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(54) Combined AFC side discharge unit and integral cutter unit.

(57) The combined AFC side discharge unit and integral cutter unit, for use in advance cutting of longwall faces includes an elongate armoured face conveyor (10) at one end of which is a side discharge unit (11), said end being raised relative to the remainder of the armoured face conveyor for location over the receiving end of a gate conveyor (13) located in a roadway running back from the armoured face conveyor, an integral cutter unit (20) is located at the discharge end of the armoured face conveyor (10) and mounted on the face side thereof. The cutter unit - (20) has at least two rotary bore type cutting elements (22 -24) overlapping in their rotary paths in a phased manner. The cutting elements (22 -24) are in line with or approximately in line with the cutter (14) of a longwall mining machine mounted on the armoured face conveyor. Ancilliary cutting means (27, 28, 29) are provided to remove cusps (25, 26) left by the rotary cutting elements (22 -24). The ancilliary cutting means are located to the rear of the rotary cutting elements (22 -24) for operation when the armoured face conveyor is moved forward by means provided therefor.

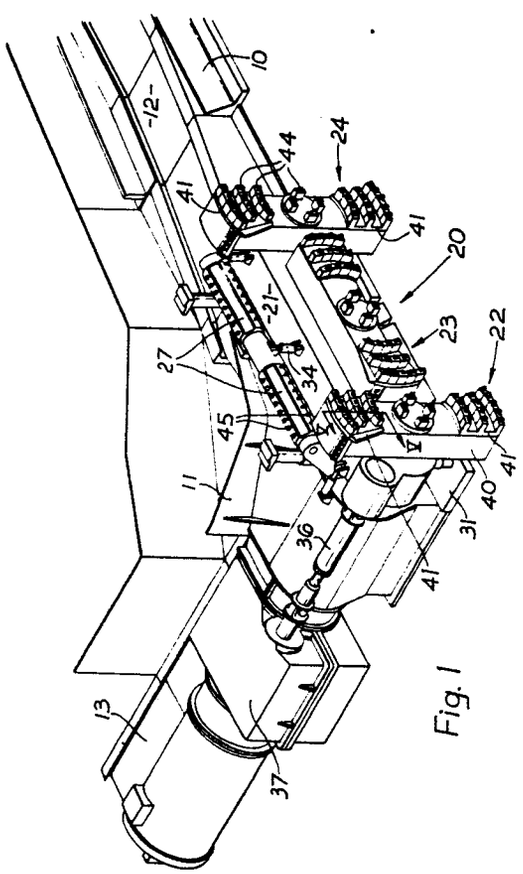

Fig. 1

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COMBINED AFC SIDE DISCHARGE UNIT AND INTEGRAL CUTTER UNIT.

This invention relates to a combined AFC side discharge unit and integral cutter unit.

A longwall coal face is worked either on an advancing system where the roadways are driven forward with the coal face or on a retreat system where the roadways are driven to a boundary first and the face retreated back along the roadway.

It is the advancing system to which this patent application refers.

It has become common practice on advancing faces for the 'conveyor -mounted' power loaders -(shearers) to excavate the coal at the end of the face in the belt road head (maingate) area. This is accomplished by the use of extended or ranging arms of the shearer reaching over and past the AFC (face conveyor) delivery drive head and gate conveyor.

Whilst technically successful over a number of years, it is time-consuming and detracts from the productivity of the shearer operation.

An alternative method is to extract the coal with a separate 'stand -alone' individually powered machine which also requires an ancilliary additional support system giving rise to ventilation, roof support and organisational problems.

On retreat faces, this problem does not arise as the coal in the roadhead area has already been excavated. Moreover, an increasingly popular AFC delivery end in the form of a side discharge unit has been introduced into the retreat system with several advantages, namely, -

(i) a more efficient discharge of coal -(especially large sized coal) from the face conveyor onto the gate conveyor compared with the end discharge on an advancing face,

(ii) carry back of fines on the bottom chain run has almost been eliminated,

(iii) a resultant decrease in power consumption.

However, the longer, higher and more bulky designs of side discharge units preclude the efficient excavation of coal by the shearer in the roadhead area on advancing faces.

An object of this invention is to provide an AFC side discharge unit for use in the advance system.

A disadvantage of known 'stand -alone' individually powered machine specifically for cutting the roadway is that these machines must be located ahead of the side discharge unit so that their cutting face is 20 to 30 feet in advance of the conveyor, thus necessitating the erection of temporary roof supports over the machine and ventilation of the tunnel ahead of the coal face.

An object of this invention is to obviate or mitigate the aforesaid disadvantages.

According to the present invention there is provided a combined AFC side discharge unit and integral cutter unit, for use in advance cutting of longwall faces, comprising an elongate armoured face conveyor at one end of which is a side discharge unit, said end being raised relative to the remainder of the armoured face conveyor for location over the receiving end of a gate conveyor located in a roadway running back from the armoured face conveyor, an integral cutter unit at the discharge end of the armoured face conveyor and mounted on the face side thereof and having at least two rotary bore type cutting elements overlapping in their rotary paths in a phased manner, said cutting elements being in line with or approximately in line with the cutter of a longwall mining machine mounted on the armoured face conveyor, ancilliary cutting means to remove cusps left by the rotary cutting element, said ancilliary cutting means being located to the rear of the rotary cutting element for operation when the armoured face conveyor is moved forward by means provided therefore.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Fig. I is a perspective view of the discharge end of a combined AFC side discharge unit and integral cutter unit according to the invention;

Fig. 2 is a plan view of the units;

Fig. 3 is a front view of Fig. 2;

Fig. 4 is a side view;

Fig. 5 is a sectional side view on the line V-V of Fig. I;and

Fig. 6 is a sectional plan view on the line VI-VI of Fig. 5.

Referring firstly to Figs. I to 4, an armoured face conveyor (AFC) I0 rises at one end, namely the discharge end and has a curved deflector blade II to guide minerals carried along the conveyor belt I2 off the goaf side edge of the face conveyor onto a gate conveyor I3 which passes under the raised end of the AFC and runs back along a roadway which is formed as the AFC is advanced towards a longwall coal face; said face is cut by a shearer mining machine (only the shearer drum I4 of which is illustrated in Figs. 2 and 3) which runs along the AFC but terminates at the inclined discharge end, and the roadway is cut by a cutter unit 20 integral with the AFC.

The cutter unit 20 is mounted on the face side of the AFC at the discharge end, which is strengthened and modified to carry the unit 20. The unit 20 comprises a gear box or transmission unit or units 2I carrying at least two forwardly facing rotary cutting elements, in this embodiment three, 22, 23,

24 phased to overlap in their rotary paths. The rotary cutters are located forwardly of the AFC only to such an extent that they are approximately in line with the shearer drum 14 of the mining machine.

In operation the rotary cutters will form cusps of coal 25 (Fig. 3) between the excavated area both at the roof and the floor of the roadway. In addition, cusps 26 are formed between the excavation of the innermost rotary cutting element 24 and the terminal cutting position of the shearer cutting drum 14. The cutter unit 20 is provided with means for removing these cusps 25, 26, including a pair of horizontal ancilliary drums 27, (or riffle bars) mounted above the transmission unit 21. These drums 27 trim the roof cusps 25 formed between the centre rotary cutter 23 and the other two cutters 22, 24. The other roof cusp 26 is trimmed by a forwardly extending hydraulic impactor 28 (Figs. 2 -4) while the three floor cusps 25, 26 are also trimmed by hydraulic impactors 29. In an alternative arrangement, the drums 27 are replaced by additional impactors 28 so that all cusps 25, 26 are trimmed down by impactors.

The upper impactor 28 is carried by a goaf side roof support canopy 30 and the lower impactors are carried on an underplate 31 below the AFC when the AFC's drive frame is advanced forward, the rotary cutters 22 to 24 advance the roadway and simultaneously the ancilliary cutters remove the cusps of coal 25, 26 which are left.

The rotary cutters are steerable for horizontal control by hydraulic tilting means connected to the transmission unit 21, namely vertical jacks 32 (Figs. 3 and 4) mounted on the underplate 31 and engaging the underside of the transmission unit 21, and fore-and-aft jacks 33 connected to the AFC and the top of the transmission unit. A secondary vertical jack 34 is provided between the top of the transmission unit 21 and the horizontal drums 27 to allow these drums to lower when not in use, in the event of roof movement. The rotary cutters 22, 23, 24 have a similar facility as hereinafter described. Shear blocks 35 (Fig. 3) between the underframe 31 and transmission unit 21 remove any strain on the vertical jacks 32 during forward movement of the cutter unit 20.

The cutters 22 to 24 and 27 are, in this embodiment, all driven from the transmission unit 21 which is connected by a flexible mechanical coupling 36 to a goaf side drive unit 37 which will drive the AFC and cutter unit 20. The drive comprises a single 2-speed motor the output of which will drive both AFC and cutter unit by splitting the primary drive; alternatively a separate drive motor may be provided to drive the cutter unit 20.

In use, the mining machine (shearer) after completing one cut along the face is positioned toward the maingate end of the conveyor, the conveyor having been advanced forward from the tailgate end which creates a snaking of the conveyor. This snaking follows the mining machine towards the maingate end and terminates near the end of the face conveyor. The mining machine is then reversed along the conveyor away from the maingate end and follows the snaking of the conveyor which forces it into the uncut face of the coal seam and thus creates a new web of coal. As the mining machine moves away from the maingate, the delivery end of the conveyor is advanced slowly forward to bring the whole conveyor into line, by virtue of the rotary cutters, etc. forming a new path, being the advancement of the roadway.

Once the roadway has been formed and the AFC including the side discharge unit is aligned, the cutter unit 20 is stopped to await the next cycle of operation. The procedure is then repeated, and at each cycle the cutter unit 20 cuts into the end of the longwall face, thereby advancing the roadway as the coal face advances, but only by a depth equal to the depth of cut of the mining machine - (shearer) e.g. 20" to 36".

The material cut by the cutter unit 20 is transported rearwards below the AFC by the gate conveyor 13.

The rotary cutters 22 to 24 are phased so that the centre cutter 23 rotates clockwise as viewed in Fig. 3 while the others rotate anticlockwise, and their stopped positions can be controlled by a clutching system which may be manually operated. Thus the innermost cutter 24 is vertically disposed when stopped so as not to interfere with the passage of the mining machine cutter drum 14 when it cuts the coal face adjacent to the roadway.

Referring now to Figs. 1, 5 and 6, each rotary cutter has a rectangular body 40 rotatable about a central pivot and a radially slidable end piece 41 at each end slidable in a key way 42 and controlled by an hydraulic ram 43. Cutting picks 44 are mounted on the front face of the body and end pieces in arcuate disposition about the central pivot, and rows of cutting picks 45 are provided on the ancilliary drums 27. When the cutters 22 and 24 are stopped and vertically disposed, the end pieces 41 can be retracted via rams 43 to accommodate convergence of the roof and floor.

The rotary cutters have a slow cutting speed of, for example 20 to 30 r.p.m. and have integral dust suppression water jets (not shown).

Claims

I. A combined AFC side discharge unit and integral cutter unit, for use in advance cutting of longwall faces, characterised by an elongate armoured face conveyor (I0) at one end of which is a side discharge unit (II), said end being raised relative to the remainder of the armoured face conveyor for location over the receiving end of a gate conveyor (I3) located in a roadway running back from the armoured face conveyor, an integral cutter unit (20) at the discharge end of the armoured face conveyor and mounted on the face side thereof and having at least two rotary bore type cutting elements (22-24) overlapping in their rotary paths in a phased manner, said cutting elements being in line with or approximately in line with the cutter - (I4) of a longwall mining machine mounted on the armoured face conveyor, and ancilliary cutting means (27-29) to remove cusps (25-26) left by the rotary cutting elements, said ancilliary cutting means being located to the rear of the rotary cutting elements for operation when the armoured face conveyor is moved forward by means provided therefor.

2. A unit as claimed in claim I characterised in that the discharge unit comprises a curved deflector blade (II).

3. A unit as claimed in claim I characterised in that the rotary cutters (22, 24) are steerable for horizontal control by means of hydraulic means (32 and 33).

4. A unit as claimed in claim I characterised in that the ancilliary cutting means includes horizontal cutters (27) adapted to trim roof cusps (25) left by the rotary cutting elements.

5. A unit as claimed in claim 3 or 4 characterised in that a secondary hydraulic means (34) is connected to the horizontal cutters (27) to allow said cutters to lower when not in use in the event of roof movements.

6. A unit as claimed in claim I, characterised in that the ancilliary cutting means includes hydraulically operated forwardly directed impactor members.

7. A unit as claimed in claim I, characterised in that the rotary cutter element comprises a body - (40) rotatable about a pivot, a radially slidable end piece (4I) at each end, and cutting picks (44) mounted on the forward face of the body and end pieces.

7. A unit as claimed in claim 7 characterised in that the end pieces (4I) are slidably controlled by hydraulic means (43) whereby, if the element is stopped and vertical, the end pieces can be retracted to accommodate convergence of the roof and floor.

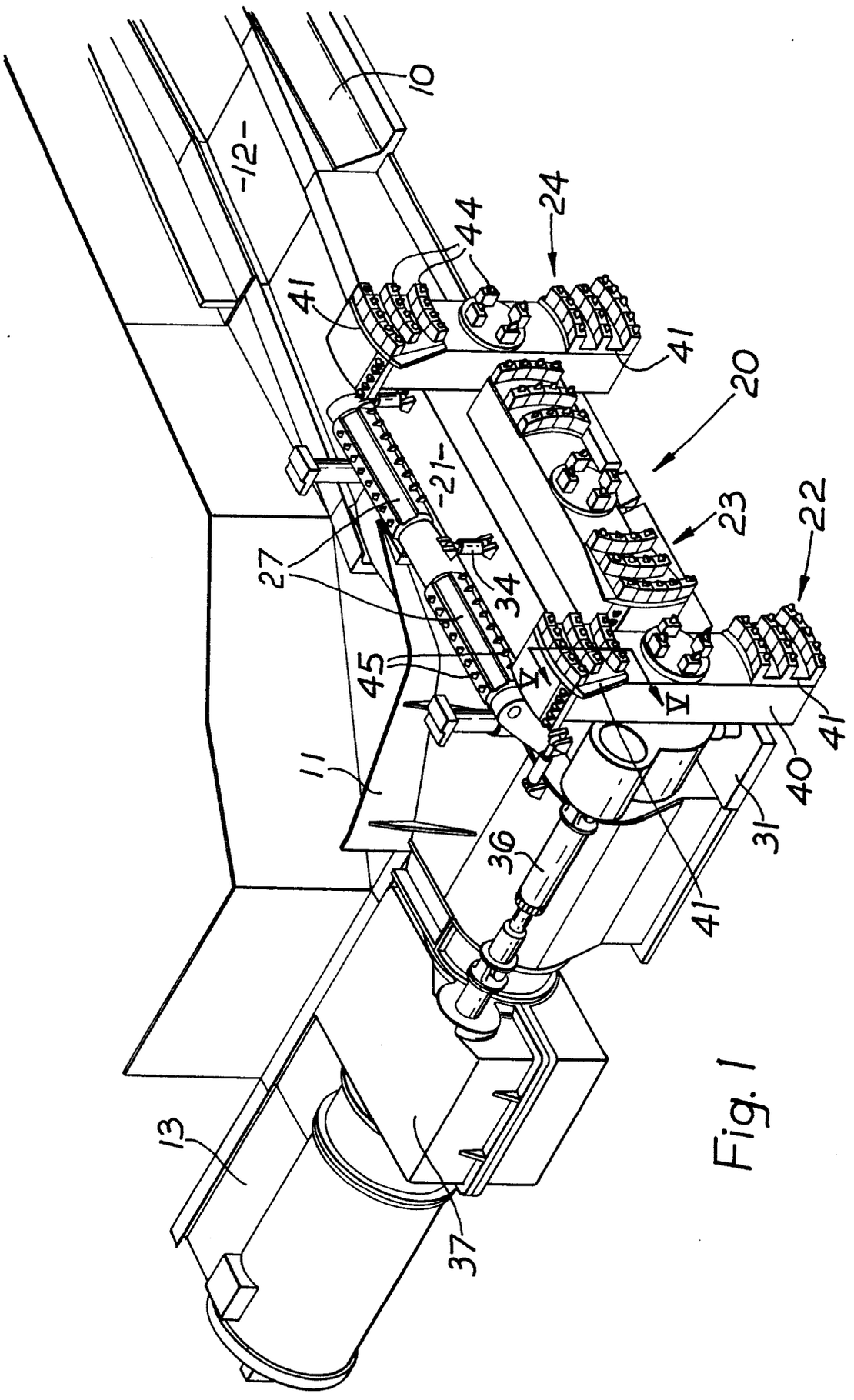

Fig. 1

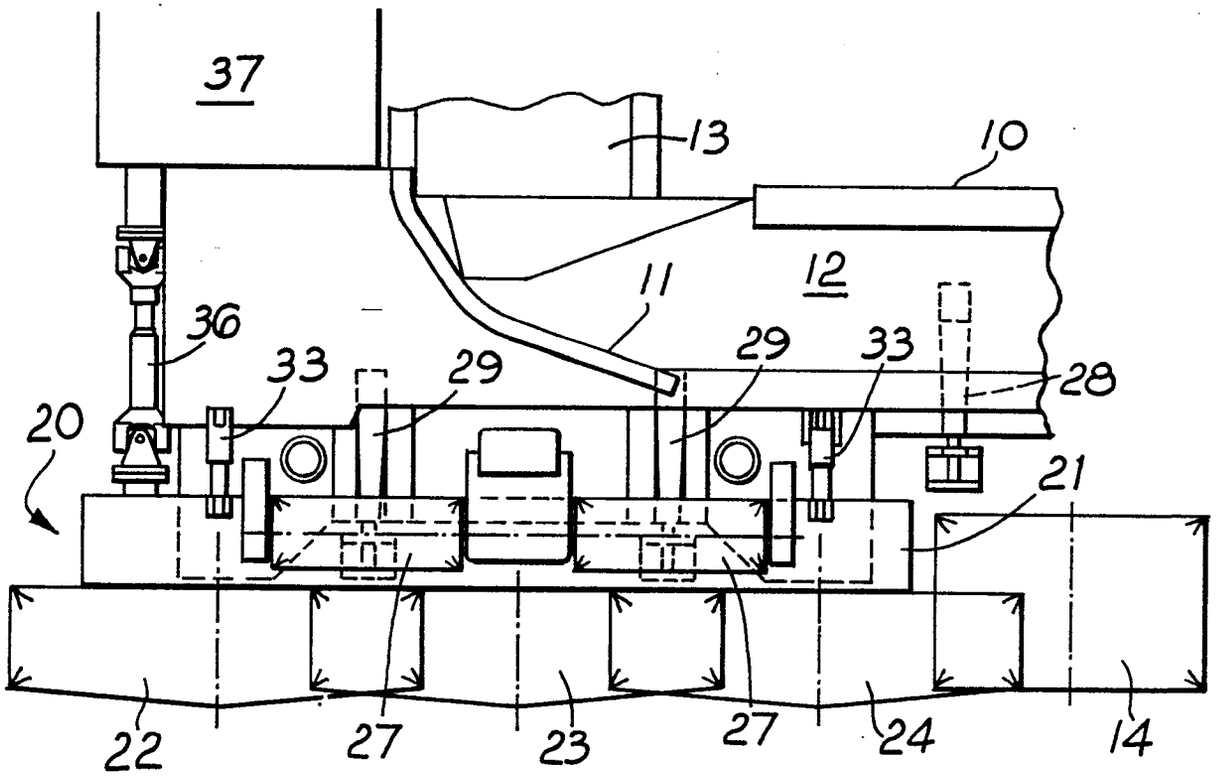
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Fig. 2

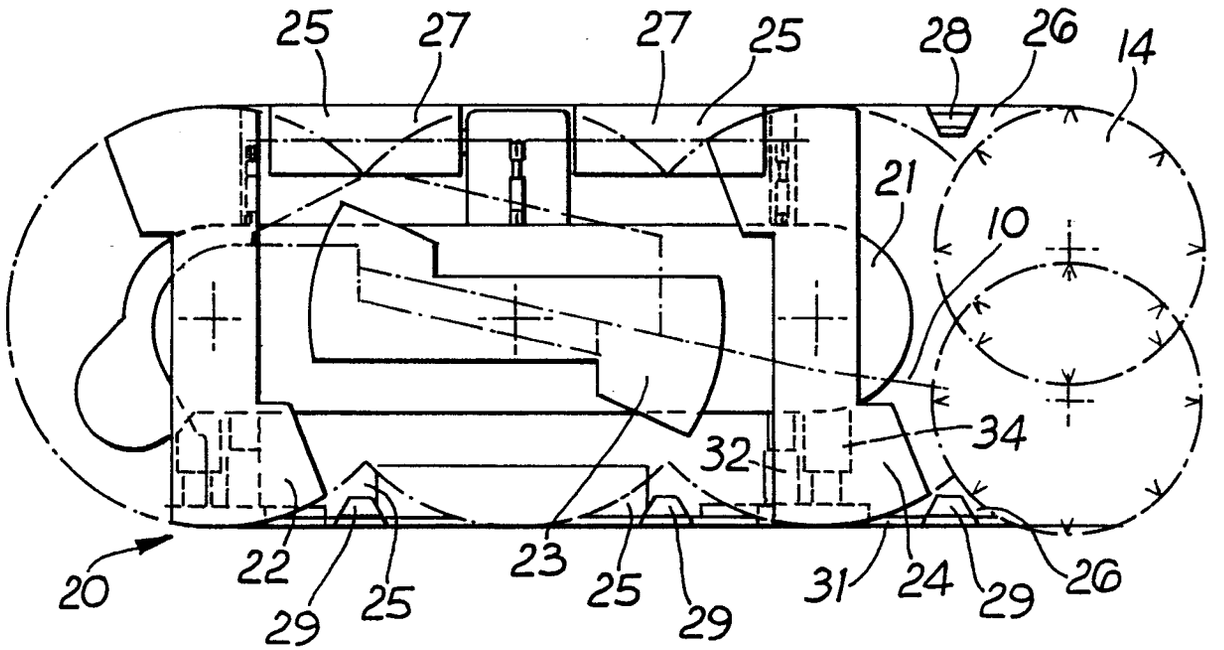
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Fig. 3

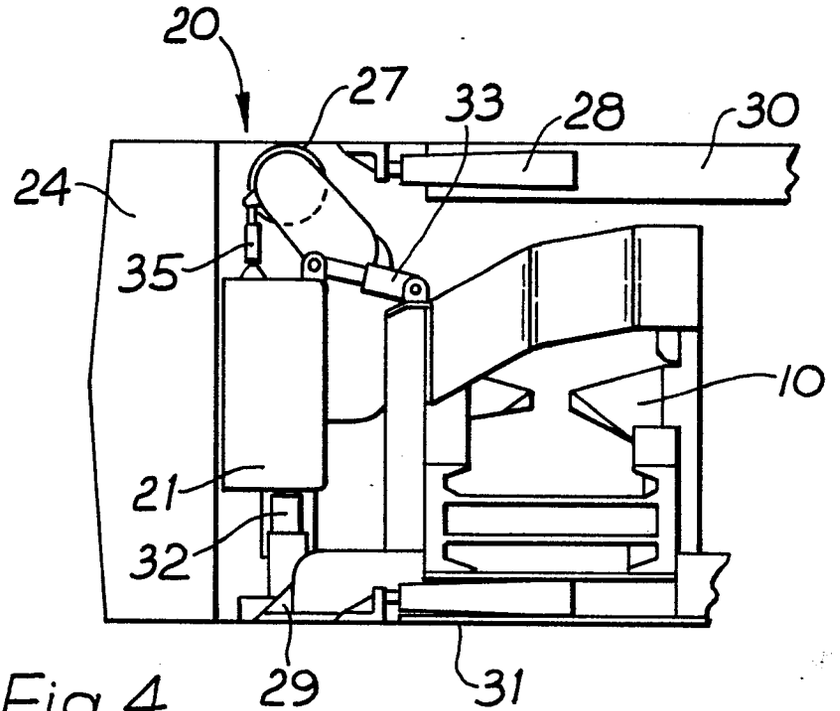

Fig. 4

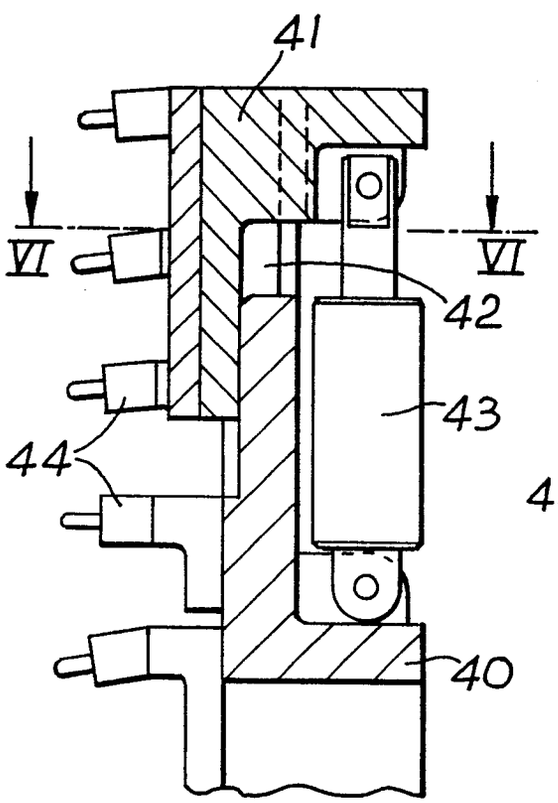

Fig. 5

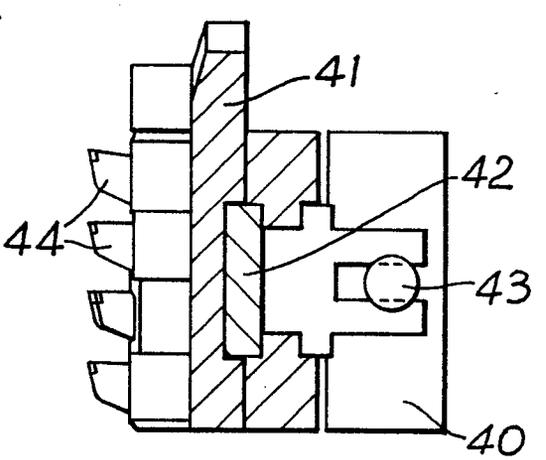

Fig. 6

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EUROPEAN SEARCH REPORT

Application number

EP 86 30 6739

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	GB-A-2 129 851 (KLÖCKNER-BECORIT) * Page 1, line 87 - page 2, line 37; figures *	1,3	E 21 C 27/24
Y	US-A-4 436 345 (SILKS) * Abstract; figures 1,2 *	1,3	
A	GB-A-2 076 451 (NATIONAL MINE SERVICE) * Abstract; figure 1 *	1,7,8	
A	GB-A-2 096 207 (HALBACH & BRAUN)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

E 21 C
E 21 D
E 21 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	01-12-1988	RAMPELMANN J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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