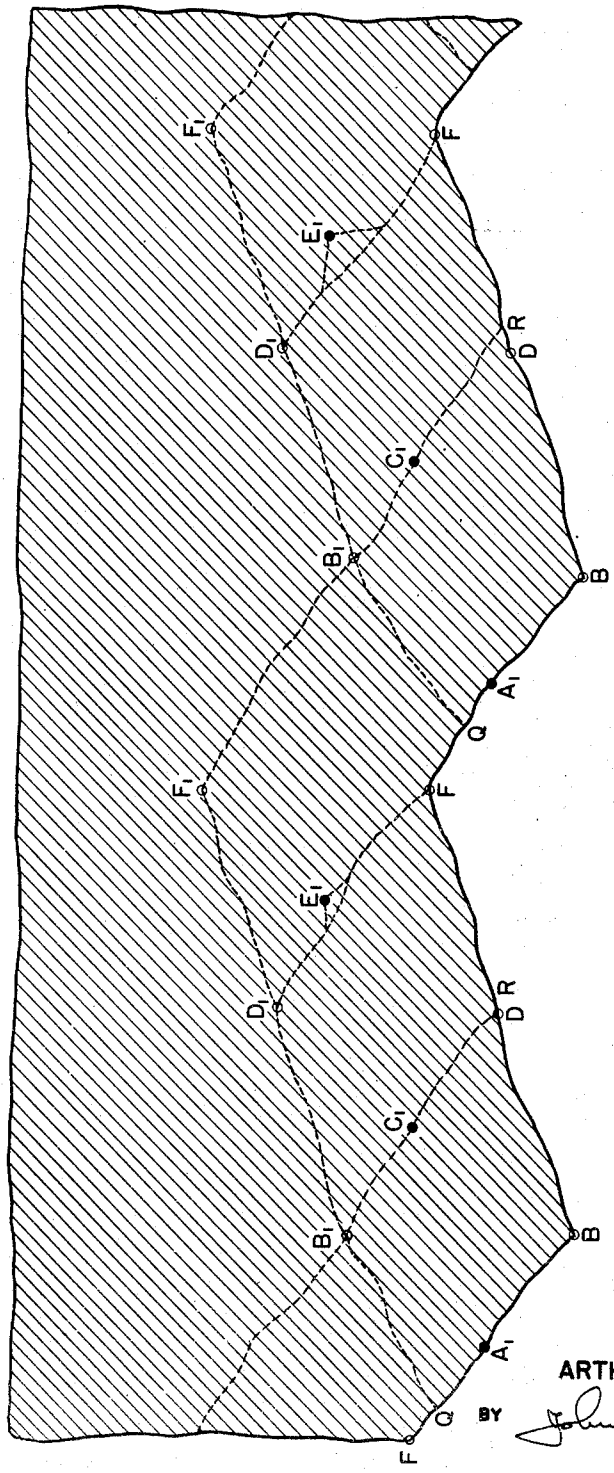
INVENTOR:
ARTHUR L. BARRETT
BY John F. Schmidt
ATTORNEY

April 29, 1958 A. L. BARRETT 2,832,579

MINING MACHINE BIT TIP PATTERNS

Original Filed Sept. 11, 1952 5 Sheets-Sheet 3

FIG. 5.



INVENTOR:
ARTHUR L. BARRETT
BY John F. Schmidt
ATTORNEY

April 29, 1958 A. L. BARRETT 2,832,579

MINING MACHINE BIT TIP PATTERNS

Original Filed Sept. 11, 1952 5 Sheets-Sheet 4

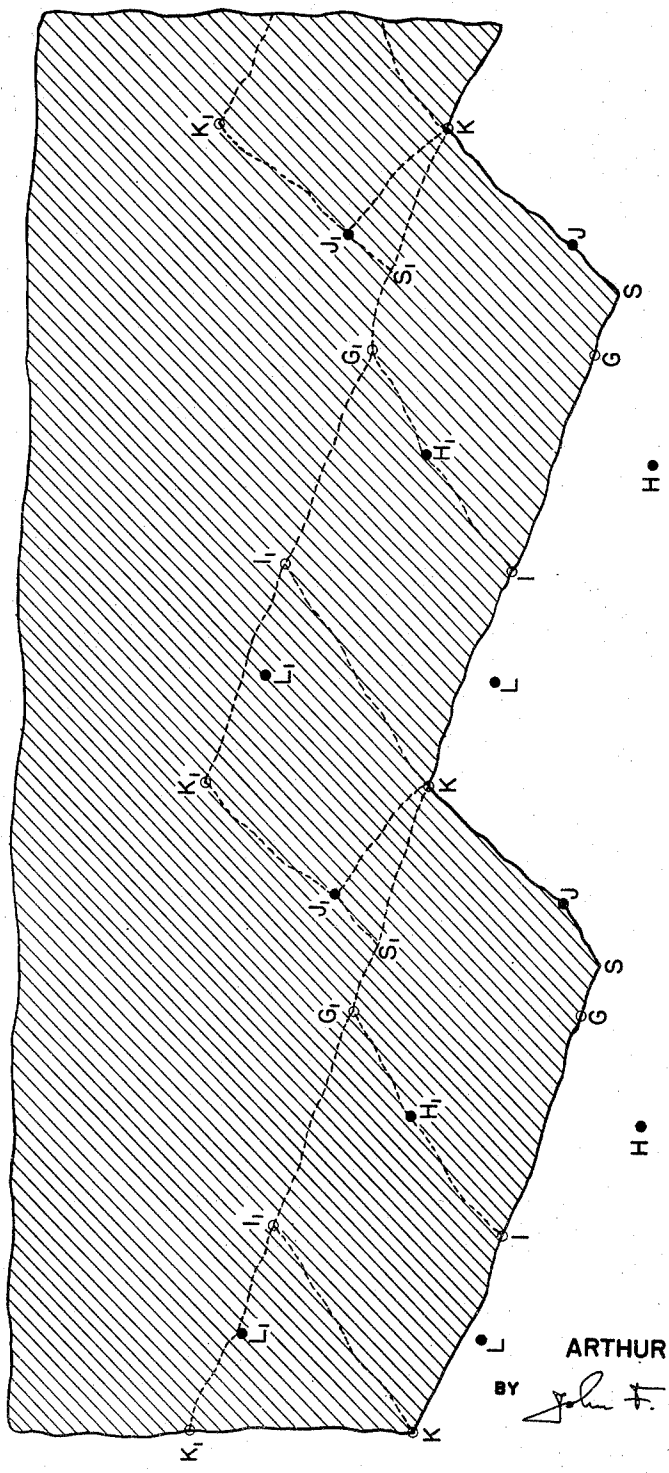


FIG. 6.

INVENTOR:
ARTHUR L. BARRETT
BY John F. Schmidt
ATTORNEY

April 29, 1958 A. L. BARRETT 2,832,579

MINING MACHINE BIT TIP PATTERNS

Original Filed Sept. 11, 1952 5 Sheets-Sheet 5

FIG. 7.

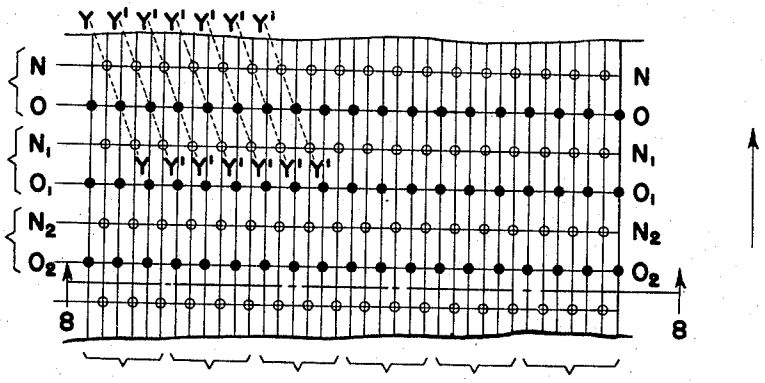


FIG. 8.

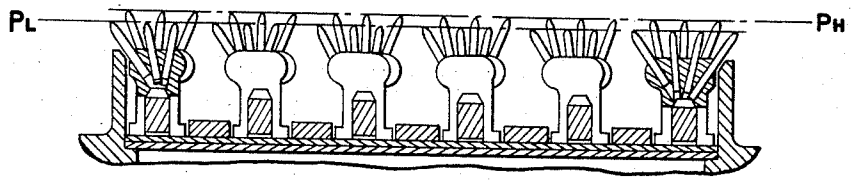
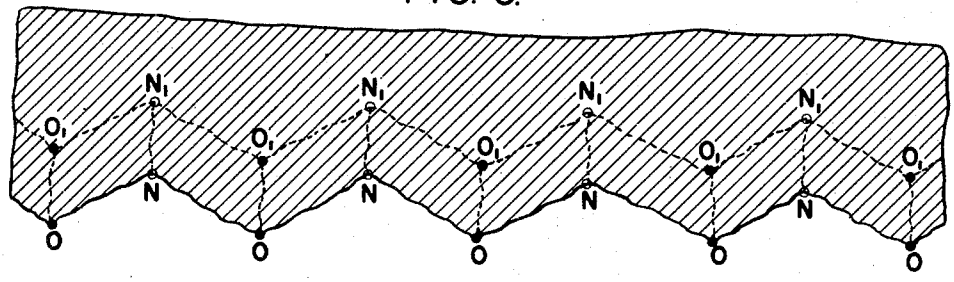


FIG. 9.



INVENTOR:
ARTHUR L. BARRETT
BY John F. Schmidt
ATTORNEY

United States Patent Office 2,832,579 Patented Apr. 29, 1958

2,832,579

MINING MACHINE BIT TIP PATTERNS

Arthur L. Barrett, Franklin, Pa., assignor to Joy Manufacturing Company, Pittsburgh, Pa., a corporation of Pennsylvania

Continuation of application Serial No. 309,095, September 11, 1952. This application July 12, 1954, Serial No. 442,518

18 Claims. (Cl. 262—28)

This invention relates to tip patterns for the disintegrating elements of a vein-attacking and disintegrating instrument of a continuous miner, particularly to tip patterns for continuous miners of the type disclosed in copending applications Ser. No. 11,688, filed February 27, 1948, now Patent No. 2,798,711; Ser. Nos. 102,995 and 102,996, filed July 5, 1949, now Patents Nos. 2,789,714 and 2,798,713 respectively; Ser. No. 181,977, filed August 29, 1950, now Patent No. 2,781,187; and Ser. No. 267,717, filed January 23, 1952, now Patent No. 2,751,204. This application is a continuation of my copending application Ser. No. 309,095, filed September 11, 1952, now abandoned, which in turn is a continuation-in-part of my application Ser. No. 139,499, filed January 19, 1950, now abandoned.

Inasmuch as there is a ready market for coal in the large lump sizes, and appreciably less of a market for fines, the coal industry puts a premium on large-size lumps of coal. This fact makes it desirable that coal be removed from the solid with as little production of fines as is consistent with efficient mining operations.

It is accordingly an object of this invention to provide improved tip patterns for the vein-attacking and disintegrating instrument of a continuous mining machine which will result in the production of a maximum of large lumps and a minimum of fines. This and other objects are achieved in tip patterns which so arrange the tips as to break the coal out in lumps and effect a minimum of pulverization of the coal while removing it from the solid.

In the drawings:

Fig. 1 is a partial sectional view of a vein-attacking and disintegrating instrument such as is used on a continuous mining machine of the type disclosed in the above-identified applications.

Fig. 2 is a schematic diagram showing the location of tips in one embodiment of the invention.

Fig. 3 is a view in section through a vein-attacking and disintegrating instrument, being essentially a view in section on line 3—3 of Fig. 2.

Fig. 4 is a schematic diagram of the type of Fig. 2, but showing another embodiment of the invention.

Fig. 5 is a view in section through a partially mined seam of coal, showing approximately the pattern achieved in a solid vein of coal by the tip arrangement shown in Figs. 2 and 3.

Fig. 6 is a view of the general type of Fig. 5, but showing approximately the pattern achieved by the tip arrangement shown in Fig. 4.

Fig. 7 shows the tip pattern of another embodiment of the invention.

Fig. 8 is a view in section substantially on line 8—8 of Fig. 7, and

Fig. 9 is a view of the general type of Figs. 5 and 6, but showing approximately the pattern achieved by the tip arrangement shown in Fig. 7.

Referring now in greater detail to the drawings, it will

be observed that Fig. 1 shows a vein-attacking and disintegrating instrument indicated generally at 2, mounted for swinging movement in vertical planes about a horizontal axis coincident with the axis of shaft 4. A plurality of bits 6 and 7 are mounted in bit blocks 8, which in turn are carried by a continuous chain 10 consisting of a plurality of links 12 and 14. As will be well understood by those skilled in the art, the instrument 2 is made up of a plurality of endless chains driven by a plurality of sprockets 16. Thus, by means of the plurality of chains 10, the several disintegrating bits 6 and 7 are mounted for movement in orbital planes, these planes of movement being all substantially parallel.

Each of bits 6 and 7 has a tip, which term as here used means the outermost extremity of the bit, and it will be understood that it is the tips that are represented by the dots in the diagrams of Figs. 2, 4, and 7.

It will be understood further by those skilled in the art that the bits 6 and 7 need not move in precisely the orbits which will be provided by the chain type or rotary drum type of instrument such as is shown in the above-identified applications. In order to make possible a clearer and easier explanation of the bit tip arrangements provided by this invention, it will accordingly be understood by those skilled in the art that the tip patterns shown represent the positions assumed by the tips when the pattern is developed, regardless of the orbit through which the tips move. The patterns shown could of course also be used for tips arranged to move rectilinearly instead of orbitally. In the embodiment of the invention shown, it is as though the chains of the instrument shown in Fig. 1 were broken all at the same transverse plane, and the chains thereafter spread out in a plane. The tip pattern thus developed can be discussed independently of whether the tips move in an eliptical, circular, or other type of orbit, on chains, a rotary drum, or otherwise.

Reference is now made in detail to Figs. 2 and 3, which show a vein-attacking and disintegrating instrument made up of six chains, each of which carries bits having tips in six positions. It will be observed that the tips lie in two substantially parallel planes P_H and P_L, and thus fall into two classes, namely high tips (bits 6) and low tips (bits 7). The high tips of bits 6 are, of course, those tips lying in the upper plane P_H, i. e., the plane furthest removed from the bit blocks; and the low tips of bits 7 are, then, those lying in the lower plane, P_L.

It is further noted that the tips in a given pattern in one chain lie in a plane which is perpendicular to the aforesaid two substantially parallel planes. Furthermore, this plane is aparallel with respect to the planes of the orbits in which the tips travel. It is further noted that the tips of bits of adjacent chains lie in planes which are parallel to the aforesaid aparallel plane. More specifically the dotted line X—X defines a plane passing through all the tips in one pattern of the leftmost chain as seen in Fig. 2. Dotted lines X'—X' define the planes of the tips in adjacent chains. As is readily seen by reference to Fig. 2, the plane X—X is aparallel—i. e., not parallel—to the planes of the orbits in which the tips move, and the planes X'—X' are parallel to said aparallel plane X—X.

It is further noted that all the tips in a given position in adjacent chains lie in a straight line; in the embodiment shown, each such line is perpendicular to the aforesaid orbital paths of the tips. Thus, the lines A—A, B—B, C—C, D—D, E—E and F—F are straight lines perpendicular to the orbital planes in which the tips move. It will be understood that the solid black circles indicate low tips and the white circles indicate high tips. Thus, the tips in every other row, A—A, C—C and

E—E are low tips, and the tips in the alternate rows B—B, D—D and F—F are high tips, with the result that the tips in plane X—X lie alternately in the two substantially parallel planes P_L and P_H.

The direction of motion of the tips, as shown in the developed schematic view of Fig. 2, is indicated by the arrow **18**. For the convenience of describing the invention, the arrow **18** is shown as a straight arrow lying in the plane of the paper, but it will, of course, be understood by those skilled in the art that the motion of the tips will actually conform to whatever shape the orbital path takes. It is further noted that the tip pattern shown in lines A—A to F—F and bracketed at the left side of Fig. 2 may be repeated as often as desired. The brackets shown at the bottom of Fig. 2 show the extent of each chain, from which it can readily be seen that each chain carries six tips.

Reference is now made to the embodiment of the invention shown in Fig. 4. In this embodiment, it will be noted that, again, the tips in a given position in adjacent chains lie in a straight row: G—G, H—H, I—I, J—J, K—K, and L—L; as shown here, each row (or line) is perpendicular to the planes of the orbits in which the tips move. It is further noted that the tips in alternate lines G—G, I—I, and K—K are high, and that the tips in the other alternate lines H—H, J—J, and L—L are in the low plane.

It is also noted however that, in the embodiment shown in Fig. 4, the tips of a single chain in a single pattern do not all lie in a plane. Instead, they have a configuration which is generally wedge-shaped; see W, W_1 of Fig. 4.

Attention is invited to the fact that each chain in the pattern of Fig. 4 is a six-position chain, as can readily be seen by reference to the brackets at the lower end of Fig. 4. Let it now be assumed that a plane indicated by the dotted lines S—S passes down through the middle of a chain. This plane, which may for convenience be called the chain mid-plane, so divides the tips that half of the tips of each chain lie on one side and the other half lie on the other side of the plane thus defined. It is further noted that the first two tips (rows G and H) lie on opposite sides of the chain mid-plane and in tip positions close to the chain mid-plane, these tip positions being known as inside positions; the last two tips (rows K and L) lie on opposite sides of the chain mid-plane and occupy the extreme tip positions from the mid-plane and are known as outside positions; the tips in the two remaining rows, I and J, likewise fall on opposite sides of the chain mid-plane and lie in intermediate positions with respect to that plane; these positions are called the intermediate positions. Thus, in the preferred form of the embodiment shown in Fig. 4, the tip arrangement for each chain is, proceeding from row G through row L: right inside, left inside, left intermediate, right intermediate, right outside, and left outside. The arrangement of the other chains in the pattern is similar to the arrangement of the leftmost chain of Fig. 4 and need not be detailed here.

As in the embodiment shown in Fig. 2, it will be understood that the tip pattern may repeat itself as shown in the bracketing of rows at the left-hand side of Fig. 4.

Reference is now made to Figs. 7 and 8, showing the third embodiment of the invention. In this embodiment, the tips are shown as being arranged in groups of three to a block, except that in alternate rows the block on the extreme right carries four tips. As best seen in Fig. 8, the tips in each block are spaced two tip positions apart. The rows with the four tip blocks in the extreme right chain are the low tip rows designated by lines O—O. The high tip rows N—N have three tips per block all the way across. It is noted that, in the preferred form of this embodiment as in the others, the tips lie in straight lines perpendicular to the planes of the obital paths. These lines are the indicated lines N—N and O—O. It is further noted that two such lines constitute a complete tip pattern which may be repeated as often as desired.

It is further noted that some of the tips in one pattern of one chain lie in a plane indicated by dotted line Y—Y. Other tips in the same pattern of the chain lie in planes Y'—Y'. Furthermore, the tips in adjacent chains lie in similar planes Y'—Y'. As in the embodiment shown in Fig. 2, plane Y—Y is apparallel to the planes of the orbital paths, and the planes Y'—Y' are parallel to said aparallel plane Y—Y.

As in the case of the embodiment shown in Figs. 2 and 4, the tips lie in two substantially parallel planes; more specifically, the tips in the rows N are high tips and the tips in rows O are low tips, as was set forth above.

Operation

Reference is now had to Fig. 5 for a better understanding of the operation of the tip pattern shown in Fig. 2. Let it be assumed that the vein-attacking and disintegrating instrument is moving upward in a vertical plane at such a rate that each tip advances vertically .3 inch as it moves in its orbit from a position in one pattern to the position occupied by the tip in the next row ahead. In other words, as the tips in row B, Fig. 2, advance to the position of the tips in row A, they move upward a vertical distance of .3 inch approximately. In still other language, the vein-attacking and disintegrating instrument is given a vertical feed of .3 inch per tip. It is further noted that the preferred difference between high tips and low tips is approximately ¾ inch.

It will be borne in mind that a great deal of approximation or guess work is involved in determining what pattern will be produced in tearing the mineral loose from a solid vein, especially in the case of coal, where definite fracture planes nearly always exist. In coal that has very definite fracture or cleavage planes, separation will occur along the cleavage planes more easily than across those planes. Inasmuch as the cleavage planes are an unknown factor, and vary from vein to vein, efforts must be made to work out a pattern on an assumption that the coal (or other mineral) is very nearly homogeneous.

Another factor which must be borne in mind in attempting to determine the profile produced by a vein-attacking and disintegrating instrument such as is employed in mining machines of the type to which this invention pertains, is the fact that the bits used, and their tips, have finite dimensions, namely width and depth, rather than being merely pinpoints applied to the mineral. The fact that a bit has width often affects the pattern, and this factor is taken into consideration in determining a separation pattern.

With the foregoing in mind, it will be assumed (having reference now to Fig. 5) that the break-line B D F B D F, shown by the lower edge of Fig. 5, has already been formed by the first tip pattern shown in Fig. 2. It must be remembered that the cross section set forth in Fig. 5 cannot show the time factor, inasmuch as the bits are on endless chains and one pattern follows another.

It will be noted from Fig. 2 that the row A_1 immediately follows the row F. Since the vertical feed is .3 inch per tip, the tips in row A_1 will have risen .3 inch in moving from the position of row A_1, Fig. 2, to the position of row F. However, it also must be borne in mind that the tips in row A_1 are low tips, and therefore project from the blocks ¾ inch less than the high tips, namely the tips in row F. This means that the tips in row A_1 accomplish practically nothing most of the time, because the coal or other mineral has already been dislodged by the tips in row F ahead of row A_1. This is indicated from the position of the points A_1 in Fig. 5 with respect to the break-line F B.

As the tips in row B_1 reach the plane of Fig. 5, they succeed in breaking coal out approximately along the lines B_1 Q and B_1 R. Points Q and R will in many cases be substantially coincident with points F and D respec-

tively. However, it is not essential that they thus coincide.

The new break-line is now F Q B_1 R F Q B_1 R etc. Into this picture come the tips in row C_1. It is readily evident from Fig. 5, that the tips in row C_1 will normally have very little work to do, provided that the mineral is being detached from the vein in the desired manner.

The break-line is substantially the same when the tips in row D_1 enter the plane of Fig. 5. The tips in row D_1 will break coal out substantially along the lines D_1 B_1 and D_1 F, with the result that the new break-line is now F Q B_1 D_1 F Q B_1 D_1 F etc.

As the tips in row E_1 come into the plane of Fig. 5, there is little if any mineral in position to be removed by them, so that the profile remains substantially unchanged as the tips in row F_1 reach the plane of Fig. 5. The tips in row F_1 will break coal out substantially along the lines F_1 D_1 and F_1 B_1, presenting a new profile B_1 D_1 F_1 B_1 D_1 F_1, and the cycle is ready to repeat.

From the foregoing, it can be seen that, normally, the low tips—namely the tips in rows A C E A_1 C_1 E_1 etc. arrive after the mineral has already been detached from the face, so normally will have little or no effect on the removal of mineral, thus reducing the production of fines. However, the low tips are in the pattern in order to remove the mineral in the event that it may not have been removed by the high tips for some reason or other at the time that the low tips reach the place in question. If the mineral being mined were not then removed by the low tips there would be interference with the normal operation of the vein-attacking and disintegrating instrument, as for example, interference of the type known in the art as "block interference"—meaning rubbing of the blocks against the face of the mineral and preventing advance or vertical feed of the vein-attacking and disintegrating instrument. Block interference is usually accompanied by what is called "coring," in which the bits serve as cutter bits and actually cut grooves in the coal instead of removing it in blocks. Inasmuch as coring produces a high percentage of fines, it is highly undesirable. The presence of the low bit tips in the patterns helps to prevent coring and the production of fines which would result.

Reference is now had to Fig. 6 for an understanding of the operation of the pattern shown in Fig. 4. Let it be assumed that the break-line produced by the first pattern of Fig. 4 is as shown at K I G S K I G S K etc. From the foregoing discussion of the pattern shown in Fig. 5, it will be understood by those skilled in the art how the new break-line K_1 I_1 G_1 S_1 K_1 I_1 G_1 S_1 K_1 etc. is formed. It will further be understood how the low tips perform little or no work in the detachment of mineral as long as the pattern operates as contemplated. One small exception may be noted, namely the effect of the tips in the rows J, J_1, and J_2 etc., as shown by the small triangle K J_1 S_1.

The patterns shown in Figs. 2 and 4, producing the profiles shown in Figs. 5 and 6 respectively, are readily adapted and well-suited to the mining of coal or other friable mineral. The pattern shown in Fig. 7 is better suited to a more nearly homogeneous mineral, as for example, potash. The profile which will be produced by the pattern shown in Fig. 7 is illustrated in Fig. 9, where it will be seen that the break-line that we start with is shown at N O N O N O N O etc., the points marked N representing the high tips and the points marked O representing the low tips. Again, it will be understood by those skilled in the art that mineral will be broken loose principally by the high tips, giving the low tips little or nothing to do except to remove an occasional fragment of mineral which has not been removed by one of the high tips for some reason.

It will be evident from the foregoing that the patterns proposed herein will provide breakage in coal or other mineral in such a manner as to break the mineral out in a maximum of large lumps and with a minimum of fines. Other advantages will be apparent to those skilled in the art.

While there are in this application specifically described three forms which the invention may assume in practice, it will be understood that these forms of the same are shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

I claim:

1. A tip pattern for the disintegrating bits of a vein-attacking and disintegrating instrument having means to move said bits in orbital paths, in which, when the pattern is developed, a plurality of tips are arranged entirely in two substantially parallel planes, said planes being substantially perpendicular to the orbital paths, said bits being so arranged that, with respect to the full width of said vein-attacking and disintegrating instrument, there are rows of bits disposed to cut a path for said disintegrating instrument and of which the tips lie in lines perpendicular to the aforesaid orbital paths, and all the bits in each one of said rows are alike in bit position, every other one of said lines of tips lying in one of said two substantially parallel planes, and the alternate lines of tips lying in the other of said two substantially parallel planes.

2. A tip pattern for the disintegrating bits of a vein-attacking and disintegrating instrument having means to move said bits in orbital paths, in which, when the pattern is developed, the tips of all the bits lie either in one or the other of two substantially parallel planes, said planes being substantially perpendicular to the orbital paths and said bits being arranged in rows across the full width of the vein-attacking and disintegrating instrument, each of which rows is composed solely of bits in a given bit position and the tips of the bits in each of said rows lying in lines perpendicular to the aforesaid orbital paths, the bit tips in succeeding rows being alternately in one or the other of said planes.

3. A pattern as in claim 2, in which all the tips in a pattern lie in parallel planes which are aparallel to the orbital paths.

4. A tip pattern for the disintegrating bits of a vein-attacking and disintegrating instrument having chains movable in parallel orbital paths and carrying bit blocks in which the bits are mounted, in which pattern, when the pattern is developed, the tips of all the bits lie either in one or the other of two substantially parallel planes, said planes being substantially perpendicular to the orbital paths and said bits being arranged in rows across the full width of the vein-attacking and disintegrating instrument, each of which rows is composed solely of bits in a given bit position, the bits in any given row being in a different bit position from the bits in the row next to it and the tips of the bits in each of said rows lying in lines perpendicular to the aforesaid orbital paths, and the bit tips in each row being in a different one of said two planes from the bit tips in the next row.

5. A tip pattern for the disintegrating bits of a vein-attacking and disintegrating instrument having chains movable in parallel orbital paths and carrying bit blocks in which the bits are mounted, in which pattern, when the pattern is developed, a plurality of tips are arranged entirely in two substantially parallel planes, said planes being substantially perpendicular to the orbital paths, said bits being so arranged that, with respect to the full width of said vein-attacking and disintegrating instrument, there are rows of bits of which the tips lie in lines, and all the bits in each one of said rows are alike in bit position, every other one of said lines of tips lying in one of said two substantially parallel planes, and the

alternate lines of tips lying in the other of said two substantially parallel planes.

6. A pattern as in claim 5, in which all the tips on one chain in the pattern lie in a plane which is aparallel to the planes of the chains.

7. A pattern as in claim 5, in which all the tips on one chain in the pattern lie in a plane which is aparallel to the planes of the chains, the tips on the other chains lying in similar planes parallel to said aparallel plane.

8. A pattern as in claim 7, in which the tips in each block are spaced two tip positions apart.

9. A pattern as in claim 5, in which all the tips in a pattern lie in parallel planes which are aparallel to the orbital paths.

10. A vein-attacking and disintegrating instrument having series of bits provided with cutting tips and movable in orbital paths, said bits arranged in a pattern which when developed has the cutting tips of all of said bits arranged entirely in one or the other of two substantially parallel planes, said planes being substantially perpendicular to the orbital paths, the bits also arranged with their tips lying in straight lines perpendicular to said orbital paths, a plurality in each of said straight lines, every other one of said lines lying in one of said two substantially parallel planes, and the alternate ones of said lines lying in the other of said two substantially parallel planes.

11. A vein-attacking and disintegrating instrument having series of bits provided with cutting tips and movable in orbital paths, said bits arranged in a pattern which when developed has the cutting tips of all of said bits arranged entirely in one or the other of two substantially parallel planes, said planes being substantially perpendicular to the orbital paths, the bits also arranged with their tips lying in straight lines, a plurality in each of said straight lines, every other one of said lines lying in one of said two substantially parallel planes, and the alternate ones of said lines lying in the other of said two substantially parallel planes.

12. A vein-attacking and disintegrating instrument according to claim 11, in which the tips also lie in straight lines perpendicular to the aforesaid orbital paths of the bits, a plurality in each of said straight lines.

13. A vein-attacking and disintegrating instrument having series of bits provided with cutting tips and movable in plane orbital paths, said bits arranged in a pattern which when developed has the cutting tips of all of said bits arranged entirely in two substantially parallel planes, said planes being substantially perpendicular to the orbital paths, the tips also lying in straight lines perpendicular to the aforesaid planes of the orbital paths, a plurality in each of said lines, and in planes parallel to each other, each of the last-named planes being substantially perpendicular to said two substantially parallel planes and being aparallel with respect to the planes of the orbital paths, the tips in each said substantially perpendicular plane lying alternately in said two substantially parallel planes.

14. A vein-attacking and disintegrating instrument having series of bits provided with cutting tips and movable in plane orbital paths, said bits arranged in a pattern which when developed has the cutting tips of all of said bits arranged entirely in two substantially parallel planes, said planes being substantially perpendicular to the orbital paths, the tips also lying in straight lines, a plurality in each of said lines, and in planes parallel to each other, each of the last-named planes being substantially perpendicular to said two substantially parallel planes and being aparallel with respect to the planes of the orbital paths, the tips in each said substantially perpendicular plane lying alternately in said two substantially parallel planes.

15. A vein-attacking and disintegrating instrument having, each in a different zone transversely thereof, a plurality of series of bits provided with cutting tips, all of said bits movable in orbital paths each of which includes a portion in which the travel is in a circular arc about a common axis, said bits arranged in rows extending transversely of said disintegrating instrument, each row comprising a plurality of bits and having the bits therein with their cutting tips in a straight line perpendicular to the planes of orbital movement of such bits and parallel to said common axis, every other one of such lines, as it travels in a circular arc about said axis, being at one and the same predetermined distance from such axis, and all of the intermediate lines, as they travel in a circular arc about said axis, being at a uniform distance, but one different from said first distance, from said axis.

16. A vein-attacking and disintegrating instrument having, each in a different zone transversely thereof, a plurality of series of bits provided with cutting tips, all of said bits movable in orbital paths each of which includes a portion in which the travel is in a circular arc about a common axis, said bits arranged in rows extending transversely of said distintegrating instrument, each row comprising a plurality of bits and having the bits therein with their cutting tips in a straight line, every other one of such lines, as it travels in a circular arc about said axis, being at one and the same predetermined distance from such axis, and all of the intermediate lines, as they travel in a circular arc about said axis, being at a uniform distance, but one different from said first distance, from said axis.

17. A tip pattern for the disintegrating bits of a vein-attacking and disintegrating instrument having means to move said bits in orbital paths, comprising a plurality of tips arranged entirely in two substantially parallel planes, said planes being substantially perpendicular to the orbital paths, the tips also arranged to lie in straight lines perpendicular to said orbital paths, a plurality in each of said straight lines, every other one of said lines of tips lying in one of said two substantially parallel planes, and the alternate lines of tips lying in the other of said two substantially parallel planes.

18. A vein-attacking and disintegrating instrument having series of bits provided with cutting tips, said bits arranged in a pattern with the cutting tips of all of said bits entirely in one or the other of two substantially parallel planes, the bits arranged with their tips lying in straight lines, a plurality in each of said straight lines, every other one of said lines lying in one of said two substantially parallel planes, and the alternate ones of said lines lying in the other of said two substantially parallel planes.

References Cited in the file of this patent

UNITED STATES PATENTS

772,152	Joy	Oct. 11, 1904
945,335	Levin	Jan. 4, 1910
1,528,546	Holmes	Mar. 3, 1925
2,304,143	Bigelow	Dec. 8, 1942
2,602,343	Barrett et al.	July 8, 1952
2,650,813	Rollins et al.	Sept. 1, 1953
2,676,005	Joy	Apr. 20, 1954

FOREIGN PATENTS

338,336	Great Britain	Nov. 20, 1930