A trench filling unit comprising a hopper (24) for the storage of material to be inserted into the trench, conveyor means (28) for moving the material from the hopper (24) into the trench, and blade means (42, 43) in use mounted in the trench having a lower edge (46, 47) defining the upper extent of the material moved into the trench. The blade means may be of variable width and may be tilttable both with respect to a horizontal and vertical axis.
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TRENCH FILLING UNIT

The present invention relates to a trench filling unit.

It has become commonly necessary for highway authorities to reinforce the edge of highways or, for example, to remove and refill French drains alongside the highway. In either case, by means of a trenching machine or otherwise, a trench is dug alongside the carriageway which then has to be filled, either with suitable material to reinforce the highway or, in the case of French drains, with suitable water permeable material.

Refilling such trenches has commonly involved delivery of the material to the site, the material being simply piled up and inserted into the trench by hand or with small excavators or, in some cases, a side tipping truck has been used. In the first case, the job becomes very time consuming and labour intensive and in the latter case, whilst quicker, control of the amount of material added to the trench is difficult.

The present invention provides a trench filling unit comprising a hopper for the storage of material to be inserted into the trench, means for moving the material from the hopper into the trench, and means, in use, mounted in the trench having a lower edge defining the upper extent of the material moved into the trench.

The means for moving the material from the hopper into the trench may be in the form of a conveyor and may preferably be in the form of a motorised belt conveyor extending through the bottom of the hopper.
The means for defining the height of the material in the trench may be adjustable both as to its width and its height with respect to the remainder of the unit, its angle with respect to the horizontal and its angle with respect to the axis of the unit. This allows the apparatus to be used to partially or completely fill the trench, to be used in different widths of trench, to compensate for camber in the surface on which the unit stands. The means for defining the height of the material within the trench may be provided in the form of a blade. The blade may be a double blade, that is two overlapping blades which may be moved apart so as to adjust the effective width of the blade so as to be substantially the same as the width of the trench. This allows use in trenches of different widths or along a trench whose width varies.

The trenching unit may include wheels whereby it may pass along a road surface, and may be self propelled or may include means whereby it can be pushed or pulled by a suitable tractor or other vehicle. The hopper is preferably at a height such that a standard tipper truck may tip material into the hopper and since the hopper will commonly have less of a capacity than a tipper truck, means may be provided on the trench filling unit whereby a truck may be connected to or pushed by the trench filling unit during the loading operation.

In use of the trench filling unit, therefore, the trench filling material may be inserted into the hopper by means of a tipper truck, the material may then be conveyed from the hopper into the trench, and the height of the material in the trench can be determined by the blade. Thus, as the trench filling unit moves
along, the blade pushes any excess material in front of the trench filling unit.

Two trench filling units embodying the invention will now be described by way of example only with reference to the accompanying drawings in which

Figure 1 is a diagrammatic front view of a first trench filling unit according to the invention,

Figure 2 is a diagrammatic side view of the apparatus of Figure 1,

Figure 3 is a diagrammatic front view of an alternative arrangement of part of the apparatus of Figure 1,

Figure 4 is a diagrammatic sectional view of part of the apparatus shown in Figure 3,

Figure 5 is a cross section on the line 5-5 of the part of the apparatus of Figure 3,

Figure 6 is a perspective view from the front of the hopper part of a second trench filling unit according to the invention,

Figure 7 is a perspective view similar to Figure 6 showing the blade part of the apparatus of Figure 6,

Figures 8-10 show the blades of the trench filling unit of Figure 6 is different dispositions,

Figure 11 shows an alternative blade arrangement,

Figure 12 shows part of the apparatus of Figure 6
showing the means by which the blade unit is moved, and,

Figure 13 is a part rear perspective view of the blade part of the apparatus of Figure 6.

Figures 1 to 5 show a first trench filling unit 10 comprising a chassis 11 (see Figure 2) which extends generally laterally across a road surface 12. The object is to fill in a trench 13 alongside the road surface 12. The chassis 11 is mounted on wheels or rollers 14, the rollers 14 allowing the trench filling unit 10 to move along the length of the road 12 parallel to the trench 13. The chassis 11 has upwardly extending legs 16 at its rear (see Figure 2, the trench filling unit moving from left to right in Figure 2), to the rear of which are mounting lugs 17 whereby the trench filling unit may be connected to, for example, an excavator or tractor 18. In the present embodiment, the trench filling unit is moved by the tractor 18 pushing the unit 10, although in alternative arrangements the trench filling unit may, be self powered by a suitable petrol or diesel engine.

The front of the chassis 11 also includes upwardly mounted legs 19 which mount rollers 21, the rollers being at a suitable disposition to engage the rear wheels 22 of a tipper type truck 23, which may be used to tip material to be inserted into the trench 13 into the trench filling unit 10.

The chassis 11 mounts a hopper 24 which as can be seen, extends across the width of the chassis and generally comprises a standard shape for a hopper, that is having upright upper walls 26 and sloping lower walls 27.
Opposite lower side walls 29,30 of the hopper adjacent to the opposite ends of the conveyor 28 include closable openings 34,35 the part of the upper wall 26 adjacent to the position of the truck 23 includes a hingable section 25 which may be hinged downwards under control of a hydraulic ram 38 so as to allow easy access of the rear end 39 of the truck 23 to allow material to be discharged from the truck 23 into the hopper 24.

The conveyor 28 is driven by a hydraulic motor 40 (not shown).

The sloped lower walls 27 of the hopper 24 extend to a point above a conveyor 28, the conveyor 28 forming the bottom wall of the hopper 24. The conveyor 28 extends from side to side between the rollers 31,32, the rollers 31,32 being mounted together with intermediate rollers 33 between two side plates 36,37.

The conveyor incorporates a belt of suitable material running over the rollers 31,32,33, and may comprise, a belt of butyl rubber which is both wear and heat resistant so that it can be used to transport both abrasive material such as rock and hot material such as hot asphalt.

It will be noted that one end (the left end in Figure 1) of the conveyor 28 extends beyond the hopper 24 to a position overlying, the trench 13.

Mounted at this left end of the trench filling unit in a blade apparatus which is used so as to ensure that the top of the material passed into the trench is not greater than a certain height within the trench. The blade arrangement comprises two blades 42,43 which
extend downwardly into the trench, the blades overlapping one another and being mounted by an arrangement whereby they may be moved apart from one another so as to vary the effective width of the combined blades, and may also be moved up and down so that the height of the lower edges 46,47 of the blades 42,43 may be adjusted. A simple arrangement of screw jacks 45 is shown in Figure 1, in which the dashed lines show the maximum extent of width and depth of the combined blades 42,43.

Details of a preferred arrangement of mounting and controlling the blades 42,43 is illustrated in Figures 3, 4, and 5. A chassis member 48 extends from the chassis 11 horizontally and mounts the blade apparatus.

Upstanding from the chassis member 48 are 3 pillars 51,52,53, the three pillars 51-53 mounting therebetween a shaft 54. As will be described hereafter, each of the opposite pillars 51,53 includes an arrangement whereby the respective end of the shaft 52,54 may be lifted or lowered together or separately so that the shaft may be lifted or lowered horizontally or may be tilted so that one end is higher than the other. This can be used to compensate for the camber of the roadway on which the apparatus is standing.

The shaft 54 mounts the blades 42,43, the blades 42,43 having on opposite edges upwardly extending fingers 56,57,58,59 which wrap around the shaft 54.

Two of the fingers 56,58 incorporate lock means 60 whereby the fingers may be connected to the shaft 54 in such a way as to stop horizontal movement along the shaft 54.

SUBSTITUTE SHEET
It will be understood that each blade 42,43 has some adjustable movement horizontally along the shaft 54.

The shape of the blades can be understood from Figure 5, and it will be seen that they lay against the chassis member 48.

Referring to the means for moving the ends of the shaft 54 up and down, referring to Figure 4, it will be seen that the pillars 51,53 incorporate a generally vertically extending screw shaft 61, the screw shaft 61 passing through a threaded bore 62 adjacent the end of the shaft 54. Rotation of the screw shaft 61 will move the end of the shaft 54 up and down. The upper end of the screw shaft 61 is connected via a universal coupling 63 to a vertical shaft 64 and handle 66, the shaft 64 being captively mounted in a horizontal top plate 67 of the pillar 51. The arrangement of pillar 51 and 53 is the same.

Operation of the trench filling unit will now be described. Initially the trench filling unit is disposed on the roadway 12 in a suitable position whereby the hopper 24 may be loaded by a truck 23. The opening 34 at the end of the hopper 24 adjacent the trench 13 is opened. The blades 42,43 are adjusted so as to be at a desired width and so that the lower edges 46,47 are at the required height and horizontal or otherwise as desired. This is carried out by undoing the lock means 60, sliding the two blades 42,43 apart to the desired distance (as seen in Figure 3, the desired distance is substantially the width of the trench). The blades are then locked to the shaft 54 by means of the lock means 60 and the ends of the shaft 54
are moved up and down so that the lower edges 46,47 are at the desired height and at the desired angle. This is done by rotating the handles 66, which rotates the screw shaft 61 and through the threaded engagement with the threaded bore 62 in the shaft 54, the ends of the shaft 54 are moved up or down. Once the blades have been set, the hopper 24 is filled by backing up a tipper truck 13 to the position shown in Figure 2, lifting the rear end of the tipper truck after the hingable section 25 has been opened as shown in Figure 2, and then material is passed from the rear of the truck into the hopper. It will be noted that the rear wheels of the truck connect with the rollers 21 of the chassis 11. A suitable tractor 18 is then connected to the lugs 17 and the hydraulic output from the tractor is connected to the hydraulic motor 40. The conveyor 28 is then set in motion by the motor 40.

The tractor then begins to push the trench filling unit 10 along the road and at the same time, the truck 23 having been put into neutral gear and the breaks disengage is pushed along by the tractor 18. As is common, because the capacity of the truck is greater than that of the hopper 24 it is necessary for the truck to remain in position continuously charging the hopper during operation of the apparatus.

The conveyor 28 moves material out from the hopper and discharges it above the trench whereby the material falls into the trench. It will be noted that the conveyor is positioned ahead of the blades 42,43 and so the conveyor is driven so as to supply more material to the trench than is required to fill the trench to the desired height, the blades then pushing a small amount of material along ahead of them, and the height to
which the material fills the trench being defined by the lower edges 46, 47 of the blades 42, 43. In this way, the trench can be very rapidly filled, typically at the rate of something in excess of 10 metres a minute.

In a typical example where a trench has been dug along the side of the road so as to widen the road or to reinforce the road, the trench filling unit may be used after the trench has been dug on a plurality of occasions, initially putting in base rock material, wherein the blades will be inserted deeply into the trench, and then with the second pass, with finer rock material, where the blades will be raised relative to the first part, and then with one or two further passes with asphalt and tarmac wherein the blades are raised higher on each occasion.

The trench filling unit can be used with relatively small man power and at a high rate.

It will be noted that the force on the front surface of the blades 42, 43 caused by material in front of the blades is transmitted through to the chassis 48. If, however, for any reason, the machine reverses, then the blades 42, 43 can pivot away from any obstruction.

There are some further features of the trench filling unit not so far described. Means may be provided to move the side plates 36, 37 along their length with respect to the chassis 11. Under these circumstances, the conveyor 28 is moved so that instead of extending beyond the hopper on the side of the trench shown in Figure 1, the conveyor extends beyond the hopper on the opposite side. In combination with this feature, the
hydraulic motor 40 may be reversible so that, on opening the opening 35, material may be discharged from the opposite side of the trench filling unit. Such an arrangement may be useful if a narrow country lane is being extended on both sides and it prevents the necessity for turning the apparatus around. Means may then be provided for disconnecting the blade arrangement 41 from one side and mounting it on the opposite side.

Referring now to the trench filling unit illustrated in Figures 6 to 13, it will be seen that in this case the trench filling unit comprises a self propelled unit 100 having six wheels 101. Similar parts in the trench filling unit 100 carry the same reference numerals as in the trench filling unit 10.

The hopper 24 is supported on two further small wheels 102.

In general terms, the hopper is similar to that shown in Figures 1-5, although a somewhat different shape.

Between the hopper 24 and the cab 103 of the trench filling unit 100 there is mounted a hydraulic swivel arrangement 104 best illustrated in Figure 12. In the case of this trench filling unit 100 the blade unit 41 is mounted to a girder section 106 which in turn is mounted to the swivel unit 104. The swivel unit 104 is rotatable about a vertical axis by means of a hydraulic ram 107 and swivelable about the axis of the unit 100 by means of the hydraulic ram 108. The girder section 106 is movable up and down horizontally by up and down movement of the swivel unit 104 controlled by extension and contracton of the rams 111 and 112 simultaneously.
The blade unit 41 is mounted to the outer end of the girder section 106. The blade unit is very much the same as shown in Figure 5, except that the two blades 42,43 include at their opposite edges, forwardly directed plates 113,114 respectively. The blade unit 41 is mounted to slide in and out towards the trench filling unit 100 by means of a ram 116.

The trench filling unit 100 operates in a similar manner to that of the trench filling unit 10 and we will only describe the differences. In the present case the unit being self propelled can be moved under its own propulsion. As before, the hingable section 25 of the hopper 24 is hinged downwardly by means of the hydraulic rams 38 so as to allow material to be fed into the hopper 24 by means of a tipper truck.

The raw material is fed from the hopper 24 by the conveyor 28 into the trench. As the trench filling unit moves along, the blade unit 41, which is now disposed behind the hopper 24, operates to level the material in the trench as before. Various positions of the blade unit 41 are shown in Figures 8 to 10. In Figure 8, the blades are in conventional position below the level of the ground on which the trench filling unit 100 stands whereby material tipped into the trench by the conveyor 28 may be levelled to a level below the level of the ground. Thus, for example, in this case, the trench filling unit may be used to insert and level road stone or concrete into the trench. In a second higher position of blade units shown in Figure 9, wherein the lower edges 46,47 of the blades 42,43 are level to the ground level, the conveyor 28 may be used to convey tarmacadam into the
trench to suitably fill the trench to the correct level.

In some situations (for example if there is a camber of the road on which the trench filling unit is standing, or where it is intended that there should be some kind of camber on the top level of the trench or layers in the trench) the blade unit 41 may be pivoted with respect to the horizontal as shown in Figure 10. In a yet further configuration shown in Figure 11, the plate 114 of the blade 46 has been deleted, and in this arrangement, the girder section 106 is pivoted rearwardly with respect to the axis of the unit 100 so that any excess material in the trench, as well as being pushed forward by the blades, is pushed to one side away from the trench filling unit. In this respect it acts in the same way of the blade of a bull dozer.

The invention is not restricted to the details of the foregoing example. As already mentioned, the trench filling unit may be self propelled if desired. The means of moving each end of the shaft 54 up and down may be altered and indeed the means for mounting the blades 42, 43 may also be varied as desired.

In a preferred arrangement, adjustment of the effective width of the blades, and their height may be controlled hydraulically by means of hydraulic rams in place of the screw means described.

Although not shown, the chassis member 48 can mount behind the blades 42, 43, a tamping unit to consolidate the material inserted into the trench 13.
CLAIMS

1. A trench filling unit comprising a hopper (24) for the storage of material to be inserted into the trench, means (28) for moving the material from the hopper (24) into the trench, and means (42,43), in use, mounted in the trench having a lower edge (46,47) defining the upper extent of the material moved into the trench.

2. A trench filling unit as claimed in claim 1 characterised in that the means (28) for moving the material from the hopper (24) into the trench comprises a conveyor (28).

3. A trench filling unit as claimed in claim 2 characterised in that the conveyor (28) is a motorised belt conveyor (28) extending through the bottom of the hopper (24).

4. A trench filling unit as claimed in any of claims 1 to 3 characterised in that the means (42,43) for defining the height of the material in the trench is adjustable both as to its width and its height with respect to the remainder of the unit.

5. A trench filling unit as claimed in claim 4
characterised in that the means (42,43) for defining the height of the material within the trench comprises a blade (42,43).

6. A trench filling unit as claimed in claim 5 characterised in that the blade (42,43) comprises two overlapping blades (42,43) which may be moved laterally with respect to one another so as to adjust the effective width of the blade (42,43) so as to be substantially the same as the width of the trench.

7. A trench filling unit as claimed in claim 6 characterised in that mechanical screw means (45) are provided to move the two overlapping blades (42,43) laterally with respect to one another.

8. A trench filling unit as claimed in claims 6 or 7 characterised in that the two overlapping blades (42,43) are movable apart and up and down by mechanical screw means.

9. A trench filling unit as claimed in claims 6 or 7 characterised in that the two overlapping blades (42,43) are movable apart and up and down by hydraulic means.
10. A trench filling unit as claimed in any of claim 5 to 9 characterised in that the means (42,43) for defining the height of the material within the trench is pivotally mounted whereby reverse movement of the apparatus allows the means (42,43) to pivot out of its operative position.

11. A trench filling unit as claimed in any of claims 1 to 10 characterised in that said means (42,43) mounted in a trench may be mounted to the trench filling unit in opposite alternative positions to as to operate in a trench on opposite sides of the unit.

12. A trench filling unit as claimed in any of claims 5-10 characterised in that means (108) is provided for pivoting said blades (42,43) about a horizontal axis.

13. A trench filling unit as claimed in any of claims 5-10 characterised in that means (107) is provided to rotate said blades (42,43) about a vertical axis so that they are at an angle to the Longitudinal axis of the trench filling unit.
INTERNATIONAL SEARCH REPORT

I. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC: E 02 F 5/12, E 02 F 5/14

II. FIELDS SEARCHED

Classification System

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Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched

III. DOCUMENTS CONSIDERED TO BE RELEVANT

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"A" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search
6th September 1989

Date of Mailing of this International Search Report
2 OCT 1989

International Searching Authority
EUROPEAN PATENT OFFICE

Signature of Authorized Officer
T.K. WILLIS

Form PCT/ISA/210 (second sheet) (January 1985)
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