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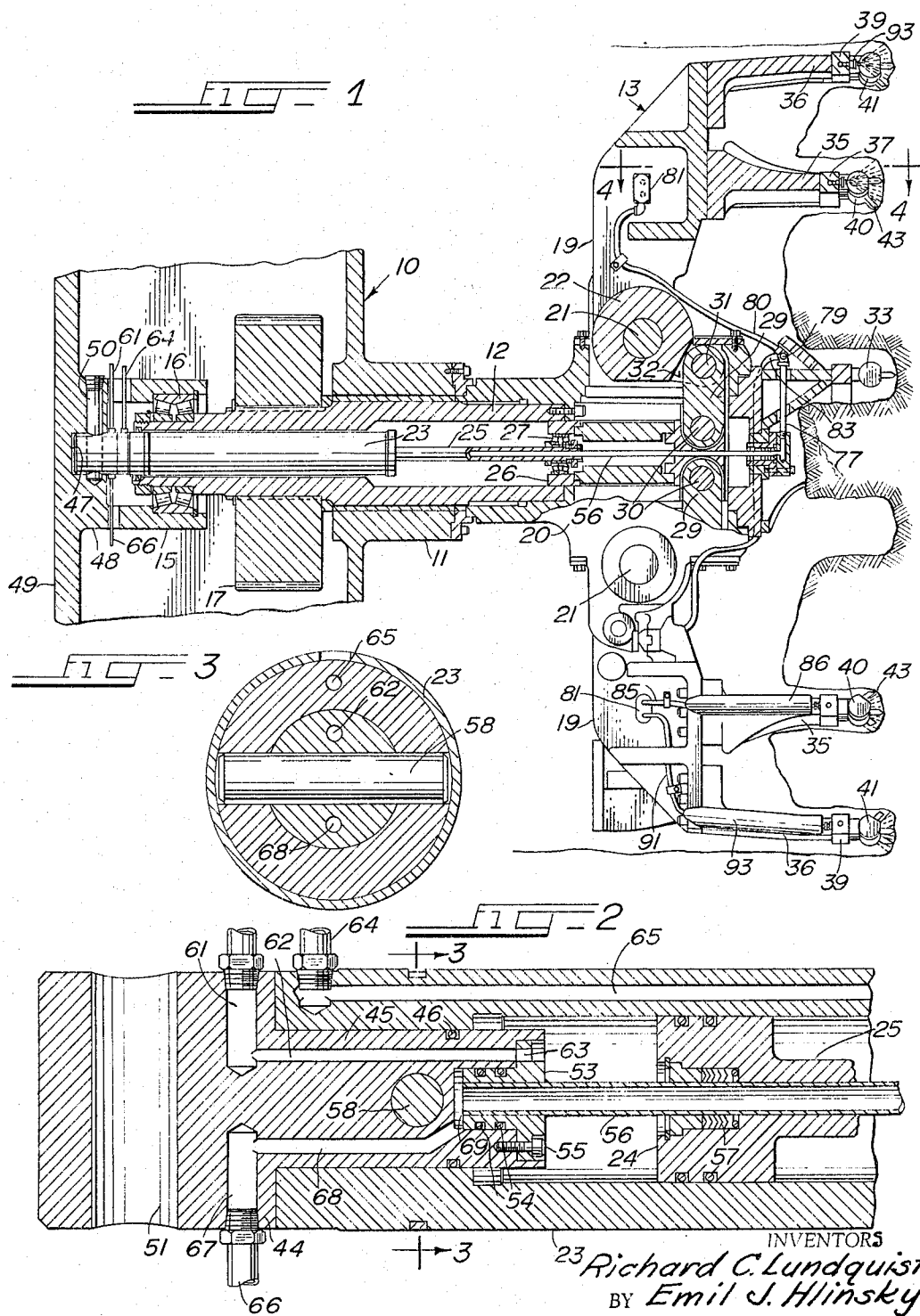
E. J. HLINSKY ETAL

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DUST LAYING SYSTEM FOR CONTINUOUS MINING MACHINE

Filed Jan. 24, 1964

2 Sheets-Sheet 1



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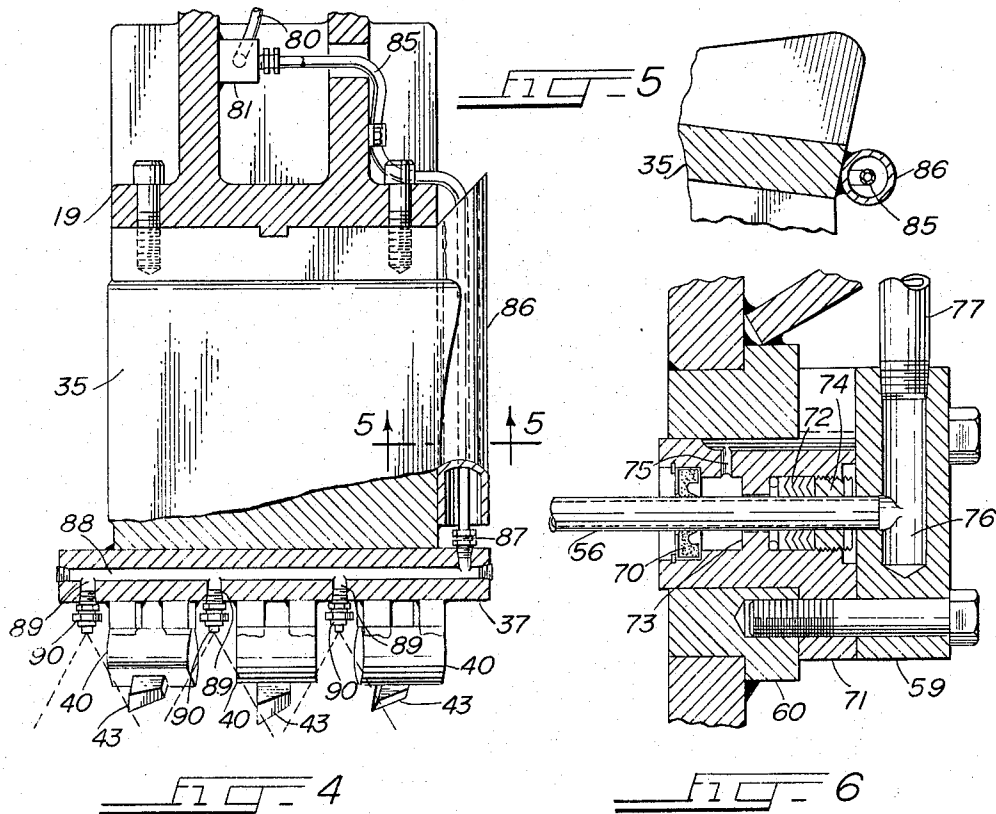
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DUST LAYING SYSTEM FOR CONTINUOUS MINING MACHINE

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This invention relates to improvements in continuous mining machines and more particularly relates to an improved system for laying the dust resulting from the mining of the coal from the face and the dropping of the coal to the ground, to be collected for loading.

In the mining of coal and particularly in the continuous mining of coal by rotary boring head types of continuous mining machines in which an entire working place is mined out by boring continuous bores in the face and picking up the mined coal from the ground, a substantial amount of dust is created, presenting a hazard and problem which has been difficult to solve.

Various sprays, such as water sprays at the top of the gear box supporting the boring heads and trimmer bars have been used, but these sprays have never been satisfactory because they require an excessive amount of water and it has never been possible to penetrate to the points of cutting with such sprays. Due to the rugged service to which the boring heads are put to mine out a working place and the fact that the boring heads are continuously rotating and are adjusted to and from extended boring positions by mechanisms coaxial with the axes of rotation of the boring heads, it has been difficult to provide a satisfactory spraying system having a low enough maintenance to be practical, in which the sprays can penetrate the points of cutting.

A principal object of the present invention is to remedy the foregoing deficiencies by providing an improved dust laying system for continuous mining machines of the boring type in which the sprays are so arranged as to penetrate at the point of cutting during the entire cutting operation.

A further object of the invention is to provide a novel spraying system for the cutter bits on the boring heads of a continuous mining machine so arranged that the sprays impinge on the coal in advance of the points of cutting, and fluid is conducted to the sprays through the mechanism for moving the boring arms to and from their extended positions.

Still a further object of the invention is to provide an improved system for spraying in advance of the individual cutter bits of a continuous mining machine of the rotary boring type, in which the bits rotatably travel about an axis and the source of supply of spraying fluid is from a stationary location coaxial with the axes of rotation of the boring heads.

Still another object of the invention is to provide an improved dust laying system for continuous mining machines having a series of circumferentially aligned and radially spaced cutter bits rotating about a horizontal axis, with a spray in advance of each cutter bit, and fluid connections to the spray in trailing relation with respect to the bits and protected from the breaking coal during the mining operation, and in which the source of supply of fluid to the sprays is in through the hollow piston rod, extending and retracting the boring arms.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a fragmentary longitudinal sectional view taken through a boring head and its support, showing the boring head in the process of performing a boring

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operation, with certain parts of the boring head shown in solid;

FIGURE 2 is a fragmentary horizontal sectional view taken through the cylinder and piston for extending and contracting the boring head and showing the fluid connection through the center of the cylinder;

FIGURE 3 is a fragmentary sectional view taken substantially along line 3—3 of FIGURE 2;

FIGURE 4 is a horizontal sectional view taken substantially along line 4—4 of FIGURE 1, looking down at the top of one of the cutter supports and showing the fluid connections in advance of the individual cutter bits, with certain parts shown in solid;

FIGURE 5 is a fragmentary transverse sectional view taken substantially along lines 5—5 of FIGURE 4; and

FIGURE 6 is an enlarged sectional view illustrating the fluid connection through the center of the rotating fluid distributor, distributing fluid to the sprays rotating with the boring arms.

In the embodiment of the invention illustrated in the drawings, we have shown in FIGURE 1 a gear housing or cutter frame 10 of a continuous mining machine having a hub 11 extending forwardly therefrom forming a bearing support for a hollow drive shaft 12 of a rotary boring head 13. The hollow shaft 12 extends from within the gear housing 10 into a bearing box 15, forming a bearing support for the rear end portion thereof, on radial thrust bearings 16. A gear 17 is keyed or otherwise secured to the hollow shaft 12 within the gear housing 10 and is driven from a suitable geared reduction train of a conventional form, for rotatably driving the boring head 13 to cut a bore in the mine face.

The boring head 13 is generally similar to that shown and described in Patent No. 2,736,542 which issued to Frank Cartledge on February 28, 1956, and includes two boring arms 19 extending radially of a hub 20 splined or otherwise secured to the end of the hollow shaft 12 and extending forwardly therefrom. The boring arms 19 are transversely pivoted to the hub 20 in advance of the forward end of the hollow shaft 12 on pivot pins 21 extending through boss portions 22 of said boring arms.

The boring arms 19 are contracted when it is desired to tram the machine from working place to working place and are extended and held in extended relation by a fluid pressure cylinder 23 having a piston 24 therein and a piston rod extending from said piston through the piston rod end of said cylinder. The piston rod 25 is connected with a slide 26 through oppositely facing radial thrust bearings 27 for moving said slide along the hub 20 and hollow interior portion of the hollow shaft 12. The slide 26 in turn is connected with the boring arms 19 by means of links 29 transversely pivoted thereto on pivot pins 30 and transversely pivoted to the boring arms 19 on pivot pins 31 pivotally connected between bifurcated cranks 32 extending from the boss portions 22.

The boring head 13 also includes pilot cutters 33 extending forwardly of the hub 20 and radially outwardly spaced cutter supports 35 and 36 spaced radially outwardly of said pilot cutters. The cutter supports 35 and 36 conform generally to the circumferential paths of travel of said cutter supports and are shown in FIGURES 1 and 4 as having manifolds 37 and 39 extending along respective of said cutter supports and having cutter blocks 40 and 41, respectively, secured thereto and projecting forwardly therefrom. The cutter blocks 40 and 41 carry the usual cutter bits and as shown in FIGURE 4 the advance cutter block 40 is inclined to one side of center to position a cutter bit 43 carried thereby to cut clearance for one side of the manifold 37 and cutter support 35. The next trailing cutter block 40 positions its cutter bit 43 to cut along the center of the seam while the extreme trailing cutter block 40 positions its cutter

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bit 43 to cut clearance for the lower side of the cutter support 35. The cutter blocks 41 have similar cutter bits positioned like the cutter bits 43.

Referring now in particular to the means for conducting dust laying liquid, such as water, to the leading ends of the cutter bits 43 for laying the dust of cutting, the cylinder 23 is shown in FIGURE 2 as having a block 44 having a reduced diameter portion 45 recessed within its head end and sealed thereto as by an O-ring 46. The block 44 extends rearwardly of the cylinder 23 within a socket 47 formed in a block or boss 48 extending inwardly of a rear wall 49 of the gear housing 10. A retaining pin 50 is mounted in the block or boss 48 and extends through a cross-drilled hole 51 of the block 44 to retain the cylinder 23 in position. The reduced diameter portion 45 of the block 44 has a sealing gland 53 recessed therein and sealed thereto as by O-rings 54. The sealing gland 53 is shown in FIGURE 2 as being secured to the end of the reduced diameter portion 45 as by machine screws 55. The sealing gland 53 also forms a support for a tube 56 extending therealong and forwardly therefrom and welded or otherwise secured thereto. The tube 56 extends along the piston rod 25 and hollow interior portion of the piston rod 25 and is sealed to said piston and piston rod as by sealing gland structure 57. The tube 56 also extends beyond the forward end of the piston rod 25 through the slide 26 into a distributor 59 carried in an end cap 60 for the hub 20 and secured thereto for rotation therewith. A transverse pin 58 serves to retain the cylinder 23 to the reduced diameter 45 of the block 44.

The block 44 is shown as having a fluid pressure passageway 61 leading thereinto from one side thereof and supplying fluid under pressure to a passageway 62 opening through the passageway 63 in the sealing gland 53, for supplying fluid under pressure to the head end of the cylinder 23 and extending the boring head 13 into the position shown in FIGURE 1. A fluid pressure pipe 64 leads into the wall of the cylinder 23 and has communication with a passageway 65 extending along said wall and opening to the piston rod end of said cylinder, to supply fluid under pressure to the piston rod end of said cylinder, to retractibly move the piston 24 and boring head 13 when it is desired to tram the machine from working place to working place.

A pipe 66, for dust laying liquid, such as water, enters the block 44 from the opposite side thereof from the passageway 61 and has communication with a passageway 67. The passageway 67 is connected with a passageway 68 extending along the reduced diameter portion 45 of the block 44 through a chamber 69, spaced rearwardly of the inner end of the sealing gland 53, and has communication with the tube 56, for supplying water thereto.

The tube 56 enters the distributor 59 and is sealed thereto and to the end caps 60 by a seal 70 at the entering end of a distributor block 71 and a second seal 72 interposed between a wall 73 of said distributor block and a retainer plug 74 threaded in said distributor block about the tube 56, and retaining said seal to said block. The space between the seal 70 and the wall 73 forms a sump for the collection of fluid which may leak past the seal 72 and accommodates the draining of the fluid through a drain passageway 75.

The distributor 59 is shown as having a transverse passageway 76 in communication with the end of the tube 56 and leading transversely of said tube. A pipe 77 is threaded in the outer end of the passageway 76 and extends radially of the tube 56 and has a fitting 79 secured to its outer end. A flexible pipe such as a hose 80 leads from the fitting 79 inwardly therefrom and along one boring arm 19 and has communication with a distributor fitting 81 at its outer end. A similar tube or hose 83 leads from the fitting 79 along the opposite boring arm 19 and has communication with a distributor 81 like the distributor 81 previously mentioned.

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The fluid communication system to the cutter supports for the two boring arms 19 is the same for each cutter support so the same part numbers will be applied to the same parts for each cutter support.

Each distributor 81 has a pipe or tube 85 leading therefrom outwardly along the boring arm 19 and extending within and along a protective pipe 86 opening to the front end of the cutter support. The pipe 85 is connected with a fitting 87 at its forward end, shown in FIGURE 4 as being threaded within the manifold 37 and as having communication with a passageway 88 extending along said manifold. The passageway 88 has communication with three cross-drilled passageways 89, 89 each one of which is positioned in advance of a cutter block 40 and has a spray nozzle 90 threaded therein. The spray nozzles 90 open forwardly of the manifold 37 to direct sprays in the paths of the cutter bits 43 in advance of said cutter bits during the entire cutting operation.

The distributor 81 also has a pipe or hose 91 connected therewith and leading radially outwardly therefrom within a protective pipe 93 extending along the retreating side of the outer cutter support 36 and having communication with the manifold 39 extending along the outer cutter support 36. The manifold 39 has nozzles 93 leading therefrom, like the nozzles 90, and spaced in advance of the cutter blocks 41 for spraying in leading relation with respect to said cutter blocks.

It may be seen from the foregoing that during the cutting operation the dust laying liquid may be supplied through the pipe 66 from a stationary source of supply and that by conducting the dust laying liquid through the center of the piston 24 and piston rod 25, the boring arms may be moved into and out of their extended cutting positions by the piston rod without interfering with the sprays, and individual sprays may be positioned adjacent the respective cutter blocks and bits and spray into the kerf at the points by cutting of the cutter bits, and thereby efficiently lay the dust caused by cutting and breaking down of the working face effected by rotatable movement and axial advance of the boring heads 13.

It may further be seen that the fluid conducting pipes are in trailing relation with respect to the cutter bits and are protected from the breaking coal and thereby make it possible to conduct dust laying fluid to lead the cutter bits without unduly complicating the fluid conducting structure, to avoid damage to the pipes during the cutting operation.

While we have herein shown and described one form in which the invention may be embodied, it may readily be understood that various variations and modifications in the invention may be attained without departing from the spirit and scope of the novel concepts thereof, as defined by the claims appended hereto.

We claim as our invention:

1. In a continuous mining machine,
 - a rotary boring head supported for rotation about a horizontal axis and having at least one boring arm extending radially of the axis of rotation thereof and mounted for movement into a radially extended cutting position and a contracted tramping position, at least one cutter support extending forwardly of said boring arm,
 - a power member coaxial with and movable along the axis of rotation of said boring head,
 - linkage means connecting said power member with said boring arm for extensibly and retractibly moving said boring arm, the improvements comprising:
 - dust laying apparatus including a distributor rotatable with said boring arm about the axis of rotation thereof,
 - a manifold extending along the front of said cutter support and having cutter blocks mounted thereon and projecting forwardly therefrom,
 - forwardly projecting cutter bits mounted in said cutter blocks,

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a series of spray nozzles mounted on and extending forwardly of said manifold, one spray nozzle being in advance of each cutter block and bit,

a fluid conductor from said distributor to said manifold and spray nozzles,

a stationary tube extending along said power member and beyond opposite ends thereof, means supplying said tube with dust laying liquid under pressure at one end thereof,

and means sealing the opposite end of said tube to said rotatable distributor for supplying dust laying liquid thereto for distribution through said spray nozzles.

2. In a continuous mining machine, at least one boring head supported for rotation about a horizontal axis and including at least one boring arm having a cutter support extending forwardly therefrom having cutter blocks and bits mounted on the forward end thereof, means mounting said boring arm for extensible and retractible movement with respect to the axis of rotation thereof, a fluid pressure cylinder held from rotation and coaxial with the axis of rotation of said boring arm and having a piston therein and a piston rod extensible therefrom having operative connection with said boring arm for extensibly and retractibly moving said boring arm, a spray nozzle mounted on said cutter support in advance of said cutter blocks and bits, a fluid conducting pipe having fluid communication with said spray nozzle, and means conducting liquid under pressure to said fluid conducting pipe during rotation of said boring head comprising a stationary tube extending through said cylinder and piston rod beyond the forward end thereof and connected with a source of liquid under pressure, and a rotatable distributor having communication with the forward end of said tube and sealed thereto to distribute fluid under pressure to said pipe and spray nozzle.

3. In a continuous mining machine, at least one boring head supported for rotation about a horizontal axis and including at least one boring arm having a cutter support extending forwardly therefrom having cutter blocks and bits mounted on the forward end thereof, means mounting said boring arm for extensible and retractible movement with respect to the axis of rotation thereof, a fluid pressure cylinder held from rotation and coaxial with the axis of rotation of said boring arm and having a piston therein and a piston rod extensible therefrom having operative connection with said boring arm for extensibly and retractibly moving said boring arm, a series of spray nozzles mounted on said cutter support in advance of said cutter bits and positioned to spray said bits during cutting, means conducting dust laying liquid under pressure to said nozzles comprising a stationary tube extending along said cylinder and piston rod and beyond the forward end of said piston rod and connected with a source of liquid under pressure, a rotatable distributor rotating about the forward end of said tube and sealed thereto, and a fluid conducting connections from said distributor to said nozzles.

4. In a continuous mining machine, at least one boring head supported for rotation about a horizontal axis and including at least one boring arm having a cutter support extending forwardly therefrom having cutter blocks and bits mounted on the forward end thereof, means mounting said boring arm for extensible and retractible movement with respect to the axis of rotation thereof, a fluid pressure cylinder held from rotation and coaxial with the axis of rotation of said boring arm and having a piston therein and a piston rod extensible therefrom having operative connection with said boring arm for extensibly and retractibly moving said boring arm, a series of spray nozzles mounted on said cutter support in advance of said cutter bits and positioned to spray said bits during cutting, means conducting dust laying liquid under pressure to said nozzles comprising a tube extending along said cylinder and piston rod and beyond the forward end

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of said piston rod and connected with a source of liquid under pressure, a rotatable distributor rotating about the forward end of said tube and sealed thereto, a fluid connection from said distributor to said nozzles including a pipe mounted on and extending along the trailing side of said cutter support, and a protective member extending along the trailing side of said cutter support and about said fluid conducting pipe.

5. In a continuous mining machine,

a rotary boring head supported for rotation about a horizontal axis and having at least one boring arm extending radially of the axis of rotation thereof having a cutter support extending forwardly therefrom and having cutter bits extending in advance of said cutter support,

said boring head being mounted for radially adjustable movement into an extended boring position and a retracted tramping position,

a rectilinearly movable power member coaxial with the axis of rotation of said boring head and rotating therewith,

a linkage connection between said power member and said boring arm for extending and retracting said boring arm,

and means supplying said cutter bits with fluid under pressure for spraying the mine face with dust laying fluid comprising:

a fluid distributor on said boring arm disposed coaxial with the axis of rotation thereof and mounted for rotation with said boring arm,

a fluid conducting connection from said fluid distributor to said cutter bits and including spray nozzles in juxtaposition to said cutter bits,

and means supplying fluid under pressure to said fluid distributor comprising:

a stationary tube extending along said power member coaxial with the axis of rotation thereof,

a fluid supply connection to one end of said tube,

and means sealing the opposite end of said tube to said fluid distributor for supplying fluid thereto during rotation of said boring head.

6. In a continuous mining machine, a rotatably driven hollow shaft supported for rotation about a horizontal axis and having at least one boring arm extending radially of the axis of rotation thereof and mounted thereon for movement from a contracted position into an extended cutting position, at least one cutter support extending forwardly of said boring arm, a cylinder and piston mounted within said hollow shaft, said piston having a central bore, a piston rod extending from said piston through said cylinder and having a bore extending therealong in alignment with the bore of said piston, a drive connection from said piston rod to said boring arm for extensibly and retractibly moving said boring arm, a spray nozzle mounted on said cutter support for penetrating the point of cutting of said boring arm, a fluid distributor mounted on said shaft for rotation therewith and having fluid communication with said spray nozzle, and means supplying fluid under pressure to said fluid distributor comprising a stationary tube leading through said cylinder, piston and piston rod in advance of the forward thereof and having fluid communication with said distributor.

7. In a continuous mining machine, at least one boring head supported for rotation about a horizontal axis and including a hollow rotatably driven shaft having a boring arm extending radially therefrom having a forwardly projecting cutter support having cutter bits extending forwardly therefrom, said boring arm being mounted on said hollow shaft for movement to and from an extended boring position, means for moving said boring arm to and from its extended positions including a cylinder in said hollow shaft, a non-rotatable liquid con-

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ducting tube concentric with said cylinder, a piston in said cylinder having a bore extending about said tube, a piston rod having operative connection with said boring arm, said piston rod having a bore forming a continuation of said bore in said piston and telescopically slidable along the outside of said tube, a fluid distributor at the forward end of said hollow shaft, a spray nozzle on said cutter support adjacent said cutter bits a fluid connection from said distributor to said spray nozzle, means supplying dust laying liquid under pressure to said non-rotatable tube, and a sealing connection between said non-rotatable tube and said distributor for supplying fluid under pressure thereto during rotation of said boring head.

8. In a continuous mining machine, at least one boring head supported for rotation about a horizontal axis and including a rotatably driven hollow shaft having a boring arm extending radially therefrom and mounted on said hollow shaft for movement to and from an extended boring position, said boring arm also having a forwardly projecting cutter support and cutter bits projecting forwardly therefrom, means for moving said boring arm to and from its extended boring position including a cylinder in said hollow shaft coaxial therewith, a piston in said cylinder having a piston rod extending therefrom through an end of said cylinder, an operative connection from said piston rod to said boring arm, a non-rotatable liquid conducting tube concentric with said cyl-

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inder, said piston rod and piston having aligned bores therein extending about said tube and being slidably movable along said tube, means sealing said piston to said tube and other means sealing said tube to said cylinder, means supplying fluid under pressure to one end of said tube, a fluid distributor rotatable with said boring arm at the opposite end of said tube, a series of spray nozzles on said cutter support adjacent said cutter bits, a fluid conducting connection from said distributor to said spray nozzles, said non-rotatable tube extending within said distributor and sealed thereto for supplying fluid under pressure to said distributor and spray nozzles for spraying said cutter bits at the points of bit penetration during the operation of mining.

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