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MINERAL EXTRACTING APPARATUS HAVING CRANK MOUNTED ROTARY CUTTER

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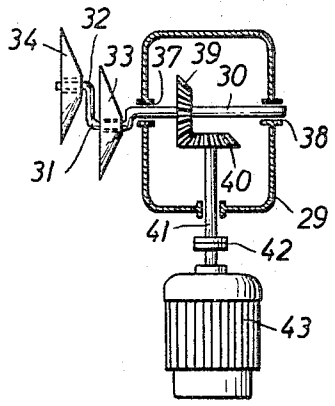

Fig. 2

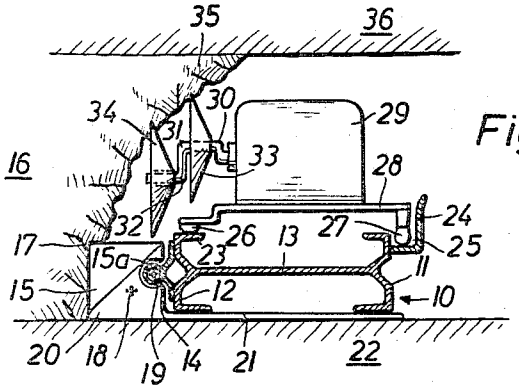

Fig. 1

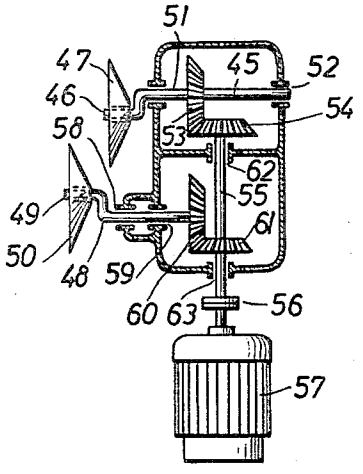

Fig. 3

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MINERAL EXTRACTING APPARATUS HAVING CRANK MOUNTED ROTARY CUTTER

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The present invention relates to a mineral extracting apparatus, and more particularly to such an apparatus for the winning or extraction of mineral from the upper portion of a mine face deposit which remains after the lower portion of such mineral deposit, such as coal, has been removed, as for instance, by long wall planing mine operations.

When extracting mineral, such as coal, by planing and cutting techniques, as are often used in long wall mining, only the lower layers or at best the lower and middle layers of the mineral seam are loosened from the deposit in the usual manner by a positive force, i.e. by planing operations. The undercut, upper portion of the mine seam deposit, as a rule, breaks apart and caves in later on by itself due to the fact that such upper portion is robbed of its support. However, this is not always the case, especially where the mineral deposits are very thick, such as where the mine face being extracted is of extraordinary height with regard to the usual dimensions of the mineway and the range of operation of the usual mining planer apparatus. Where such vertically thick of extraordinarily high seams of mineral, such as coal, are encountered, it is advisable and even necessary to win or extract the upper portions of the mine face also by positive force, in order to avoid the formation of too large an overhang of upper portion coal or other mineral which could interfere with the mine supports required between the mine floor and the mine roof to stabilize the condition of the mineway and which could also endanger the personnel working at the mine face. The positive force required to extract the overhanging mineral or upper level mineral from a mine face of extraordinary height may be provided in terms of manual labor, with the use of coal pick hammers, etc., although the mechanical or automatic winning or extraction of mineral such as coal has been attempted in the past because of the increase in efficiency possible thereby.

For instance, it has been proposed already, in the case of winning or extracting coal to include an additional coal planer along the upper part of the row of pit props or mining props which are located adjacent the coal face in the mineway or mine shaft. Such coal planer is supposed to move along the roof of the mine seam exposed thereat, whereby to perform a paring or peeling action on such roof coal. In this way, not only the upper portion of the coal deposit but also the coal which remains in the middle strata will be loosened effectively. However, such a device requires a support at the mine face which is considerably heavier than usually provided, in view of the mine face which understandably must be kept open to permit the planer to extract the roof coal and upper seam coal yet provide sufficient safety for the personnel working at the mine face.

It is an object of the present invention to overcome disadvantages and drawbacks of previous mining arrangements for the extraction of mineral from the upper portion of mine seams, especially those of extraordinary height or vertical thickness.

It is another object of the present invention to provide a mineral extracting apparatus adapted to be displaced back and forth along a mine face for extracting

overhanging mineral from the upper portion of a mine face, particularly one of extraordinary height, after the lower portion thereof has been extracted.

It is a further object of the present invention to provide a mineral extracting apparatus of the foregoing type which may be used in conjunction with elevated, elongated guide means adapted to be positioned longitudinally along the mine face, such that the mineral extracting apparatus of the invention will be guided at a pre-determined elevation above the mine floor corresponding to the level of the overhanging mineral in the upper portion of the mine face to be extracted.

It is a still further object of the present invention to provide a mineral extracting apparatus of the foregoing type which accomplishes the winning or extracting of mineral from the upper portion of the mine face by alternate thrusts of eccentrically mounted rotatable cutting tools, preferably in flat, conical disc form.

It is a still further object of the present invention to provide an arrangement of the foregoing type utilizing a mineral extracting apparatus, in which the guide means is a mining conveyor of the conventional type, such as a double chain scraper conveyor.

Other and further objects of the present invention will become apparent from a study of the within specification and accompanying drawings in which:

FIG. 1 is a schematic side view of a mineral extracting apparatus in accordance with the invention mounted on a guide means in the form of a mining conveyor shown in section, with a coal planer of the conventional type being arranged at the side of the conveyor adjacent the mine face to illustrate the normal level of operation thereof in comparison with the level of operation of the mineral extracting apparatus of the invention,

FIG. 2 is a schematic top view of the mineral extracting apparatus of the invention showing details of construction and the operative connection of the single shaft embodiment with a driving motor, and

FIG. 3 is a schematic top view of a mineral extracting apparatus of the dual shaft embodiment illustrating the manner of operatively connecting such shafts with the driving motor therefor.

It has been found in accordance with the present invention that a mineral extracting apparatus, especially useful for extrcating overhanging mineral from the upper portion of a mine face of extraordinary height after the lower portion thereof has been extracted, may be provided. Such mineral extracting apparatus comprises a movable base adapted to be displaced back and forth along a mine face, rotatable shaft means mounted on said base and extending outwardly beyond said base on the side thereof adjacent the mine face, a pair of corresponding crank portions located on the outwardly extending shaft means in axially displaced relation with respect to one another and in opposing rotatable relation for rotation out of phase with one another, and a corresponding pair of disc cutters positioned on said shaft means at said crank portions, respectively, and adjacent such mine face for engaging extractively the mine face in alternate thrusts during rotation of said shaft means for the removal of mineral from such mine face.

Preferably, the disc cutters have about the same radius and are rotatable with respect to the shaft means, and the crank portions are out of phase about 180°. The crank portions, preferably also have a different eccentricity from one another. In accordance with a specific embodiment of the invention, the disc cutters are substantially in the shape of cones and have a cone axis which is substantially shorter than the radius of the cone base, such cone base being remote from the movable base and adjacent the mine face.

Specifically, in accordance with the one particular embodiment of the invention, the mineral extracting apparatus comprises a movable base adapted to be displaced longitudinally back and forth along a mine face, a rotatable shaft mounted on said base, one end of the shaft extending outwardly beyond the base on the side of the base adjacent the mine face and having a pair of opposing crank portions located in tandem thereon, and a pair of disc cutters positioned on the shaft at the crank portions, respectively, and adjacent such mine face for engaging extractively the mine face in alternate thrusts during rotation of the shaft for the removal of mineral from such mine face. More specifically, the pair of opposing crank portions are located about 180° apart axially in tandem on the shaft and the disc cutters have about the same radius and are rotatable with respect to the shaft to effect the desired extraction of mineral, such as coal, from the mine face in alternate tangential thrusts during rotation of the shaft. The crank portions as aforesaid preferably possess a different eccentricity from one another with respect to the axis of the shaft.

In accordance with another particular embodiment of the present invention, the mineral extracting apparatus comprises a movable base adapted to be displaced longitudinally back and forth along the mine face, a pair of substantially parallel spaced apart rotatable shafts mounted on such base, one end of each shaft extending outwardly in the same direction beyond the base on the side of the base adjacent the mine face, the end of one shaft extending outwardly axially beyond the end of the other shaft and both shafts having a crank portion at the outwardly extending end thereof, said shafts being mounted for rotation such that the crank portions thereof are out of phase, and a pair of disc cutters positioned on the shafts at the crank portions, respectively, and adjacent the mine face for engaging extractively the mine face in alternate thrusts during rotation of the shafts for the removal of mineral from such mine face. More specifically, in the same way, the crank portions are preferably out of phase about 180° and the disc cutters have about the same radius and are rotatable with respect to the corresponding shaft on which the particular disc cutter is positioned, whereby the effect the extraction of mineral in alternate tangential thrusts during rotation of the shaft to which the particular disc cutters is secured. In this case, as well, it is preferred to provide the crank portions with a different eccentricity from one another with respect to the axis of the corresponding shaft.

Referring to the drawing, an embodiment is shown in FIGS. 1 and 2 in which a pair of disc cutters is provided on the same shaft whereas in FIG. 3 an embodiment is shown in which the disc cutters are provided on separate shafts.

Thus, in FIG. 1, a mining arrangement is shown including a double chain scraper conveyor **10** of the conventional type including the vertical side walls **11** and **12** and the horizontal central plate **13**, such conveyor being positioned adjacent the mine face **16** along the extent thereof whereby to convey away from the site of mining operations extracted mineral, such as coal, conducted onto the upper side of central plate **13**. Endless double chains having their forward flights on the upper side of plate **13** and their return flights on the lower side of plate **13** are provided and such chains are interconnected transversely by scraper bars spaced apart along the chains to accomplish the conveying of mineral along the top side of central plate **13**. Constructions of this type are well known.

Such conveyor is usually employed in conjunction with a mining planer **15** of the usual type and the conveyor is disposed longitudinally along the mine face to permit the planer **15** to be guided therealong in extractive engagement with such mine face. As shown in FIG. 1, the conveyor **10** is provided with a guide rail or

pipe **14** on the vertical side wall **12** adjacent the mine face **16** and the planer **15** is mounted for movement therealong at groove **15***a* on the side of planer **15** remote from the mine face. The planer **15** extracts mineral up to a height corresponding to point **17** in mine face **16** and extracted mineral is plowed by the planer **15** upwardly and rearwardly onto conveyor **10** along the upper side of plate **13**. The plowing is accomplished by suitably shaping the side face **20** of planer **15** depending upon the direction of movement of such planer. The planer is conducted along the mine face by means of an endless chain **18** connected at either side to planer **15** and having its return portion **19** passing through the hollow pipe **14** attached to the conveyor **10**, with the ends of the drive chain being mounted on appropriate drive wheels at the ends of the mineway in which the mining operation is carried out. Such drive wheel mountings for the chain are well known.

In order to stabilize the planer **15** in its movements back and forth along the mine face, a keel or underlying transverse arm **21** is provided at the rearward side of the planer so that the same passes along the mine floor **22** under the bottom of conveyor **10**. The weight of conveyor **10**, especially considering the added weight of the extracted mineral being conveyed therealong, is sufficient to keep the planer upright and by suitable advancing means (not shown) attached, for example, to vertical side wall **11**, the conveyor **10** and in turn the planer **15** may be urged constantly toward the mine face **16**. Such advancing means may take the form of a piston cylinder arrangement connected to a bracing pit prop in reinforcing engagement with the mine floor **22** and mine roof **36**, whereby to constantly urge through the piston cylinder arrangement the conveyor, and in turn the planer toward the mine face **16**.

As shown in FIG. 1, the vertical side wall **12** of conveyor **10** is provided with a track **23** whereas the vertical side wall **11** is provided with a retaining flange **24** forming a groove **25** operatively parallel with the track **23**. In this way the forward foot **26** and rearward foot **27** may be suitably mounted on track **23** and in groove **25**, respectively, for displacement therealong so as to permit the carriage **28** of the mineral extracting apparatus of the invention to move back and forth adjacent the mine face for the purposes desired. The feet **26** and **27** may be provided in a constructional form to reduce sliding friction along track **23** and groove **25**, such as providing these feet as rollers, wheels, low friction slide runners, etc. The motor housing **29** is situated on the carriage **28** and is provided with a shaft **30** rotatably mounted thereon. Such shaft contains integrally the crank portions **31** and **32**, each of which carries a disc cutter **33** and **34**, respectively, preferably in the form of flat cones, i.e. in which the cone axis is substantially shorter than the radius of the cone base. The cone base is preferably positioned remote from the housing **29** and adjacent the mine face **16**. The disc cutters are shown as having about the same radius and are preferably rotatable with respect to the shaft **30** at the crank portions **31** and **32**, respectively, to permit a tangential thrust to be exerted against the overhanging roof mineral **35** at the upper portion of the mine face **16**. The crank portions **31** and **32** are preferably out of phase about 180° and by providing these crank portions with a different eccentricity from one another, the appropriate disc cutters will attack the overhanging mineral **35** alternately and within a different peripheral range from one another. By the alternate thrusts of the disc cutters during rotation of shaft **30**, the removal of mineral from the overhanging portion **35** of the mine face will be carried out most efficiently.

As may be seen more clearly in FIG. 2, the shaft **30** is journaled at **37** and **38** in housing **29** such that the beveled gears **39** and **40** transmit the rotational force of shaft **41** to shaft **30**, and in turn to the crank portions **31** and **32** and thence to the disc cutters **33** and **34**. Drive

shaft 41 is connected via a suitable coupling 42 with motor 43 which may be of any conventional type, such as electric motor or a compressed air motor, etc.

In the embodiment shown in FIG. 3, in place of the single shaft 30 containing the eccentric crank portions 31 and 32 with appropriate disc cutters thereon, a pair of separate, spaced apart substantially parallel shafts 45 and 48 are provided in housing 44, shaft 45 containing integrally the crank portion 46 with the appropriate disc cutter 47 thereon and the shaft 48 containing integrally the crank portion 49 with the appropriate disc cutter 50 thereon. Shaft 45 is journaled at 51 and 52 on housing 44 whereas shaft 48 is journaled at 58 and 59 on such housing in an offset manner to permit the operative connections between drive shaft 55 and the appropriate shafts 45 and 48 via the bevel gears 53, 54, and 60, 61, respectively. In turn, the drive shaft 55 is journaled at 62 and 63 on housing 44 and is operatively coupled via the coupling 56 with the drive motor 57 which is analogous to motor 43 of FIG. 2.

In the case of the dual shaft embodiment of FIG. 3, each crank portion is offset with respect to the other, and preferably such crank portions are offset about 180° by the beveled gearing employed to achieve the alternate thrusts of the disc cutters 47 and 50 tangentially against the overhanging mineral, such as coal, for the efficient extraction thereof. It is preferable, in this case, as well, to provide the disc cutters with about the same radius and to provide the crank portions with different eccentricities from one another with respect to the corresponding shaft axis so that the range of each disc cutter will be different and accordingly, the operation of one will complement the operation of the other. In the same way as in the case of the embodiment of FIGS. 1 and 2, one disc cutter is positioned closer to the mine face than the other so that the horizontal thickness of mineral which may be worked by the mineral extracting apparatus may be increased.

By providing the disc cutters in each of the embodiments as rotatable on the crank portions of the particular shaft or shafts, i.e., freely rotatable or rotatable independently of the rotation of such shaft or shafts, the disc cutters may thrust tangentially against the overhanging mineral and dig into the same yet give way by rotating on the particular crank portion so as not to set up excessive forces in the apparatus during contact with the overhanging mineral. Of course, by providing the crank portions offset with respect to one another, and preferably 180° apart, and by providing different degrees of eccentricity of such crank portions, preferably, as well as the positioning of one disc cutter closer to the mine face than the other, the desired alternative extractive engagement of the disc cutters will be enhanced within the range of operation permitted.

It will be realized that the embodiment shown in FIG. 3 is to be mounted on a carriage similar to carriage 28 as shown in FIG. 1 and all similar elements of each embodiment may actually be the same in construction and form, except with regard to the use of one shaft or two shafts and the appropriate bevel gearing and journaling required in each case.

With regard to the advantages of the present invention, it will be appreciated that the mine face 16, shown in FIG. 1, is of extraordinary height or unusual vertical seam thickness, and therefore the usual planer 15 can only accomplish the removal of the lower portion of the mineral up to a height generally designated by the point 17. While some of the upper portion mineral will fall under its own weight, an overhang 35 will still remain which must be removed if the mining extraction operations are to be at all efficient and safe. Since the mineral extracting apparatus of the invention is positioned for longitudinal movement along the top of the conveyor 10 or other suitable guide means, the range of the disc cutters

will be at the upper level of the mine face well above the mine floor and the uppermost point 17 representing the range of operation of the planer 15. As the normal mining operations progress and an overhang 35 is formed, then the planer 15 may be stopped, and the mineral extracting apparatus of the invention started whereby to remove the overhanging mineral, or if desired, depending upon the circumstances, the operation of the planer and the mineral extraction apparatus of the invention may be carried out simultaneously inasmuch as separate vertical levels of operation are carried out by these devices. It will be noted that flange 24 extends upwardly beyond the upper end of conveyor 10 at side wall 11 in order to provide suitable reinforcement for the carriage 28 in the event excessive forces are met at the mine face in the overhanging portion 35, for instance, which would otherwise derail carriage 28 or tilt the mineral extracting apparatus out of its normal operating position. It will be noted from FIG. 1 that without the mineral extracting apparatus of the present invention, the overhanging mineral 35 could not be readily extracted and such mineral would either be lost or manual means for its extraction would become necessary. Naturally, the height of the planer 15 cannot be extended indefinitely due to the operational limitations thereof, the weight thereof, the type of mineral being extracted, the unevenness of the mine floor and of the mine seam being worked, etc.

Naturally, as the shaft or shafts will be rotated, the disc cutters will thrust alternately aginst the overhanging coal from therebelow sufficiently to loosen the mineral whereby the same will fall under its own weight. The intermittent thrusts of the disc cutters during each rotation of the shaft or shafts provides an efficient extracting of the overhanging mineral without undue stress on the working parts, and preferably in the embodiment utilizing two separate, spaced apart shafts, each with a separate disc cutter, the shafts are rotated at the same speed and the disc cutters are of the same diameter, yet with the crank portion of one shaft being of a different eccentricity from the other, whereby to acheive the even intermittent thrusts of the overhanging coal without undue wear on the operating parts. Preferably, in the case of the embodiment using two separate shafts, such shafts are positioned at the same height, although such shafts may be arranged at different heights if desired. The latter possibility might be found most useful where the disc cutter closest to the overhanging coal does not reach as high as the other disc cutter so that the normal upward and outward profile of the overhanging coal may be accommodated more efficiently in the extraction operations. The disc cutters when mounted on two separate shafts at different heights will always attack the mine face at different heights correspondingly whereas in the usual case where both disc cutters are on the same shaft, such disc cutters will attack the mine face or overhanging mineral at substantially the same height.

While the eccentricity of the two crank portions may be the same, it is particularly advantageous to provide the crank portion closest to the mine face with the smaller eccentricity because of the advantage that the disc cutter which possesses a relatively small range of operation, i.e. when periodically swinging up and down or rotating, is thrust against the mine face with greater force than otherwise. Preferably, the disc cutters are situated on the corresponding crank portions so that such disc cutters may carry out a rotary motion with respect to the particular shaft or shafts at least as long as the edge of the disc cutter is in contact with the overhanging mineral. Thus, the disc cutter will roll off or roll with the mine face surface bringing about a partial rotation of the disc cutter counter to the rotation of the crank portion and corresponding shaft.

It will be appreciated by the artisan that the mineral extracting apparatus of the invention may be adapted to varying conditions depending upon the vertical height

of the mine seam and the upper portion thereof which is to be extracted. Thus, by suitable expedients, the range of elevation of the device in question may be varied, as for example, by varying in turn the height of the guide means upon which the mineral extracting apparatus may travel along the mine face. Moreover, the carriage 28 of the instant apparatus may be provided with adjustable feet to adjust the height of the carriage from the mine floor or from the guide means, such as the conveyor, upon which the carriage may be mounted.

Advantageously, the carriage of the mineral extracting apparatus of the invention should, if possible, be located on the conveyor such that one or even both of the rotating disc cutters will be located more or less immediately above the conveyor side wall adjacent the mine face. In this way, practically the entire upper portion of the mine face which is extracted by the loosening force of the disc cutters will be loaded automatically into the conveyor. Unlike the mineral extracted from the lower portion of the mine face in the usual way by a planing apparatus, the extracted mineral does not have to be plowed or otherwise conducted onto the conveyor for removal.

It will be obvious to the artisan that while the mineral extracting apparatus of the invention may travel back and forth along the mine face with the same frequency and speed as the normal planer for the mineral in the lower portion of the mine face, even so it might prove best to arrange the equipment in such a way that the planer will pass back and forth along the mine face several times before the instant upper level mineral extracting apparatus will have to travel back and forth along the mine face. In fact, it may only be necessary to travel in one direction to extract the overhanging mineral whereupon the instant upper level apparatus may be stopped and only conducted in the opposite direction after the usual planer extraction operations have been carried out to a further extent whereby to expose a new portion of overhanging mineral. Experience has shown that less energy by far is required to extract mineral from the upper portion of the mine face than from the lower and/or middle portions thereof, and this is probably due to the fact that the upper portion is no longer supported between the mine floor and mine roof once the lower portion of the mineral deposit has been removed. Naturally, in the overhanging upper portion mineral, such mineral by its own weight will aid in the loosening occasioned by the instant upper level apparatus.

Generally, the mineral extracting apparatus of the present invention may be used where the range of vertical height of the mine seam which may be extracted by the usual planer is approximately only about ¼ of the height of the vertical seam. While the exact numerical value is not important, what is important is the fact that the height of the range of extraction operations of the usual planer is only a fraction of the entire height of the deposit of mineral to be worked. In such cases, the mineral in the upper portion of the seam will always overhang to a greater or lesser extent. The thrust effect of the rotating disc cutters in accordance with the invention alternately brought against the overhanging mineral in quick succession in consequence of the speed of rotation of the shaft or shafts provides an excellent loosening effect with a minimum of effort and wear and tear on the working parts, and this is true whether both disc cutters are mounted on the same shaft or on separate, spaced apart shafts. Nevertheless, the advantage of the embodiment in which the disc cutters are on separate shafts as opposed to the embodiment where such disc cutters are on the same shaft, is that one disc cutter together with its shaft may be removed if the situation is such that the remaining disc cutter is capable by itself of removing the overhanging mineral in the upper portion of the mine seam.

While the disc cutters have been shown as substantially flat, conical or dish-like elements, it will be realized by the artisan that such cutters may have different shapes, as for example the shape of a flat double cone, i.e. with the opposing apexes situated remote from one another. Inasmuch as the rotating cutting edges of the disc cutters are particularly heavily taxed during the extraction operations of the overhanging mineral, they may be equipped advantageously with replaceable hard-metal tools or cutting blades in order to avoid premature wear and tear.

It will be realized by the artisan that the foregoing specification and drawings have been set forth by way of illustration and not limitation, and that various modifications and changes may be made without departing from the spirit and scope of the present invention, which is to be limited only by the scope of the appended claims.

What is claimed is:

1. Mineral extracting apparatus which comprises a movable base adapted to be displaced back and forth along a mine face, rotatable shaft means mounted on said base and extending outwardly beyond said base on the side thereof adjacent the mine face, a pair of corresponding crank portions located on and integrally connected with the outwardly extending shaft means in axially displaced relation with respect to one another and in opposing rotatable relation for rotation out of phase with one another, and a corresponding pair of disc cutters positioned on said shaft means at said crank portions respectively and adjacent such mine face for engaging extractively the mine face in alternate thrusts during rotation of said shaft means for the removal of mineral from such mine face.

2. Apparatus according to claim 1 wherein said disc cutters have about the same radius and are rotatable with respect to said shaft means independently of the rotation of such shaft means, and said crank portions are out of phase about 180°.

3. Apparatus according to claim 2 wherein said crank portions have a different eccentricity from one another.

4. Apparatus according to claim 2 wherein said disc cutters are substantially in the shape of cones and have a cone axis which is substantially shorter than the radius of the cone base, such cone base being remote from said movable base and adjacent the mine face.

5. Mineral extracting apparatus which comprises a movable base adapted to be displaced longitudinally back and forth along a mine face, a rotatable shaft mounted on said base, one end of said shaft extending outwardly beyond said base on the side of said base adjacent the mine face and having a pair of opposing crank portions located axially in tandem thereon and integrally connected therewith, and a pair of disc cutters positioned on said shaft at said crank portions respectively and adjacent such mine face for engaging extractively the mine face in alternate thrusts during rotation of said shaft for the removal of mineral from such mine face.

6. Mineral extracting apparatus which comprises a movable base adapted to be displaced longitudinally back and forth along a mine face, a rotatable shaft mounted on said base, one end of said shaft extending outwardly beyond said base on the side of said base adjacent the mine face and having a pair of opposing crank portions located about 180° apart axially in tandem thereon, and a pair of disc cutters of about the same radius positioned on said shaft at said crank portions respectively and adjacent such mine face and rotatable with respect to said shaft independently of the rotation of such shaft for engaging extractively the mine face in alternate tangential thrusts during rotation of said shaft for the removal of mineral from such mine face.

7. Apparatus according to claim 6 wherein said crank portions have a different eccentricity from one another with respect to the axis of said shaft.

8. Mineral extracting apparatus which comprises a movable base adapted to be displaced longitudinally back and forth along a mine face, a pair of substantially parallel spaced apart rotatable shafts mounted on said base,

one end of each shaft extending outwardly in the same direction beyond said base on the side of said base adjacent the mine face, the end of one shaft extending outwardly axially beyond the end of the other shaft and both shafts having a crank portion at the outwardly extending end thereof and integrally connected therewith, said shafts being mounted for rotation such that the crank portions thereof are out of phase, and a pair of disc cutters positioned on said shafts at said crank portions respectively and adjacent such mine face for engaging extractively the mine face in alternate thrusts during rotation of said shafts for the removal of mineral from such mine face.

9. Mineral extracting apparatus which comprises a movable base adapted to be displaced longitudinally back and forth along a mine face, a pair of substantially parallel spaced apart rotatable shafts mounted on said base, one end of each shaft extending outwardly in the same direction beyond said base on the side of said base adjacent the mine face, the end of one shaft extending outwardly axially beyond the end of the other shaft and both shafts having a crank portion at the outwardly extending end thereof, said shafts being mounted for rotation such that the crank portions thereof are out of phase about 180°, and a pair of disc cutters of about the same radius positioned on said shafts at said crank portions respectively and adjacent such mine face and rotatable with respect to the corresponding shaft on which the particular disc cutter is positioned independently of the rotation of such corresponding shaft for engaging extractively the mine face in alternate tangential thrusts during rotation of said shafts for the removal of mineral from said mine face.

10. Apparatus according to claim 9 wherein said crank portions have a different eccentricity from one another with respect to the axis of the corresponding shaft.

11. Mineral extracting arrangement for extracting overhanging mineral from the upper portion of a mine face

of extraordinary height after the lower portion thereof has been extracted, which comprises elevated elongated guide means adapted to be positioned longitudinally along a mine face, a carriage mounted on said guide means for movement back and forth thereon adjacent a mine face at a predetermined elevation above the mine floor corresponding to the level of the overhanging mineral in the upper portion of the mine face, a motor means situated on said carriage for movement therewith, horizontal rotatable shaft means operatively connected to said motor means and mounted on said carriage and extending outwardly beyond said carriage on the side thereof adjacent the mine face, a pair of corresponding crank portions located on the outwardly extending shaft means in axially displaced relation with respect to one another and in opposing rotatable relation for rotation out of phase about 180° with one another, and a corresponding pair of disc cutters positioned on said shaft means at said crank portions respectively and adjacent the mine face at said elevation and rotatable with respect to said shaft means independently of the rotation of such shaft means for engaging extractively the overhanging mineral in the upper portion of the mine face in alternate thrusts during rotation of said shaft means for removal of such mineral from the mine face.

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