

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets

(11)

Publication number:

0 164 242
A2

(12)

EUROPEAN PATENT APPLICATION

(21)

Application number: 85303725.7

(51)

Int. Cl.⁴: **E 01 C 19/48**
// E01C23/09

(22)

Date of filing: 28.05.85

(30)

Priority: 29.05.84 GB 8413629

(71)

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(43)

Date of publication of application: 11.12.85
Bulletin 85/50

(72)

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(84)

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

(74)

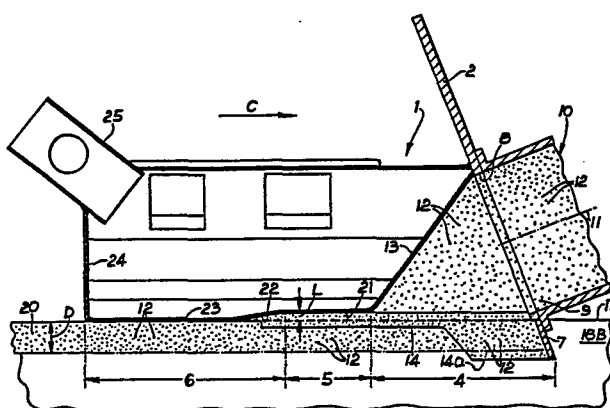
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Method of machine filling a trench and apparatus for effecting same.

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The invention relates to a method and apparatus for the machine filling of a trench with a flowable filler e.g., asphalt. The method comprises introducing filler 12 into the trench 18 from a mould 1, the latter being advanceable along the trench 18, and the mould 1 precluding forward spreading of filler 12 to trench area 18B, with advancement of the mould 1 commencing when a pre-determined filler pressure is sensed, the filler 12 firstly being shaped and/or skimmed to a level L above the top of the trench 18, and thereafter being pressed to a level contiguous with surfaces 17 to either side of the trench 18 by means of a pressure plate 23. The mould 1 comprises leading, intermediate and trailing mould portions 4, 5, 6, the leading portion 4 being provided with restraining wall(s) 7, the intermediate portion being provided with shaping/skimming surface 21, and the trailing portion 6 being provided with a transition surface 22 and pressure plate 23.



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"METHOD OF MACHINE FILLING A TRENCH AND
APPARATUS FOR EFFECTING SAME"

This invention relates to a method of machine filling a trench and apparatus for effecting same, with a flowable filler such as asphalt or concrete intended to form a surfacing layer.

Conventionally, trenches, or at least the upper levels of trenches, are surface layered, e.g. with asphalt etc., by hand, in circumstances where a trench has been dug into a previously asphalted road or pavement surface. Such hand filling is labour intensive, requiring the filler to be barrowed from a dumped supply and also usually requiring additional plant in the form of a tamping roller to ensure that the filler and indeed other filling material in the trench is adequately compacted and that the final level of the trench is contiguous with the original road or pavement surface to either side of the trench. Whilst for small scale operations hand filling is economically viable, for large scale operations such as the requirement to meet the extensive underground cable installations demanded when cable T.V.

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networks are installed, a mechanised system would be highly advantageous, and the present invention is aimed at providing such a mechanised method and apparatus for trench
5 filling with asphalt etc.

According to a first aspect of the present invention, a method of machine filling a trench with a flowable filler comprises:-

(a) introducing the filler into the
10 trench from a mould itself supplied from a filler supply source, and the mould being progressively advanceable along the trench;

(b) allowing the filler upon being discharged from the mould into the trench to
15 spread from the mould into pressure contact with the sides of the trench, whilst precluding forward spreading of the filler, to any appreciable extent, to an area of the trench in advance of the mould, and whilst
20 allowing a build up in pressure of the filler within the mould and/or trench to a pre-determined amount;

(c) commencing advancement of the
mould along the trench when the pre-determined
25 filler pressure is sensed so as to achieve progressive filling of the trench;

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(d) shaping and/or skimming the filler by means of the mould to a level projecting from the top of the trench by a predetermined amount; and

5 (e) maintaining at least a trailing end of the mould (with respect to the direction of mould advance) in pressure contact with the filler by means of a pressure plate to compress the filler to a level
10 contiguous with surfaces to either side of the trench.

According to a second aspect of the present invention, there is provided apparatus for carrying out the above defined method, the
15 apparatus comprising a mould attachable to a vehicle (so as to be advanceable with respect to a trench to be filled) by means of an attachment member, the mould being elongate, and at least partially of inverted "U"-
20 section, and comprising:-

(a) a leading mould portion (having regard to the direction of advance of the mould, in use) incorporating an inlet orifice for the introduction into the mould of filler
25 from a supply source, and at least one restraining wall extending at least laterally

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to preclude, in use, entry of filler to any appreciable extent into an area of trench in advance of the mould, with the restraining wall(s) being so dimensioned as to penetrate,
5 in use, at least an upper portion of the trench;

(b) an intermediate mould portion extending from the leading mould portion and comprising a shaping/skimming surface serving,
10 in use, to shape/skim the filler to a predetermined level above the top of the trench; and

(c) a trailing mould portion comprising a downwardly inclined transition
15 surface extending contiguously from a trailing end of the shaping/skimming surface, and a pressure plate extending contiguously from the trailing end of the transition surface to define a downstream, outlet end of the mould
20 to compress or displace the filler such that the trench is surfaced to a level contiguous with surfaces to either side of the trench.

The invention thus provides a method and apparatus for mechanising the filling, or
25 surfacing, of a trench, with the operation being continuous, so long as a source of

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filler material remains available, in contrast to the intermittent, hand filling technique. The sensing of the pressure of the filler encourages filler density consistency, whilst
5 the pressure plate is intended to squeeze out any voids remaining in the filler and to produce a satisfactory surface finish to the filler at the level of the original surfaces to each side of the trench.

10 Pressure filling of the trench with filler results not only from continuously charging the mould with pressurised filler, but also constraining the pressurised filler between the sides of the trench, the
15 restraining wall of the leading mould portion and the shaping/skimmming surface of the intermediate mould portion.

It will be appreciated that the mould needs to have lateral dimensions determined by
20 the width of the trench to be filled, the method and apparatus in accordance with the invention being particularly suitable for filling relatively small width trenches, e.g. 100 mm, as would be required for the laying of
25 underground cables for a cable T.V. network, and with such a trench the depth of fill would

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be approximately 60 mm for example.

The mould in accordance with the invention may be mounted on a vehicle generally of the kind described in my GB Patent 2116620. Thus, the vehicle may
5 comprise basically a wheeled chassis, a power unit mounted on the chassis, a bulk filler receiving hopper mounted on the chassis, an auger located at the bottom of the hopper to
10 work and compact the filler, and a compaction tube associated with the lower end of the auger. The compaction tube is conveniently vehicle mounted, with the mould attachable to the vehicle at an outlet end of the compaction
15 tube.

The mould, over its leading and intermediate portions is preferably opened bottomed and of generally inverted "U"-shape, so that filler is discharged into the trench
20 from the open bottom of the leading mould portion.

The attachment member of the mould may comprise an attachment plate with a plurality of bolt holes for releasably attaching the
25 mould to the vehicle. The mould, and in particular the leading mould portion, may

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comprise a relatively large inlet orifice
e.g., a circular through hole, corresponding
in cross section to the outlet end of the
compaction tube, the leading mould portion
5 gradually being reduced in cross section from
the inlet orifice.

The mould may comprise two parallel,
spaced apart, side plates extending over at
least the length of the intermediate and
10 leading mould portions and over the
intermediate mould portion interconnected by
the shaping/skimmming plate, which is
preferably planar. The side plates may also
extend along part of the transition surface.
15 The side plates at the leading mould portion
are preferably provided with downwardly
extending webs at the leading end of the
leading mould portion, and at their terminal
ends are conveniently combined with the
20 lateral restraining wall, so that all three
plates constitute the restraining wall, all
three plates projecting downwardly so as to be
able to penetrate as far as possible, in use,
towards the bottom of the trench, e.g. by up
25 to 55 mm (for a trench requiring a 60 mm deep
filling of asphalt etc). The side plates are

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preferably spaced apart by a distance slightly less than the width of the trench so as to leave marginal edges between the outsides of the side plates, and the inside of the trench, to accommodate any irregularities in trench width. It follows that filler can spread into these marginal edges and the filler can finally be compacted by the pressure plate into these marginal edges. With this arrangement the pressure plate is preferably fan-shaped in plan extending from the narrower, shaping/skimming plate to a dimension approximating to, or just exceeding, the width of the trench. The pressure plate may be located in a plane which is parallel to that in which the shaping/skimming surface is located. It is also preferred to provide the mould with a pair of outer, parallel side plates, spaced apart by a distance exceeding the width of the trench, so that lower edges of these outer side plates may constitute slide shoes to slide along the road or pavement surface beyond the trench and hence dictate the position of the mould, and in particular its shaping/skimming surface and pressure plate, with respect to the trench.

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If the mould in accordance with the invention is intended for use with asphalt, the mould is preferably provided with a burner mounting, whereby a burner nozzle, e.g. for propane, may
5 be mounted on the mould to heat the latter.

The invention will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:-

10 Figure 1 is a side elevation of a mould for use with the method and apparatus in accordance with the first and second aspects of the invention;

 Figure 2 is an enlarged axial section
15 through Figure 1;

 Figure 3 is an underneath plan view of Figure 1;

 Figure 4 is an end elevation of Figure 1 in the direction of arrow A; and

20 Figure 5 is an end elevation of Figure 1 in the direction of arrow B.

 In the drawings, a mould 1 is attachable to a vehicle (not shown), such as that described in GB patent 2116620, by an
25 attachment member in the form of an inclined attachment plate 2 provided with a plurality

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of attachment bolt holes 3, the vehicle incorporating a hopper from which trench filler e.g., asphalt, is conveyed to the mould 1 e.g., by a screw auger, the vehicle, and hence the mould 1, being movable in the direction of arrow C.

The mould 1 comprises a leading mould portion 4, an intermediate mould portion 5 and a trailing mould portion 6, with the leading and intermediate portions having an open bottom and being generally of inverted "U"-shape.

A leading end of the leading mould portion 4 is defined by the attachment plate 2 which incorporates a restraining wall formed partly by a tongue 7 on a lower edge of the attachment plate 2, the tongue 7 extending transversely of the trench to be filled, as will be described in detail later. The leading mould portion 4, and in particular its attachment plate 2, also comprises a relatively large asphalt inlet orifice in the form of a circular through hole 8 corresponding in diameter to outlet end 9 of a compaction tube 10 of the vehicle, the other end of the compaction tube 10 being in

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communication with the vehicle hopper and the compaction tube 10 also housing an auger (not shown) rotatable about longitudinal axis 11 to displace asphalt, which is indicated at 12 by the randomly dotted area of Figures 2 and 4. The leading mould portion 4 behind the hole 8 is gradually reduced in cross section by means of an inclined plate 13 extending over the length of the leading mould portion 4.

The mould 1 comprises a first pair of parallel side plates 14 spaced apart by almost the width of the trench to be filled as can be seen from Figure 4, and extending over the length of both the leading and intermediate mould portions 4 and 5, the side plates 14 being downwardly extended at webs 14a at the leading end of the leading mould portion 4, and the webs 14a being attached to the lateral tongue 7, so that the two webs 14 and the tongue 7 all constitute restraining walls.

As can be seen from Figure 3, the mould 1 also comprises a second pair of parallel side plates 15 spaced apart by a distance exceeding the width of the trench, so that lower edges 16 of these outer side plates 15 constitute slide shoes, to slide along the

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road or pavement surface indicated at 17
beyond the trench, indicated at 18. It would
normally be the case that the trench 18 is
initially filled with hardcore etc., to a
5 surface level 19, with the method and
apparatus of the invention being employed to
provide an asphalt, finishing layer 20 to a
depth D of only 60mm for example.

The intermediate mould portion 3 is
10 provided with a shaping/skimming surface
indicated at 21, which surface is planar, and
to opposite edges of which surface are
attached one each of the inner side plates 14.
As can best be seen in Figure 2, the inner
15 side plates 14 extend beyond the intermediate
mould portion 5 over a part of inclined
transition surface 22 which extends
contiguously from the skimming surface 21 to
pressure plate 23 of the trailing mould
20 portion 6, the pressure plate 23 being
generally planar and being generally fan-shaped
in plan, extending from the shaping/skimming
surface 21, which is less than the trench
width W, to a dimension just exceeding the
25 width of the trench. A terminal end of the
pressure plate 23 is defined by an upwardly

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extending end wall 24 which carries a mounting holder 25 for a propane burner nozzle (not shown) but available to heat the mould 1 and hence to maintain the asphalt within the mould 1 within an optimum workable and mouldable temperature range.

Considering now the method by which the apparatus and in particular the mould 1 operates, as mentioned previously asphalt 12 is discharged into the trench and in particular onto a surface level 19 from the open bottom of the leading mould portion 4, with discharge of asphalt into an area 18B of the trench 18 in advance of the mould 1 being constrained by the retaining wall 7 and webs 14a of the leading mould portion 4 and with asphalt making pressure contact with sidewalls 18A of the trench 18. In accordance with the method of the invention, mould advance is commenced when a pre-determined fluid pressure is sensed. This is preferably achieved by the arrangement described in my patent GB2116620 i.e. the auger is fluid driven and the auger drive fluid pressure is sensed and/or monitored, so that hydraulic drive to road wheels of the associated vehicle is coupled to

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the auger drive. In other words, the rate of advance of the mould 1 along the trench 18, and hence the rate of trench filling is controlled in accordance with the prevailing asphalt conditions, including ambient temperature. In general, the mould 17 of my GB Patent 2116620 is simply replaced by the special mould 1 shown in Figures 1 - 5 of this application to attain the trench filling method and apparatus herein described. As the vehicle and hence the mould 1 progresses along the trench 18, the skimming surface 21 of the intermediate mould portion 5, together with the side plates 14 of the intermediate mould portion 5, compress and shape the asphalt 12 to a level L slightly above that of the surface 17 to either side of the trench 18. Continued advancement of the mould 1 brings the transition surface 22 into engagement with the elevated asphalt L, thus beginning compression of the elevated asphalt, and finally the pressure plate 23 of the trailing mould portion 6 compresses the asphalt layer 20, removing any remaining voids, and ensures that the fill is only to the level of the surfaces 17 to each side of

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the trench 18.

CLAIMS

1. A method of machine filling a trench with a flowable filler comprising:-

(a) introducing the filler (12) into the trench (18) from a mould (1) itself supplied from a filler supply source, and the
5 mould (1) being progressively advanceable along the trench (18);

(b) allowing the filler (12) upon being discharged from the mould (1) into the
10 trench (18) and to spread from the mould (1) into pressure contact with the sides (18A) of the trench (18), whilst precluding forward spreading of the filler (12), to any appreciable extent, to an area (18B) of the
15 trench (18) in advance of the mould (1), and whilst allowing a build up in pressure of the filler (12) within the mould (1) and/or trench (18) to a pre-determined amount;

(c) commencing advancement of the
20 mould (1) along the trench (18) when the pre-determined filler pressure is sensed so as to achieve progressive filling of the trench (18);

(d) shaping and/or skimming the
25 filler (12) by means of the mould (1) to a

level (L) projecting from the top of the trench (18) by a predetermined amount; and

(e) maintaining at least a trailing end (6) of the mould (1) (with respect to the direction of mould advance) in pressure contact with the filler (12) by means of a pressure plate (23) to compress the filler (12) to a level contiguous with surfaces (17) to either side of the trench (18).

2. Apparatus for filling a trench with a flowable filler (12) by the method defined in Claim 1, comprising a mould (1) attachable to a vehicle (so as to be advanceable with respect to a trench (18) to be filled) by means of an attachment member (2), the mould (1) being elongate, and at least partially of inverted "U"-section, and comprising:-

(a) a leading mould portion (4) (having regard to the direction of advance of the mould (1), in use) incorporating an inlet orifice (8) for the introduction into the mould (1) of filler (12) from a supply source, and at least one restraining wall (7) extending at least laterally to preclude, in use, entry of filler (12) to any appreciable

extent into an area (18B) of trench (18) in advance of the mould (1), with the restraining wall(s) (7) being so dimensioned as to penetrate, in use, at least an upper portion
5 of the trench (18);

(b) an intermediate mould portion (5) extending from the leading mould portion (4) and comprising a shaping/skimming surface (21) serving, in use, to shape/skim the filler
10 (12) to a predetermined level (L) above the top of the trench (18); and

(c) a trailing mould portion (6) comprising a downwardly inclined transition surface (22) extending contiguously from a
15 trailing end of the shaping/skimming surface (21), and a pressure plate (23) extending contiguously from the trailing end of the transition surface (22) to define a downstream, outlet end of the mould (1) to
20 compress or displace the filler (12) such that the trench (18) is surfaced to a level contiguous with surfaces (17) to either side of the trench (18).

3. Apparatus as claimed in Claim 2, wherein the mould (1) is vehicle mounted, the vehicle comprising a wheeled chassis, a power

unit mounted on the chassis, a bulk filler -
receiving hopper mounted on the chassis, an
auger located at the bottom of the hopper to
work and compact the filler, and a compaction
5 tube (10) associated with the lower end of the
auger and in communication with the inlet
orifice (8) of the mould (1) for transfer of
filler (12) from the compaction tube (10) to
the mould (1).

4. Apparatus as claimed in Claim 3,
wherein the mould (1), over its leading and
intermediate portions (4, 5) is opened
bottomed and of generally inverted "U"-shape.

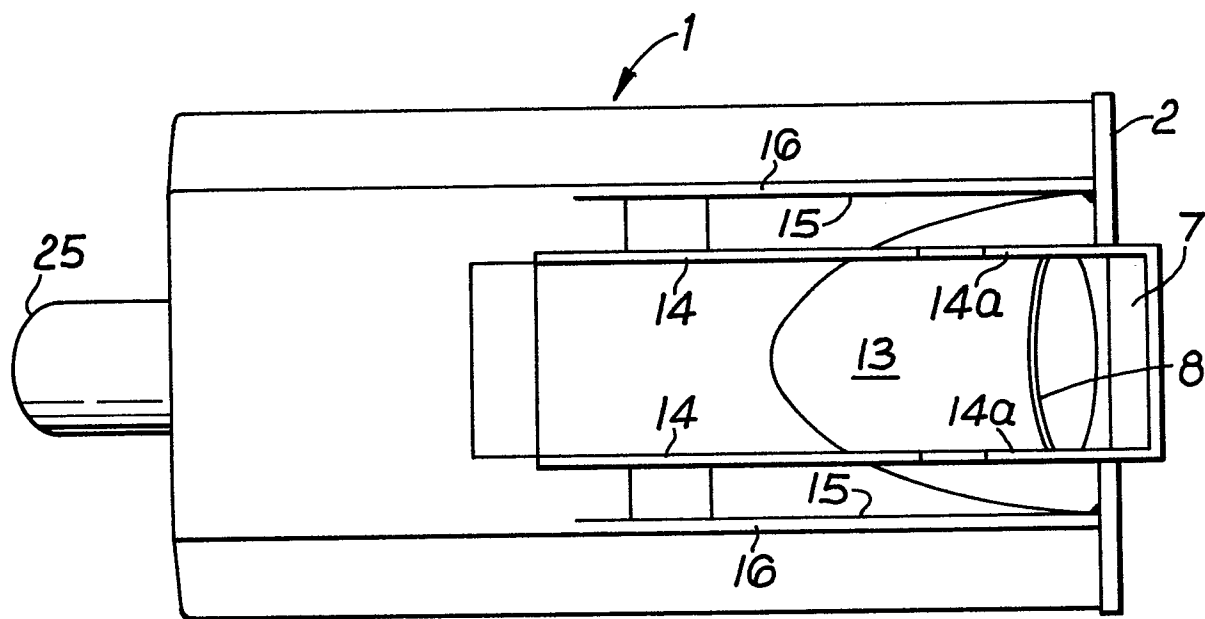
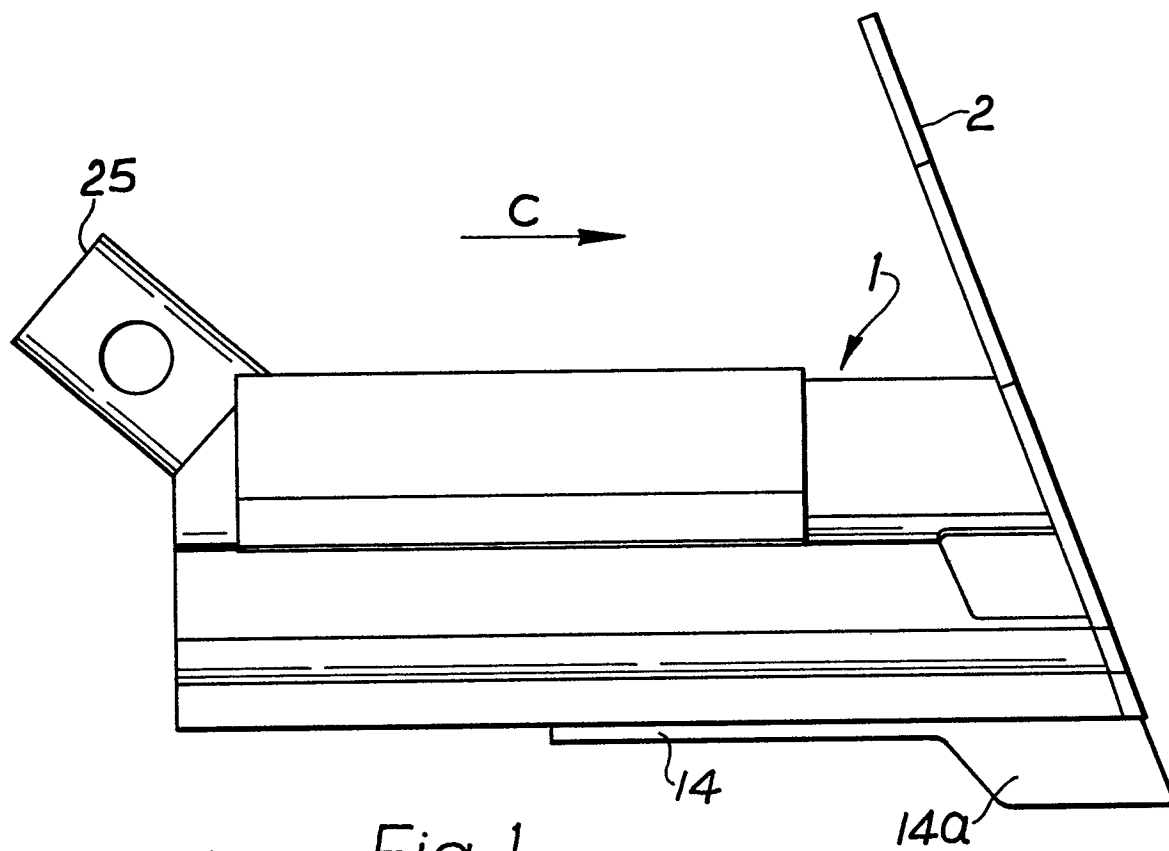
5. Apparatus as claimed in Claim 3
or Claim 4, wherein the leading mould portion
(4) is gradually reduced in cross-section from
the inlet orifice (8).

6. Apparatus as claimed in any one
of Claims 2 to 5, wherein the mould (1)
comprises two parallel, side plates (14)
spaced apart by a distance slightly less than
5 the width of the trench (18) extending over at
least the length of the intermediate and
leading mould portions (5, 4) and, over the
intermediate mould portion (5), interconnected
by the shaping/skimming plate (21).

7. Apparatus as claimed in Claim 6,
wherein the side plates (14) are provided with
downwardly extending webs (14a) at the leading
end of the leading mould portion (4), which
5 webs (14a) at their terminal ends are combined
with the lateral restraining wall (7).

8. Apparatus as claimed in any one
of Claims 2 to 7, wherein the mould (1) is
provided with a pair of outer, parallel side
plates (16), spaced apart by a distance
5 exceeding the width of the trench.

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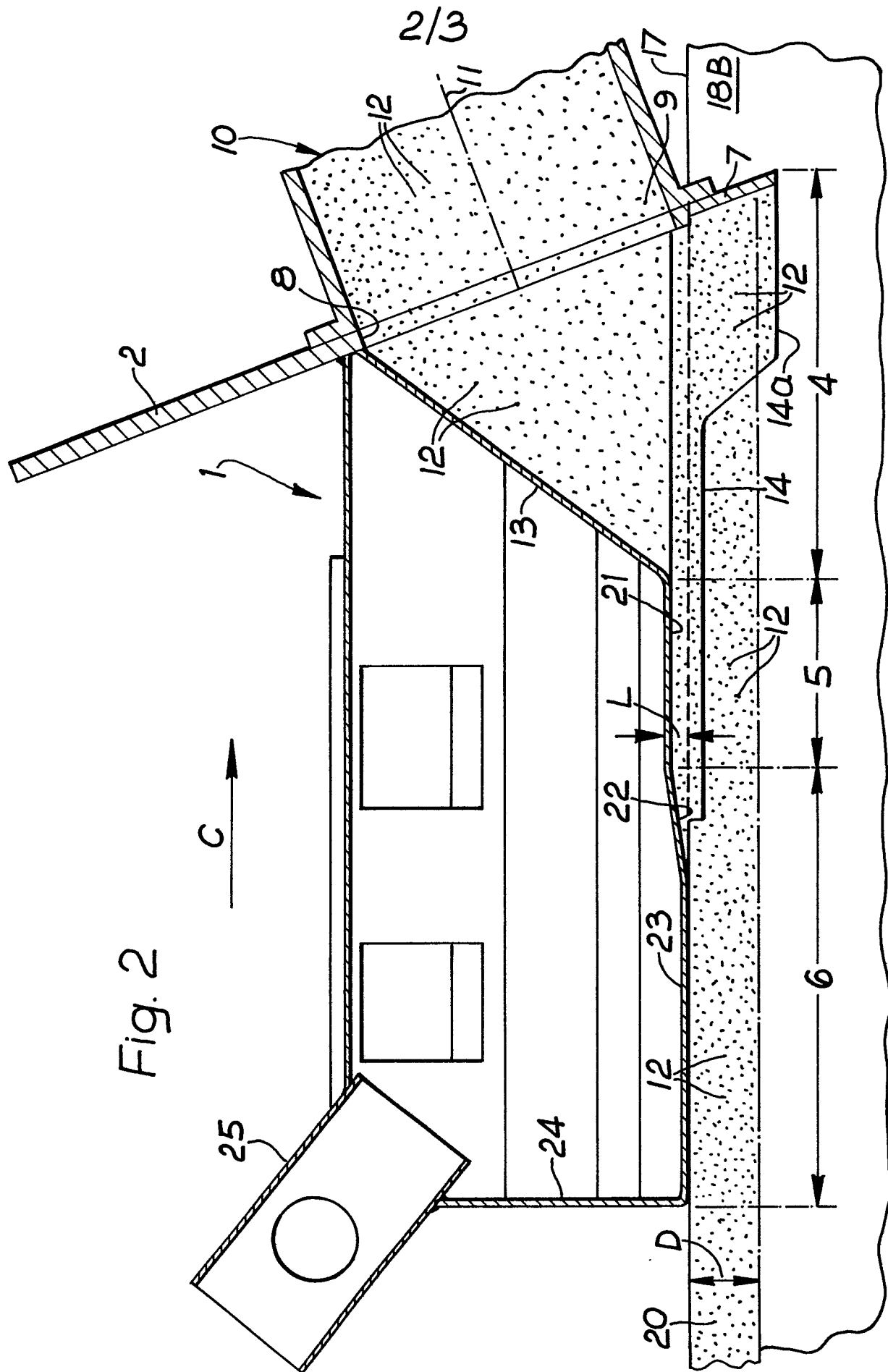


Fig. 2

