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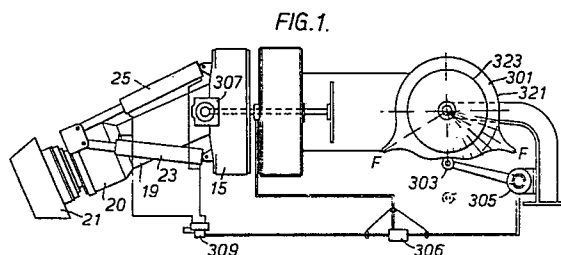
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54 **Excavating machines.**

57 A tunnelling, ripping or heading machine comprises a machine body and excavating means (20) connected to said body by a mounting arrangement (15). The mounting arrangement (15) is movable, relative to the body of the machine, in a first direction, under manual control. Such movement automatically activates movement in a second direction so that a predetermined excavation pattern results.

A method of excavating using such a machine is also described.



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EXCAVATING MACHINES

This invention relates to tunnelling, ripping, heading and other excavating machines.

According to the present invention there is provided an excavating machine, said machine
5 comprising a machine body and excavating means connected to said body by a mounting arrangement, the mounting arrangement being movable under manual control, relative to the body of the machine in a first direction, said movement automatically activating
10 movement in a second direction, so that a predetermined excavation pattern results.

Preferably the movement in said first direction is rotational movement relative to the body of the machine. More preferably said rotation is about a
15 longitudinal axis of the body.

Preferably the movement in said second direction is pivotal movement relative to the body of the machine.

Preferably the machine includes a cam operated
20 driving arrangement for the mounting arrangement, the cam being profiled according to the shape of the excavation to be cut. More preferably the rotation of the cam is related to the movement of the mounting arrangement in said first direction.

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Preferably said mounting arrangement is additionally capable of manually controlled movement in a third direction relative to the body. More preferably said third direction is longitudinally of the body of the machine.

The present invention also provides a method of excavating comprising providing an excavating machine having a machine body and excavating means connected to said body by a mounting arrangement, and effecting under manual control movement of the excavating means relative to the body in a first direction, said movement automatically activating movement in a second direction so that a predetermined excavation pattern results.

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

Figure 1 illustrates the control mechanism whereby the movements of the cutting means of a tunnelling machine are controlled; and

Figure 2 illustrates the cutting cycle for the tunnelling machine controlled by the mechanism of Figure 1.

A tunnelling machine having control means in accordance with the present invention comprises a main body equipped with a turret 15 mounted for sliding movement forward and aft of the machine on a turret slide. Such movement enables the position of cutter drum 21 to be advanced as the cutter drum 21 cuts into the face of the tunnel. Turret 15 is also mounted for rotational movement about the machine's longitudinal axis, this movement being effected by means of a slewing ring gear driven by four pinion gears (not shown).

Interconnecting turret 15 and cutter drum 21 is

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boom 19. Boom 19 is capable of pivotal movement about turret 15. This pivotal movement is effected by hydraulic rams 23 and 25. In addition, the plane about which the pivotal movement is achieved can be
5 altered by the above-mentioned rotational movement of the turret about the machine's longitudinal axis.

Hydraulic rams 23 and 25, together with the rotational movement of turret 15, enable boom 19 to be moved to virtually any orientation in a direction
10 generally forwardly of the machine.

The movements of the boom 19, carrying cutter drum 21 and turret 15 are automatically controlled so that the cutter drum carries out the cutting pattern as illustrated in Figure 2. The sequence of movement
15 of the boom and cutter drum in cutting out a new section of tunnel is as follows:-

1. the cutter drum is sumped at position A;
2. the drum is traversed to point B, then to point C and returns to point A, these movements resulting in the
20 cutting of a flat floor section;
3. the drum is elevated along a vertical line to position D;
4. the drum is moved along an arc to position E, returned along the same arc to position D and continues
25 to position F, these movements resulting in the formation of the tunnel walls;
5. the drum is then moved inwardly to position G and along a smaller radius arc to position H, this movement resulting in the cutting of the inner section of the
30 tunnel extension.

The above-described movements result in the cutting away of the whole of the rock in the extended portion of the tunnel. These movements require manual control over the turret movements and cutter drum rotating speed but

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are otherwise controlled entirely by the use of a cam 301 which is profiled so as to produce the desired boom movements in the following way. Engaging surface of cam 301 is a cam follower 303. During rotation of cam 301 cam follower 303 moves substantially vertically under
5 control of cam 301. Cam follower 303 is linked to a potentiometer 305 the setting of which depends upon the vertical position of cam follower 303. Potentiometer 305 is connected to an arrangement 306 which performs an electronic comparison as well as slave control of a
10 further potentiometer 307 by potentiometer 305. Potentiometer 307 controls certain boom movements and together the movements of the boom are controlled by the two potentiometers. Thus hydraulic rams 23 and 25 are extended or retracted according to signals passed from
15 arrangement 306 to a valve assembly 309. Turret 15 is hydraulically^{rotated}/under the control of the driver, thus rotating cam 301.

During rotation of cam 301 an engagement of that part of the surface of cam 301 from F to F (the lower portion
20 of cam 301 as seen in Figure 1) the turret and boom carry out the movements which enable the cutter to effect the cutting of the tunnel floor. When cam follower 303 engages the circular outer portion 301 of the cam the motion is such that the cutter effects the cutting of the
25 tunnel walls. Subsequently the cam follower 303 is caused to engage the inner cam surface 323 and during rotation of the cam the inner central portion of the tunnel (movement of the cutter from G to H as seen in Figure 2) is effected.

30 The shape of the tunnel to be cut may be varied by altering the shape of the cam.

Control means in accordance with the present invention may be fitted to excavating machines other than tunnelling machines, for instance, ripping or heading machines.

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CLAIMS:

1. An excavating machine comprising a machine body and excavating means connected to said body by a mounting arrangement, the mounting arrangement being movable, under manual control, relative to the body of the machine in a first direction, characterised in that said movement automatically activates movement in a second direction so that a predetermined excavation pattern results.
2. An excavating machine according to claim 1 characterised in that one of said movements is rotational movement relative to the body of the machine and the other of said movements is pivotal movement relative to the body of the machine.
3. An excavating machine according to claim 1 characterised in that said movement in a first direction is rotational movement relative to the body of the machine.
4. An excavating machine according to claim 2 characterised in that said rotational movement is about or parallel to the longitudinal axis of the body of the machine.
5. An excavating machine according to any of the preceding claims characterised in that said movement in a second direction is pivotal movement relative to the body of the machine.
6. An excavating machine according to any of the preceding claims characterised in that said movement in a second direction is automatically activated by said movement in a first direction by means of a cam operated driving arrangement for the mounting arrangement, the cam being profiled according to the shape of the excavation to be cut.
7. An excavating machine according to any of the

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preceding claims characterised in that said mounting arrangement is additionally capable of manually controlled movement in a third direction relative to the body of said machine.

5 8. An excavating machine according to claim 6 characterised in that said third direction is longitudinally of the body of the machine.

 9. An excavating machine according to any of the preceding claims characterised in that said excavating
10 machine is a tunnelling, ripping or heading machine.

 10. A method of excavating comprising providing an excavating machine having a machine body and excavating means connected to said body by a mounting arrangement, and effecting under manual control
15 movement of the excavating means relative to the body in a first direction, characterised in that said movement automatically activates movement in a second direction so that a predetermined excavation pattern results.

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FIG. 1.

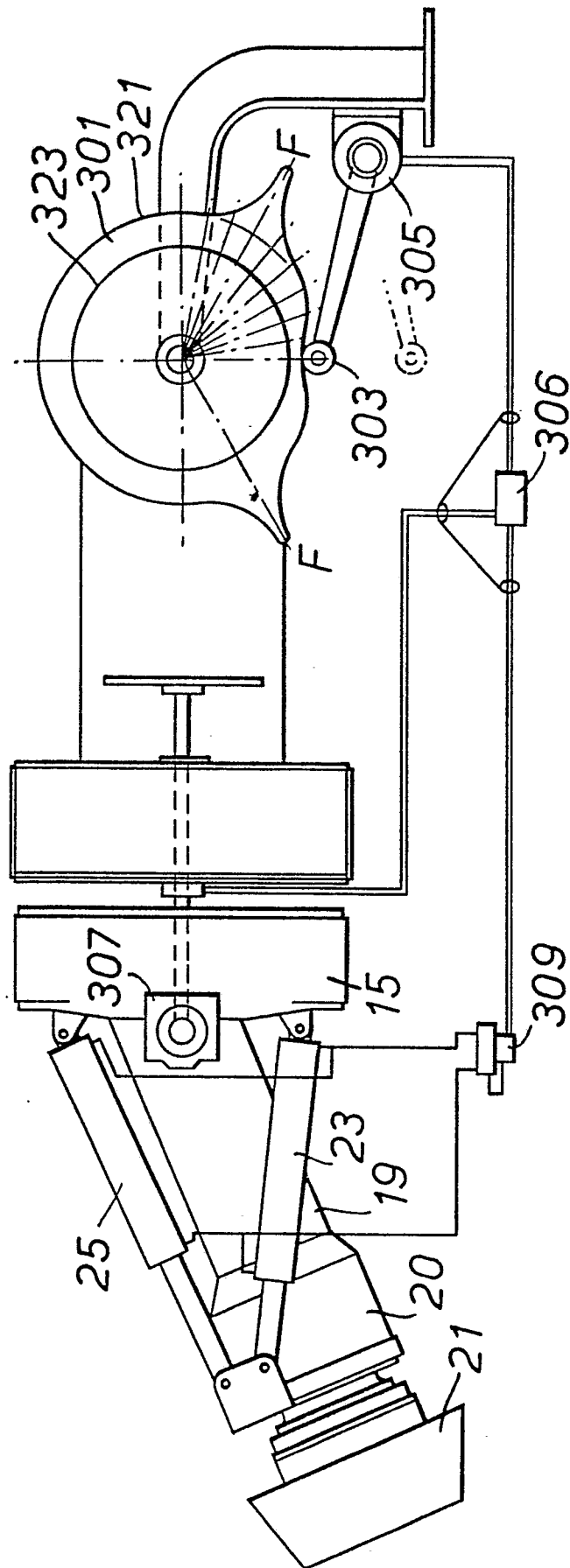
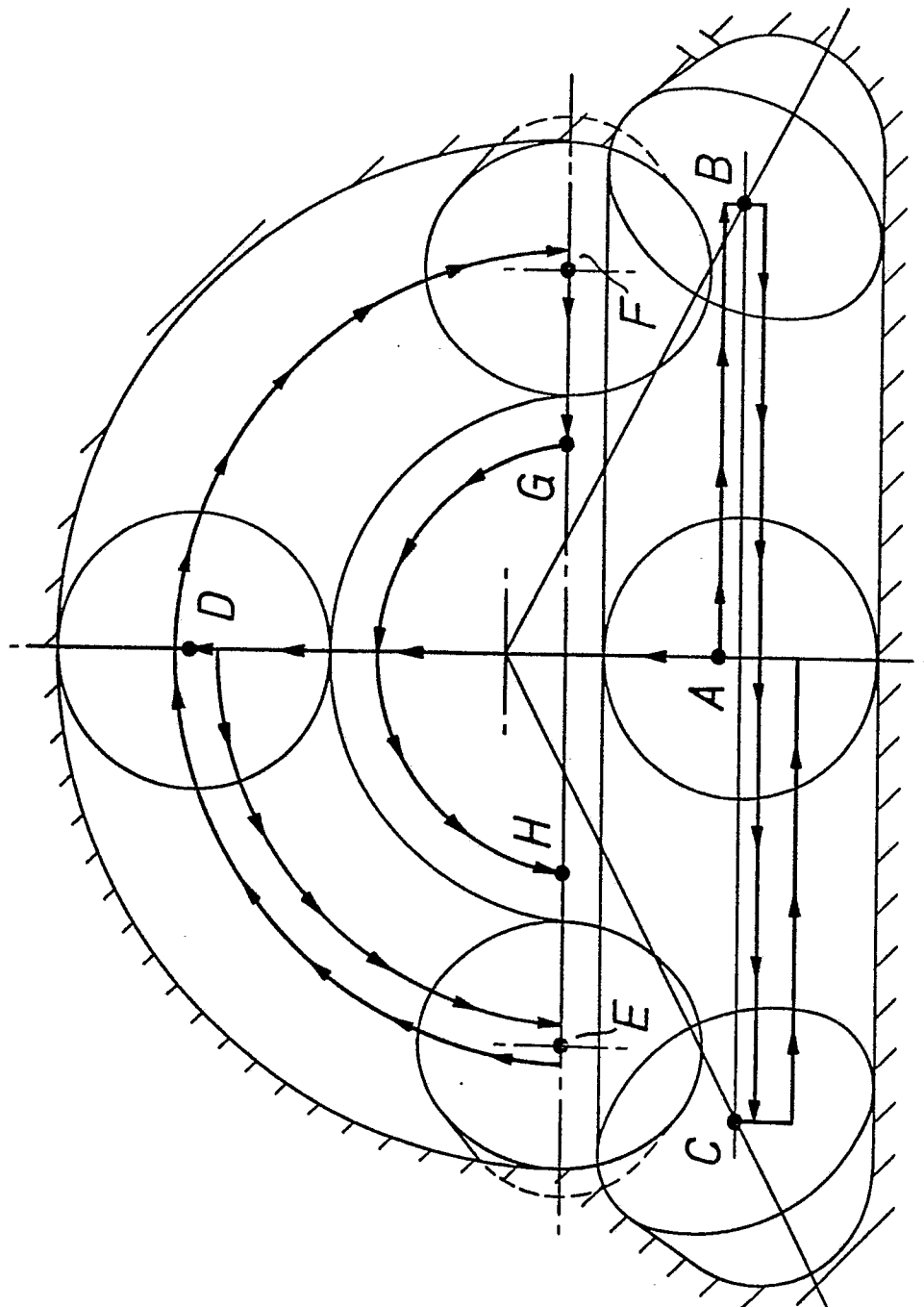


FIG. 2.





European Patent
Office

EUROPEAN SEARCH REPORT

0040078

Application number

EP 81 30 2074

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>GB - A - 1 472 590</u> (ANDERSON MAVOR) * Page 2, lines 36-40; figures 1-3 * -- <u>GB - A - 1 180 910</u> (MAVOR & COULSON) * Page 2, lines 28-56; figures 1,2 * -- <u>GB - A - 1 488 489</u> (COAL INDUSTRY) * Page 2, lines 65-101; figures 1-3 * -- A <u>GB - A - 1 466 098</u> (STELMO) A <u>US - A - 1 580 001</u> (BICKNELL) A <u>DE - A - 2 201 403</u> (EICKHOFF) A <u>FR - A - 2 282 528</u> (WESTFALIA) ----	1,6,10 1,6,10 1,10	E 21 D 9/10 TECHNICAL FIELDS SEARCHED (Int. Cl.) E 21 D E 21 C CATEGORY OF CITED DOCUMENTS X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons & member of the same patent family, corresponding document
☒ The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
The Hague	11-08-1981	HAKIN	