



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 338 758 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
27.08.2003 Bulletin 2003/35

(51) Int Cl.7: **E21C 37/16, F42D 1/08**

(21) Application number: **03251038.0**

(22) Date of filing: **20.02.2003**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT SE SI SK TR**
Designated Extension States:
AL LT LV MK RO

(72) Inventor: **Carnegie-Smith, David**
Walliston, Western Australia 6076 (AU)

(74) Representative: **Schlich, George William et al**
Mathys & Squire
European Patent Attorneys,
100 Gray's Inn Road
London WC1X 8AL (GB)

(30) Priority: **20.02.2002 US 359251 P**

(71) Applicant: **RockTek Limited**
Pinjarra, W.A. 6208 (AU)

(54) Apparatus and method for fracturing a hard material

(57) Apparatus 10 for fracturing a hard material 24 includes a loading head 12 provided with a guide tube 14 for receiving a cartridge 16 containing a charge of energetic material. A flexible elongated conduit 26 is advanced and retracted through the tube 14 via a reel 88. The conduit 26 is also in communication with a stemming loader 30 which holds a supply of particulate stemming material. Tube 14 is supported by a carriage 70 which is able to slide along a member 52 by operation of a rod 76 and cylinder 78. A motor 60 is also coupled to the member 52 to effect rotation of the member 52 and thus tube 14 about an axis A which is parallel to a

hole 18 drilled in the material 24. By appropriate operation of the motor 60 and rod 76, the tube 14 can be moved into and out of alignment with the hole 18. When the tube 14 is moved into alignment with the hole 18, cartridge 16 is loaded into the tube 14 and pushed through the tube 14 into the hole 18 by advancing the conduit 26. Particulate stemming material from the loader 30 is then injected through the conduit 26 into the hole 18. Tube 14 and conduit 26 are then retracted from the hole 18 and subsequently moved out of alignment therewith. The cartridge 16 may then be initiated to cause fracturing of the material 24.

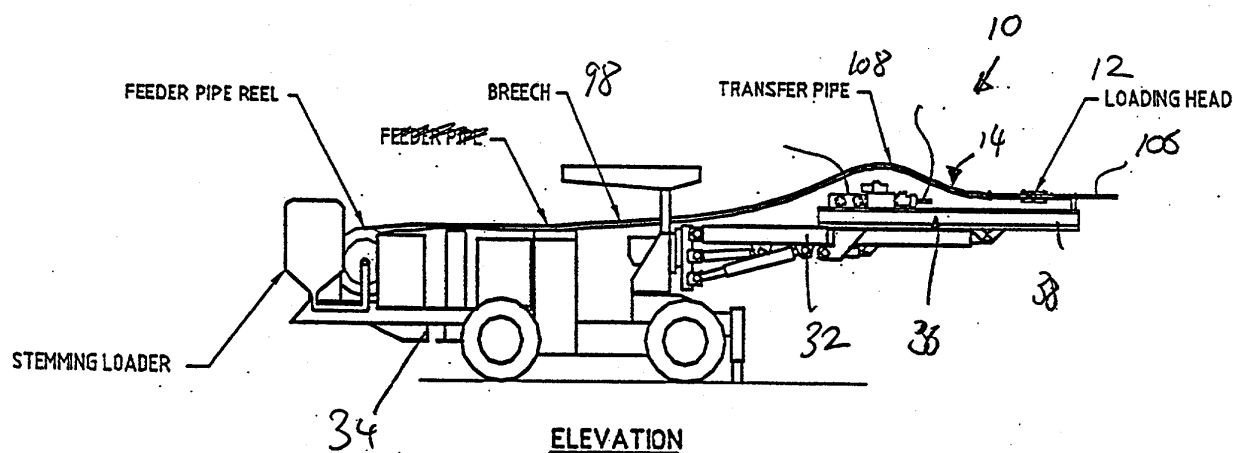


FIG 2A

EP 1 338 758 A1

Description

Field of the Invention

[0001] This specification relates to an apparatus and method for fracturing a hard material particularly, thought not exclusively, for application in mining and civil excavation.

Background of the Invention

[0002] The most common underground mining rock fracturing and/or breakage processes are:

(a) mechanical methods using rock cutting techniques using specialised equipment such as tunnel boring machines (TBM's) and impact breakers; or

(b) drill and blast techniques where holes are drilled into a rock face, explosive charges placed in the drillholes connected up to a firing box, and once the area is clear the explosives initiated. The initiated explosives create shock waves and a rapid build up of gas pressure to cause the rock to crush, fracture and disintegrate into smaller pieces.

[0003] A major impediment with the drill and blast technique or indeed other techniques using explosives is its cyclical nature. The technique is slow and tedious because a miner operating a drilling machine must stop drilling, get down from the machine and manually load the explosive. This means that either additional personnel or equipment is required to charge and load the explosives and initiators or productive cycle time is lost while the drill operator stops to load the drill holes as well.

[0004] Recently in mining and civil excavation work, small charge blasting or controlled fracture techniques have been introduced as an alternative to conventional drill-and-blast, mechanical breakers, chemical expansion agents and, in some cases, hand methods. The term "small charge blasting" as used herein includes any excavation method where relatively small amounts of an energetic substance (typically a kilogram or less) is consumed for each drill hole or alternatively where a fluid is sealed in the bottom of a drill hole and pressurised in order to propagate a fracture in the material to be broken. The term "sealing" refers to the partial or total blockage of the hole to impede escape of the high-pressure gas pulse or fluid from the hole. Examples of small charge blasting devices and methods are described in US patents 5,765,923, 5,308,149 and 5,098,163.

[0005] The pressurised fluid can be generated in a number of different ways including by: combustion of a propellant; an electrical discharge into a conductive fluid; or mechanical compression of the fluid. Some form of stemming seals the hole for sufficient time to enable the fluid pressure to cause fracturing of the rock.

[0006] Small charge breakage can be highly mechanised and automated so that it can be carried out more or less continuously to increase productivity. It can also allow excavation machinery to remain near the face due to reduced flyrock discharge, and has an additional advantage of producing a relatively small seismic signature due to the small amount of blasting agent used and the lack of a shock wave.

[0007] By and large, the systems used for automated small charge breakage have relied on either gas injectors for injecting a compressed gas pulse into a hole where a barrel of the gas injector itself acts as a stemming bar or alternately have coupled a cartridge containing energetic material directly to an end of a stemming bar which is then inserted into a hole. One problem with such systems is damage to the components inserted into the drill hole due to the energy released and pressure waves produced. Additionally, it is difficult to accurately and quickly align the gas injector or stemming bar with the drilled hole. It is typical in such system for a common boom to support both the drilling system, (eg a rail, drill steel and drifter), and a gas injector or a stemming bar. However the additional weight provided by the stemming bar or gas injector upsets the weight distribution of the boom and makes it difficult to maintain accurate alignment. This is exacerbated by the addition of a recoil mechanism which is often incorporated to reduce recoil forces on the system arising from the injector/stemming bar being held in the hole when the energetic substance is initiated.

Summary of the Invention

[0008] It is an object of the present invention to provide an apparatus and method for fracturing of hard material which attempts to alleviate the disadvantages in the above described prior art.

[0009] According to the present invention there is provided an apparatus for fracturing a hard material, said apparatus including at least:

a loading head provided with a guide for receiving a cartridge containing a charge of energetic material, and guiding said cartridge into a hole formed in a face of a hard material to be fractured;

a system for advancing said cartridge along said guide to a toe of said hole; and,

a stemming loader for loading a particulate stemming material into said hole through said guide.

[0010] Preferably said system for advancing said cartridge includes a flexible elongated member having a first end which abuts an end of said cartridge distant said hole, and a device for advancing and retracting said flexible elongated member.

[0011] Preferably said flexible elongated member is a

conduit and constitutes a part of said stemming loader, said stemming loader further including a stemming injector for injecting particulate stemming material into a second end of said conduit.

[0012] Preferably said stemming injector includes a blower for blowing said particulate stemming material into and along said conduit.

[0013] Preferably said apparatus further includes an alignment mechanism for moving said guide into and out of alignment with said hole.

[0014] In one embodiment, said alignment mechanism rotates said loading head about an axis parallel to an axis of said hole, to move the guide into and out of alignment with said hole.

[0015] However, in an alternate embodiment, said mechanism slides said loading head along an axis perpendicular to an axis of said hole, to move the guide into and out of alignment with said hole.

[0016] Preferably said apparatus further includes a drilling system for drilling said hole, said drilling system including a rail and a drill slidably mounted on said rail, wherein said alignment mechanism is supported on said rail.

[0017] It is further envisaged that said loading head includes a stemming bar which can be moved into and out of alignment of said hole for insertion into said hole to support said particulate stemming.

[0018] Preferably said stemming bar includes a transmitter for transmitting a signal into said hole for operating an initiator or a detonator contained in said cartridge.

[0019] According to the present invention there is also provided a method of fracturing a hard material, said method including the steps of:

providing a guide for receiving a cartridge containing a charge of energetic material;

aligning said guide with a hole formed in a face of a hard material;

inserting the cartridge into said guide;

advancing said cartridge along said guide into said hole;

injecting particulate stemming material through said guide into said hole; and,

initiating said energetic material.

[0020] Preferably said method of aligning includes advancing said guide into abutment with said face of said hard material.

[0021] Preferably said step of advancing said cartridge includes pushing said cartridge along said guide.

[0022] Preferably said step of pushing includes advancing a length of a flexible elongated member into said guide to push said cartridge along said guide into

said hole.

[0023] Preferably said step of injecting particulate material includes forming said flexible elongated member as a conduit and blowing said particulate stemming material through said conduit into said hole.

[0024] Preferably said method further includes a step of retracting said conduit from said hole as said particulate material is blown into said hole.

[0025] Preferably said method further includes a step of attaching said guide to a drilling system which includes a rail and a drill mounted on said rail and supporting said guide on said rail.

[0026] Preferably said method includes providing an alignment mechanism for moving said guide into and out of alignment with said hole.

[0027] Preferably said method further includes a step of providing a stemming bar coupled to said alignment mechanism, moving said guide out of alignment with said hole; and moving said stemming bar into alignment with said hole and into abutment with said particulate stemming in said hole.

[0028] An embodiment of the present invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is an exploded view of a loading head incorporated into the apparatus for small charge blasting;

Figure 2a is an elevation view of an apparatus for small charge blasting mounted on a conventional drillrig;

Figure 2b is a plan view of the apparatus depicted in Figure 2a; and,

Figures 3-11 depicted in sequence a method of small charge blasting using the apparatus depicted in Figures 1-2b.

Detailed Description of Preferred Embodiment

[0029] Referring to the accompanying drawings and in particular, Figures 1-3, 6 and 7 an apparatus 10 for small charge blasting includes a loading head 12 provided with a guide in the form of a tube 14 for receiving a cartridge 16 containing a charge of energetic material, and guiding the cartridge 16 to a collar 18 of the hole 20 formed in a face 22 of a hard material such as a body of rock 24 to be fractured. The term "energetic material" is used here in a general sense to include a propellant, an explosive, a pyrotechnic, and any combination thereof. The apparatus 10 also incorporates a flexible elongated member in the form of a conduit 26 as part of a system for advancing the cartridge 16 along (and more particularly through) the tube 14 to a toe 28 of the hole 20. A stemming loader 30 (see Figure 7) is also provided for loading a particulate stemming material; such as

sized and graded aggregate material, into the hole 20 through the tube 14.

[0030] As shown in Figures 2a and 2b, an embodiment of the apparatus 10 is attached to a boom 32 of a jumbo 34 and also supports a drilling system or rig 36 comprising a rail 38, drifter 40 and drilling steel 42, all of conventional construction.

[0031] Looking at the components of the apparatus 10 in more detail with particular reference to Figure 1, the loading head 12 includes a swing arm 44 comprising a first relatively short member 46 which is attached at one end 48 to one end 50 of a second longer member 52 which extends perpendicular to the member 46. An opposite end 54 of the member 46 is formed with a profiled socket 56 for receiving a splined drive shaft 58 of a motor 60.

[0032] The motor 60 is attached by a series of bolts 62 to a motor bracket 64. The motor bracket 64 in turn is coupled by bolts 66 to a mounting bracket 68. The mounting bracket 68 is attached to the rail 38 of the drilling system 36.

[0033] A carriage 70 is slidably mounted on the member 52. To facilitate the sliding motion of the carriage 70, the carriage incorporates a number of rollers or wheels 72. The carriage 70 supports a cradle 74 to which is attached the tube 14.

[0034] A rod 76 of an extension cylinder 78 is attached to a bracket 80 of the carriage 70. End 82 of the cylinder 78 opposite the rod 76 is coupled by a bracket 84 to an end 86 of the member 52.

[0035] The motor 60 moves the tube 14 by way of rotation about an axis A parallel to an axis B of the hole 18 (see Figure 5) into and out of alignment with the hole 18. Further, the extension cylinder 78 can be operated to move the carriage 70 along the member 52 and thus lineally advance and retract the tube 14 from the face 22. The combination of the motor 60, swing arm 44, rod 76, extension cylinder 78 and carriage 70 constitute an alignment mechanism for moving the tube 14 into and out of alignment with the hole 18.

[0036] Referring to Figure 7, it can be seen that the conduit 26 which is used for advancing or pushing the cartridge 16 is wound on a reel 88 which can be operated to advance or pay out the conduit 26 (i.e. feed it into and along the tube 14) and to retract or reel it in. When the reel 88 pays out the conduit 26, one end of the conduit 26 pushes the cartridge 16 through the tube 14 towards and into the hole 20. However, the tube 26 also forms part of the stemming loader 30 used for loading particulate stemming material into the hole 20. In this regard, a second end of the tube 26 can be selectively placed into fluid communication with a stemming feed pipe 90 into which is fed particulate stemming material from a stemming kettle 92. An end of the stemming feed pipe 90 upstream of the kettle 92 is coupled to a blower 94. The blower 94 blows air into the stemming feed pipe 90 in which is entrained the particulate stemming material from the kettle 92. Thus, the blower 94 blows the

particulate stemming material through the conduit 26 and the tube 14 into the hole 20.

[0037] As also shown in Figure 7, an upstream end 96 of the tube 14 is provided with a breach 98 for facilitating loading of cartridges 16 into the tube 14. The breach 98 is held by a breach support 100. In this particular embodiment, the cartridge 16 is pre-coupled to an initiator line 102 which is unwound from a reel 104.

[0038] As depicted in Figures 2a and 2b, the apparatus 10 is attached to a jumbo 34 with the loading head 12 attached by mounting bracket 68 to rail 38 of the drilling system 36. The stemming kettle 92 and reel 88 are mounted to the rear of the jumbo 34. The breach 98 is located in a position where an operator of the jumbo 34 can easily manually load the cartridges 16 into the breach 98. The tube 14 has a relatively short rigid section 106 which is supported by the cradle 74 and a flexible hose portion 108 attached to an upstream end of the rigid section 106. The breach 98 is provided in the hose portion 108.

[0039] The operation of the apparatus 10 will now be described with particular reference to Figures 3-11.

[0040] Referring to Figure 3, the jumbo 34 (not shown in this Figure) is operated in a conventional manner to drill the hole 20 into the body of rock 24. As is known in the art, during this process, the drifter 40 is advanced along the rail 38 to advance the drilling steel 42 into the body of rock 24 producing a hole 20. While this is happening, the loading head 12, which is coupled to the rail 36 by the bracket 68, is disposed so that the tube 14 is out of axial alignment with and lineally spaced from, the face 22.

[0041] After the hole 20 has been drilled to a required depth, the jumbo operator operates the drilling system 36 so as to retract the drilling steel 42 from the hole 20. This is achieved by sliding the drifter 40 along the rail 38 away from the face 22 as shown in Figure 4.

[0042] Next, as shown in Figure 5, the motor 60 is operated to rotate the swing arm 44 (and thus the tube 14) about axis A, so that the tube 14 is in axial alignment with the hole 20. At this stage, the tube 14 remains spaced from the face 22.

[0043] The extension cylinder 78 is now operated to extend the rod 76 thereby sliding the carriage 70 along the member 52 and lineally advancing the tube 14 to the collar 18 of the hole 20, as shown in Figure 6.

[0044] Thereafter, a cartridge 16, to which an initiator lead 102 has been attached, is inserted into the breach 98. The breach is then closed. The breach 98 when closed is provided with an opening to allow the lead 102 to feed into the hose portion 108. Next, the reel 88 is operated to pay out or advance the conduit 26 so that one end of the conduit 26 abuts the cartridge 16 and pushes it along the hose portion 108 and rigid portion 106 of the tube 14 into the hole 20 and to the toe 28 of the hole 20.

[0045] With the conduit 26 still in the hole 20, particulate stemming material 110 from the stemming kettle

92 is blown through the conduit 26, and thus the tube 14, into the hole 20. The reel 88 is operated to retract or reel in the conduit 26 from the hole 20 as the stemming material flows through it. Accordingly, the hole 20 from the cartridge 16 to the collar 18 is filled with particulate stemming material 110. The injection of stemming material ceases when the packed stemming reaches the collar 18 of the hole 20. The extension cylinder 78 is again then operated to retract the rod 76 sliding the carriage 72 along the member 52 away from the face 22 thus similarly lineally retracting the tube 14 from the face 22, as depicted in Figure 8. The lead 102 is then cut. The motor 60 is operated to rotate the swing arm 44 about axis A to rotate or swing the tube 14 out of axial alignment with the hole 20, as depicted in Figure 9. This action will cause at least a part of the length of the lead 102 to pull out of the tube 14. If any portion of the lead 102 remains within the tube 14 it can easily be pulled out manually so that it is free of the apparatus 10. The boom 32 of the jumbo is then retracted to further space the apparatus 10 from the face 22, as shown in Figure 10.

[0046] Finally, the lead 102 is attached to a battery or other type of energy source which is then operated to cause initiation of the energetic material within the cartridge 16. This results in a fracturing of the rock in the vicinity of the hole 20 as schematically illustrated in Figure 11. In particular, if the energetic material is a propellant its initiation can result in a penetrating core fracture of the rock. The fractured rock if not released from the face 22 can be removed by an impact breaker.

[0047] The above process can then be repeated as required to cause further fracturing of the rock 24.

[0048] Now that an embodiment of the present invention has been described in detail it would be apparent to those skilled in the relevant arts that numerous modifications and variations may be made without departing from the basic inventive concepts. For example, in the illustrated embodiment, the cartridge 16 is attached to an initiator lead 102 which is physically coupled to a battery or some other source for providing power to initiate the energetic substance held within the cartridge 16. However in a further embodiment, the cartridge 16 may be detonated by radio waves in which case the initiator lead 102 is not required. However in such an embodiment the cartridge 16 may (though not necessarily) be provided with a short antenna for receiving the radio signals. More particularly, the apparatus 10 may further include a stemming bar coupled to a second swing arm and second carriage 70 which can be rotated into axial alignment with the hole 20 and then lineally advanced to bear on or support the particulate stemming material 110 in the hole 20 where the stemming bar includes some form of transmitter for transmitting a radio signal into the hole to provide either initiation signals/commands which can be received by a circuit in the cartridge 16 to initiate the energetic material. Indeed, the stemming bar and an initiator in the cartridge can be config-

ured in a manner as set out in Applicant's Patent Application No. PCT/AU98/00929 (the contents of which is incorporated herein by way of reference) so that a signal is transmitted via that stemming bar also provide operational power for the initiator.

[0049] In a further variation, rather than rotating the tube 14 (and/or stemming bar if provided) into and out of axial alignment with the hole 20, the tube 14 (and stemming bar) can be moved lineally along an axis perpendicular to the axis B of the hole 20 into and out of axial alignment with the hole 20.

[0050] All such modifications and variations together with others that would be obvious to a person of ordinary skill in the art are deemed to be within the scope of the present invention the nature of which is to be determined from the above description and appended claims.

Claims

1. An apparatus for fracturing a hard material, said apparatus including at least:

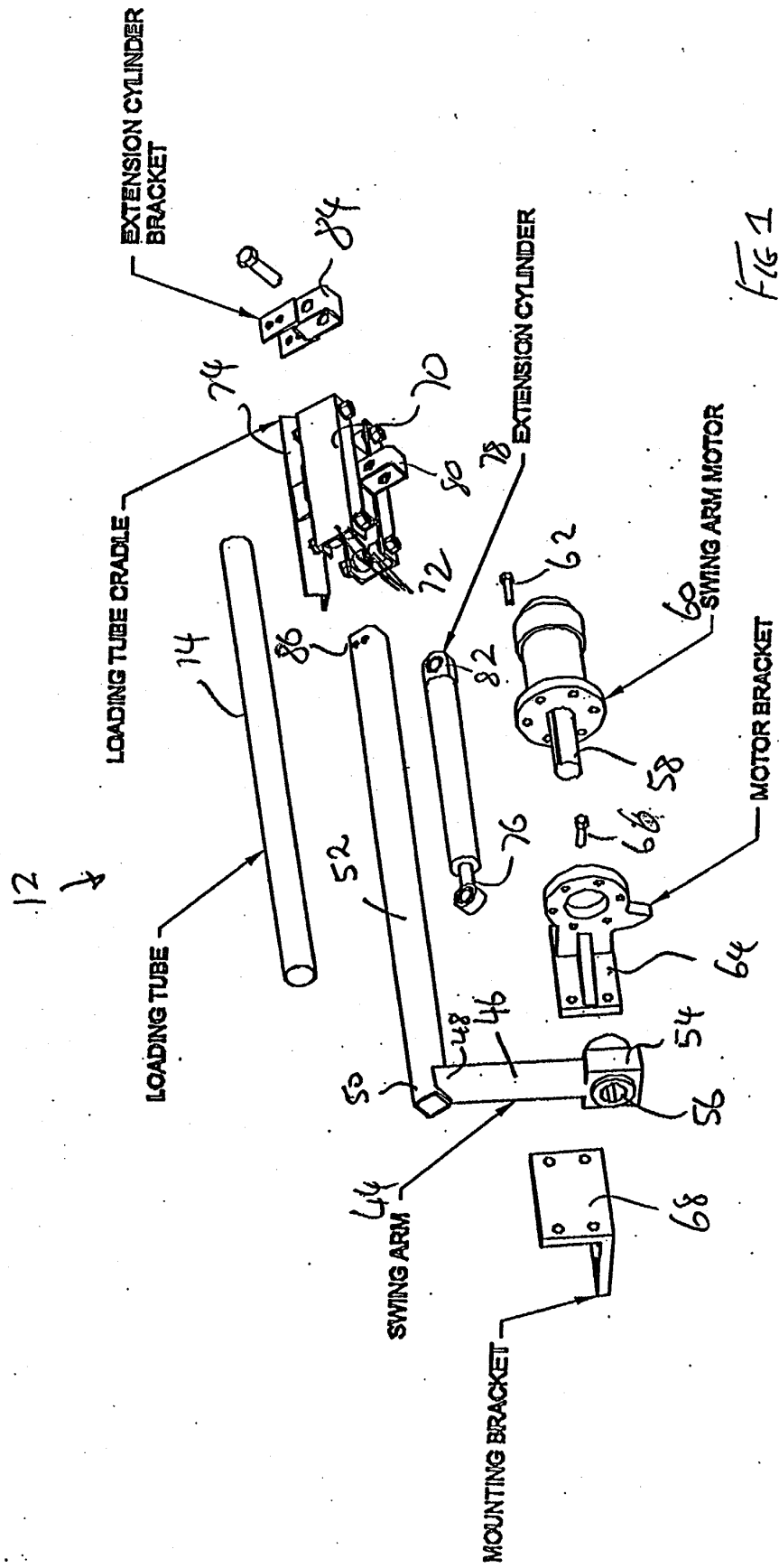
a holding head provided with a guide for receiving a cartridge containing a charge of energetic material, and guiding said cartridge into a hole formed in a face of a hard material to be fractured;

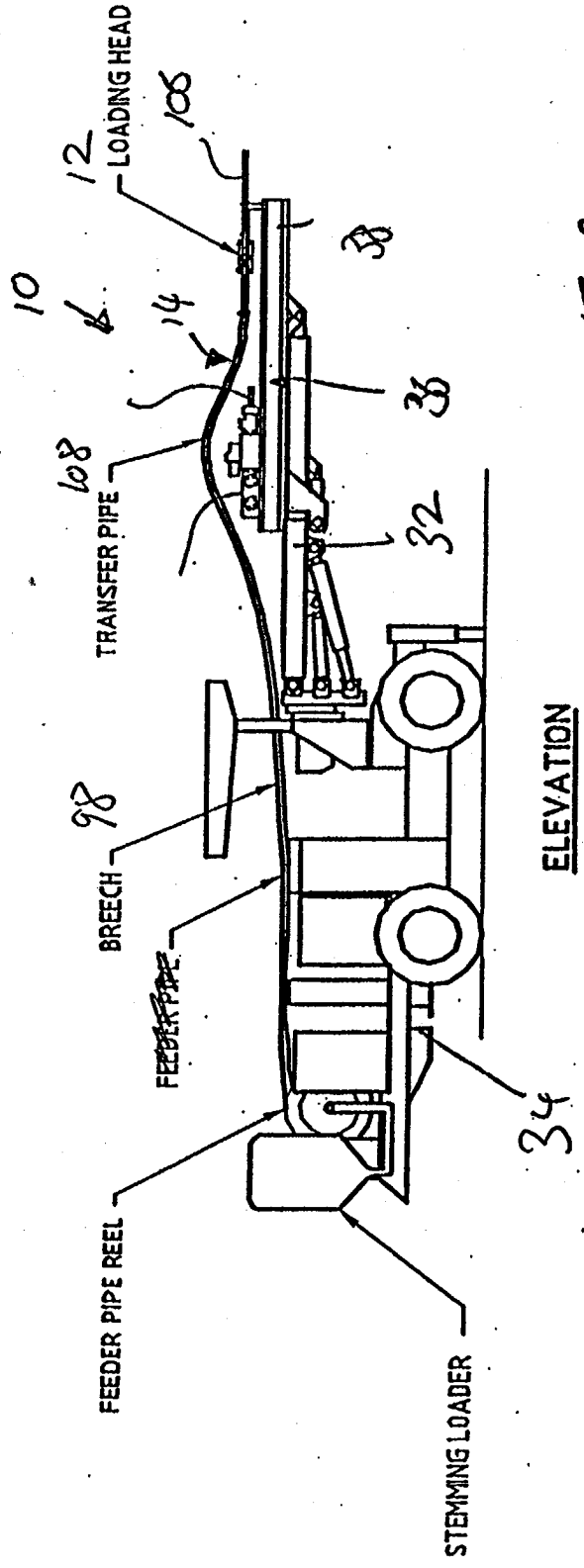
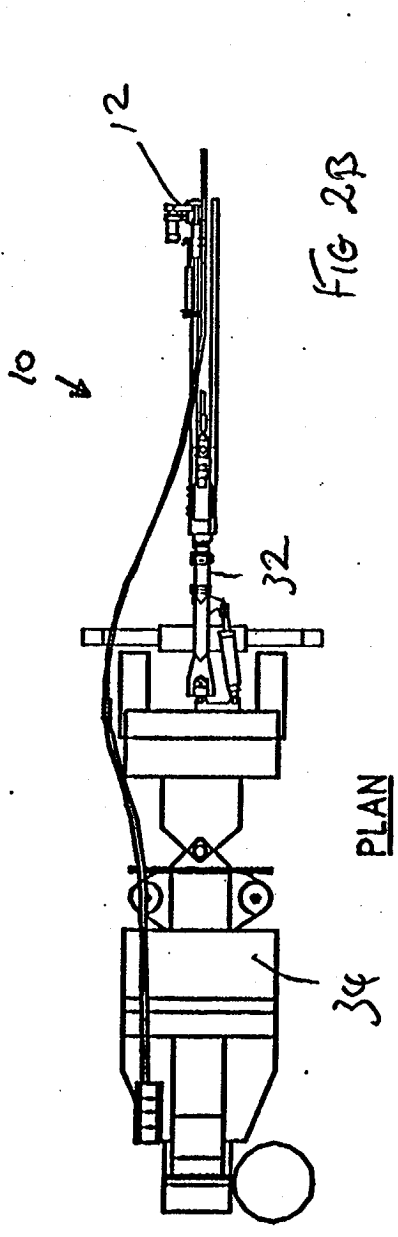
a system for advancing said cartridge along said guide to a toe of said hole; and,

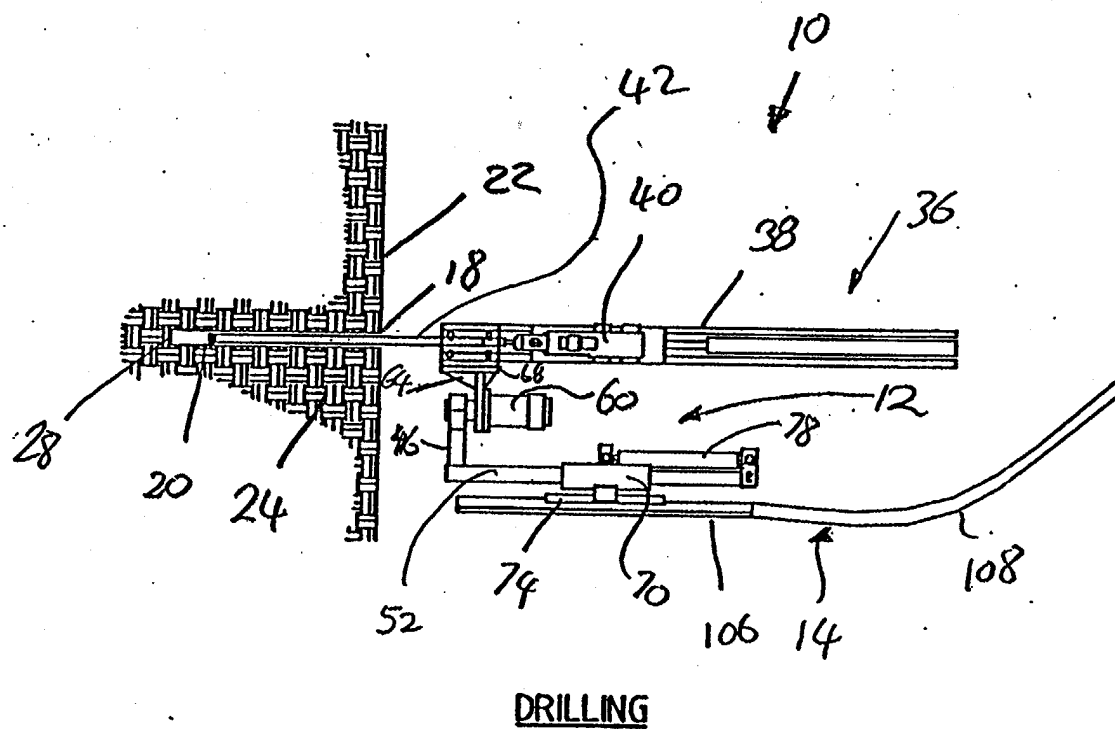
a stemming loader for loading a particulate stemming material into said hole through said guide.

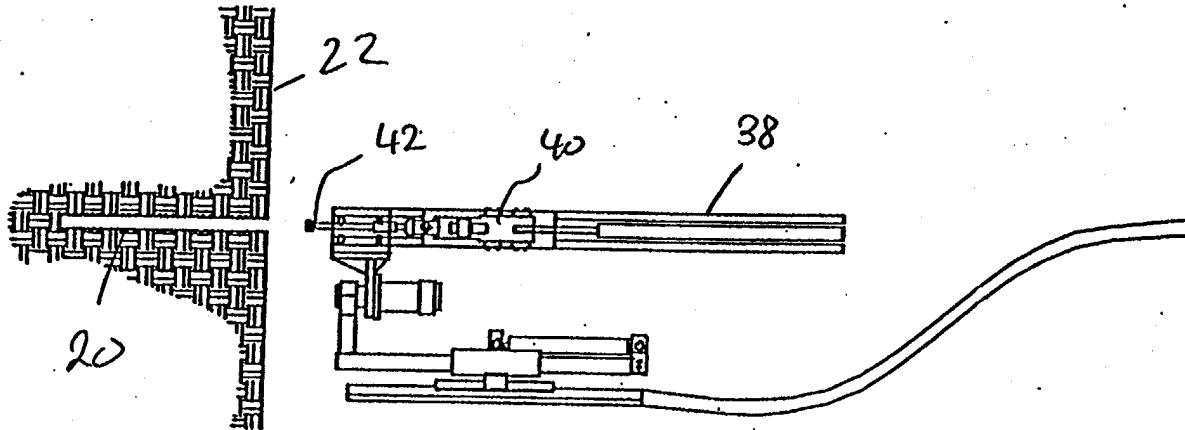
2. The apparatus according to claim 1 wherein said system for advancing said cartridge includes a flexible elongated member having a first end which abuts an end of said cartridge distant said hole, and a device for advancing and retracting said flexible elongated member.
3. The apparatus according to claim 2 wherein said flexible elongated member is a conduit and constitutes a part of said stemming loader, said stemming loader further including a stemming injector for injecting particulate stemming material into a second end of said conduit.
4. The apparatus according to claim 3 wherein said stemming injector includes a blower for blowing said particulate stemming material into and along said conduit.
5. The apparatus according to any previous claim further including an alignment mechanism for moving said guide into and out of alignment with said hole.

6. The apparatus according to claim 5 wherein said alignment mechanism rotates said loading head about an axis parallel to an axis of said hole, to move the guide into and out of alignment with said hole. 5
7. The apparatus according to claim 5 wherein said alignment mechanism slides said loading head along an axis perpendicular to an axis of said hole, to move the guide into and out of alignment with said hole. 10
8. The apparatus according to claim 5 further including a drilling system for drilling said hole, said drilling system including a rail and a drill slidably mounted on said rail, wherein said alignment mechanism is supported on said rail. 15
9. The apparatus according to any previous claim wherein said loading head includes a stemming bar which can be moved into and out of alignment of said hole for insertion into said hole to support said particulate stemming. 20
10. The apparatus according to claim 9 wherein said stemming bar includes a transmitter for transmitting a signal into said hole for operating an initiator or a detonator contained in said cartridge. 25
11. A method of fracturing a hard material, said method including the steps of: 30
- providing a guide for receiving a cartridge containing a charge of energetic material; 35
- aligning said guide with a hole formed in a face of a hard material; 40
- inserting the cartridge into said guide; 45
- advancing said cartridge along said guide into said hole; 50
- injecting particulate stemming material through said guide into said hole; and, 55
- initiating said energetic material.
12. The method according to claim 11 including the step of advancing said guide into abutment with said face of said hard material.
13. The method according to claim 11 wherein said step of advancing said cartridge includes pushing said cartridge along said guide.
14. The method according to claim 13 wherein said step of pushing includes advancing a length of a flexible elongated member into said guide to push said cartridge along said guide into said hole.
15. The method according to any of claims 11-14 wherein said step of injecting particulate material includes forming said flexible elongated member as a conduit and blowing said particulate stemming material through said conduit into said hole.
16. The method according to claim 15 including a step of retracting said conduit from said hole as said particulate material is blown into said hole.
17. The method according to any of claims 11-16 including a step of attaching said guide to a drilling system which includes a rail and a drill mounted on said rail and supporting said guide on said rail.
18. The method according to any of claims 11-17 including the step of providing an alignment mechanism for moving said guide into and out of alignment with said hole.
19. The method according to claim 18 including a step of providing a stemming bar coupled to said alignment mechanism, moving said guide out of alignment with said hole; and moving said stemming bar into alignment with said hole and into abutment with said particulate stemming in said hole.



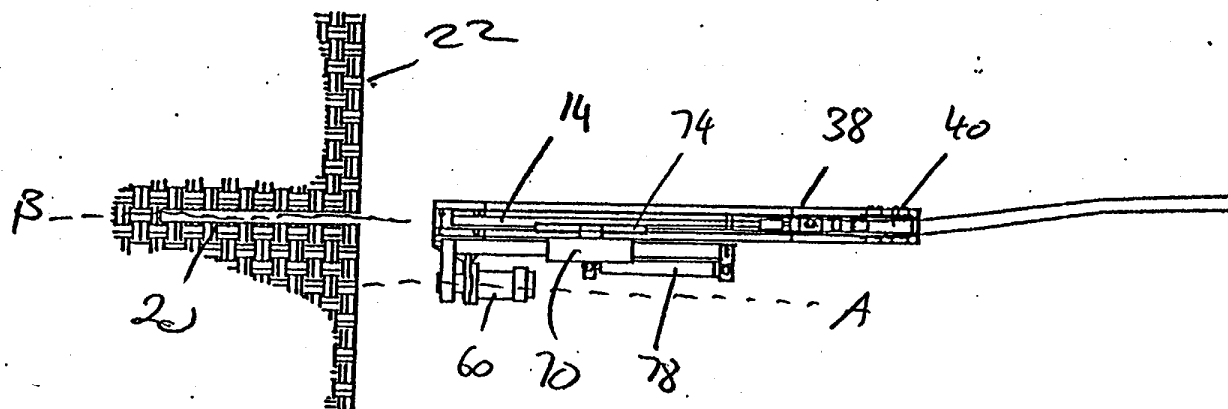






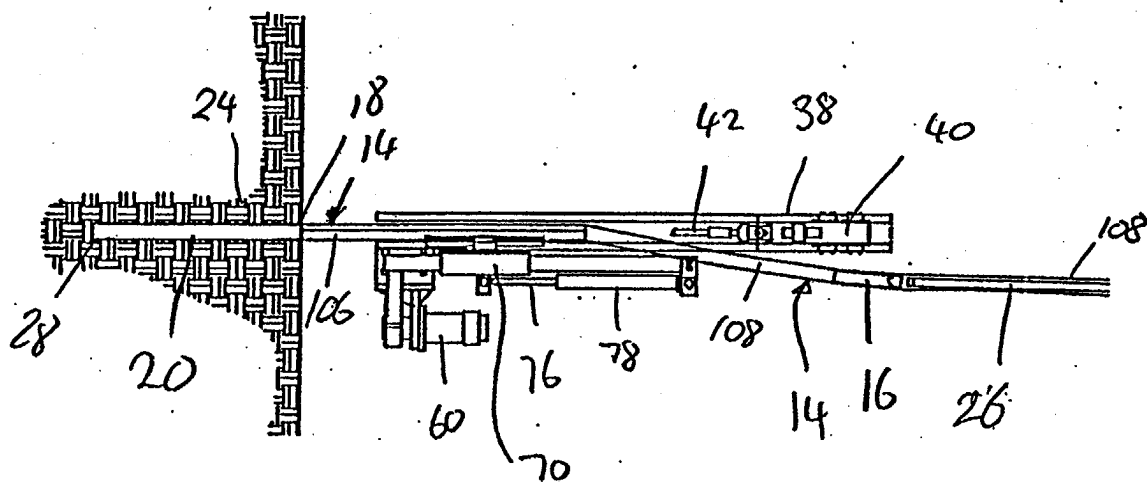
RETRACTING DRILL

FIG 4.



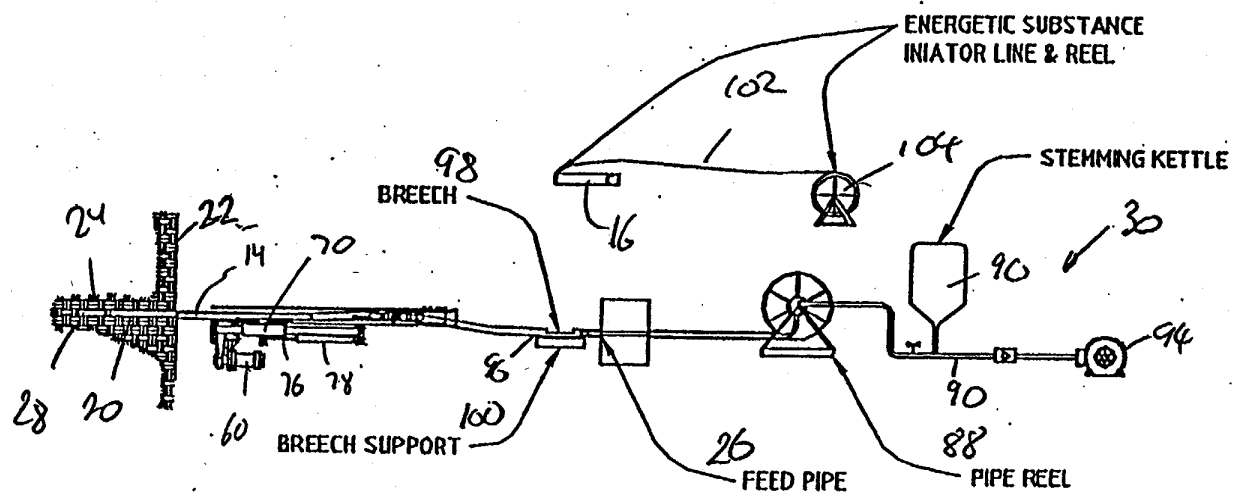
ALIGNED LOAD TUBE

FIG 5



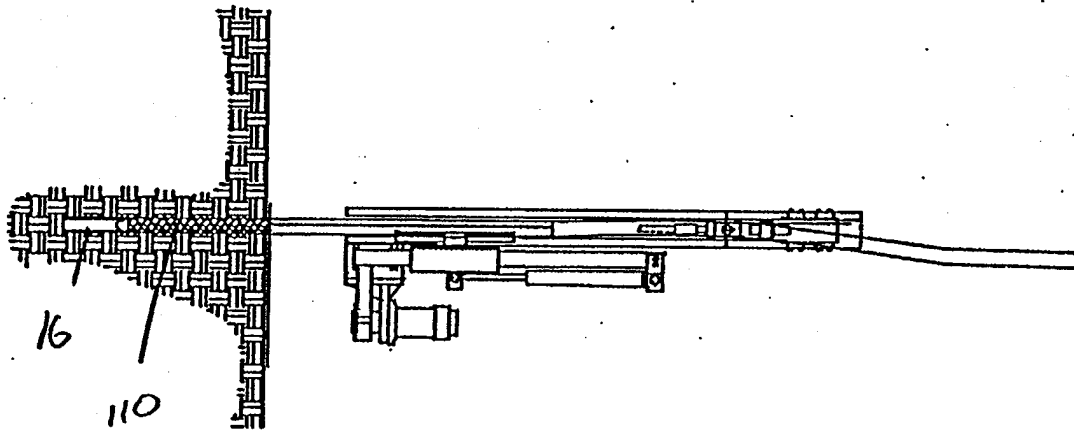
ADVANCE LOAD TUBE TO HOLE COLLAR

FIG 6



INSERT CARTRIDGE

FIG 7



RETRACT LOAD TUBE

FIG 8

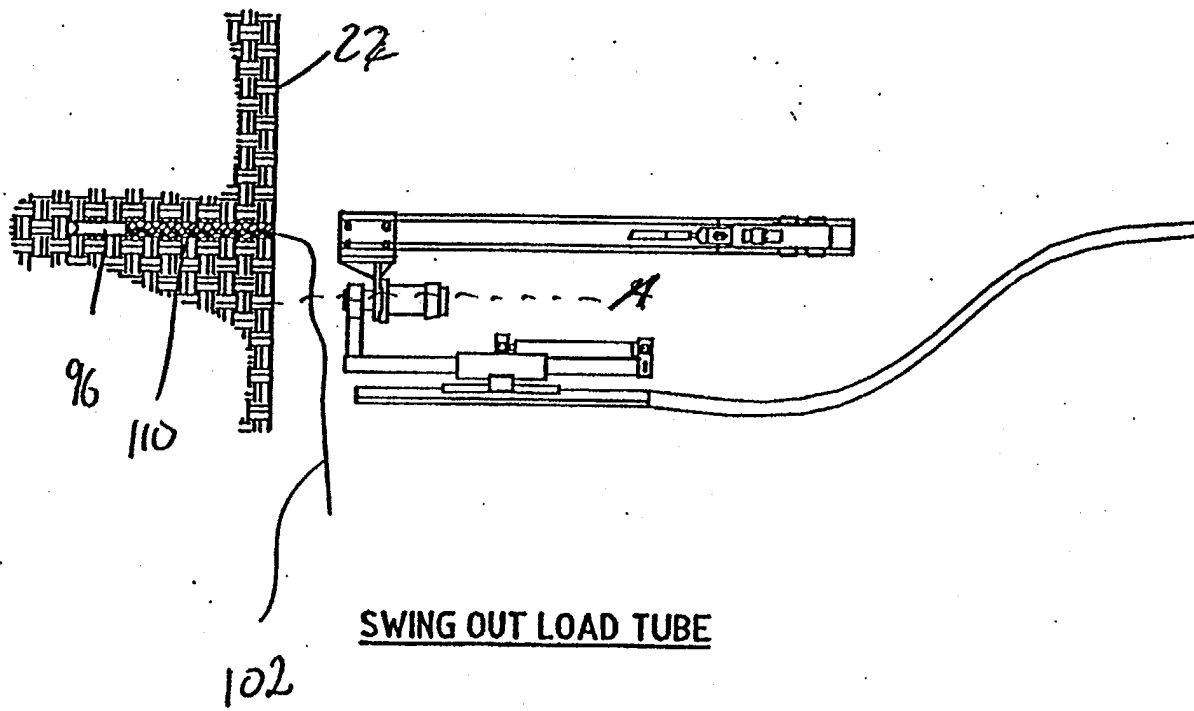


FIG 9

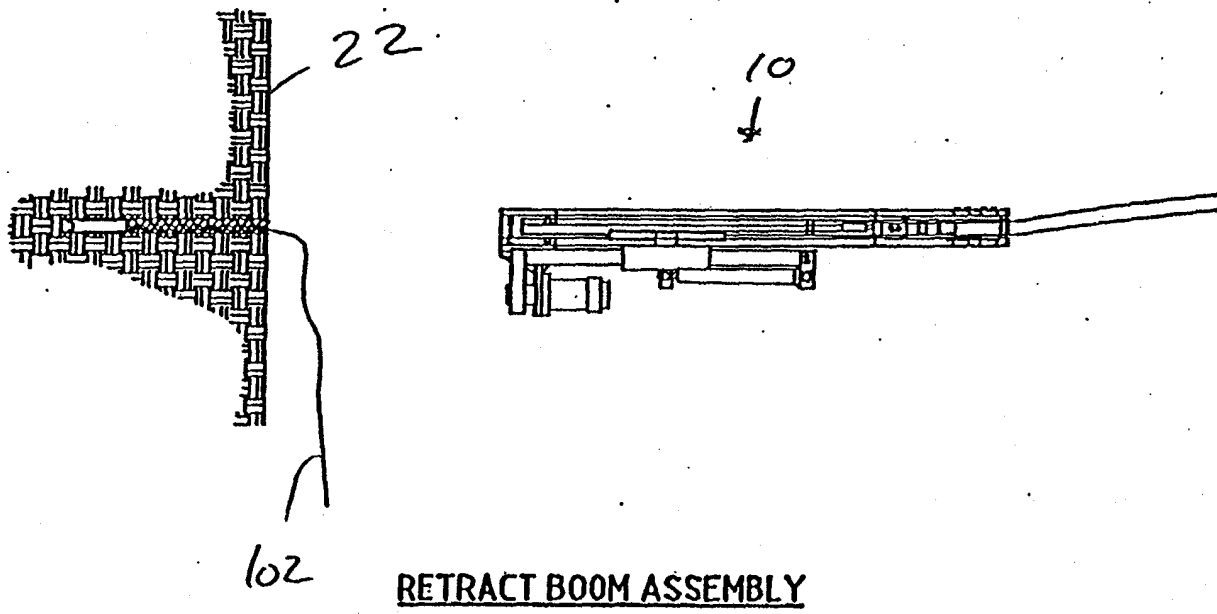


FIG 10

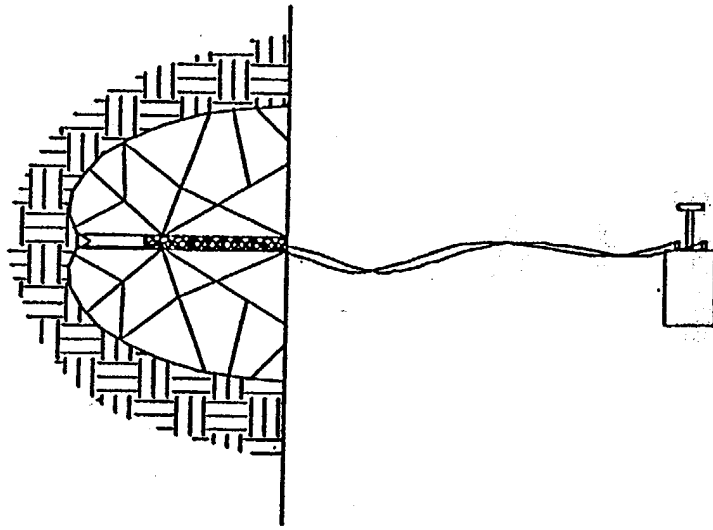


Fig 11



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 25 1038

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.7)
Y	US 4 522 125 A (MARZ HORST F) 11 June 1985 (1985-06-11) * column 2, line 44 - line 56 * ---	1-19	E21C37/16 F42D1/08
Y	DE 952 781 C (MUELLER & BIERMANN APPBAU BLEC) 22 November 1956 (1956-11-22) * page 2, column 2, line 64 - line 69 * ---	1-19	
Y	US 6 347 837 B1 (FOURIE OCKERT R ET AL) 19 February 2002 (2002-02-19) * column 2, line 42 - line 50 * * column 11, line 60 - line 64 * ---	5-10, 16-19	
A	US 2 703 528 A (AKRE ROBERT L ET AL) 8 March 1955 (1955-03-08) * column 5, line 48 - column 6, line 2 * -----	1-19	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			E21C F42D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 16 May 2003	Examiner Garrido Garcia, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 03 25 1038

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-05-2003

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4522125	A	11-06-1985	CA 1190421 A1	16-07-1985
			AU 2793384 A	13-12-1984
			ES 8504383 A1	01-07-1985
			FI 842136 A ,B,	10-12-1984
			MW 784 A1	11-12-1985
			MX 160359 A	12-02-1990
			NO 842288 A ,B,	10-12-1984
			SE 8403046 A	10-12-1984
			ZA 8403986 A	30-01-1985
			ZM 1784 A1	21-12-1984
DE 952781	C	22-11-1956	NONE	
US 6347837	B1	19-02-2002	AU 715874 B1	10-02-2000
			CA 2365671 A1	14-09-2000
			HK 1030335 A2	20-04-2001
			HK 1030336 A2	20-04-2001
			HK 1030520 A2	27-04-2001
			HK 1030521 A2	27-04-2001
			WO 0054000 A1	14-09-2000
			TW 470847 B	01-01-2002
			AU 3572200 A	28-09-2000
US 2703528	A	08-03-1955	GB 767860 A	06-02-1957