# United States Patent

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[54] **ROAD SUPPORT STRUCTURE**
**7 Claims, 3 Drawing Figs.**


[52] **U.S. Cl.** ..... **94/4,** 52/169, 52/300; 61/44
[51] **Int. Cl.** ..... **E01c 9/00**
[50] **Field of Search** ..... 61/42, 43, 44; 52/300, 169, 252, 259; 94/174, 4



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**ABSTRACT:** A support device for covering an excavation with a minimum interruption of the flow of vehicular traffic over the excavation including opposed support walls having fixedly secured thereto prefabricated L-shaped support members and prefabricated T-shaped support beams extending between opposed support members and fixedly secured thereto. The support members and the support beams both have reinforcing rod projections which are inserted into soft cement so as to form a permanent and strong supporting structure.

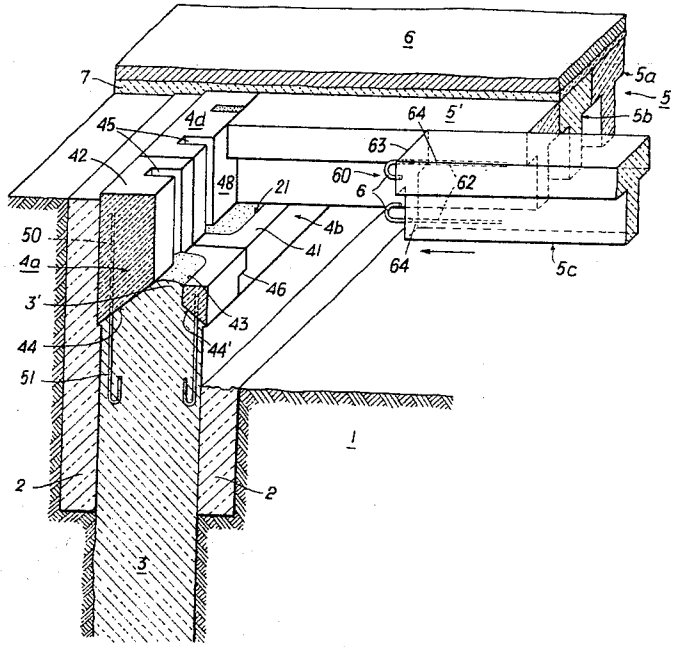
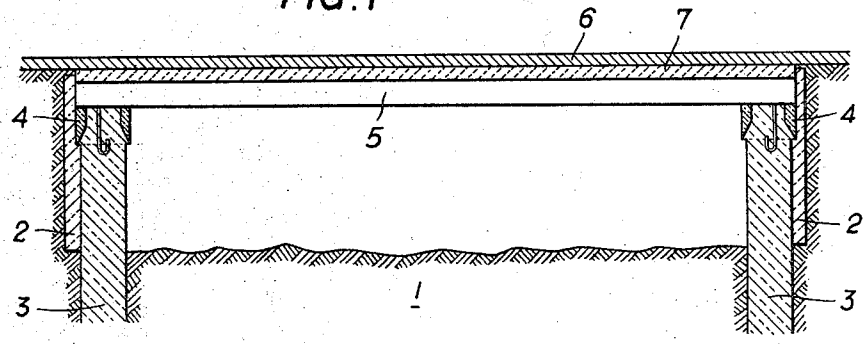



FIG. 1



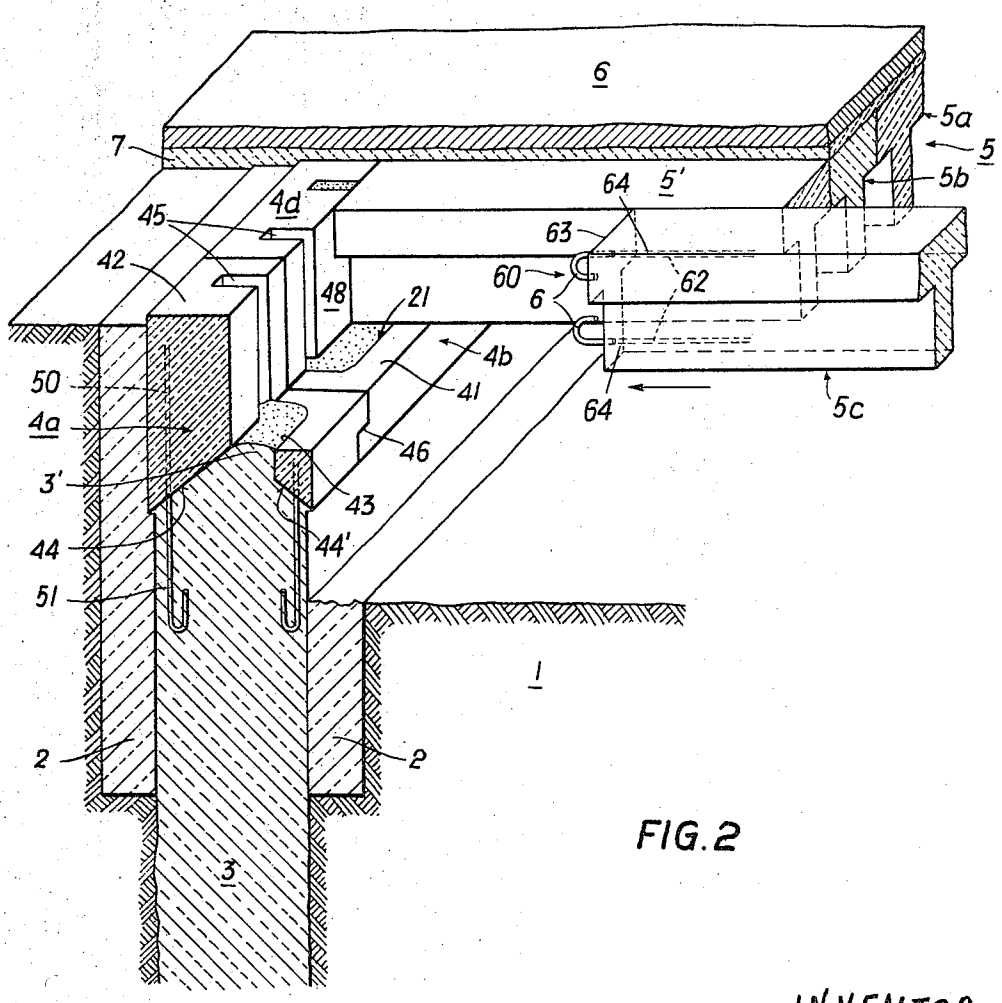




FIG. 2

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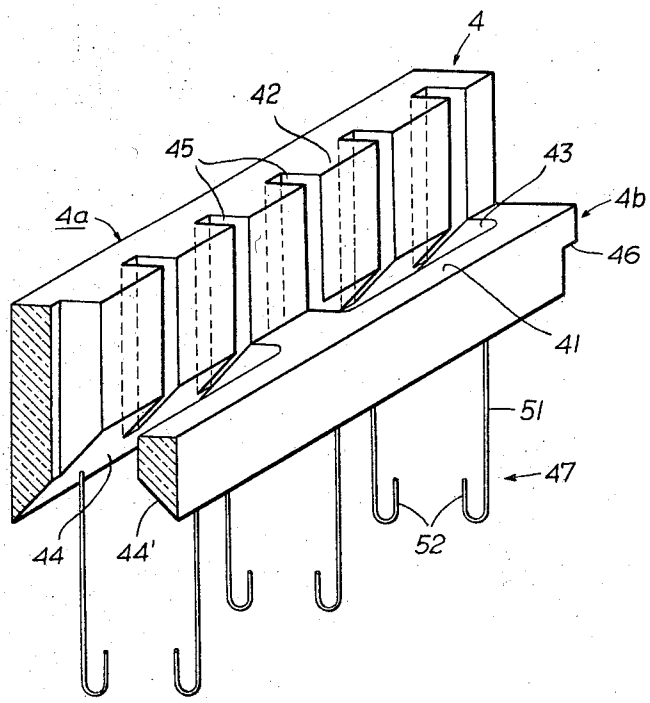
FIG. 3

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# ROAD SUPPORT STRUCTURE

This invention relates to a method and apparatus for the construction of a covering for an excavated foundation.

In large metropolitan cities, there is a constant necessity for new construction which requires removal of large street areas. This arises with the need for subway tunnels, street overpasses, underground garages and even in construction of large buildings.

It has been known in the prior art to do this by excavating guide ditches along opposed longitudinal sides of the excavation site and the placing of guide walls in these ditches for support members. Thereafter, the area between these members is excavated and a supporting structure is constructed extending between the opposed longitudinal walls. After this has been completed excavation below this reconstructed covering may be continued without disturbing traffic which would be passing over the reconstructed street.

However, one of the problems that has been faced in the prior art has been the necessity of allowing for extensive setting time of the concrete covering which extends between the two opposed support members. In some cases it has been necessary to wait a month or more before the road structure can be reconstructed over the area to be excavated. This interruption of traffic in large metropolitan areas can be quite inconvenient. Therefore, in this type of construction which is ever expanding in today's world, it is necessary to avoid these long periods of interruption of the passage of vehicular traffic through streets.

The present invention is an improvement over the prior art devices since it provides for the utilization of prefabricated support beams which are mounted and embedded permanently in concrete support members at opposed sides of the excavated site. This permits the immediate replacement of the road surface with a minimum loss of time and interruption of the traffic flow.

The above task is accomplished, according to the present invention, by providing for a prefabricated support base which can be permanently installed and avoids the necessity of temporary steel plates or other temporary structures during the complete excavation beneath the surface of the ground.

The invention additionally includes ancillary supporting and reinforcing concepts which provide for the necessary strength to permit normal traffic to pass over a road surface laid upon the support which excavation continues below ground level.

Accordingly, it is an object of this invention to provide a supporting structure for replacement of a road surface which structure is strong and may be installed quickly and efficiently allowing for the resumption of normal traffic flow with a minimum of interruption.

A further object of this invention is to provide addition reinforcement features that enhance the strength of the supporting structure to insure against possible damage or injury due to buckling of the supporting structure during the excavation process.

The various novel features which characterize the invention are pointed out with particularlity in the claims annexed to and forming a part of the specification. For a better understanding of the invention, its operating advantages and specific objective obtained by its use, reference should be made to the accompanying drawings and descriptive material in which there are illustrations which describe performing embodiments of the invention.

In the drawings:

FIG. 1 is a front elevation partially in section showing the support structure of the present invention.

FIG. 2 is a perspective view partially in section of a portion of FIG. 1.

FIG. 3 is a perspective view partially in section of the support element shown in FIGS. 1 and 2.

Referring to the drawings, there is shown the complete structure of the covering for an excavation, for example, for a tunnel below street level after the construction of the device to be hereinafter described.



When the work is to be begun, two guide ditches, approximately 2 meters in depth, are dug into the solid ground **1** extending from the level of the street **6**, along each of the opposed longitudinal sides of the site to be excavated, without interrupting normal street use by vehicular traffic. Each ditch is lined or filled with a wall **2**, as shown in FIG. 2, leaving an open space between each pair of walls **2**. In FIG. 1 only one guide wall **2** is shown; however, in FIG. 1 the tunneling has been substantially completed and the inner one of the guide walls **2** along each longitudinal side of the excavation has been removed since the supporting structure has been completed.

Turning again to FIG. 2, when the guide walls **2** have been inserted, the ground between the guide walls **2** is excavated to the desired depth. Then concrete is poured into the excavated opening up to a level located between the upper and lower edges of the outer guide wall **2** to form the support wall **3**. The crown **3'** of the wall **3** is slightly below ground level and will provide the support means for the cross beams to be added later. These beams in turn will support the reconstructed road at the proper time.

Immediately after pouring of the concrete walls **3**, the prefabricated support members **4** (FIG. **4**) are embedded upon the crown **3'** of the still fresh cement side walls **3** being held for setting purposes by the guides **2**.

The prefabricated members **4**, as is best seen in FIGS. **2** and **3**, include a plurality of downwardly projecting reinforcing iron rods **47**, which during prefabrication are fixedly mounted (FIG. **2**) to the block **4** by the upper extremities **50** of stem **51**. The downwardly projecting extremity **52** is U-shaped and during assembly the U-shaped projection is inserted into the freshly poured concrete so as to be immovable when the concrete is hardened. In the preferred embodiment, the U-shaped members are arranged in opposite pairs and arranged so that the extremities **52** of the U-shaped portions are closer to each other than the stem portions **51**. It has been found this enhances the strength of the structure; the extremity of one of said rods inserted into arm **4*a*** and the rod of each pair inserted into arm **4*b***.

Turning now to FIG. **3**, the support member is basically L-shaped and the upstanding arm **4*a*** of the member **4** is serrated by a plurality of vertically extending slots **45** forming vertical legs **42**, the upper face **4*d*** of which is at ground level. The horizontally extending arm **4*b*** has a series of grooves **43** in the horizontal face **41** which are freely communicable with the vertical slots at the point the vertical arm joins the horizontal arm and also as seen in FIG. **2** open to the crown **3'** of the side wall **3**. During installation of the support member **4**, concrete enters into the grooves **43** from the crown **3'** which is still soft, and additional concrete is poured into the grooves **43** to make a firm bond between the support member **4** and the crown **3'** of the concrete wall **3**. Care is taken however, not to place any concrete in the vertical slots **45** above the horizontal plane of surface **41** of arm **4*b*** at this time. Also the concrete in the grooves **43** is leveled to form a single contiguous level or step **21** having a flat surface between the freshly poured concrete and the surface **41** of the horizontally extending portion **4*b*** of the support member **4**.

After the concrete has set, and rods **47** are firmly secured to walls **3**, it is now possible to remove, as seen in FIG. **1**, the inner guide members **2** and to proceed with excavation of the ground **1** without further delay. At this time the road which has not been previously disturbed is excavated between longitudinal sides of the excavation site and the ground below to a depth sufficient to allow insertion of the support device for the reconstructed road over the excavation. When the concrete has set, and the sure engagement of the support member **4** with the side walls **3** has been achieved, it is now possible to insert T-shaped cross beams to form the supporting surface for the reconstructed road. In the embodiment shown the flat portion **5*a*** is in the uppermost position and the narrower stem **5*b*** downwardly extends therefrom. As was the case with the supporting member **4**, each end (one shows) of the cross beam **5** (FIG. **2**) has horizontally extending reinforcing rods **60** of a U-

shaped, arranged in opposed pairs, in which the U-shaped extremity **61** are curved towards each other and closer together than stems **64**. Rods **60** are located in alignment with and inserted into the vertical slots **45** of the upwardly extending arm **4***a* of the support member **4**. These cross beams are prefabricated and the extremity **62** of the hook is fixedly mounted to the beam. One hook is embedded in the flat portion **5***a* and the other in stem **5***b*.

In assembly, fresh concrete is poured into the slot **45** and the cross beams **5** are inserted so that the hooks **60** extend into the fresh concrete. The surface base **5***c* of the stem **5***b* rests on the surface **41** of the support member **4** and the leveled concrete in the grooves **43**.

The adjacent support beams **5** are arranged to form a contiguous level surface **5'** of flat portion **5***a* and are prefabricated in a fashion that all adjacent members bear against each other in flush relationship and the projecting hooks **60** fit into spaced slots **45** as desired. The front ends **63** also come flush against surface **48** of arm **4***a* since hooks **60** project outwardly from the surface of front end **63** of beam **5**, a distance less than the depth of slots **45**.

It is also pointed out that the support members **4** are beveled inwardly at **44** along the bottom edge of arm **4***a* and at **44'** of the bottom edge of arm **4***b* to make the insertion of members **4** into the fresh concrete forming wall **3** simpler. The adjacent members **4** are interlocked by means of a step shaped locking arrangement at edge **46** of adjoining support members **4**.

When assembling the supporting beams **5**, they are lowered into the grooves **45** to rest upon the step **21** formed by surface **41** and concrete is then poured into the grooves **45**. This provides support for the road to be reconstructed, in a relatively short time.

Once the support beam has been inserted, it is then possible to insert an intermediate covering layer **7** of any suitable material which may be metal and to construct on the top the road surface **6** again.

It is apparent from the forgoing description that various modifications may occur to those skilled in the art without departing from the spirit and scope of the present invention. Such modifications are intended to be included within the present invention and, accordingly, the specific embodiments disclosed should not be construed as limiting.

I claim:

**1**. A method of forming a support structure over an area to be excavated so that the area can be excavated without interferring with the activities being carried out directly above the excavated area comprising the steps of excavating a pair of laterally spaced guide ditches downwardly to a point below ground level along the opposed longitudinal sides of the area to be excavated; inserting a guide wall into each of the guide ditches; excavating the space between the guide walls along each of the longitudinal sides of the area to be excavated to a desired depth; pouring concrete into the excavated space between the guide walls along each longitudinal side of the area to be excavated to form side support walls with the upper ends of the side support walls being located below ground level; providing prefabricated support members with an upper surface, a step in the side of the support member below its upper surface, a vertical slot in the side of the supporting member above the step, and an opening through the lower part of the support member; placing the prefabricated support members into the upper surface of the concrete forming the support walls before the concrete has set for affixing the support members to the support wall so that the concrete of the support wall enters into the opening in the lower part of the support member and whereby the upper surfaces of the support members are located at substantially ground level and the lower step therein are located below ground level, pouring concrete into the openings in the support members for effecting additional bonding between the support members and the upper surface of the side support walls; allowing the concrete in the side support walls and in the openings in the support member to perfect the bond between the side support walls and the support members; lowering support beams onto the support members to rest upon the lower step and to extend between support members on opposed longitudinally extending sides of the area to be excavated; providing projections extending from the ends of the support beams and inserting the projections into vertical slots in the support members when the beams are being supported on the support members; pouring concrete into the vertical slots to establish a fixed bond between the projections and the support members; and covering the support beams with a permanent material for forming a permanent surface over the area to be excavated.

**2**. A method, as set forth in claim **1**, comprising the steps of providing projections extending downwardly from the lower surface of the support members, inserting the projections downwardly into the side support walls when placing the support members on the side support walls so that the projections extend into the walls before the concrete sets so that when the concrete sets the support members are integrally secured to the side support walls.

**3**. A support structure for covering an area to be excavated so that the area can be excavated without interferring with the activities being carried out directly above the excavated area, for example, when the area to be excavated is located below a roadway, comprising a pair of laterally spaced longitudinally extending upright poured-in-place concrete support walls located on opposite longitudinally extending sides of the area to be excavated prior to the commencement of the excavation, said support walls formed to a desired depth in accordance with the depth of the area to be excavated, a plurality of prefabricated L-shaped support members secured within the concrete forming the top of said support walls so that said support members are integrally attached to said support walls, said L-shaped support members each comprised of a first leg extending upwardly from said support wall and a second leg supported on the top of said support wall and extending transversely outwardly from the lower end of said first leg toward the opposite said support wall, said second legs of said L-shaped members having openings therethrough for receiving the concrete forming the top of said support walls, a plurality of prefabricated T-shaped support beams extending transversely between said support walls and disposed in bearing contact on and integrally bonded to said L-shaped support members, and means forming a permanent surface deposited on the top of said support beams for providing a covering over the area to be excavated so that the space below the support beams and between said support walls can be excavated without interrupting activities above the excavated area.

**4**. A support structure, as set forth in claim **3**, wherein a plurality of vertical slots formed in the surface of said first legs of said support members which face inwardly toward the opposite said support members, and at least a pair of downwardly projecting reinforcing rods secured within said support members, the upper extremity of one of said rods being secured within said first leg of said support member and the other said rod being secured within the second leg of said support member, and the ends of said rods located below said support member being bent into a U-shaped configuration with the U-shaped portions extending toward one another, and the lower portions of said rods extending downwardly from said support members being integrally secured within the concrete forming said side support walls.

**5**. A support structure, as set forth in claim **4**, wherein the bottom surfaces of said first leg and said second leg of said support member secured within said side support walls are beveled inwardly and upwardly, and adjacent said support members are disposed in abutting relationship and the abutting surfaces thereof are provided with a step interlock for effecting interengagement therebetween.

**6**. A support structure, as set forth in claim **5**, wherein said T-shaped support beams each comprise a horizontally arranged head portion and a vertically arranged stem portion extending downwardly from said head portion, the lower end of

said stem portion being supported on the upper surface of said second leg of said support member, a pair of vertically spaced rods extending outwardly from each end of said support beams with one of said rods being secured within the head portion of said support beam and the other said rod being secured within the stem portion of said support beam, the ends of said rods extending outwardly from the ends of said beams being bent into a U-shaped configuration inwardly toward one another, and the U-shaped ends of said rods being disposed within the vertical slots in said first legs of said support members and concrete deposited within said vertical slots for



securing said rods within said slots.

7. A support surface, as set forth in claim 6, wherein the side surfaces of said head portions of said support beams are disposed in contacting engagement so that the upper surface of said head portions form a continuous surface over the area to be excavated, and said means forming a permanent surface comprising a sub-surface material deposited over the upper surface of said support beams, and a permanent roadway surface disposed over said subsurface material.