May 5, 1953 J. YARMAK 2,637,542

KERF-BORING MACHINE FOR MINING COAL AND LIKE MINERALS

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FIG. 1.

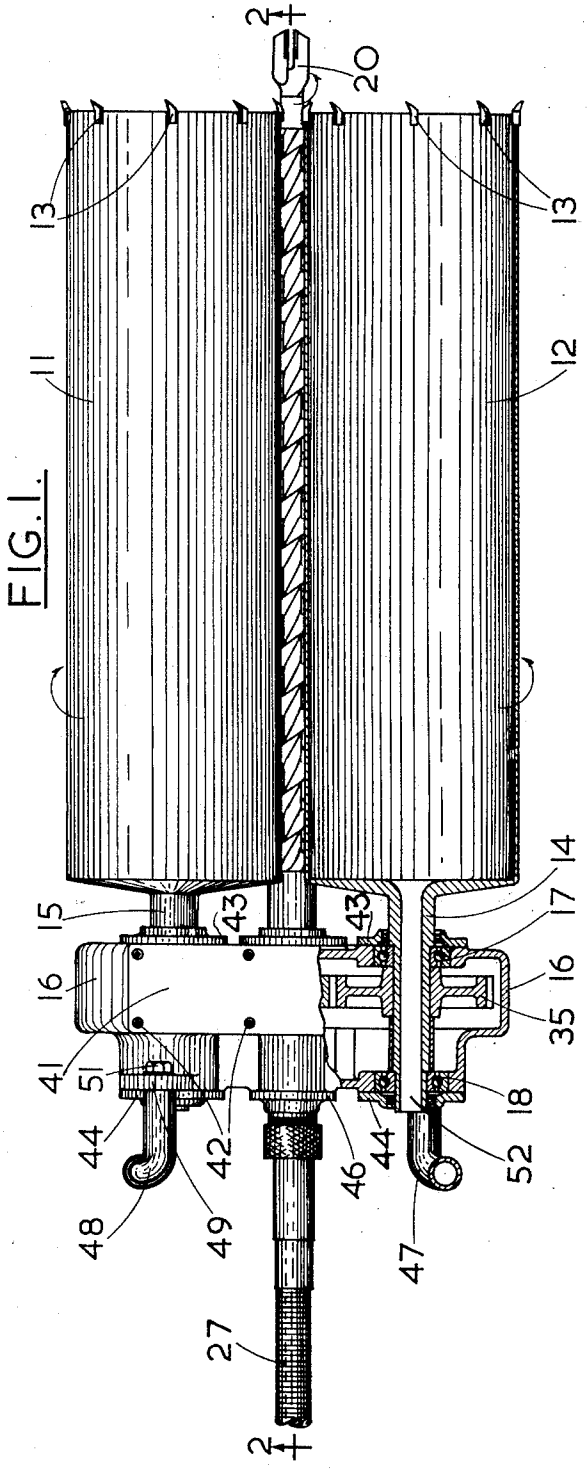
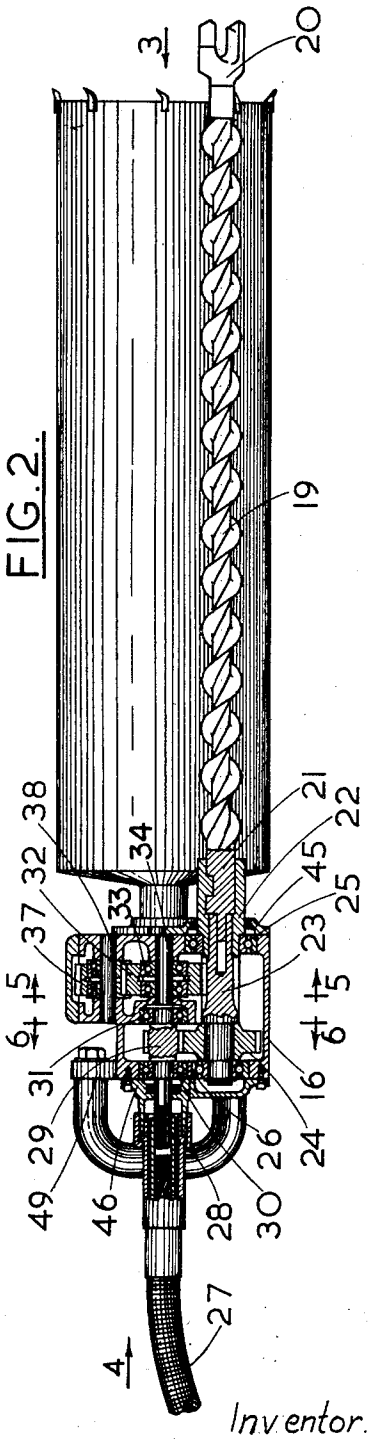


FIG. 2.



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FIG. 3.

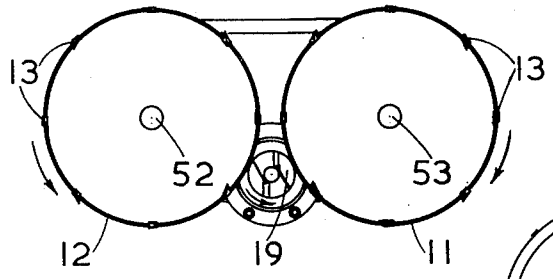


FIG. 4.

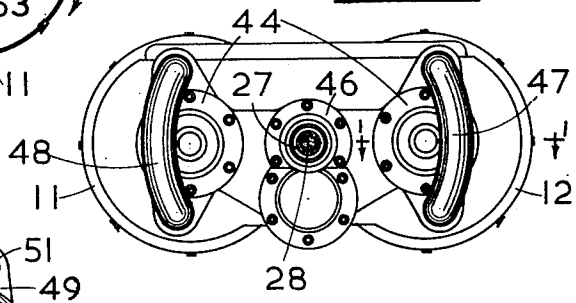


FIG. 6.

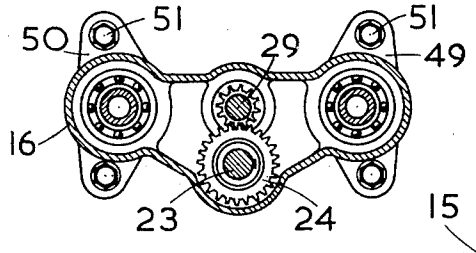


FIG. 5.

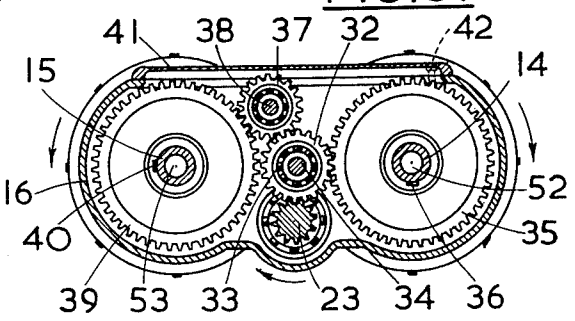
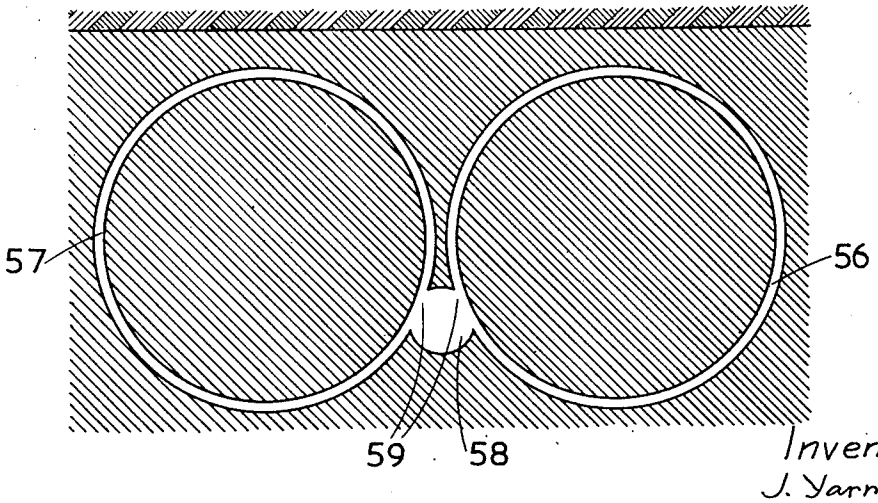


FIG. 7.



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FIG. 9.

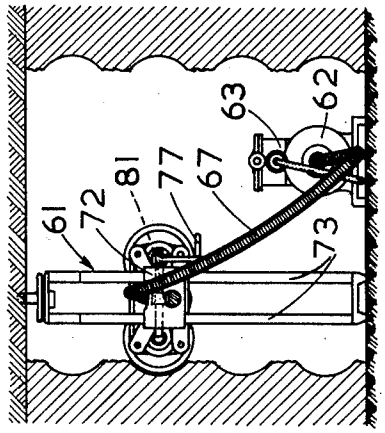


FIG. 8.

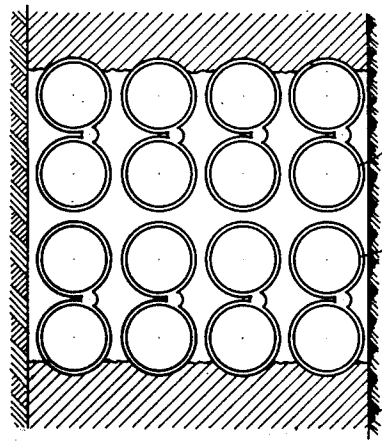
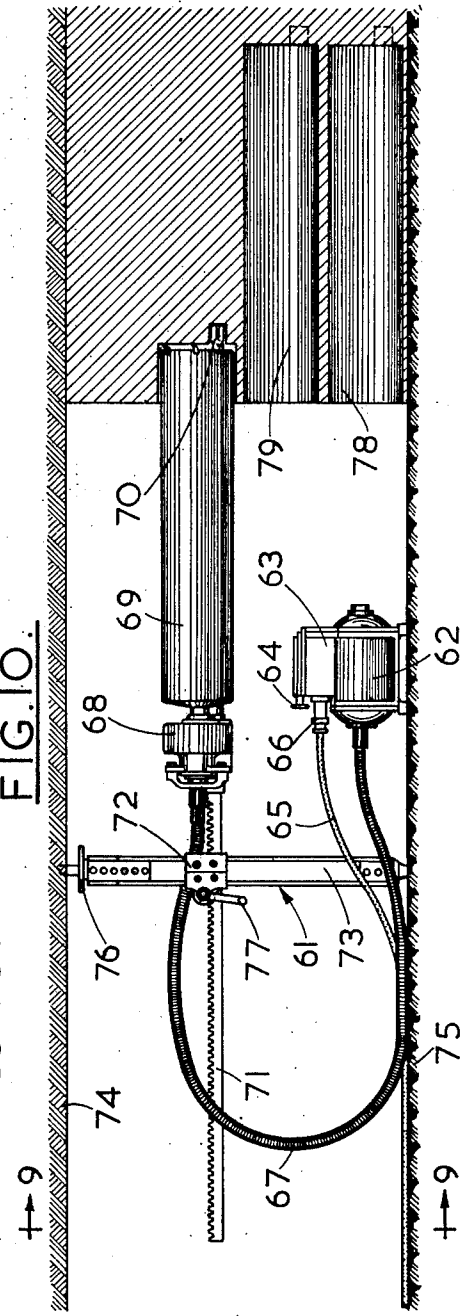


FIG. 10.



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KERF-BORING MACHINE FOR MINING COAL AND LIKE MINERALS

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Application October 18, 1948, Serial No. 55,202
In Great Britain October 20, 1947

3 Claims. (Cl. 262—7)

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This invention refers to kerf-boring machines for mining coal and like minerals, and more particularly to machines adapted for boring a series of substantially parallel circular kerfs or cuts and holes on working face which kerfs or cuts and holes are used during the mining process.

A kerf-boring machine according to this invention is adapted to bore simultaneously one or more pairs of circular ring-shaped holes of relatively large diameter and one or more holes of a relatively small diameter. These holes form kerfs or cuts of substantial depth on the working face of a coal seam or other mined mineral. After boring, the core of each ring-shaped hole or cut may be detached easily from the coal seam face or from the mineral mass, as well as the remaining pillars of coal or other mineral between kerfs or cuts. So that even the hardest coal or like minerals may be severed or mined in finished transportable pieces from the mass without shot-firing or any other special breakdown means.

In mining practice, additional to the hole boring or drilling machines with a single borer or drill, there are well known hole boring or drilling machines, having several parallel borers or augers arranged in a row which, when the machine is advanced, form cuts at the coal face like a breast cutting machine of a well known cutter chain type. The thickness of this cut or kerf is equal to the diameter of the borers or drills and the width is nearly equal to the sum of the diameters of the total number of borers in the row.

As is well known also, the boring of holes by means of tubular borer forming ring-shaped circular cuts in mineral or rock with a core in the centre of the hole is often used for geological testing even in the hardest rock.

Ring-shaped boring has on the one hand an evident advantage, compared with the usual full hole boring or drilling, because here a part only of the rock or mineral inside the area of the hole circle is reduced to powder-like holings or cuttings, while in the usual full boring the whole amount of rock or mineral inside the bored hole is so reduced.

The second advantage of ring-shaped boring, as is well known, is that the cutting speed on all the cutting bits of the tubular borer is nearly the same for each bit, whereas on the full-borer or drill there is a great inequality of the cutting speed near the centre of the borer or drill compared with its periphery, especially when the borer or drill is of a large diameter.

But, on the other hand, the well known method of boring of holes by means of ring shaped cuts

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suffers from its own failings because of which its use is limited to special purposes only. These failings are the great difficulties connected with removing the holings from ring-shaped holes, and also the remaining core out of the deep holes.

In the kerf boring machines for mining coal and like minerals constructed according to the subject of the invention, the above-mentioned advantages of ring-shaped boring are used to a considerable degree, whilst the failings are avoided.

A kerf-boring machine according to this invention comprises at least one pair of round tubular borers of relatively large diameter and having thin walls. The borers are arranged parallel to each other with a small distance between them where an ordinary worm or twist drill of the usual small diameter is attached. The twist drill-head with its drill bits protrudes a little further forward than the tubular borer heads with their cutting bits.

Both tubular borer heads are partly overlapped by the drill head of the central worm drill. Thus both ring-shaped holes are always connected with the central hole of smaller diameter.

Both borers and the drill are rotatably mounted in a casing and are rotated by an electric or compressed air motor directly or by means of a flexible shaft.

By the described construction of the machine, whilst the whole machine is advanced toward the coal face the tubular borers and the drill are operating simultaneously. The cuttings from each two ring-shaped holes of larger diameter are forced during the boring process into the central full hole of small diameter and are uninterruptedly delivered away by the spiral ribs of the worm or twist drill.

The reactions to the cutting forces are balanced inside the machine casing because the directions of rotation of the two large diameter tubular borers are opposite to each other. The thickness of the ring shaped cuts may be made very small so as to ensure a very easy action of the machine and cause only a very small percentage of the coal or other mineral to be reduced to powderlike cuttings.

Because of the features described, the machine may be constructed so as to be of very light weight and suitable for operation by hand.

In some cases, however, when a higher productivity is desired and therefore a more powerful motor is required the machine must be heavier. In these conditions a stronger forward thrust is required also and the machine may be constructed

so as to be supported by a pillar or prop wedged between the roof and floor of the seam, as used in mining practice now for well known powerful drills or drilling machines.

A machine constructed according to this invention may be used in every case of mining practice where shot firing is undesirable and the coal or other mineral is too hard for the use of compressed air or electric hammers to dislodge it.

The invention will now be described by way of an example of an embodiment with reference to the accompanying drawings in which:

Figure 1 is a plan view of the machine adapted for hand operation, partly in section along line 1—1 on Figure 4.

Figure 2 is a side elevation with section along irregular line 2—2 on Figure 1.

Figure 3 is a front elevation view looking in direction of arrow 3.

Figure 4 is a rear elevation view looking in direction of arrow 4.

Figure 5 is a cross section along line 5—5 in Figure 2.

Figure 6 is another cross section along line 6—6 in Figure 2.

Figure 7 is a section through the working face showing the shape of a kerf or cut formed by the machine in a coal seam.

Figure 8 is a vertical section through working place of the seam showing series of kerfs or cuts made by machine on coal face.

Figure 9 is a vertical section along line 9—9 on Figure 10 showing driving motor and supporting prop.

Figure 10 is a longitudinal section through working place in a coal seam showing the machine supported by a prop in working position.

Referring to the drawings, a kerf-boring machine comprises one pair of round tubular borers 11 and 12 equipped at the forward ends with cutting bits 13. On Figure 1 the borer 11 is shown in outside view and the borer 12 is shown in longitudinal section.

Both borers 11 and 12 by their tail ends 14 and 15 are rotatably journaled in casing 16 by means of anti-friction bearings 17 and 18. The borers 11 and 12 are arranged substantially parallel to each other. Between the tubular borers 11 and 12 there is located a worm or twist drill 19 of usual type and of small diameter. The drill 19 is equipped as usual with blades tipped with hard alloy and forming the cutting head 20 which protrudes ahead of the borer bits 13.

By its rear end 21 the drill 19 is drivingly mounted in boss 22 which is secured on a pinion shaft 23. On the same pinion shaft 23 is keyed also the spur gear 24. The drill 19 and the pinion shaft 23 are journaled in casing 16 by means of two anti-friction bearings 25 and 26.

The drill 19 is arranged substantially parallel to the tubular borers 11 and 12.

The machine is driven from a separate motor, as shown for example on Figures 9 and 10 by means of a flexible shaft 27 (Figures 1 and 2) the rotating core of which is drivingly connected with shaft 28 an integral part of which is the pinion 29. The shaft 28 is journaled in two anti-friction bearings 30 and 31.

The pinion 29 meshes with and drives the spur gear 24 (Figures 2 and 6), and so rotates the pinion shaft 23 and worm drill 19. The pinion shaft 23 meshes with and drives idler 32 which is journaled by means of two anti-friction bearings 33 on axis 34. The idler 32 meshes with and drives spur gear 35 which is keyed on tail end 14 of the tubular borer 12 by means of key 36. The same idler 32 also meshes with idler 37 journaled by means of anti-friction bearings on the axis 38 and meshed with spur gear 39 secured on the tail end 15 of the second tubular borer 11 by means of key 40.

Thus when the central drill 19 is rotated in a right hand direction or clockwise, when looking toward the coal face, the tubular borers 11 and 12 have opposite directions of rotation relative to each other as shown by arrows on Figures 1 and 5.

All the driving gears are enclosed inside casing 16 containing lubricant and covered by lid 41 held in position by bolts 42. To prevent escape of lubricant along the rotating shafts there are provided oil seals and packings in flanges 43 and 44 surrounding tail ends 14 and 15 and also in flanges 45 and 46.

For holding the machine, in case where it is intended for hand operation, in working position, there are provided two handles 47 and 48 attached to the lugs 49 and 50 by means of bolts 51. The handles 47 and 48 are easily detachable so as to provide fixing means for mechanically supporting the machine, during operation, such as for example a bar, screw or rack supported by a prop or turret wedged between the roof and floor of the seam.

The tail ends 14 and 15 are provided with central axial holes 52 and 53 through which compressed air or water may be supplied to the inside of each tubular borer 11 and 12 as means for removing cuttings out of the kerfs in cases where the borings are directed downwards or during wet boring or in any other case when supply of compressed air or water is desirable.

On Figure 8 is shown a preferred position of kerfs or cuts formed by a machine which is the subject of this invention on coal face of a seam in a narrow development chamber or an entry. The boring is preferably started from lower rows 54 and 55.

The shape of a cut formed by the machine is shown in an enlarged scale on Figure 7. Here may be noted clearly the proportion in sizes of separate parts of a cut. Ring-shaped groove parts 56 and 57 of the cut are formed by the tubular borers 11 and 12 (Figure 1) and hole part 58 is drilled by the twist or worm drill 19. There may also be clearly noted openings 59 connecting parts 56, 57 and 58 of the cut. Through openings 59 cuttings from the parts 56 and 57 of the cut are forced during operation of the machine into the hole part 58 and are removed clear of the cut.

A construction of the machine according to this invention and using a supporting prop 61 is shown on Figures 9 and 10.

In this construction an electric motor 62 mounted separately from the machine is used as a driving means. The motor 62 is provided with a switch box 63 operated by switch knob 64. Power to the motor 62 is supplied by trailing cable 65 and a flameproof cable plug 66. A flexible shaft 67 connected with rotor of the motor, is adapted to transmit rotation from motor 62 to the driving gearing 68 of the kerf-boring machine which is constructed as described previously.

The machine is provided with one pair of tubular borers 69 and a twist drill 70. But instead of handles for hand operation, as was described previously, there is provided a rack bar 71 supported by a transverse block 72 secured on the

prop structure 73 which is adapted to be wedged between roof 74 and floor 75 of the seam by means of screw jack 76.

By turning the handle 77 journaled in the transverse block 72 and provided with pinion 81 meshed with rack bar 71 in one direction, the bar 71 is advanced forward toward the coal face. The cutting elements of the machine are thus thrusted into the coal face and being rotated simultaneously will make a cut or kerf. After the cut has reached a desired depth as for example that of previously-bored kerfs 78 and 79, the boring heads will be withdrawn from the seam by turning the handle 77 in the opposite direction.

The transverse block 72 may be secured at any desired height to form cut in required position.

After finishing boring, all coal on the working face becomes severed into transportable pieces which may be taken from the face easily and removed without blasting or application of any other special breaking down means.

It is to be understood that in accordance with subject of this invention there may also be constructed more powerful kerf-boring machines provided with two or more pairs of tubular borers, each pair of which is provided with its own twist drill for removing cuttings or holings from the cut as was described previously. These machines are adapted for boring two or more pairs of circular ring-shaped kerfs or cuts and two or more holes of relatively small diameter simultaneously.

I declare that what I claim is:

1. A kerf-boring machine for mining coal and like minerals comprising in combination at least one pair of tubular borers of a relatively large diameter and having thin walls, arranged parallel to each other, with a relatively small gap between them and one twist drill of a relatively small diameter located in said gap between the tubular borers; a common casing for rotatably supporting said borers and drill by their tail ends; power means comprising a separate motor and a transmission including a flexible shaft for rotating said borers and said drill; means including handles or grips for hand support of the whole machine and for thrusting into coal or other mineral during boring of the kerf or cut.

2. A kerf-boring machine for mining coal and like minerals comprising in combination at least

one pair of tubular borers of a relatively large diameter and having thin walls, arranged parallel to each other, with a relatively small gap between them and one twist drill of a relatively small diameter located in said gap between the tubular borers; a common casing for rotatably supporting said borers and drill by their tail ends; power means comprising a separate motor and a transmission including a flexible shaft for rotating said borers and said drill; means including a prop structure adapted to be wedged between the roof and the floor of a seam for supporting the whole machine; means including a rack bar and driving pinion attached to said prop for thrusting the machine into coal or other mineral during boring of the kerf or cut.

3. A kerf-boring machine for mining coal and like minerals comprising in combination at least one pair of tubular borers of a relatively large diameter and having thin walls, arranged parallel to each other, with a relatively small gap between them and one twist drill of a relatively small diameter located in said gap between the tubular borers, a common casing for rotatably supporting said borers and drill by their tail ends, said parts forming the structure of a movable boring head; power means comprising a separate driving motor and a flexible transmission for rotating said borers and said drill, means adapted for supporting the whole boring head at any height between the roof and the floor of a seam, and means adapted for thrusting said boring head into coal or other mineral during boring of the kerf or cut and for withdrawing it back.

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