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(54) **Composite platform with a self-centering movable intermediate element for manufacturing road underpasses having monolithic structure.**

(57) Composite platform for manufacturing road underpasses having monolithic structure.
The underpass (10) is advanced through an excavation in the roadway (14), whilst across said excavation there leans at least one central movable plate (20) which, after reaching a preestablished position, is moved back by drive means (36) so that it occupies a substantially central position on the interrupted roadway (14). To said movable plate (20) is joined at least one pair of stationary side plates (24), which provisionally form, together with the central plate (20), the roadbed of the interrupted roadway (14).

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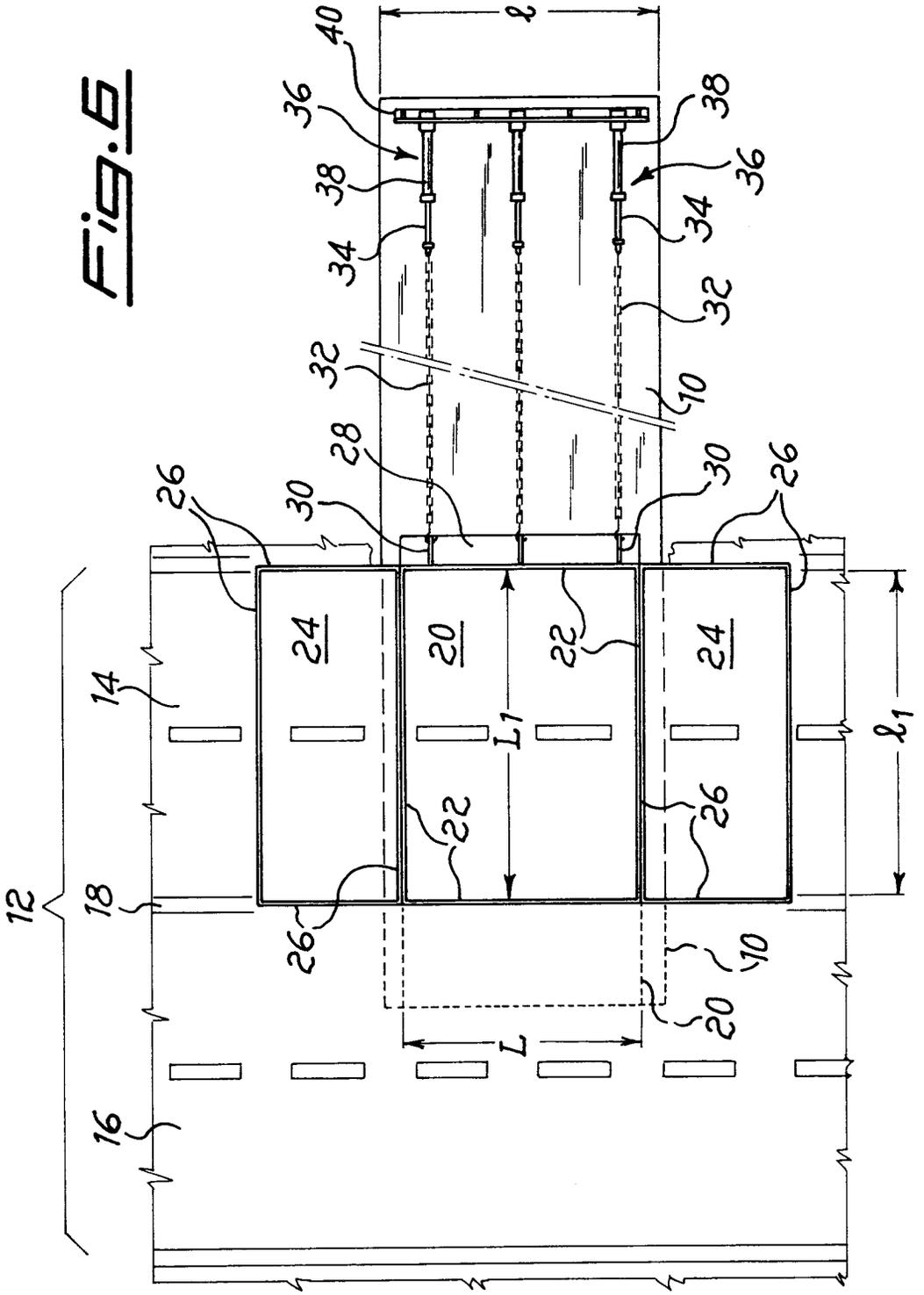
Fig.6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The present invention relates to a composite platform with a self-centering movable intermediate element for the installation of road underpasses having monolithic structure, particularly suitable to avoid any discontinuance of the traffic flow.

It is known that, in order to solve the problem of manufacturing underpasses affecting a road the vehicular traffic of which could not or was not sought to be interrupted, diversions have been made and then traditional techniques have been adopted, so as to build the structure in its final arrangement. More recently, endeavours have been made to extend to the road field the hydraulic laying technique, already well established in the railway crossings field.

Such a technique consists in prefabricating a monolithic box-like structure apt to constitute the underpass, and in locating the said structure in an area external to the road one, by limiting the traffic without ever interrupting it just for the time necessary to lay the structure, which generally requires no more than a few days.

In the practice this technique is carried out as follows, A slab called "laying platform", provided with a thrust bearing wall, is positioned at a certain distance from the road (or motorway) bed, in such a way as not to interfere with the traffic at all.

On this slab is laid a thin sheet of plastic material, in particular polyethylene, upon which is built on the spot the monolithic structure of reinforced concrete which will constitute the underpass.

As soon as the said structure is ready to be installed, that is when the so-called "seasoning period" is over, there are provided thrust means, consisting of a plurality of hydraulic jacks which are installed between the said slab of the structure and the relevant thrust bearing wall.

At this time the cross cutting of the road bed is started by a trench from the outer side edge of the said bed up to a suitable distance from the roadway where the vehicular traffic goes on running. The underpass is then installed in the excavation made in the road bed and is progressively advanced as the excavation proceeds. The end of the element forming the underpass is then brought in correspondence of the central reserve, whilst the gaps between the outer parts of the underpass and the opposite walls of the excavation are being concurrently filled.

An antislip plate is then positioned over the monolithic structure forming the underpass in correspondence of the impassable roadway and is thereafter suitably secured along the edges corresponding to the beginning and the end of the roadway. On the said plate is then built the roadbed to allow the final bituminization and the consequent restoration of the road as well as of the traffic running thereon. In this manner the first roadway is put back to its original state; the monolithic structure can be further advanced until it reaches its final position; and the interruption as well as the restoration of the second roadway are effected as the vehicles are passing on the first roadway.

The above described known solution has the considerable inconvenience due to the fact of requiring that a plate of considerable thickness be laid upon the monolithic structure, anchored along both opposite edges of the roadway interruption and linked, in case, to a stop beam generally made of steel, conveniently anchored too to the interrupted roadway.

The said plate can be set beforehand only within defined limits of the overall width of the plate itself, which are generally in the region of 4-5 m; this solution, however, is not conveniently applicable to structures of greater sizes, namely to monolithic structures whose width requires the application of a plate whose overall width is greater than the above cited one.

When the above limits of width are exceeded, the said sheet or base plate results in fact to be subjected to very strong shearing stresses, which originate strains that can be difficultly absorbed or anyway borne particularly by thin, even if reinforced, plates. Moreover, the anchoring of the plate to the stop beam, which is usually effected by means of ropes, is effective only with shiftings of some consequence which, on the other hand, are decidedly incompatible with the rigid anchoring at both sides of the structure.

A further and considerable inconvenience of this known solution is due to the fact that the stress conditions of the plate result to be extremely variable according to the circumstances, whereby it is impossible to provide the plate with standardized modular resistance characteristics. It is therefore necessary, each time, to give the plate convenient resistance characteristics, so as to make it fit, without inconveniences, to the specific case in which it should be applied.

Another considerable inconvenience is due to the fact that, in the case of particularly wide plates, the stresses which originate therein, due both to the handling of the monolithic structure on which said plates rest, and to the vehicular flow which passes on said plates, may cause significant as well as unmanageable deformations which finally obstruct the passage of the vehicles on the said plates, at the evident risk of the users of this clearly provisional roadway.

Another not negligible inconvenience derives from the considerable forces coming into play, necessary to control the forward motion of the monolithic structure, motion which is substantially counteracted by the weight of the plate resting on it, which is firmly fastened to the roadbed and cannot therefore perform any motion. This makes it necessary, in some cases, to insert lubricating substances between the said plate and the monolithic structure, in order to diminish the sliding frictions; this operation clearly involves, however, a considerable increase in both the times and the working difficulties.

There has now been conceived, and forms the

object of the present invention, a composite platform with a self-centering intermediate movable element for the manufacture of underpasses as indicated above, which allows to eliminate all the inconveniences of the traditional solution.

One of the main objects of the present invention is therefore to provide a platform for the manufacture of road underpasses having monolithic structure, which can be regarded in every respect as a composite platform the shape and arrangement of which with respect to the monolithic structure allow to split up in the best possible way the forces originating from the laying of the said structure, allowing concurrently a drastic reduction of such forces, which considerably facilitates the above operation, reducing at the same time the costs as well as the times thereof.

Another important object of the present invention is to provide a platform by means of which it is possible to quickly obtain, above the monolithic structure, a wholly reliable segment of roadbed and to rapidly proceed at the same time, without substantially modifying the features of this part of roadbed, to the following step, namely the laying of the monolithic structure until it is brought into its final position.

Another not negligible object of the present invention is to provide a substantially modular platform whose size may therefore be widened at will, in accordance with any width of the monolithic structure to be laid, without this widening affecting the forces and the strains to which said platform is subjected.

Just for the sake of explanatory clearness, it should be pointed out that, all over the present description, by the term "laying" of the monolithic structure or underpass there are meant the whole operations necessary to excavate the roadbed and to shift the monolithic structure to gradually insert it in the said excavation, both when the platform according to the invention has not yet been applied to the monolithic structure and when it has been prepared so as to proceed with the laying operations until the moment when the monolithic structure has been brought to its final position.

The features as well as the advantages of the platform according to the present invention will clearly appear from the following detailed description of one of its non limiting embodiments, with reference to the enclosed figures wherein:

FIGURE 1 is an enlarged view along a longitudinal section partly showing the upper part of the monolithic structure wherein there are also visible one end of the central element of the platform according to the invention and one of the means provided for the handling of the said element;

FIGURE 2 is a partially broken view along a longitudinal section of a motorway wherein there is being laid the monolithic structure which has been brought until the central reserve dividing the two roadways;

FIGURES 3 to 5 are views analogous to that of Fig. 2, showing the handling of the intermediate element of the platform according to the invention whilst the monolithic structure is gradually advanced beyond the position corresponding to that of the central reserve;

FIGURE 6 is a schematic plan view showing the platform according to the invention, with the monolithic structure in the position corresponding to that of Fig. 2, and

FIGURE 7 is a schematic plan view of the platform according to the invention where the monolithic structure has been wholly laid.

With reference to the above figures, the road underpass to be laid, having monolithic structure, is indicated in its whole by 10 and it should be transversally inserted below a motorway 12 comprising two roadways or lanes 14, 16 separated by a central reserve 18. The monolithic structure 10 is provided at its front part, in a known manner not shown, with a protruding part or extension to prevent the ground, during the laying operation, from entering inside it.

A cross excavation of the first roadway 14 in which the monolithic structure 10 will be inserted is first effected, said excavation allowing the partial laying of the said structure until its front end is arranged in correspondence of the central reserve 18 which, in Figgs. 2 to 5, is schematically represented by a small triangle whose vertex is downward bent. This preliminary operative step of partial laying of the monolithic structure 10 is carried out in a known way, e.g. according to the traditional solution hereinabove described and therefore it is not described in detail.

During such first operative step, the composite platform according to the invention has not yet been applied to the monolithic structure even though, in order to reduce the working times, to the latter there could be preliminary applied, if necessary, the movable intermediate element of the platform, which will be described hereinafter together with the platform itself as a whole.

With specific reference to Fig. 2, it can be seen that the intermediate element of the platform according to the invention, indicated by 20, consists of a metal plate of suitable sizes - as will be hereinafter explained - which is rested against the upper face of the monolithic structure 10. In particular, plate 20 is placed in correspondence of the front end of the monolithic structure 10.

Referring now also to Figgs. 6 and 7, it can be seen that plate 20 has a width (L) slightly smaller than the width (l) of the monolithic structure 10, and it is located in a central position with respect to the side edges of the monolithic structure.

Plate 20 has further a length (L1) substantially equal to the length (l1) of roadway 14, so that said plate 20, once it has been arranged as hereinabove stated, occupies the whole width of said roadway 14.

The side edges of plate 20, indicated by 22, extend upward to such a height that their upper edge results to be substantially in line with the edge of the roadway, as it is shown in Fig. 2 in particular. By virtue of this arrangement, the room defined by plate 20 with its edges 22 could be filled with suitable materials apt to enable the restoration of the roadbed.

The composite platform according to the present invention, besides the movable intermediate element formed by plate 20, comprises two suitably sized side plates 24 which are set side by side on two opposite sides of plate 20, in particular the two sides which cross the direction of the vehicular traffic of roadway 14.

As can be seen particularly in Figgs. 6 and 7, both side plates 24 have substantially the same length as that of the central plate 20, while their width is dependent upon the fact that they must not move when the underpass 10 is advanced as hereinunder explained.

From said Figgs. 6 and 7 it can in fact be seen that the side plates 24 partly rest upon the monolithic structure 10 to an extent corresponding to the portion not engaged by the central plate 20. The remaining portion of the side plates 24 is conveniently sunk in the ground, more particularly into the roadbed of roadway 14. This is carried out by previously removing a portion of the roadbed of roadway 14 by a predetermined height and a width corresponding substantially to that of plates 24, and by subsequently laying the said plates in the area wherein the roadbed had been removed, as represented in Figgs. 6 and 7. Then, as it had already been done for the central plate 20, some filling material will be carried above plates 24 to restore the roadbed, said material being kept within the boundaries of road way 14 by the upward bent side edges 26 of the side plates 24. Thanks to a new roadbed being built above the central plate 20 of the side plates 24, it is thus possible to restore the roadway 14, which is in working order again.

Still with reference to the enclosed Figures, the central plate 20, defined as movable intermediate element of the platform according to the invention, is provided, on its side facing the outer edge of the motorway 12, with a protruding rim 28 from which essentially longitudinal ribs 30, of a length equal to the width of rim 28, extend upward, at a suitable distance which is dependent on the width of plate 20.

As it can be seen more clearly in Fig. 1, at the end of each rib 30 there is anchored the end of a link chain 32 whose other end is joined to the end of the stem 34 of a control piston 36 whose cylinder 38 is secured to a supporting wall 40 which is secured in any known way (not shown) to the upper part of the underpass 10.

As it can be seen still more clearly in Fig. 1, but as it is shown in the other figures too, the control pistons 36, and more particularly the supporting wall 40, are arranged at the end of the monolithic structure 10 opposite to the end to which the central plate 20 is applied.

Referring now in particular to Figgs. 2 to 5, there is described the way in which the platform according to the present invention is used for performing the second working step of the laying of the monolithic structure, allowing the latter to be taken up to its final installation position.

Since the vehicular flow has been restored along the first roadway 14, as hereinabove described, it is now possible to effect an excavation analogous to the previous one across the second roadway 16 as partly shown in Figgs. 3 to 5, in which it can be seen that the excavation has now gone beyond the line corresponding to the central reserve 18.

It is now possible, by known means not shown, in particular the same which allowed to bring the monolithic structure 10 to the position of Fig. 2, to make the latter further advance, e.g. from the position of Fig. 3 to that of Fig. 4; in the latter figure, in particular, it can be seen that the central plate 20 has moved forward of the same length, being supported by the underpass 10. Just for the sake of clarity of drawing the portion of the central plate 20 which went past the central reserve 18 has been enlarged on purpose with respect to its actual size: in fact, in this second working step the gradual forward motion of the monolithic structure 10, and accordingly of plate 20, is in the region of few centimetres only.

In Fig. 6 it can be seen that the side plates 24 have remained in their place, whilst the new advanced position taken on by the central plate 20 is represented by a broken line.

The fact that the side plates 24 have not shifted from the position of Fig. 6 is due both to their area of contact with the monolithic structure 10 being very limited (whereby the sliding frictions are relatively reduced), and to their being firmly sunk in the ground for the most part of their surface. The side plates 24 could further be provided with vertical ribs (not shown) extending parallel to the traffic direction along roadway 14, so as to increase the resistance of said plates to being shifted from the position in which they have been installed.

It should be noted, by the way, that the forward motion of the central plate 20 is made possible also because the friction between the opposite edges 22, 26 of plates 20, 24 is very limited and at any rate such as not to prevent reciprocal movements of the said plates. In this respect it should be noted that the roadbed of the roadway 14 made over the plates 20, 24 must not be continuous but discontinuous, namely it will have separation lines in correspondence of the opposite edges of plates 20, 24.

Then the movable plate 20 is moved back by the control pistons 36, and shifted from the forward position of Fig. 4 to the receded position of Fig. 5 in which it can be seen how its front end is set back with res-

pect to the line 18 of the central reserve. In this case too the extent to which the movable plate 20 has been moved back has been enlarged on purpose for clarity of drawing, but it is clear that the recession is of few centimetres only. Thus the handling of plate 20, which takes place, by the way, at a very low speed, will have no bearing on the course of the traffic flow over the roadway 14.

As it is shown in Fig. 5, stem 34 of the control pistons 36 is wholly held in the relevant cylinder 38, whereby the working stroke of said stem corresponds to the extent to which the movable plate 20 recedes. It is clear, however, that such extent could be smaller than the working stroke of stems 34 of pistons 36, so as to allow to grade each time the extent of the above recession, according to the specific exigencies.

To accomplish the laying of the monolithic structure 10, successive steps are adopted, identical to the previous ones as far as procedure and sequence are concerned, except for the excavation laying across roadway 16, which can be made either little by little or all in one go.

Before making the monolithic structure 10 further advance, two operations are necessary. The first consists in shortening chains 32 suitably, in any known manner, said shortening corresponding to the extent of which the movable plate 20 had receded. The second operation consists in drawing stems 34 out of the control pistons 36 again, and in securing the duly shortened chains to the ends thereof.

Actually, the conditions of Fig. 3 have been substantially restored, with the remarkable difference that the end of manufacture 10 lies beyond the central reserve 18. Then the procedure is as before, by further advancing manufacture 10 and making the movable plate 20 move back after it has gone past the central reserve 18 again. These operations are repeated in sequence, until the manufacture or underpass 10 has been set to its final installation position as represented in Fig. 7.

The handling of the movable plate 20 upon manufacture 10 can be made easier for instance by way of placing therebetween a suitable lubricating substance which reduces the power of the forces required to make said plate move back.

Once the manufacture has been set to the position of Fig. 7, steps are taken, in any known manner not shown, to put the roadbed in roadway 16 back in operation, and to give the roadbed of roadway 14 its final aspect, so that the original conditions of the whole roadbed be restored.

Of course, in order to restore the original conditions of roadway 14, plates 20 and 24 should be removed, and this could be easily made as the traffic is being temporarily diverted to roadway 16.

From what has been described above there clearly stand out the advantages deriving from the use of the composite platform according to the present invention; the most significant of them can be summarized as follows.

The platform, and particularly the central plate 20, does not require to be given a particularly high resistance to stresses, in that the stresses to which it is subjected are reasonably limited. It rests in fact upon the underpass and is subjected to a drive action only, which is spread, moreover, all along its width and is effective intermittently during the recession steps only.

The said plate can even be regarded as modular: in fact, although in the considered embodiment there is only one plate, for wider underpasses or roadways there can be used two or more central plates set near to one another and suitably interconnected, e.g. by means of welding, without the spreading of the stresses produced in such plates being substantially modified. It ensues that the said movable intermediate element, consisting in the case at issue of only one plate, could be used, with a plurality of interconnected plates, for underpasses or roadways of even considerable width.

The same remarks can be made about the stationary side plates 24, particularly as concerns the width of the roadway to which they should be applied, because for those plates too is applicable the module pattern which makes them capable of being joined with analogous plates having the same functions.

Even the stresses produced in the stationary side plates 24 are limited, because they are just subjected to a substantially frictional stress between their side edge and the side edge of the underpass upper face.

The laying of the monolithic structure is considerably easier than the traditional procedure; further, the underpass can be installed in extremely short times with respect to the traditional systems.

The motions of the central plate 20 (forward together with the monolithic structure and backward under the pistons actuation) do not involve any particular difficulty nor do they require the intervention of specialized labour. Moreover, it should be considered that, thanks to the used components, it is possible to keep the costs of the equipment as a whole within certain limits.

It should also be stressed that the forward and backward motions of the central plate 20 can be opportunely automatized by providing suitable fixed sensors set upstream and downstream of the plate itself, apt to detect the maximum forward and backward positions, and to control therefore the activation and deactivation of the pistons which drive the forward motion of the monolithic structure and the backward motion of the plate. By way of these automation means the intermediate movable element consisting of plate 20 results to be self-centering as it will be always located in the course of time substantially within the boundaries of the roadway to which it is applied.

Finally, it is clear that variations and/or modifications can be made in the composite platform with a self-centering movable intermediate element for manufacturing road underpasses according to the present invention, without departing from the scope thereof.

Claims

1. Composite platform for manufacturing road underpasses having monolithic structure, apt to provisionally form the roadbed of at least one roadway interrupted by a cross excavation wherein said underpass is advanced, below the platform, characterized by the fact of comprising at least one movable central plate (20) which rests on the upper face of the underpass (10), as well as at least two stationary side plates (24), each having one edge near a side edge of the central movable plate (20), the latter being connected with means controlling its movements on the underpass (10), means which act in a direction opposite to that of the means which control the movements of the underpass, whilst the stationary side plates (24) are anchored to the roadbed of said roadway (14).

2. Composite platform according to claim 1, characterized by the fact that the movable plate (20) has a width (L) slightly smaller than the width (L) of the underpass (10), wilst its length (L1) is substantially the same as the width (L1) of the roadway (14) to which said movable plate (20) is applied.

3. Composite platform according to claim 1, characterized by the fact that the stationary side plates (24) rest with one of their edges upon a portion of the side edge of the upper face of the underpass (10).

4. Composite platform according to claim 1, characterized by the fact that the central movable plate (20) and the stationary side plates (24) have upward bent edges (22, 26) so that said plates (20, 24) can be filled with material apt to provisionally form the roadbed of roadway (14).

5. Composite platform according to claim 1, characterized by the fact that the central movable plate (20) is allowed to advance with the underpass (10) when the latter is driven into the excavation made across roadway (14) until a preestablished position at which said means controlling its movements cause it to move backward of a pre-established stretch too.

6. Composite platform according to claim 5, characterized by the fact that said forward and backward motions of the movable plate (20) take place with respect to an intermediate position in which said plate (20) is in a central position on said roadway (14).

7. Composite platform according to claim 1, characterized by the fact that the central movable plate (20) is connected at one end thereof, by means of chains (32) with control pistons (36) located on the underpass (10), apt to make the movable plate (20) shift upon the same.

8. Composite platform according to claim 7, characterized by the fact that the control pistons (36) are connected with the movable plate (20) by means of reducible metal chains.

9. Composite platform according to claim 1, characterized by the fact that at least one layer of lubricating substance is placed between the movable plate (20) and the underpass (10).

10. Composite platform according to claim 6, characterized by the fact that fixed sensors are joined thereto, and are apt to detect the maximum forward and backward positions of the movable plate (20) and to actuate accordingly the means controlling the movements of the monolithic structure (10) or those of said plate (20).

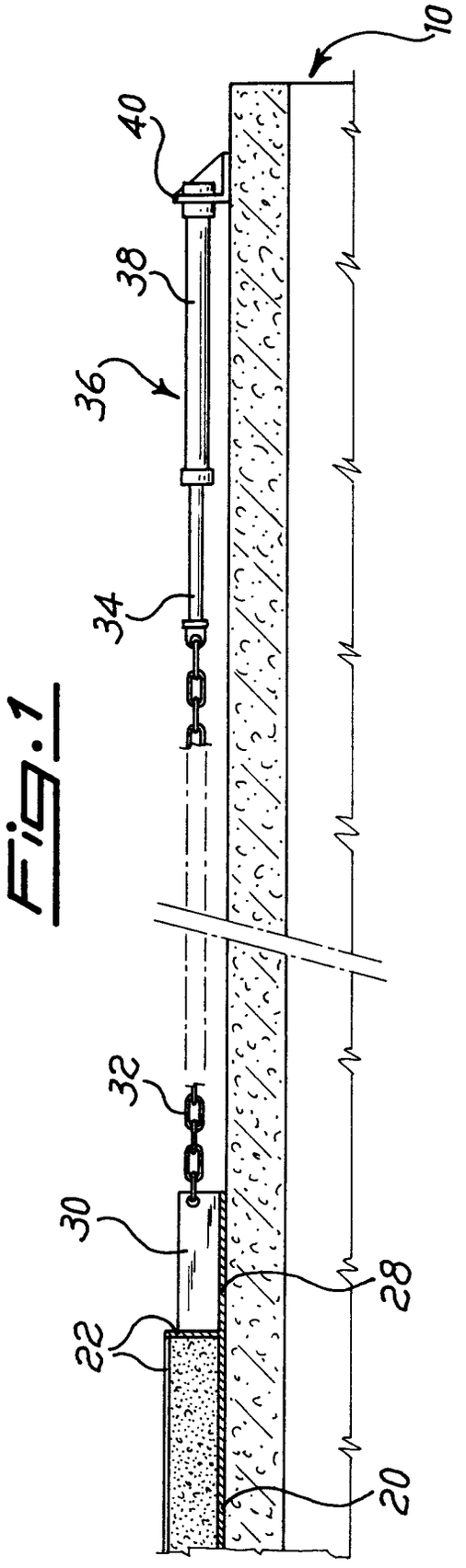

Fig.1

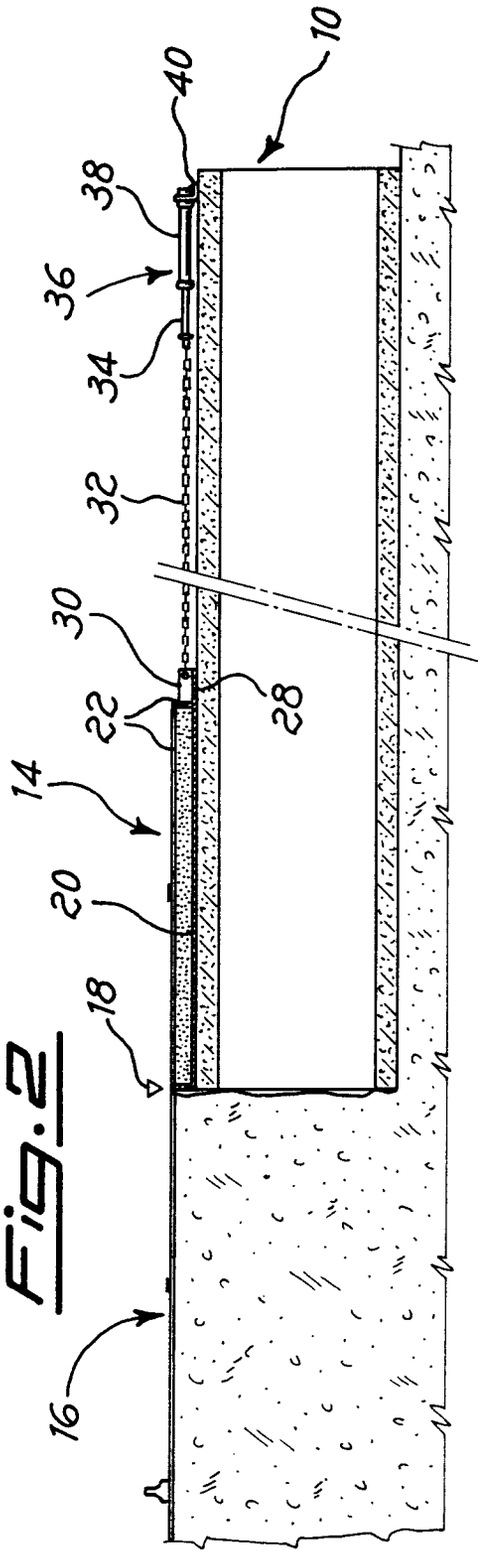

Fig.2

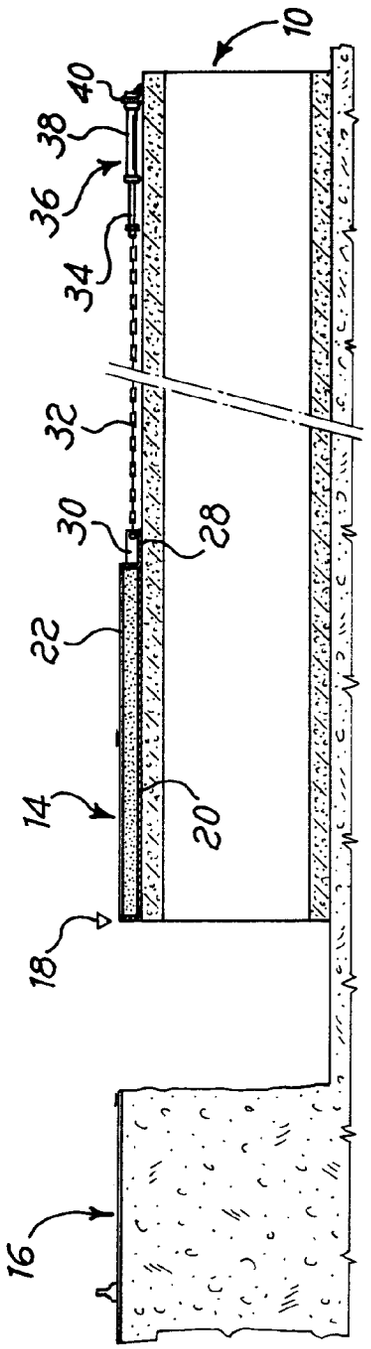

Fig.3

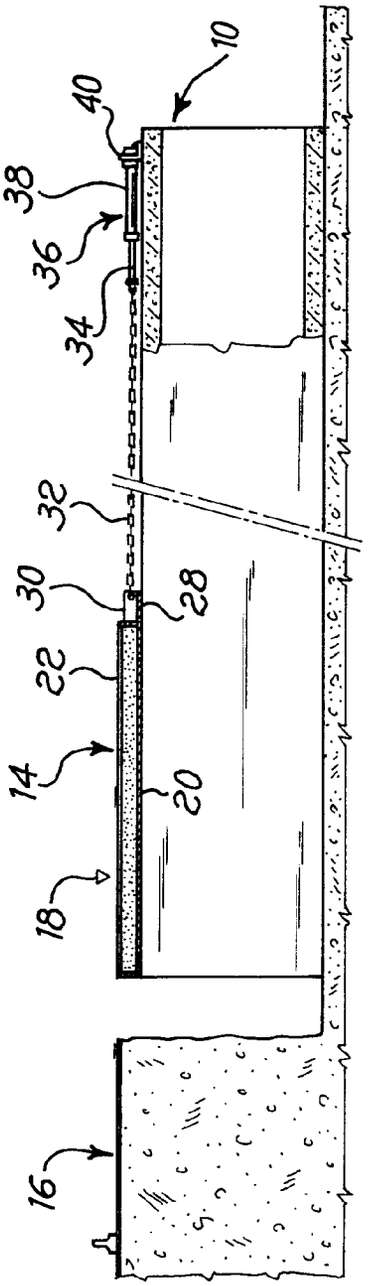

Fig.4

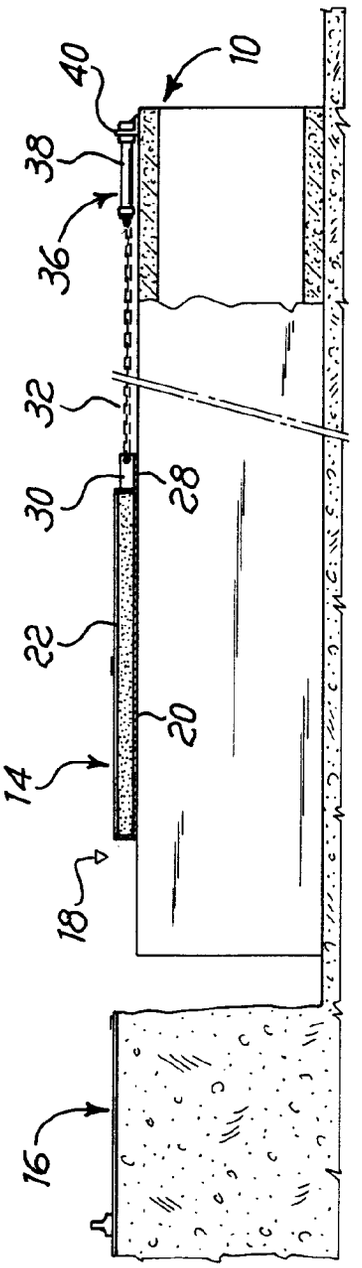

Fig.5

Fig.6

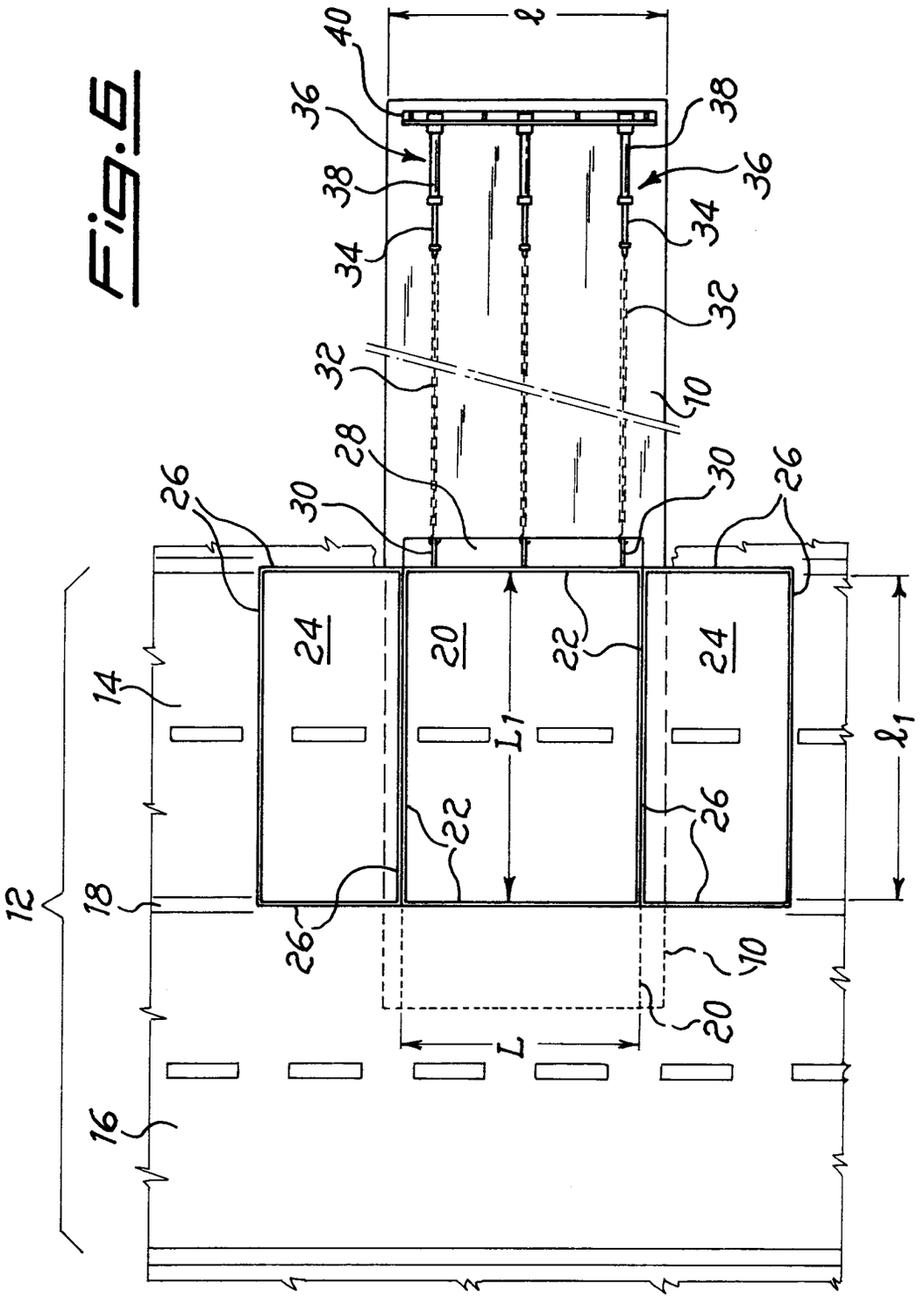
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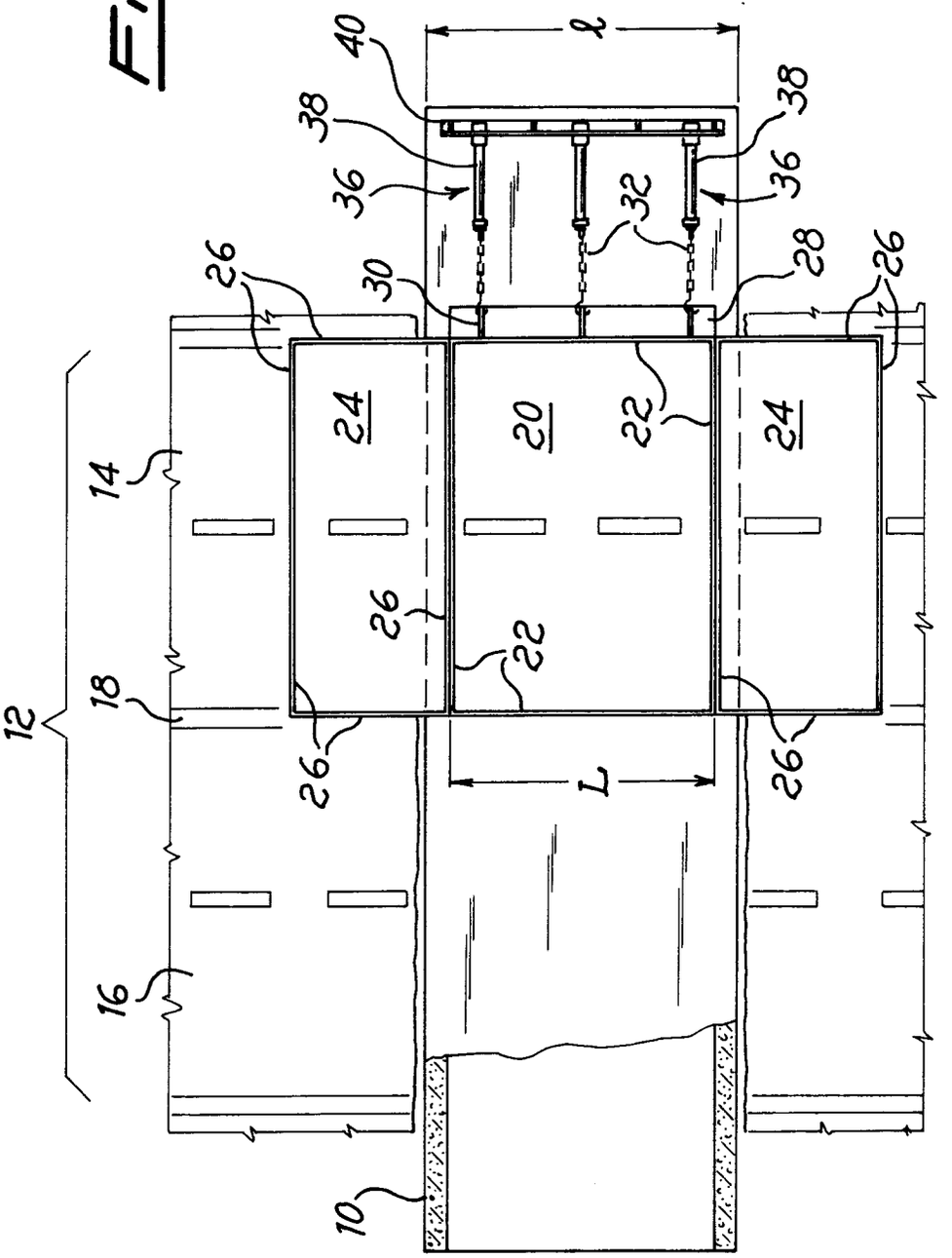
Fig.7



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EUROPEAN SEARCH REPORT

Application Number

EP 91 83 0079

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.5)
A	DE-A-2 148 366 (EMKA ING. BAUGES.) * the whole document *	1	E01D21/04
A	DE-A-3 817 004 (DYCKERHOFF & WIDMANN)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

E01D
E21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 SEPTEMBER 1991	DIJKSTRA G.

CATEGORY OF CITED DOCUMENTS

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