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MEANS FOR COVERING AND RENDERING WATERPROOF EXPANSION JOINTS FOR ROAD BRIDGES AND OTHER CIVIL ENGINEERING CONSTRUCTIONS

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Fig.1.

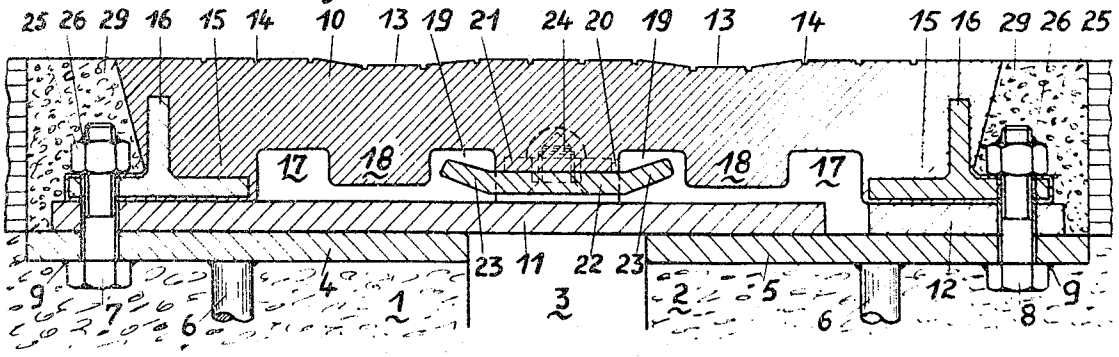


Fig.2.

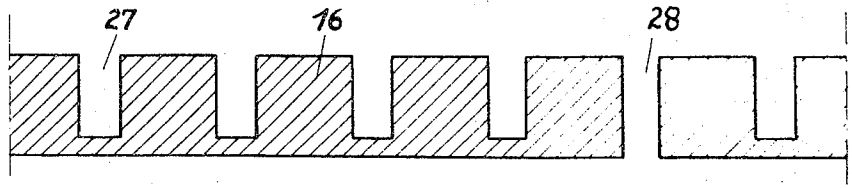


Fig.3.

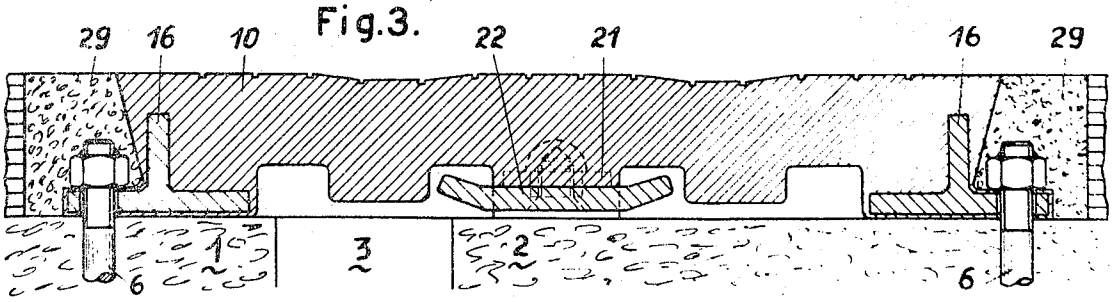


Fig.4.

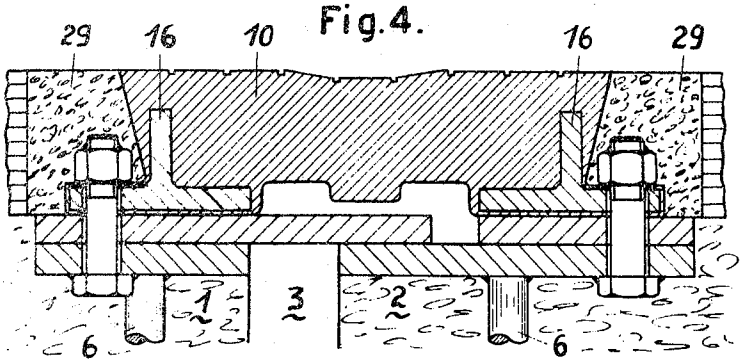
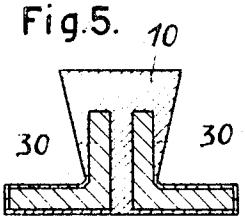


Fig.5.



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MEANS FOR COVERING AND RENDERING WATERPROOF EXPANSION JOINTS FOR ROAD BRIDGES AND OTHER CIVIL ENGINEERING CONSTRUCTIONS

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ABSTRACT OF THE DISCLOSURE

Means for covering and rendering waterproof an expansion joint for a bridge or other construction where sections made of metal or other material are interrupted at intervals to lend a strip of rubber or other elastomer a certain lateral flexibility. Metal sheets are positioned within depressions in the strip to engage protuberances in the strip and thereby to cancel the tendency of the strip to rise. By the strip acquiring lateral flexibility being prevented from rising, undesirable upward bulging is avoided.

It is well known that road bridges of a certain length and other similar constructions have to have expansion joints. The necessity to provide an even road surface at these points raises problems which are difficult to solve. Elastic means are desired, at these points, which are resistant to abrasion in a similar manner as the remainder of the roadway. The material used must be capable of expanding and contracting together with the variations in the width of the joint, and of protecting the latter against rainwater.

A number of proposals have been submitted, such as for instance the use of bitumen, asphalt and similar substances. Whilst these materials provide a relatively good resistance to compression, their elasticity is not very good, and it follows that their tightness is insufficient when the joint tends to open up. Rubber and elastomers are the most effective agents and are utilised on a wide scale. Their resistance to abrasion and bad weather conditions is satisfactory. However, difficulties are encountered when trying to fit them correctly.

An existing method consists of the use of strips or sheets placed side by side, made of rubber or other synthetic elastic material, compressed between metal sections secured on both sides to the parts of the construction which are separated by the expansion joint. The fact that the elastic material in question can only be used in compression reduces its applications and leads either to inadequate tightness when the construction is subjected to considerable contraction, or to excessive widths, or to difficulties in fitting it when a considerable initial compression of the elastic material is to be achieved. Moreover, the possibility of compressing the section is limited, and the section is thus liable to become too rigid and therefore to affect the construction itself, or to bulge excessively, thus presenting the risk of coming out of its seating. On the other hand, the elastic sections used so far are unable to adapt themselves to some changes in the shape of the joint, particularly at right angles to thin streams of water. Sections of strips or sheets have to be fitted against them in order to comply with the said shape, which in turn results in the formation of multiple joints which adversely affect the tightness of the whole.

The device in accordance with this invention used in expansion joints is constructed with a view to eliminating the drawbacks mentioned. On the one hand, it is intended for compression as well as expansion and, on the other hand, the device may consist of one single part

whose length equals that of the expansion joint to be covered. The device may conveniently adapt itself to variations in the shape of the said joint.

The device in accordance with the invention may consist chiefly of an elastic strip of rubber preferably synthetic rubber, or of other suitable elastic material such as syntheic elastomers, containing metal sections partially or wholly slotted at the points where the strip has to present a certain longitudinal flexibility, for instance to permit it to be rolled on to a reel or to adapt itself to variations in the shape of the deck, said sections being used to advantage for the engagement of fixing devices (bolts or similar components) for the strip with metal or other fastening plates or feet, respectively unitary with each of the parts which are separated by the expansion joint. The elastic strip preferably has variations in its cross-section and shape with a view to facilitating its transverse expansion and contraction.

The elastic strip may be secured directly to each part of the construction, the surface of each part being preferably prepared at the point of contact with the strip.

It has been found that in the case of elastic strips of considerable width, any tendency to bulge under powerful forces of compression is prevented by the presence of stiffeners, preferably metal plates, each of which is applied to a boss of the strip and whose edges, which may be raised, engage in grooves along the said boss. The plates may be secured with the aid of bolts or other devices. In the event of considerable contraction of the strip, the edges of the plates push against the base of the corresponding groove, thus producing a force which tends to push the plate downwards, therefore preventing the elastic strip from lifting.

The strip may be secured to the construction with the aid of two metal or other lateral sections, preferably T-shaped, partly or wholly notched at the points where the strip has to present a certain longitudinal elasticity. These sections may be partially inserted in the strip and their remaining parts covered with a thin layer of rubber or other elastomer of which the strip is made, which constitutes a favourable feature. This rubber layer ensures a tight joint between the sections and the respective part of the construction. Furthermore, it protects the section against corrosion. In the case of fairly or extremely narrow strips, such as for the formation of fixed joints, the metal plates may be dispensed with altogether and the lateral sections can be L-shaped.

In order to elaborate on the above, the accompanying drawings illustrate embodiments of means constructed in accordance with the invention in the form of non-restrictive examples.

FIG. 1 is a transverse cross-section of a wide strip with intermediate supporting parts and a central stiffener.

FIG. 2 shows a longitudinal cross-section of a lateral fastening section.

FIG. 3 is a transverse cross-section of a very long strip fitted and secured to the joint units directly.

FIG. 4 is a transverse cross-section of a more narrow strip, without stiffener.

FIG. 5 is a cross-section of a narrow strip, such as for a fixed joint.

Referring to FIGS. 1 and 2 of the drawings, a deck **1** and abutment **2** form between them an expansion joint **3** and are in known manner, provided with metal plates **4** and **5**, which are secured to them by dowels **6**. These plates are provided with openings to take bolts **7**, **8** whose heads are secured against revolving by weld beads or weld points **9**. Bolts **7**, **8** are used to secure an elastic strip **10**. A plate **11** is placed on one of the plates, for instance plate **4**, and secured by bolts **7**, and covers joint **3** and is supported by plate **5**. A further plate **12** secured

by bolts 8 lies on plate 5. Both plates 11 and 12 are of identical thickness so as to form a level supporting surface. The cross-section of strip 10 is in the approximate shape of an extended trapezium whose top, which is the longest side, has two longitudinal depressions 13 of shallow depth. It is also preferably provided with small grooves or anti-skid corrugations 14. The sides of the lower face of the strip are provided with two seatings 15 in which are partially inserted anchorage sections 16, preferably T-shaped, said sections 16 having their bases located at the lower portions of the seating and their webs surrounded by the strip. Each seating is followed by a depression 17, a protuberance 18 substantially beneath corresponding depression 13, and a depression 19 which surrounds a central protuberance 20. The central protuberance contains, at about 9 cm. intervals, small metal plates 21 with a central threaded opening. Metal plates 22, whose cross-section is in the shape of a flat web, with two wings 23, sloping or not, of gradually decreasing thickness, and whose edges are preferably rounded, are inserted in the appropriate depressions and are secured to the strip 10 with the aid of screws 24 engaged with the threaded openings of small plates 21, in such a manner that their webs lie against the lower face of central protuberance 20, whilst the wings 23 extend inside depressions 19. The dimensions of each plate 22 is such that when the strip 10 is not subjected to any stress, its web is clearly drawn up against the lower face of central protuberance 20, whilst the extremity of each wing 23 is located in the vicinity of the angle formed by the base of hollow 19 and the adjacent side of protuberance 18. The elastic strip 10 is held in position by bolts 7 and 8 in appropriate openings in the outer half of each base of sections 16. The bolts are fitted with nuts 25 preferably held in position by weld beads or weld points 26. The nuts 25 can be joined together by a steel rod welded to each nut, and this rod can then be used to reinforce the concrete to be filled in.

The anchorage units 16 are provided with spaced notches 27 in their webs and are divided over their whole cross section by gaps 28.

In different form of construction of FIG. 3, plates 4 and 5 are dispensed with altogether. The surface of the deck and abutment is smooth; and dowels 6 and bolts 7 form single units. In this case, plates 22 are located above one of the fixed parts, e.g. abutment 2.

The device shown in FIG. 4 comprises the identical components, with the exception of plates 22 and their fastening devices.

In the form of construction shown in FIG. 5, the strip takes the form of a block 10 made of rubber or other elastomer, and also of trapezium-shaped cross-section whose short side is located at its lower part. Anchorage units 30 are angle-irons whose vertical arms, which are also notched, are surrounded by the strip and whose horizontal arms are provided with openings for the insertion of fastening bolts.

In order to install for instance the embodiment shown in FIGS. 1 and 2, the variations in length of the bridge are first determined, in other words the width of the joint as a function of temperature. This gives a sufficient approximation of the distance to be provided between bolts 7 and 8, so that the elastic strip, at the mean temperature of the prevailing climate, is at rest, viz. neither stretched nor compressed. All that has to be done then is to allow for the prevailing conditions in order to calculate the distance to be provided between the bolts. Plates 4 and 5 together with their bolts can then be fastened with the aid of dowels 6. Intermediate plates 11 and 12 are fitted and kept in position by bolts 7 and 8 respectively. Elastic strip 10 is then fitted. It is secured for instance by the bolts 7 on which nuts 25 are threaded. If the ambient temperature is more or less the same as that which prevailed when sheets 4 and 5 were fastened, thus if the distance between bolts 7 and 8 has also remained unchanged, bolts 8 can easily be inserted in the corresponding openings of section 16. If this is not the case, a hydraulic jack for instance can be used, which compresses or stretches, as the case may be, strip 10 to bring about the width required.

The fitting operation is completed by tightening nuts 25 which may be kept in position, as stated above, by weld points or some other method. The empty space between each side of the strip and the side of the roadway is then filled in, for instance, with soft concrete 29.

The behaviour of the elastic strip in accordance with the invention as a function of variations in the width of the joint is as follows: when the temperature drops, i.e. when the construction contracts, the strip is subjected to a pull and remains straight. When the temperature rises, the construction expands, i.e. the strip is compressed. The extremities of wings 23 come in contact with the angle of depression 19 and, if the strip is compressed further, the force exerted on the wings by the strip tends to push each plate 22 downwards, in other words to cancel any tendency of the strip to rise, as is the case with existing devices.

The fitting of the other devices shown is carried out in a manner similar to that described above.

An additional advantage is the fact that the thin film of rubber or similar substance surrounding section 16 protects the latter against corrosion and provides a waterproof joint between this section and the material below.

In a simplified form of construction, the stiffener can be replaced by rigid discontinuous parts of a cross-section more or less identical to that of hollows 19, which are simply inserted in the latter. Their effect is similar to that of the stiffener.

It is understood that various different forms of construction are possible as regards the shapes and dimensions of the parts described, as well as the materials from which they are made. The different sections and plates can for instance be made of synthetic material of suitable characteristics, or some plates can be dispensed with, whilst the bolts and dowels can form one single unit, without by so doing exceeding the scope of the invention.

I claim:

1. In a roadway or like construction which includes a pair of roadway sections of predetermined width disposed in spaced relation to present an expansion joint therebetween and presenting interrupted stepped portions so that said roadway sections define a groove between them which has a flat bottom interrupted by a gap whereby said sections may expand without interference, the improvement comprising:

an expansion member filling said groove so as to be commensurate with said roadway sections, said expansion member including a pair of anchor means secured respectively to the stepped portions of said roadway sections and presenting rigid upstanding flanges along the opposite sides of said groove, a resilient strip having opposite side edges embedding said flanges therein, said strip having an upper surface effecting an essentially smooth continuation between the upper surfaces of said roadway sections, said strip being provided with depressions parallel to and spaced inwardly of said flanges and on either side of a central region of said strip, the bottom surface of said strip having a downwardly projecting supporting rib opposite said central region and a pair of downwardly projecting auxiliary ribs spaced on opposite sides of said supporting rib and opposite respective ones of said depressions, said depressions, said supporting rib and said auxiliary ribs extending transversely across said strip, and said auxiliary ribs being spaced above said flat bottom of the groove whereby movement of said roadway sections towards each other tends to cause said strip

to buckle downwardly to force said auxiliary ribs toward said flat bottom of the groove, and

a reaction plate fixed to the bottom of said supporting rib and having opposite side portions projecting from opposite sides of the supporting rib in upwardly inclined relation toward, but terminating in closely spaced relation to respective ones of said supporting ribs, whereby compression of said strip engages said supporting ribs against said opposite side portions of said reaction plate tending to force said supporting rib downwardly and prevent upward buckling of said central region of the strip.

2. In the roadway or like construction as defined in claim **1** wherein each said anchor means includes laterally projecting portions extending outwardly beyond said strip and provided with openings for securing the anchor means to respective stepped portions of said roadway sections.

3. In the roadway or like construction as defined in claim **2** wherein said projecting portions of the anchor means are coated with protective material.

4. In the roadway or like construction as defined in claim **3** wherein said upstanding flanges are interrupted at intervals along their lengths to allow transverse flexibility of said expansion member.

5. In the roadway or like construction as defined in claim **1** wherein said upstanding flanges are interrupted at intervals along their lengths to allow transverse flexibility of said expansion member.

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