

12

EUROPEAN PATENT APPLICATION

21 Application number: 84302352.4

51 Int. Cl.³: **E 02 F 5/10**
E 02 F 5/12

22 Date of filing: 06.04.84

30 Priority: 08.04.83 GB 8309615

43 Date of publication of application:
31.10.84 Bulletin 84/44

84 Designated Contracting States:
AT BE CH DE FR GB IT LI NL SE

71 Applicant: **Sandow, Reginald Patrick**
Ros-Sann Lelant Downs
Hayle Cornwall TR27 6LL(GB)

72 Inventor: **Sandow, Reginald Patrick**
Ros-Sann Lelant Downs
Hayle Cornwall TR27 6LL(GB)

74 Representative: **Bryer, Kenneth Robert**
Coosehecca Chacewater
Truro TR4 8QU Cornwall(GB)

54 **Trenching apparatus.**

57 Apparatus for forming a trench comprises a blade carrier (17, 18, 19) holding a blade (26), in use, in a position with its leading edge inclined upwardly towards the rear of the carrier; a soil lifting plate (33) is secured to the leading edge of the blade to be drawn through the ground and lift out the soil to form a trench the same width as the plate. Side walls (35) prevent the removed soil from falling back into the trench until a hopper (42) forming part of the apparatus, and itself having downwardly projecting trench-supporting side walls (48, 49), has passed.

Stones or gravel, or a flexible cable, or a drainage pipe, can be introduced into the bottom of the trench through the hopper and inclined soil-return deflector plates (59, 60) carried by the hopper act to draw the displaced soil back over the trench so that the trench opening, filling and closing operations are all done in a single pass.

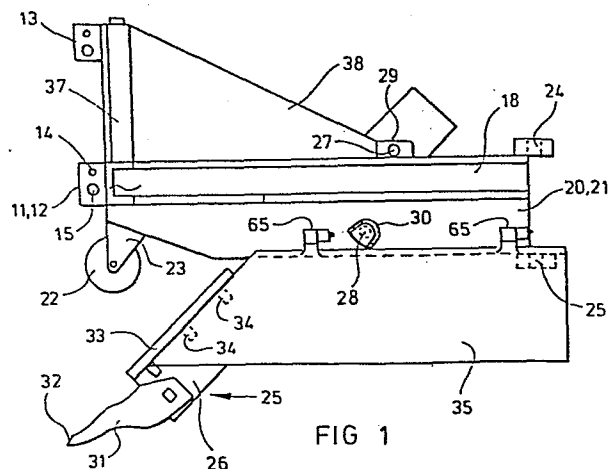


FIG 1

- 1 -

Trenching Apparatus:

The present invention relates to trenching apparatus, namely apparatus for excavating a trench. Advantageously apparatus according to the present invention can be combined with trench filling apparatus and with drain laying equipment whereby to act in a single pass to excavate a trench, lay a drainage pipe in the bottom of the trench, and fill the trench with a permeable material such as gravel or stones and then re-cover the trench with the excavated material. The present invention also encompasses such a combination.

Prior art attempts to produce drainage channels in one pass include the so-called "mole" plough which comprises a rigid blade having a bulbous enlargement at the bottom end and carried by an adjustable mounting on a tractor or track laying vehicle. The blade is inserted into the ground substantially vertically with the bulbous portion lowermost and by drawing this through the ground an inverted "keyhole" shape slot is formed. The parallel sides cut by the blade quickly recombine leaving a subterranean channel which assists drainage. Attempts have been made to combine a mole plough with a drain laying machine, but these have not been entirely successful.

The object of the present invention is to provide a trench forming excavating tool which acts to form a trench rapidly and easily, into which trench a drainage pipe or other permeable drainage-assisting mater-

- 2 -

ial can be laid and which can then be back-filled leaving the drainage pipe or drainage material in position.

5 According to one aspect of the present invention, therefore, apparatus for forming a trench comprises a blade rigidly carried by a blade carrier for support by a tractor vehicle (the term "tractor" being used
10 to define any vehicle for drawing the blade through the ground) so as to be drawn in use through the ground in the manner of a ploughshare, the blade being generally flat, lying in a plane generally normal to the ground, and having a leading edge inclined at an angle to the plane of the ground, a transverse plate being
15 secured to at least part of the leading edge of the blade, the width of the plate defining the width of the trench to be formed by the tool.

20 In use of the tool of the present invention the transverse plate is drawn through the ground at an angle such that the soil contacted thereby experiences a "lift" from the trench being formed whilst surplus soil can flow to either side of the trench forming plate as the tool is drawn through the ground. The apparatus
25 of the present invention provides means for resisting any tendency of the trench forming plate to sink into the ground, for which purpose the mounting assembly by which it is carried preferably fixedly retains the tool to the tractor vehicle in a controlled or controllable
30 orientation.

In order to ensure adequate loosening of the soil for subsequent displacement by the trench forming plate

- 3 -

as this is drawn through the ground, the lower end of the leading edge of the blade may be provided with a rigid tooth similar to the cutting teeth with which buckets and other tools of a conventional excavating machine are provided. Such tooth is preferably arranged with the major portion of its lower face extending generally parallel to the ground and a cutting tip inclined slightly downwardly whereby to exert a slight downward pressure on the tool as it is drawn through the ground. Further in order to avoid clogging by vegetation when the tool is used on grassland, there is preferably provided an additional downwardly directed blade, or a wheel which serves to cut the surface of the ground as the tool is drawn through it.

Preferably the blade and the plate are made from plate steel and reinforcing fillets are provided at selected locations between the blade and the tooth. Such reinforcing fillets may be permanently secured to both the blade and the plate or may be so arranged as to permit exchange of the plate for another of a different width. In a preferred embodiment the blade carrier has a central slot within which the blade can be located, and transverse pins are passed through spaced apertures in the blade carrier, traversing the slot whereby to define locating points for the blade on the carrier. The blade has cooperating apertures for receiving the pins, and different apertures may be provided for locating the blade in various different positions with respect to the carrier to vary the depth to which the blade extends thereby varying the depth of the trench formed by the plate and blade as they are drawn through the ground.

- 4 -

If the tool is drawn by a track-laying vehicle having a three point linkage, however, this depth can also be adjusted by varying the height at which the three point linkage is set to carry the tool.

5

Preferably the blade carrier comprises two side members defining the said slot, these side members being joined at the rear by a pivotal coupling member suitable for attaching subsequent components of the apparatus in a train to be towed by the tool. Such pivotal coupling also allows the components of a train to turn with respect to one another making it easier to turn the equipment at each end of a field without requiring complex uncoupling and recoupling operations.

15

In the preferred embodiment the slot for the blade is spanned at the forward end by a transverse stiffening member. This transverse stiffening member may also carry the lower pair of a three point linkage coupling for attachment to the three point linkage of the tractor vehicle as mentioned above. Such side members may also carry an upright member which supports the upper connection for the three point linkage. Triangular braces on the transverse stiffening member and on the upright are provided for ensuring complete rigidity of the tool in use. Such triangular braces, in the form of triangular fillets or gusset plates, extend between the side members and the transverse stiffening member, between the side members and the upright (on either side of the slot) and between the transverse stiffening member and the upright member.

20
25
30

In use of the tool soil is displaced by the transverse

- 5 -

plate, lifted to the surface and allowed to flow laterally outwardly onto the shoulders of the trench as the tool is drawn through the ground. In order to prevent the soil from falling back into the trench after the plate has passed, the side members are preferably provided with depending lateral flaps which extend downwardly for a depth substantially equal to the depth to which the transverse trench-forming plate extends whereby to prevent displaced soil from re-entering the trench too soon. Such re-entry is not allowed in fact until after the subsequent part of the apparatus has passed, whereupon back-filling is encouraged by means which will be described in greater detail below.

According to another aspect of the present invention trench forming and filling apparatus comprises, in combination, a trench forming tool and trench filling equipment including a hopper for stones or other like trench filling material (hereinafter referred to as "fill"), the hopper having two parallel depending lower chute walls extending parallel to the length of the equipment (that is parallel to the longitudinal axis thereof) and two laterally inclined guide members spaced more widely at their forward end than at their rearward end whereby to guide displaced soil inwardly towards the trench as the apparatus is drawn along.

Such guide members may be attached to the hopper in any suitable manner, for example by means of chains or guide rods or the like.

Preferably the hopper is provided at its rear end with a lower gate which determines the level of fill

- 6 -

in the trench as the hopper is drawn past. The two parallel depending lower chute walls extend in operation into the trench itself and constitute an effective continuation of the depending flaps of the trench forming tool, being very slightly closer together, for example by the thickness of the material of the flaps, and again preventing displaced soil from re-entering the trench until the required filling material has been placed in the bottom of the trench by the hopper.

10 The rear gate determining the "fill" level is preferably adjustable since the height of the hopper above the ground is effectively fixed, so that the depth of fill can be varied simply without requiring the apparatus to be removed from the ground.

15 The present invention also comprehends drain laying apparatus comprising a trench forming tool as defined above, trench filling apparatus and a pipe guide operable to direct a flexible pipe into a trench formed by the trench forming tool immediately prior to filling the trench by the trench filling apparatus.

25 Such pipe guides are preferably carried on the hopper itself, and, in the preferred embodiment, extend through the interior of the hopper to a point at the lowermost region of the hopper where the pipe can be laid directly onto the floor of a trench formed by the immediately preceding trench-forming tool.

30 The present invention also comprehends drain laying apparatus as hereinbefore described, in combination with a stone separator acting to remove stones from the soil at least in a broad strip adjacent the trench being formed, and operable to direct stones separated

- 7 -

from the soil into the hopper whereby to de-stone the soil and lay the stones as a permeable fill below the ground level and immediately above a drain pipe laid in the bottom of the trench.

5

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

10 Figure 1 is a side view of the trench forming tool constituting a part of the embodiment of the present invention;

 Figure 2 is a plan view of the tool illustrated in Figure 1;

15 Figure 3 is a side view, partly in section, of the apparatus of the invention, including a hopper having a pipe-laying guide;

 Figure 4 is a perspective view from above and behind of the assembled apparatus;

20 Figure 5 is a perspective view from above and in front of the assembled apparatus; and

 Figure 6 is a sectional view taken on the line VI-VI of Figure 4.

25 Referring now to the drawings, the tool illustrated is adapted to be mounted on a three point linkage of a tractor vehicle. Because of the forces which will be involved in drawing the tool through the ground it is anticipated that the tractor vehicle will be a

30 track-laying vehicle capable of exerting a considerable traction. As is known, the conventional three point linkage as is used on, for example, agricultural tractors and other such tractor vehicles, comprises two

- 8 -

tongue-like elements lying in a common horizontal plane, the third plane of the tongues being generally vertical, and a third tongue which forms, with the other two, a triangle lying in a generally perpendicular transverse plane with respect to the longitudinal axis of the vehicle. These tongues are mounted at the ends of arms which can pivot about horizontal transverse axes and suitable hydraulic actuators are provided for causing the arms to turn so as to effectively raise and lower the implement attached to the linkage. The quadrilateral linkage formed by the upper arm and the two lower arms ensures that the equipment carried by the linkage is maintained in approximately the same orientation as it is raised and lowered, although in practice the rear of the tool is raised more than the front upon elevation. For mounting to such a linkage the tool of the present invention is provided with three pairs of linkage connector plates generally indicated 11, 12 and 13. The two pairs of lower linkage connector plates, 11, 12 each have two coupling holes 14, 15 for receiving a connector pin and the plates are mounted on a transverse channel section member 16 such as by welding. The transverse channel member 16 is secured to a main body assembly comprising two channel section elements 17, 18 secured together to define a central slot 19 extending through-out the length of the tool and only spanned by the transverse reinforcing member 16.

Secured to the channel section members 17, 18 the respective downwardly extending plates 20, 21, these two plates being spaced, like the channel members mentioned above, from one another by the slot 19.

- 9 -

The channels of the channel members 17, 18 are placed facing outwardly away from the slot 19 with the upper channel members and the lower plate members being secured by welding along the adjacent flange of the channel member to secure the two components on each side of the slot 19 together. Two coupling rings 24, 25 of substantial dimensions are welded to the rear end of the channel elements 17, 18 and the plates 20, 21 spanning the slot 19 and securely retaining the left and right sides of the body element in the predetermined configuration. The forward ends of the two sides are, of course, retained in position by the upper transverse support 16 which spans the slot 19. The lower plate members carry a cutter wheel 22 on an arm 23 which extends forwardly for a short distance beyond the forward end of the channel members 17, 18.

Located in the slot 19 is the trench forming leg of the tool, generally indicated 25. This leg comprises a generally flat substantially rectangular blade 26 having two holes formed therein for receiving pins 27, 28 passing through pin housings 29, 30 respectively secured to the channel members 17, 18 and to the lower plate members 20, 21 respectively, to constitute a secure, but removable, fixing for securing the blade 26 to the longitudinal body of the tool.

At the forward lower end of the blade 26 there is a foot 31 having a tapered tooth-like shape with a chisel edge 32 for penetrating the soil. The leading edge of the blade 26 is covered by a transverse trench

- 10 -

forming plate 33 the transverse width of which determines the width of the trench being formed, and which may be tapered or have parallel sides. Triangular reinforcing fillets 34 are welded in position between the trench forming plate 33 and the plate 26 constituting the main support of the leg 25.

In operation the tool is drawn through the ground by a tractor vehicle in the manner of a plough, but instead of cutting the soil and turning it like a plough share the cutter wheel 22 parts the surface vegetation and the tooth 31 loosens the soil, whilst the trench-forming plate 33 elevates it and allows it to fall loosely on either side of the thus-formed trench. To prevent the loose soil from falling back into the trench the tool is further provided with guard plates 35, one on either side of the longitudinal body assembly and spaced slightly less than the width of the trench-forming plate 33 so that these project slightly into the upper part of the trench as the tool passes, thereby preventing the loosened soil from falling back into the trench until such time as this is required.

Because of the substantial forces which are applied to the tool in use, triangular reinforcing webs are provided between the longitudinal body assembly and the transverse arm 16, and the upper connector linkage 13 is supported on an upstanding column 37 which is reinforced by a pair of triangular webs 38 secured to the upper edge of the upper channel members 17, 18 on either side of the slot 19.

- 11 -

A hopper 42 is attached to the trench-forming tool at the rear by means of the two rings 24, 25 which constitute upper and lower pivots for receiving a vertical pivot pin 39 which passes through two lugs 40, 41 formed on the forward end of the hopper 42, and which are positioned so that the upper lug 40 passes over the upper ring 24 and the lower lug 41 passes under the lower ring 25. This allows the tool to support the hopper 42, determining its vertical level with respect to the ground and at the same time allowing it to pivot about the vertical axis defined by the pin 39 so that the combination does not act rigidly when the equipment is being turned.

The hopper 42 comprises an upwardly open chamber defined by a forward wall 43, two lateral inclined walls 44, 45 and a rear inclined wall 46. The front wall 43 is substantially vertical and the two lateral inclined walls 44, 45 slope inwardly from a relatively wide spacing at the top to define a narrow parallel sided slot 47 at the bottom. The width of the slot 47 is very slightly less than the spacing of the guard plates 35 which in turn are spaced slightly less than the width of the trench-forming plate 33 which defines the width of the trench being formed by the tool in use.

Projecting downwardly from the lower parallel edges of the inclined sides 44, 45 are two guide plates 48, 49 the height of which is rather less than the

- 12 -

depth to which the digging tooth 31 of the tool projects so that the plates 48,49 constitute, in use, reinforcing slide guides for holding up the sides of the trench and also for preventing displaced soil from re-entering the trench. It is important to note that the outwardly inclined walls 45,44 are spaced from the ground level generally indicated by the line G in Figures 1 and 3 by the distance d in Figure 3 so that they do not come into contact with the displaced soil which will be lying in a curving mound, which contact would cause further displacement of the soil and thus waste of energy in laterally displacing it further than is necessary.

At the rear the two guide plates 48,49 are spanned by an adjustable rear plate 50 the position of which can be varied in a vertical plane by means (not shown) and for a purpose which will be described in greater detail below.

A grid of longitudinal bars 51 extend between the vertical front wall 43 and the inclined rear wall 46 of the hopper 42 to act as a filter for large stones which are to be fed into the hopper by means of a chute 52 forming part of a stone feed mechanism on a vehicle which is moved alongside the trench-forming tool of the present invention in a manner which will be described in greater detail below. The grid 51 is carried by a rectangular frame 62 pivoted at pivots 63 to the side wall of the hopper. An hydraulic ram 64 is provided for turning the grid from a closed position, illustrated in Figure 4, to an open position past vertical to allow any stones lodged in the grid to be tipped over the side of the hopper 42.

- 13 -

The forward wall 43 is formed with a guide channel 53 having an upper forwardly facing guide mouth 54 and a lower curved exit 55 defined by a curved front plate 56 and a curved rear plate 57 extending into the slot 47 defined by the two guide plates 48, 49. These components define a guide channel for a pipe 58 carried in a coil, for example on the tractor vehicle and led through this guide into the bottom of the trench formed by the tool.

10

Finally, the side walls 44, 45 of the hopper carry support legs 57, 58 in the form of rigid lugs which carry trailing guides 59, 60 which act as soil displacement plates widely spaced at the forward end and held more narrowly together at the rearward end by the legs 57, 58. The guide plates 59, 60 act as the equipment is drawn across the soil to laterally displace the loose soil on either side of the hopper 42 inwardly towards the trench line causing it to back fill into the trench as the equipment passes it over it. Chains 61, 62 extend from the forward end of each leg 57, 58 to a cross bar 63 carried by the hopper front wall 43.

15

20

In operation, then, the tool is drawn over the ground so that the trench forming plate 33 cuts a trench the width of which is determined by the width of the plate 33 by lifting the soil and allowing it to fall freely on either side, where it is retained by the cover plates 34 until the guide plates 48, 49 pass that particular point. A pipe 58 is fed down the guide constituted by the entrance chute 54, the guide channel 53 and the two curved plates 56, 57 and is laid in the bottom of the trench. Stones entering the hopper 42 through the chute 52 and filtered by the grid of bars 51

25

30

are laid over the pipe 66 to form a permeable fill,
and the level of this fill is determined by the back
plate 50 the vertical adjustment of which determines
the height above the pipe 58 to which the stones can
5 reach before being cut off by the plate 50 itself.
The stones may be introduced from a separate supply
such as a quarry, in which case they would most con-
veniently be in the form of gravel or chippings, fed
by a suitable mechanism from a lorry leading to the
10 chute 52. Alternatively, a known stone separating
machine may be used for separating stones from the soil
in a strip covered by the machine adjacent the trench-
forming tool, in which case the stones delivered by the
chute 52 will have been separated from the soil in the
15 field being treated, and it is for this reason that the
grid of bars 51 is required since the range of sizes
of stones thus separated may include rather large stones
which would block the trench or extend above the height
defined by the back plate 50. Finally, as the tool
20 passes, the two guides 59, 60 cause the displaced soil
to be moved laterally to refill the trench leaving a
drainage pipe covered with a permeable fill at the bottom
and a usable depth of tilth for agricultural purposes
in the upper layer, the depth of this upper layer being
25 such that it can be worked by ploughing or rotovating
or any other cultivating process without disturbing the
stones in the lower part of the trench. Effective
drainage is thus obtained without causing any interrup-
tion to the working surface of the field as was previously
30 the case with surface laid drainage stone channels. The
pipe 58 may be of any convenient flexible type, although
a corrugated pipe having a plurality of small apertures
allowing the entrance of drainage water along the
whole of its length is preferred.

- 15 -

Additional chains 67 extend from the front cross beam 16 to the sides 44, 45 of the hopper 42 to restrict pivoting movement during normal use; these can be released to allow pivoting when required.

5

Within the hopper 42; along the inside of the wall 44 is a shutter plate 68 movable between a retracted or open position as shown in Figure 6 and a closed or extended position where it closes the bottom of the hopper 42. The shutter plate 68 is connected to an hydraulic actuator 70 for effecting the movement. A cover plate 69 extends over both the shutter plate 68 and the actuator 70 to protect it from abrasion or damage by the material moving through the hopper in use of the equipment. Thus when filling trenches with gravel, if the hopper is still partly full at the end of a run the tool can be raised out of the ground by means of the three point linkage and escape of gravel can be prevented by closing the bottom of the hopper with the shutter plate 68.

20

In another embodiment, not shown, provision is made for ready interchange of the trench-forming components to allow trenches of different widths to be produced.

25

For this purpose the soil plate 33 is held removably on the blade 26, and the side plates 35 and 48, 49 can be removed and replaced. In this embodiment the hopper is split horizontally to allow the lower components to be replaced to effect such trench width interchange. The line of the horizontal separation is approximately two thirds down the inclined side walls 44, 45 of the hopper 42.

30

- 16 -

5 It has been found that the most satisfactory inclination of the soil lifting plate 33 is in the region of 45° although a shallower angle to the ground will result in less tractive force being required. At steeper angles the soil tends to be compacted by the forward motion rather than lifted.

Claims:

- 5 1. Apparatus for forming a trench, characterised in that it comprises an elongate blade (26) carried on a blade carrier (17, 18, 19) adapted to be supported by a tractor vehicle so as to be drawn in use through the ground lying in a generally upright plane with its leading edge inclined rearwardly and upwardly in relation to the direction of forward movement of the apparatus, a soil lifting plate (33) being secured to the said leading edge of the blade (26) so as to lie in a plane orthogonal to the plane of the blade (26), the width of the said soil lifting plate determining the width of the trench formed by the apparatus.
- 10 2. Apparatus according to Claim 1 characterised in that the said upright blade (26) is removably housed in a slot (19) in the said blade carrier (17, 18, 19) and held in such a way as to be movable between a working position in which its leading edge is inclined upwardly and rearwardly, and a transport position in which the said leading edge is inclined downwardly and rearwardly.
- 15 3. Apparatus according to Claim 1 or Claim 2, characterised in that the blade carrier (17, 18, 19) has two generally parallel side walls (35) on either side of the said blade (26), lying in planes generally parallel to the plane of the blade (26) and spaced a distance not greater than the width of the soil lifting plate (33) on the leading edge of the blade (26), the side walls extending downwardly from the blade carrier so that in use they extend into at least the upper part of a trench formed by the tool as it is drawn through the ground.
- 20 25 30

4. Trench forming and filling equipment, characterised in that it comprises trench forming apparatus according to any preceding claim, in combination with trench filling apparatus comprising a hopper (42) having
5 inclined walls (44, 45, 46) defining a vessel with a longitudinally extending opening (47) in the lower part thereof, and two generally parallel depending side walls (48,49) extending downwardly from the said opening and being in approximate alignment with the
10 said side walls (35) of the trench forming apparatus whereby to project at least partly into the trench formed by the trench forming apparatus as it is drawn through the ground with the trench filling apparatus attached thereto so as to follow in the same path.

15
5. Trench forming and filling equipment according to Claim 6, characterised in that the said hopper (42) carries two laterally inclined soil deflection members (59,60) in the form of elongate plates lying in gener-
20 ally upright planes and spaced more widely at the forward ends than at the rear so as to deflect soil lifted out of the trench by the soil lifting plate (33) and return it to the line of the trench, filling in over any material introduced into the bottom of the trench
25 through the said hopper.

6. Trench forming and filling equipment according to Claim 4 or Claim 5 characterised in that the said hopper (42) includes guide means (53,54,56,57) by which
30 elongate flexible pipes or cables can be introduced into the bottom of the trench prior to the introduction of

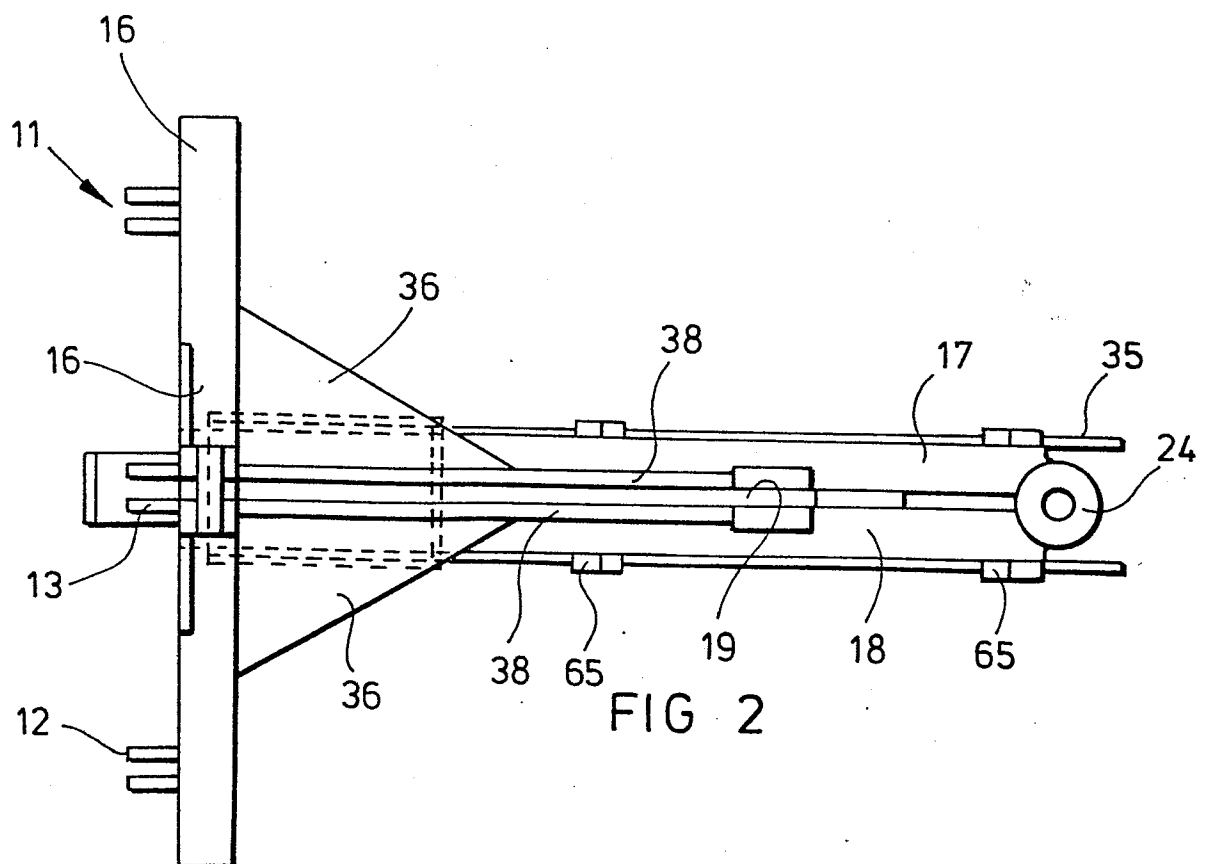
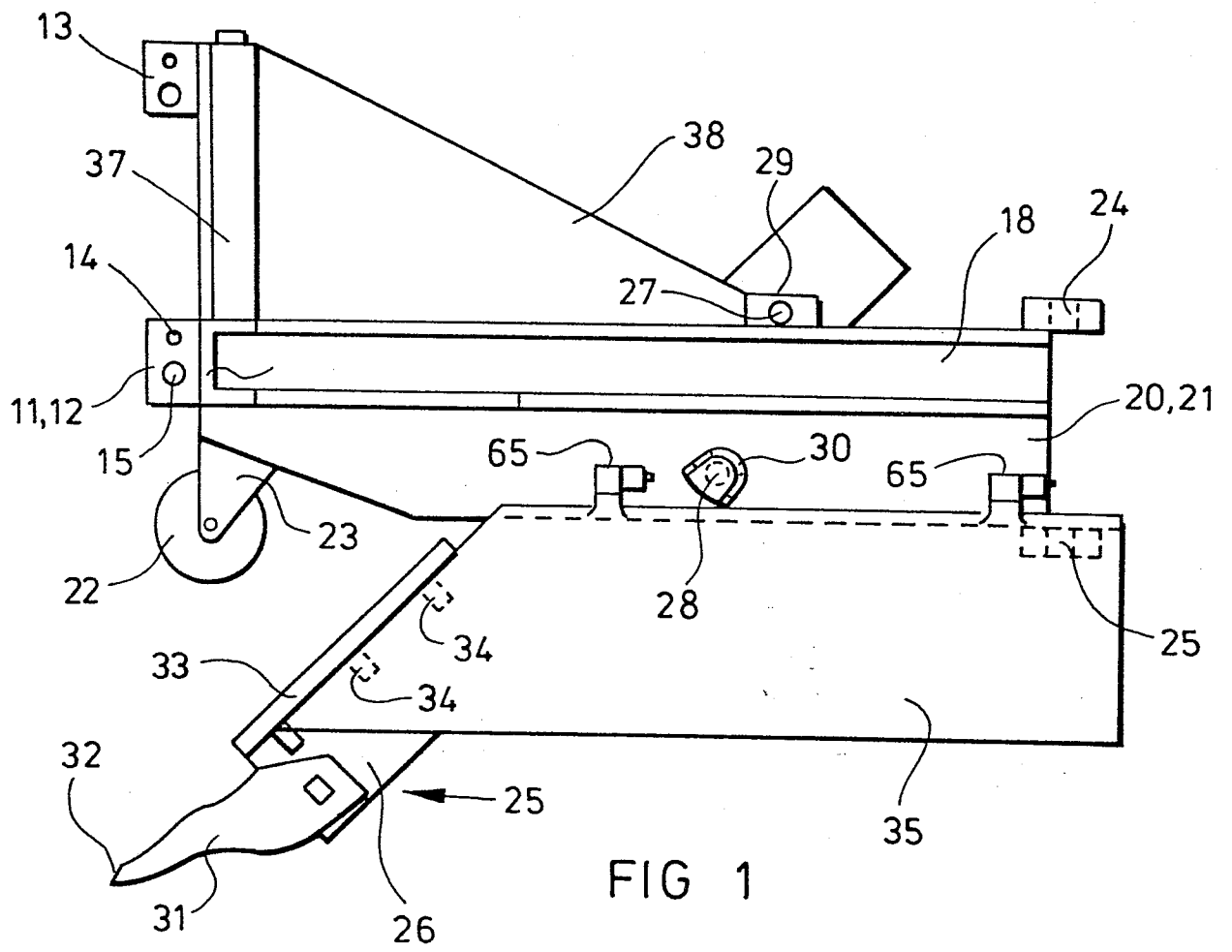
material through the opening (47) in the bottom of the hopper (42) and the back-filling of soil by the said soil deflection plates (59,60).

5 7. Trench forming and filling equipment according to
any of claims 4,5 or 6, characterised in that the hopper
(42) has a rear wall (46) carrying an adjustable plate
(50) which extends transversely of and between the said
two downwardly projecting lower side walls (48,49) of
10 the hopper (42), the said adjustable plate determining
the level in the trench of material introduced thereinto
through the hopper (42).

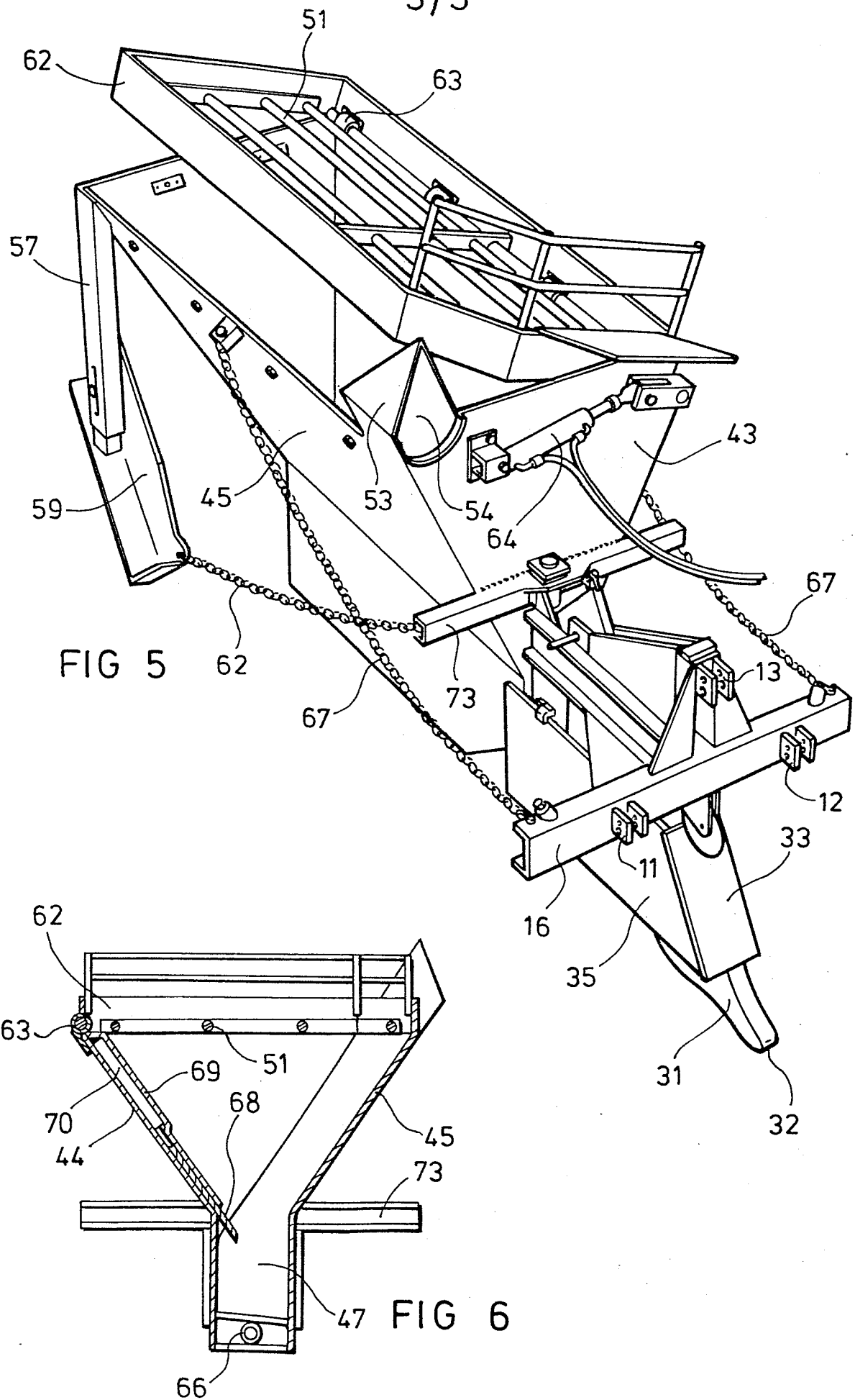
15 8. Trench forming and filling equipment according to
any of Claims 4 to 7, characterised in that the said
hopper (42) is provided with a shut-off plate (68)
displaceable between a first, retracted position, in
which it leaves the hopper opening unobstructed and a
second, extended position, in which it projects into the
20 said hopper opening (47) whereby to prevent or at least
substantially restrict the movement of material in the
hopper (42) through the said opening (47).

25 9. Trench forming and filling equipment according to
any of claims 4 to 8, characterised in that the top of
the hopper is covered by a grid of bars (51) serving to
prevent the entry of large stones above a size range
determined by the spacing of the bars into the hopper
the bars being carried by a surrounding frame (62) which
30 is mounted by pivotal connection means (62) to the upper
rim of the hopper to be tiltable to an inclined position
to allow any large stones caught by the bars (51) to be
tipped off.

10. Trench forming and filling equipment according to any of Claims 4 to 9, characterised by the further addition of apparatus for removing a surface layer of soil adjacent to or alongside the trench being formed,
5 separating from the removed soil stone or other particles above a given size or size range, returning the fine soil particles to the ground and supplying the separated stones and other large particles to the hopper (42) of the trench filling apparatus so as to be introduced
10 thereby into the bottom of the trench.



3/3





European Patent
Office

EUROPEAN SEARCH REPORT

0123468
Application number

EP 84 30 2352

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. ³)
X	GB-A-2 055 440 (GILCHRIST) * Page 1, lines 65-112; figures *	1, 4, 6, 7	E 02 F 5/10 E 02 F 5/12
Y		3, 5, 8, 10	
Y	US-A-4 142 817 (LAZURE) * Figures 1, 5 *	3	
A		1	
Y	FR-A-2 284 715 (KOMPEER) * Page 3, lines 24-27; figure 1 *	5	
Y	GB-A-1 361 611 (THORNTON AND GARNETT) * Page 1, lines 59-64; figure *	8	TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
Y	FR-A-2 204 101 (MATROT) * Page 3, lines 20-26; figure 2 *	10	E 02 F A 01 B
A	FR-A-1 399 392 (NIEDERWEMMER) * Page 3, column 1 ; figure 6 *	9	
A	FR-A-1 156 475 (POYPE)		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11-07-1984	Examiner RAMPELMANN J.
CATEGORY OF CITED DOCUMENTS		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	
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			



DOCUMENTS CONSIDERED TO BE RELEVANT			Page 2
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
A	GB-A-1 587 077 (BIRTILL)		

A	DE-B-1 176 064 (BETHÄUSER)		

			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11-07-1984	Examiner RAMPELMANN J.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone		T : theory or principle underlying the invention.	
Y : particularly relevant if combined with another document of the same category		E : earlier patent document, but published on, or after the filing date	
A : technological background		D : document cited in the application	
O : non-written disclosure		L : document cited for other reasons	
P : intermediate document		& : member of the same patent family, corresponding document	