

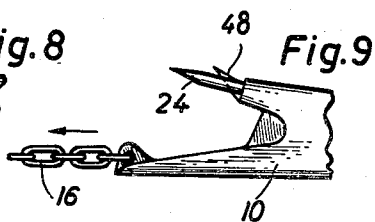
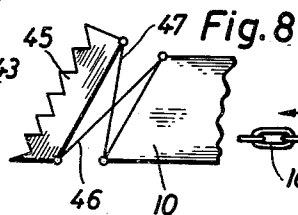
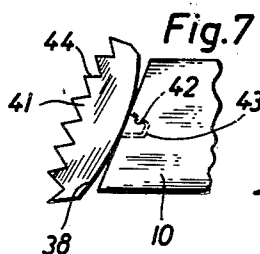
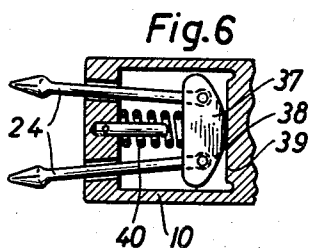
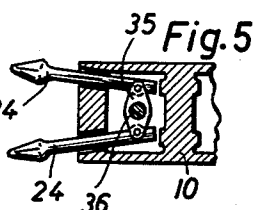
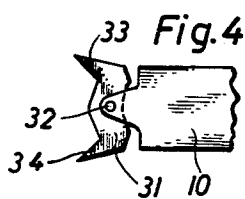
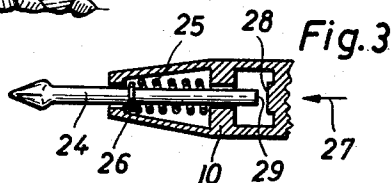
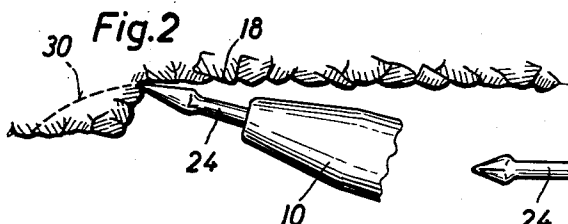
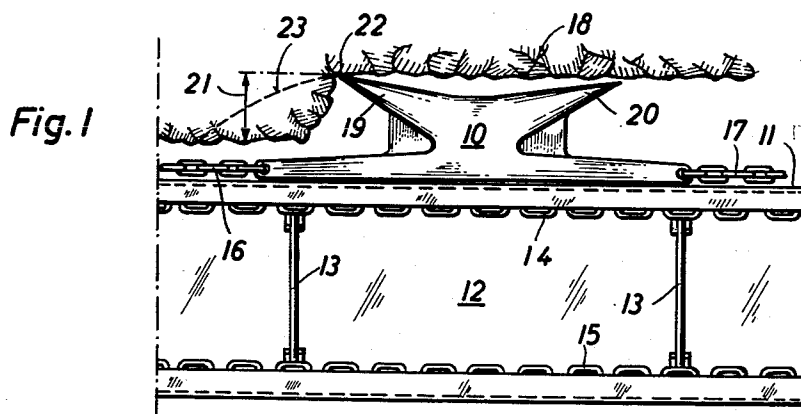
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J. HERRMANN

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MINING PLANERS HAVING AN IMPACT ACTION

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INVENTOR:
JULIUS HERRMANN
BY
Burgen, Dinklage & Sprung
ATTORNEYS

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MINING PLANERS HAVING AN IMPACT ACTION

Julius Herrmann, Westphalia, Germany, assignor to Gewerkschaft Eisenhütte Westphalia, Wethmar, near Lunen (Westphalia), Germany, a corporation of Germany

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5 Claims. (Cl. 262—8)

This invention relates to new and useful improvements in mining planers and is a division of my copending application Serial No. 510,788, filed May 24, 1955 now Patent No. 2,873,959.

Mining planers such as coal mining planers are known and comprise a planer cutting head which is drawn along a mine face for the cutting or plowing of a strip of mineral, such as the coal, from the mine face. The mining planer is particularly well adapted for a type of mining known as long wall mining and may be used for efficiently removing coal by the long wall method and especially from narrow seams.

The mining planer preferably has a planer cutting head which is movable in either direction along a longitudinally extending conveyor. The planer head is provided with cutters for cutting in each direction and is drawn back and forth along the leading portion of the conveyor.

In operation, the planer conveyor is positioned along the mine face of a long wall panel in a mining gallery and rests on the mine floor. The conveyor is composed of sections which are connected together so as to allow a flexing therebetween. The conveyor is urged toward the mine face and the planer cutting head is drawn back and forth along the conveyor by means of a flexible traction element such as a chain cable or the like. As the planer cutting head is drawn back and forth along the conveyor, and the conveyor is urged toward the mine face, the planer cuts and turns or plows cut material in a substantially continuous manner into the conveyor which, in turn, continuously transports the material for removal.

Upon casual observation of the planer in operation, it may be noted that the forward movement does not take place uniformly, but that the same is effected more or less irregularly with jerky motions. If a measuring member is inserted between the planer and the traction element such as the chain, it may be noted that the pulling tension continuously changes.

One object of this invention is a mining planer construction which will utilize the irregular forward motion of the planer head to obtain an increased efficiency in output. This and still further objects will become apparent from the following description read in conjunction with the drawing, in which:

Fig. 1 is a diagrammatic plan view showing a portion of a conventional plow planer in operation,

Fig. 2 is a plan view of an embodiment of a planer cutting tool, in accordance with the invention,

Fig. 3 shows the cutting tool of Fig. 2 partially in section,

Fig. 4 is a side elevation of a portion of an embodiment of a planer cutter in accordance with the invention,

Fig. 5 is a partial section of a further embodiment of a planer cutter in accordance with the invention,

Fig. 6 is a partial section of a still further embodiment of a planer cutter in accordance with the invention,

Fig. 7 is a side elevation of a still further embodiment of a planer cutter in accordance with the invention,

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Fig. 8 is a diagrammatic side elevation of a still further embodiment of a cutter in accordance with the invention, and

Fig. 9 is a plan view of a portion of a planer head showing a still further embodiment of a cutter construction in accordance with the invention.

In accordance with the invention the irregular forward motion of the planer and the variation in tension of the flexible traction element are used to produce an impact or striking action on the planer cutter to aid in the cutting action and to increase the output. The planer, in accordance with the invention, has a conventional planer head with a planer cutter movable along the mine face by means of a flexible traction element. In accordance with the novel feature of the invention, a cutting tool defines at least a portion of the planer cutter and is mounted for limited yielding movement against increased cutting resistance in a direction substantially opposite to the cutting direction of the planer. In operation, as the cutter encounters an increased cutting resistance, the same yields, i.e., moves, in a direction substantially opposite to the cutting direction for a limited distance. The energy gained in this manner, for example, the increased kinetic energy of the planer, is then utilized for the additional actuation of the cutter, as for example, the inertia of the planer may be utilized for increased cutting action upon striking the cutting tool when the same reaches its end limit of yieldable movement.

The invention will be described in further detail with reference to the embodiments shown in the accompanying drawing.

Referring to Fig. 1, the planer consists of the planer head 10 which is movable back and forth along the leading portion 11 of the longitudinally extending conveyor 12. The conveyor 12 of conventional construction has the two laterally guided chains 14 and 15 which are connected to each other at spaced intervals by the scraper flights 13. The chains 14 and 15 are driven in any conventional manner as, for example, around a sprocket wheel, by a drive motor and the scraper flights 13 effect the conveyance of the mined material by dragging the same along the conveyor.

The planer head 10 is drawn back and forth along the conveyor by means of the flexible traction element consisting of the chain 16—17. The planer head has the planer cutters 19 and 20 for cutting in each direction of travel.

The conveyor 12 is positioned longitudinally along a mine face as, for example, a long wall in coal mining. The conveyor is urged toward the mine face as, for example, by means of pneumatic jacks and the like and the planer head 10 with planer cutters 19 and 20 drawn back and forth in contact with the coal, by means of the flexible traction elements 16, 17 driven in any conventional manner. As the planer pulls in the direction of the portion of the chains 16, cutter 19 effects the cutting of the coal which is automatically plowed into the conveyor for removal. When the direction is reversed so that traction is exerted on the portion 17 of the chain, the cutter 20 effects the removal of the coal and the plowing of the same into the conveyor. In each direction of motion, a strip of coal corresponding to thickness 21, is removed from the mine face and forced into the conveyor for removal. The conveyor with the planer is continuously advanced by means of the force of the pneumatic jacks or the like.

In order to effect the removal of the coal, the planer cutter 19 and planer head 10 is pulled with the elastic tension at 22 by means of the chain 16 or by means of another flexible traction element such as a cable rope or the like. The cutter 19 in this connection penetrates to a certain depth into the coal until the tension in the trac-

tion element 16 has risen to such an extent that the coal is broken off approximately along the line of fracture 23. The planer thereupon due to the sudden decrease in resistance moves forward rapidly by a small amount, tension of the traction element 16 being correspondingly decreased. Since, however, chain 16 is drawn forward at a constant speed by the drive, tension soon again increases. The cutter 19 again penetrates into the coal and the process is repeated in the manner described. The fact that the coal is not a completely homogenous mass and that the flexible traction element such as the chain 16—17 has a certain elastic extensibility, are factors contributing to the un-uniform motion of the planer.

In accordance with the invention, in order to utilize this un-uniform motion to advantage, at least a portion of the planer cutter 19—20 may be defined by the pick-like cutting tool 24, as shown in Figs. 2 and 3. The cutter tool 24 is axially movable to a limited extent within the planer head 10. As shown in Fig. 3, cutter tool 24 is axially slidable between an extended position in which its collar 26 strikes the planer head 10 and a rear position in which the base 29 strikes the portion 28 of the planer head 10. Tool 24 is resiliently urged to its forward position as is shown in Fig. 3 by means of a spring 25 which presses against the collar 26. The tension of the spring 25 should be somewhat less than the pulling forth exerted by the chain 16.

In operation as the planer head 10 is pulled by the chain 16 in the direction shown in Fig. 1, the cutting tool 24 contacts the mine face as shown in Fig. 2 the tool 24 first of all penetrates a small amount into the coal. As the resistance in the coal increases, the forward penetration speed of the tool 24 correspondingly decreases. The planer head, however, is pulled forward at a uniform speed so that the spring 25 compresses and planer head 10 moves forward in relation to the cutting tool 24. The stop surface 28 of the planer head 10 finally, however, strikes the base 29 of the cutter tool 24 so that a portion of the inertia force of the forwardly moving planer head 10 and of the chain 16 is transmitted to the cutting tool 24 which is accordingly accelerated forward and which in turn breaks off the coal approximately along the dotted line 30 as shown in Fig. 2. In this connection the cutting tool 24 is suddenly released from the load and is suddenly moved axially to its forward position as shown in Fig. 3 by means of the biasing force of the spring 25. The cutting tool 24 and the planer head then continues to move forward with the same speed until the cutting tool 24 again encounters the increased resistance of the coal and the procedure is repeated.

In place of a flexible traction element, the forward motion of the planer head 10 as, for example, in the direction 27 as shown in Fig. 3 may be effected in the known manner by a spring, pressure cylinder, or the like.

If two planers of identical construction were simultaneously used under identical conditions the irregular movements of the planer heads would, at best, only rarely coincide. In the same manner, the resistance encountered along the vertical length of the planer cutters or the individual cutting tools vertically positioned along the planer cutter head rarely coincide. This phenomena may be advantageously utilized in accordance with the invention as illustrated in the following embodiments:

In accordance with the embodiment as shown in Fig. 4 of the drawing, the front end of the planer head 10 has a leaf-shaped cutting tool 31 which is pivoted at a horizontal pin 32 and which terminates on the tool cutting tips 33 and 34 both of which face forward in the direction of motion of the planer head 10 in operation and are positioned substantially vertically one above the other. If the planer is pulled forward by the chain 16 with a constant speed and if the cutter 34, for example, encounters a greater resistance than the cutter 33, the cutter 34 will lag somewhat behind and the leaf will pivot about pin 32. The forward speed of the cutter 34

will thus be less than the forward speed of advance of the planer head 10. On the other hand, however, the opposite cutter point 33 will be forced at a correspondingly greater speed against the coal, loosening it. Finally, the lower end of the leaf 31 will strike against the planer head 10 and the inertia force of the planer head will be concentrated at the lower cutting point 34 so that the latter will overcome the increased resistance which opposed it. If the point 33 of the leaf 31 would first meet correspondingly increased resistance as compared to the point 34, and the process would of course be reversed.

In the embodiment shown in Fig. 5 the two elongated cutting tools 22 are pivotally connected to the double arm lever 35 which is pivoted about the pin 36 in the plow planer head. The cutting tools 24 in the normal position are in a substantially vertical plane one above the other and their operation is substantially identical to that described in connection with the embodiment shown in Fig. 4.

In the embodiment as shown in Fig. 6, the cutting tools 24, instead of being attached to the double arm lever 35 are pivotally connected to the ends of a cam lever 37, the convex rear side 38 of which rests against a flat support surface 39 of the planer head 10. A spring 40, resiliently urges the lever rearwardly so that its surface 37 contacts the supporting surface 39 of the planer head. The spring 40 also tends to resiliently hold the cam 37 in a position as shown, with the central portion of the convex surface 38 in contact with the support surface 39. The operation of this embodiment is substantially identical to that described in connection with Figs. 4 and 5, except that upon the swinging of the cam lever 37, there is obtained a continuous displacement of the pivot point, i.e., the point of contact of the convex surface 38 and flat support surface 39 and thus a continuous change of the lever ratio.

In the embodiment as shown in Fig. 7, a single, flattened cutter 41 is mounted in front of the planer head 10. The forward edge of the cutter 41 is serrated forming the cutting teeth 44 and the rear edge 38 is convex shape forming the rolling face 38. In addition, the rear end of the cutter 41 has the projection 42, which engages in the socket 43 which is somewhat larger than the projection 42 to allow a limited movement therein. Due to the looseness of fit of the projection 42 in the socket 43 and the convex rolling surface 38, the cutter 40 may swing or pivot in a vertical plane, i.e., roll on the surface 38. In operation, if the teeth 44 in the upper portion of the cutter 41 encounter increased resistance, the cutter will roll on the convex rolling face 38 so that the motion of the upper cutter teeth with respect to the planer head is retarded while motion of the lower cutting teeth with respect to the planer head is increased until the limit of motion is reached and the planer head strikes the upper portion of the cutter 41 transmitting its inertia of movement to the upper teeth, increasing their cutting action. Conversely, if the lower portion of the cutter 41 encounters the increased resistance, the procedure is reversed.

In the embodiment as shown in Fig. 8, the cutter 45 is in the form of a flat plate with a serrated forward cutting edge defining individual cutting teeth. The cutter 45 is connected to the planer head 10 by the crossed levers 46 and 47, pivotally connected to the cutter 45 and the planer head 10. The cross lever connection allows swinging or pivoting of the cutter 45 in a substantially vertical plane and thus allows in operation a portion of the cutter 45 to have its forward motion retarded with respect to the planer head 10 a limited distance upon encountering increased resistance in the same manner as described in the embodiment shown in Figs. 4, 5, 6 and 7.

Depending on the hardness and the cleavability of the

material to be mined, one or the other of the various embodiments shown may prove more advantageous.

As shown in Fig. 9, the planer cutter on planer head 10 is defined by a number of cutting tools 24, 48, staggered with respect to each other and positioned vertically one above the other. The cutting tool 24 may, for example, be movable, to correspond to the cutting tool 24 shown in Figs. 2 and 3, while the cutting tool 48 may be stationary.

In accordance with the invention, depending on the nature of the coal or other material to be mined, it is possible either to increase the capacity or reduce the power consumption of the planer. The above described features of the planer head and cutter may also be used in the same or similar form in scraper boxes or other mining tools having a stripping action in the mining of coal or other ores.

While the invention has been described in detail with reference to the specific embodiments shown, various changes and modifications will become apparent to the artisan which fall within the spirit of the invention and the scope of the appended claims.

I claim:

1. In a mining planer having a planer head with a planer cutter movable along a mine face, the improvement which comprises a cutting tool defining at least a portion of said planer cutter formed by at least two vertically spaced apart cutting members connected together by a cross member, said cross member being pivotally connected at its central portion to the planer head for limited movement of said cutting members relative to the planer head in substantially their cutting direction and the direction reversed thereto and stop means substantially rigid with the planer head limiting the movement of said cutting members in the direction opposite their cutting direction.

2. In a mining planer having a planer head with a planer cutter movable along a mine face the improvement which comprises a cutting tool defining at least a portion of said planer cutter formed by a cutting plate having a serrated forward cutting edge and a convex shaped rear portion positioned in rocking engagement with a substantially flat support surface defined by said planer head whereby each end of said cutting tool may rock relative to the planer in substantially its cutting direction and the direction reversed thereto, and stop means substantially rigid with the planer head limiting the movement of each end of the cutting tool in the direction opposite its cutting direction.

3. In a mining planer having a planer head with a planer cutter movable along a mine face, the improvement which comprises a cutting tool defining at least a portion of said planer cutter formed by a cutter plate

having a serrated forward edge and connected to said planer head by a pair of crossed lever arms for pivoting each of its ends relative to the planer head in substantially its cutting direction and the direction reversed thereto and stop means substantially rigid with the planer head limiting the movement of said cutting tool in the direction opposite its cutting direction.

4. In a mining planer having a planer head with a planer cutter movable along a mine face, the improvement which comprises a cutting tool defining at least a portion of said planer cutter formed by a cutting plate having a serrated forward cutting edge and pivotally connected to the planer head for limited pivoting relative to the planer head between a first position with an end portion of the cutter edge retracted adjacent the planer head and the other end of the cutter edge advanced from the planer head in its cutting direction and a second position with said first mentioned end of the cutter edge retracted adjacent the planer head and the other end of the cutter edge advanced from the planer head in its cutting direction, and stop means substantially rigid with the planer head limiting the movement of said cutter tool between said first and second position.

5. In a mining planer having a planer head with a planer cutter movable along a mine face, the improvement which comprises a cutting tool defining at least a portion of said planer cutter formed by a cutting plate having at least two vertically spaced-apart cutting tips which face forward in the cutting direction of the planer head, said cutting tool being pivotally connected to the planer head for pivoting relative thereto between a first position with the upper cutting tip retracted adjacent the planer head and the lower cutting tip advanced from the planer head in its cutting direction and a second position with the upper cutting tip advanced from the planer head in its cutting direction and the lower cutting tip retracted adjacent the planer head and stop means substantially rigid with the planer head limiting the movement of said cutting tool between said first and second position.

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