October 2018: Candidate Cover Sheet

Patent Examination Board

Exam Paper: FD4 Infringement and Validity

Candidate No:

Venue:

At the end of the examination:

1. Count up the number of sheets you have used which you wish to be marked.
2. Use the boxes on each sheet of the answer script to number the sheets: '1 of 25', '2 of 25' etc.
3. If you have used extra sheets, please add your candidate number and the examination reference to these sheets too.
4. Do not staple the sheets, or use adhesive tape or treasury tags.
5. Write the number of sheets of paper you have put in this envelope here (do NOT include this cover sheet in your calculations).

No. of Sheets	

6. Place the answer sheets that you wish to be marked in order in the white envelope provided with this sheet uppermost and the examination paper detail and your candidate details **showing through the envelope window**.
7. Seal the envelope and leave it on your desk face up.
8. Leave any spare answer script paper on your desk.
9. You may take the examination paper with you.

For examiner's use only:

	Assessment task							
	Construction	Infringement	Novelty	Inventive Step	Sufficiency	Amendment	Advice	Total
Marks awarded								

CCS1

Final Diploma

Patent
Examination
Board

FD4 Infringement and Validity

Tuesday 02 October 2018 10:00 to 15:00

INSTRUCTIONS TO CANDIDATES

1. The whole assessment task is to be attempted.
2. The total number of marks available for this paper is 100.
3. Start each part of your answer on a new sheet of paper.
4. Write your answers on alternate lines.
5. Do not state your name anywhere in the answers.
6. Write clearly, as examiners cannot award marks to answer scripts that cannot be read.
7. The scripts will be photocopied for marking purposes.
   a) Use only **black ink**.
   b) Write on one side of the paper only.
   c) Write within the printed margins.
   d) Do not use highlighter pens on your answer script.
8. Instructions on what to do at the end of the examination are on the Candidate Cover Sheet.
9. Any candidate script removed from the examination room will not be marked.
10. This question paper consists of 18 sheets, including this sheet, and comprises:
    Assessment task (1 sheet)
    Client letter (1 sheet)
    Document A Patent (8 sheets)
    Document B Alleged Infringement (3 sheets)
    Document C Prior Art (1 sheet)
    Document D Prior Art (2 sheets)
    A spare set of Claims of the Patent (Document A) for you to annotate and include in your answer if you wish (1 sheet).

Assessment task

Your client sends you the letter and documents listed on the Instructions to Candidates.

Your task is to prepare advice to your client on whether the attached granted patent may be enforced and defended.

You should prepare notes on which you would base your advice in which you:

- **a) Provide an opinion on infringement and validity, in the UK only.**
- **b) Identify other patent-related legal issues pertinent to the facts presented.**
- **c) Outline possible actions that may be taken to strengthen your client's legal position.**
- **d) Summarise the opinions formed in a) to c) above.**

Note the following:

- a) You should accept the facts given to you and base your answer on those facts.
- b) You should not make use of any other special knowledge that you may have of the subject matter concerned.

Total: 100 marks

Client letter

Dear Attorney

Thanks for your time at the networking event two days ago – it was quite a fortuitous meeting.

As I mentioned to you, our business is concerned with providing electrification systems to towns and cities to enable them to provide tram and trolley-car routes into towns along existing roadways. A tram is a road vehicle which runs on tracks and a trolley-car is a road vehicle which runs on wheels. Both are powered by electricity supplied from overhead electricity cables. A tram usually has a single pantograph connector to receive electricity (the return route being through the tracks), whereas a trolley-car has two poles, one connecting to the power cable, the other providing the return route.

We have recently been awarded a patent for our new electrification system (Document A). I was pleased because I drafted the priority document. The grant of the patent represents a major advantage to us because the local authorities, which commission electrification projects, appear to like our system. We have been told that they appreciate the inherent safety capabilities and low electrical power losses.

One of the key features of our design is the use of a constant force coil spring. Confidentially, you should know that it is only in the past few months that our technical team has been able to design and manufacture a constant force coil spring with the necessary strength to be able to withstand the forces applied to it in use. Previous experiments used helical springs.

In order to become a supplier to a town or city, there is usually a tender process, where interested parties submit a proposal to the relevant local authority. We are currently working on opportunities to provide the electrification for several towns and cities for their new tram and trolley-car projects.

A recent tender on which we bid was for Mains Town. The Mains Town tender document specified that our system, or an equivalent, must be used. Because of this, and because of our patent, we thought that we were odds-on to be awarded the contract.

I have recently found out that another business, Me2 Ltd, also tendered and has been awarded the Mains Town contract. I attach a copy of Me2's press release (Document B).

In order to warn them off, I sent the Mains Town local authority and the Managing Director of Me2 a letter to tell them that they had better not use our system. The Managing Director of Me2 has replied saying that he considers that our patent is invalid and has provided a couple of documents (Documents C and D). He also mentions that he will take action against us for the letter I sent to Mains Town, which seems crazy to me.

I have reviewed the documents and neither seems to relate to our system. I have been told that Document C was referenced in our industry magazine *Tram Electrification Monthly* in January 2016. Document D seems to be about trains.

It is important that we do whatever we can to stop Me2 on the Mains Town contract. If we do not, they will likely compete with us on all other upcoming contracts, many of which are significantly larger than the Mains Town contract.

I shall come over to your office next week to discuss the strategy you advise we adopt. In the meantime, please prepare a note which I can share with my management team to discuss internally.

Yours
George Stevenson

GB2987654

Priority Date: 14 July 2015
Filing Date: 14 July 2016
Grant Date: 6 September 2018

Power Supply

This invention relates to the provision of electricity, and particularly the provision of electrical power to a road-going vehicle.

It is well known to provide electrical power to vehicles to power those vehicles. In some cases, electrical power is applied through a rail. The vehicle is provided with contacts to accept the electrical power from the rail. A known system of this type is deployed in the London Underground train system, which ferries people around London. It is also known to provide electrical power to a train using an overhead electricity (OHE) cable. The OHE cables are located between overhead pylons, which are like poles with arms which extend over the rails and are distributed along the train track. The train is typically provided with a pantograph (a frame on top of the train provided with a carbon electrical contact point) to pick up the electrical power supplied from the OHE cable.

It is known that such OHE cables are formed from metal, due to the inherent electrical conductivity of metal. The more conductive a metal, the lower the resistive losses along the cable (if a metal has a relatively high resistance, the passage of electricity will heat the wire, which further increases electrical resistance), and so it is desirable to make a cable from a material with low resistance and high electrical conductivity. An ideal material from a conductivity perspective is copper. However, copper has a fairly large coefficient of thermal expansion and so expands and contracts noticeably when it is heated and cooled (for example on a hot day or during a cold day).

The OHE cables are typically suspended from a carrier cable (or catenary) by dropper wires. The carrier cable is also susceptible to environmental changes. As the ambient temperature increases, the carrier cable will expand, causing the carrier cable to sag. Conversely, when the temperature decreases the carrier cable contracts, thereby causing the carrier cable to become taught. This can affect the tension applied to the OHE cable.

As shown in Figures 1A to 1D, there is a prior art train apparatus for ensuring that the tension in a carrier cable is maintained, from which carrier cable an OHE cable for a railway is suspended. The apparatus comprises a series of weights which are attached to an end of a carrier cable to maintain the tension in the carrier cable. In particular, the weights are supported on a frame and the frame is attached to the end of the carrier cable via a pulley system.

The OHE cable may be attached to a further OHE cable to ensure that the electrical power supply is maintained. The traditional OHE cables have a core of copper and may be coated or covered (at least on a non-contact side) by a protective cover. The dropper wires are clamped to the OHE cable and this can cause delamination of the protective cover over time.

Whilst the foregoing prior art system is useful it has drawbacks.

For example, as trams and trolley-cars make a reappearance in many cities around the world, there is a need for OHE cables to be installed along roadways which were (or are still) used by other road vehicles. The provision of tensioning weights is considered potentially hazardous, especially as the weights used in the above prior art train apparatus can be of 1000kg or more. For example, whilst failure of a carrier cable running along a train track will simply result in the weights falling onto the railway siding, along a roadway there is a potential for injury to people or vehicles that are using the road.

For trams and trolley-cars, the way around this problem has been to suspend the carrier cable from adjacent buildings by suspension cables or to provide gantries which are closer together than they need to be to ensure adequate tension. The first solution requires the local authority to obtain permission from the building owners, which can be lengthy and expensive; the second option is deleterious because of the installation of otherwise unnecessary gantries.

In order to address this problem there is provided a system in accordance with Claim 1.

In particular, the resilient biaser is preferably a spring. With the use of a spring, as the cable tends to contract or expand (for example under ambient environmental conditions) the spring can compensate and deliver the appropriate level of tension to the cable.

It is particularly preferred that the spring is a constant force spring rather than a helical (compression or tension) coil spring, although either may be used.

The constant force coil spring is preferably located in a protective metal housing.

Advantageously, the protective metal housing can protect the resilient biaser from the elements and, in the unlikely event of a failure, will protect pedestrians from the resilient biaser.

The resilient biaser is preferably connected to an end of the cable via a rigid connection. The resilient biaser may be connected to the gantry via a non-rigid connection, preferably a ball-and-socket joint, to allow relative motion between the biaser and the cable.

The cable of the invention is formed in accordance with Claim 5.

We have surprisingly found that OHE cables which have a core of non-circular cross section are better able to withstand the securing forces used to secure the cables in use and hence delaminate less. We believe that as the number of sides the core has decreases (when looked at in cross section) the better the engagement between the OHE cable and the contact point on the road vehicle. We have also surprisingly found that as the cable becomes flatter in a contact zone, the lower the electrical losses along the OHE cable in use and the lower the wear on the contact point of the tram/trolley-car.

Advantageously, we use a rubber cover to our cables, which improves the clamping interaction between the cable and the dropper wires.

In order that the invention may be more fully understood it shall now be described, by way of example only, and with reference to the accompanying drawings, in which:

Figure 1A to 1D show various aspects of a prior art train apparatus;
Figure 2 is a perspective view of a system according to the invention;
Figures 3A, 3B, 3C are views of a resilient biaser of the system of Figure 2; and
Figures 4A to 4C show various examples of cables according to the invention.

As previously stated, Figure 1A shows the well-known system for providing power to trains on railways RL. The carrier cable C is strung between pylons P and adopts the natural curved path of a suspended cable. Dropper lines or cables D depend from the carrier cable C to suspend an OHE cable O at a set distance above the railway line RL. A return line R is also provided which is in electrical communication with the rail RL. Transformers T are provided on at least some of the pylons P.

A dropper line D is shown in Figure 1B. The dropper line D depends from the carrier cable C and grasps the OHE cable O by a clamping mechanism CM.

A cross section of the OHE cable is shown in Figure 1C. The OHE cable O has a substantially circular cross section with a pair of rebates A_1, A_2 which extend along the OHE cable O to allow the dropper line D, using its clamping mechanism CM, to retain the OHE cable O in place. As will be appreciated, because the OHE cable O has a substantially circular cross section, the contact point between the flat electrical contact of the pantograph on the train lies on a tangent to the OHE cable O.

As is seen from Figure 1D, weights W are suspended from the carrier cables C at successive or periodic pylons P via a pulley system PS to maintain the desired tension within the carrier cables C.

Turning now to Figure 2, there is shown an apparatus 1 according to the invention for powering a tram or trolley-car along a road 2 in a town or city. The apparatus 1 has plural gantries 3 (*i.e.* gantries 3A, 3B, 3C…) located along the roadway 2. The gantries 3 span the road 2 from one side to the other to provide a through-path to allow the trams or trolley-cars or other road users to use the road 2. The gantries 3 are typically located inboard of paths PP used by pedestrians.

The gantries 3 each have a pair of ground engaging legs 4 which are secured to the road 2, and between the legs 4 is a rigid beam 5 for supporting the weight of the cables.

Strung between successive gantries 3 (*e.g.* gantry 3A and 3B) are one or more overhead electricity (OHE) cables 6, each carried by a carrier cable C and dropper lines D. At a first gantry 3 (*e.g.* gantry 3A) a carrier cable C is supported by and secured to the beam 5 (*e.g.* beam 5A) by a resilient biaser 7. At a second gantry 3 (*e.g.* gantry 3B) the carrier cable C is fixedly secured to the beam 5 (*e.g.* beam 5B) through a pair of rigid arm supports 8.

The combination of a resilient biaser 7 at one end of the carrier cable C and a rigid connection at the other end of the carrier cable 5 removes the need for weights to tension the carrier cable C, which removes a potential risk when deploying the system in towns.

As shown in Figure 3A, the resilient biaser 7 comprises a constant force coil spring 8. A constant force coil 8 spring comprises an elongate strip of metal 9 which naturally forms into a coil and is supported for rotation on a bobbin 10. As the name implies, when the coil is stretched out (Figure 3C) the restoring force F (*i.e.* the force encouraging the spring to adopt its coiled 'equilibrium' position (Figure 3B) is the same, independent of how much the spring 8 has been uncoiled. This is clearly beneficial over a helical compression spring, which has a restoring force dependent upon how much it has been extended (according to the well-known Hooke's law).

As seen in Figure 3B, the bobbin 10 has a central aperture 10A which is able to receive a spindle 11 (Figure 3C). The constant force coil spring 8 is located within a housing 12 (shown in dotted lines, Figure 3C) to protect the spring 8 from the elements when installed. The constant force coil spring 8 is coiled around bobbin 10 supported on the spindle 11 and is secured to the bobbin 10 at a first or proximal end of the constant force coil spring 8 to provide a limit for the uncoiling of the constant force coil spring 8. The spindle 11 is freely rotatable within the housing 12. The housing 12 is preferably a metal can which shields the constant force coil spring 8, the bobbin 10 and spindle 11 from the elements, and, if the connection between coil spring 8 and cable C fails, will house the spring 8 as it retracts rather than allowing it to whip around, potentially being injurious to passers-by. The housing 12 is secured to the gantry 3 via a ball-and-socket joint 13.

As shown in Figure 4A, there is a cross section of an OHE cable 6A of the invention. The OHE cable 6A has a cross section which is hexagonal. The OHE cable 6A has a conductive core 60A, typically formed from copper, or a copper alloy, a protective coating 61A and a pair of rebates 62A for receiving a clamping mechanism of a dropper wire (not shown). The coating 61A is a polymeric or plastics material – we prefer to use a rubber material, which is elastic and withstands the clamping forces in use. The contact point 63A for providing a contact surface with the electrical contact on the tram or trolley-car is a flat surface. Although a circular tube has the smallest ratio of surface area to volume and so one would suspect is preferable for a OHE cable, we have surprisingly found that a cable with a non-circular cross section is less susceptible to degradation in use and provides a more robust contact with the contact point on the tram/trolley-car.

Other OHE cable constructions according to the invention are shown in Figures 4B to 4C. We have surprisingly found that as the area for contacting the contact point on the tram/trolley-car increases (for a given cross-sectional dimension, the power losses along the cable in use decrease. We have further surprisingly found that a more robust connection between dropper wire and OHE cable of the invention is generated, when the OHE cable O is coated, leading to fewer failures in use. Accordingly, the rectangular cable 6C of Figure 4C is preferable to the pentagonal cable 6B of Figure 4B, which is preferable still over the hexagonal cable 6A of Figure 4A. Notwithstanding our preference, each of the cables 6A–6C outperform the standard cable O of the prior art (Figure 1C).

Claims

1. A system for providing electrical power to a road vehicle, the system comprising at least a pair of gantries and an overhead cable supported by a carrier cable extending from the gantries at an elevated position, the gantries each having a support leg for engaging the ground either side of a road and a beam spanning the road between support legs, the overhead cable being connected or connectable to a supply of electricity, a first end of the carrier cable being rigidly secured to a first of the gantries a second end of the carrier cable being secured to the second gantry by a resilient biaser arranged to generate tension in the carrier cable.

2. A system according to Claim 1, wherein the cable has a core and a sheath, the core being formed of a first material and the sheath being formed of a second material.

3. A system according to Claim 1, wherein the resilient biaser is a spring.

4. A system according to Claim 3, wherein the resilient biaser is secured to the gantries via a flexible connector and is rigidly secured to a first end of the carrier cable.

5. A cable for carrying electricity, particularly in an overhead power system, the cable comprising a core and a sheath, the core being formed of a relatively conductive material and the sheath being formed from an elastic material, the core having a cross section which is not circular.

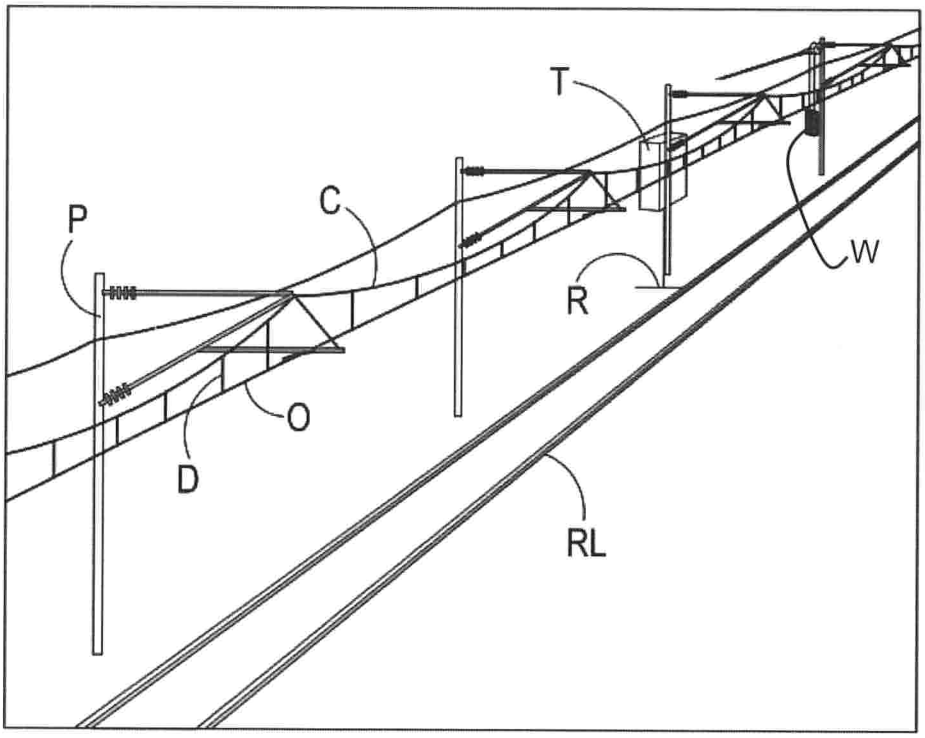


Figure 1A
(Prior Art)

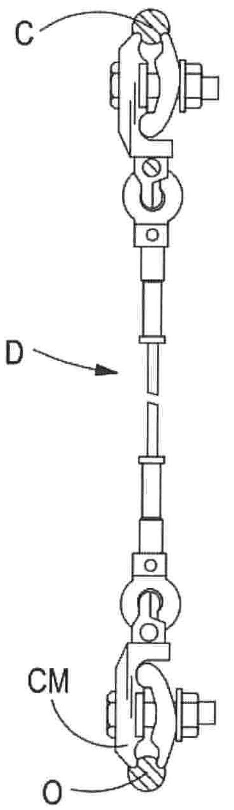


Figure 1B

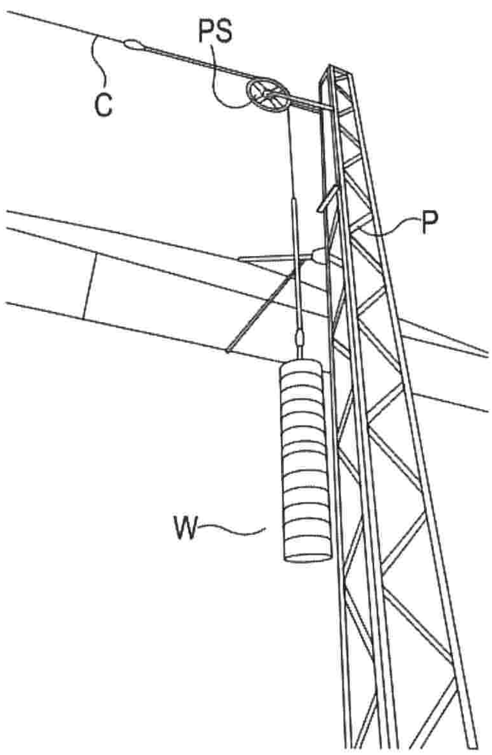


Figure 1D

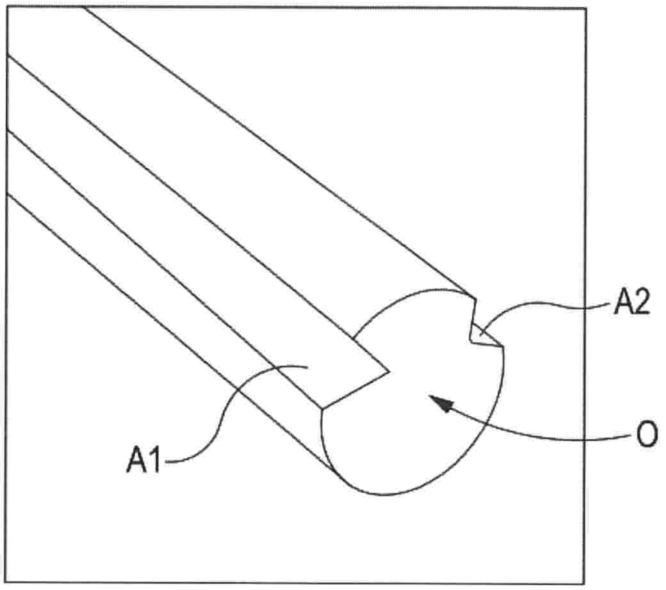


Figure 1C
(Prior Art)

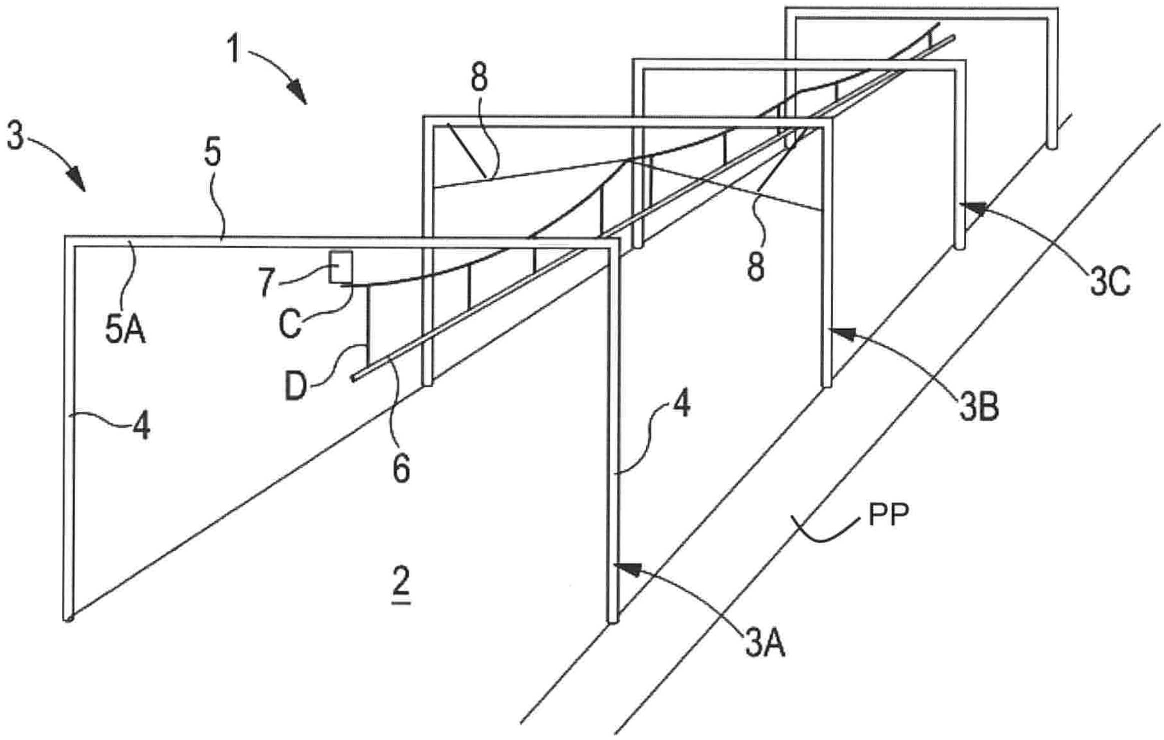


Figure 2

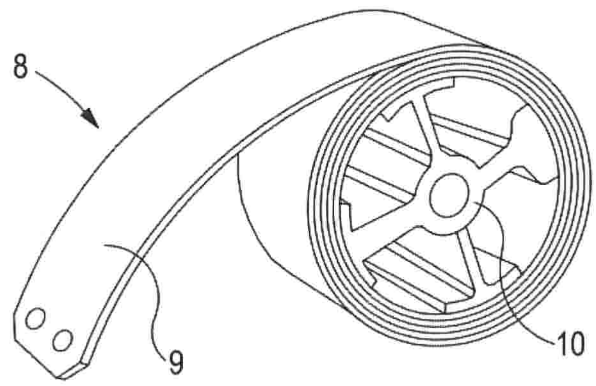


Figure 3A

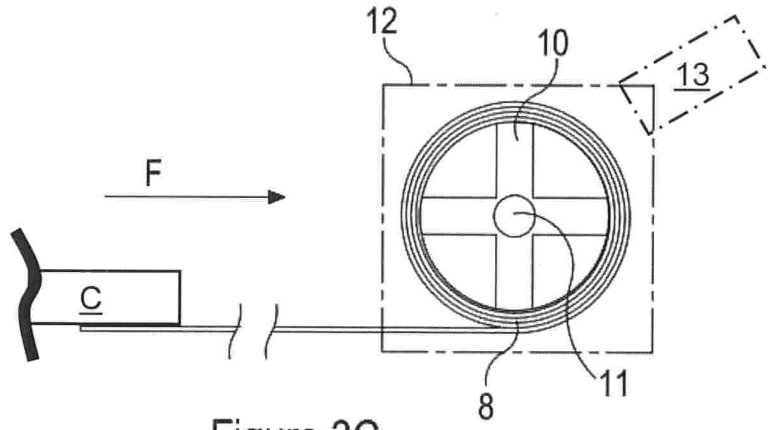


Figure 3C

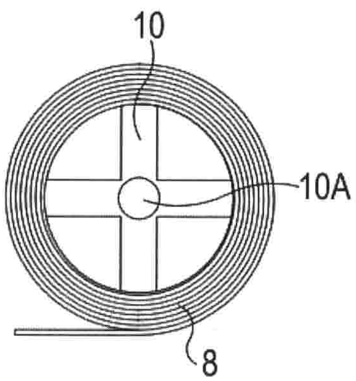


Figure 3B

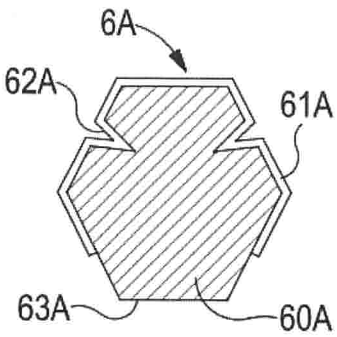


Figure 4A

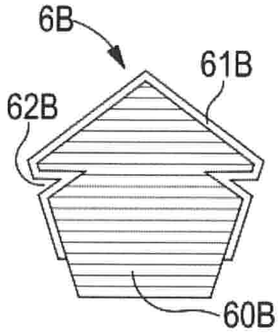


Figure 4B

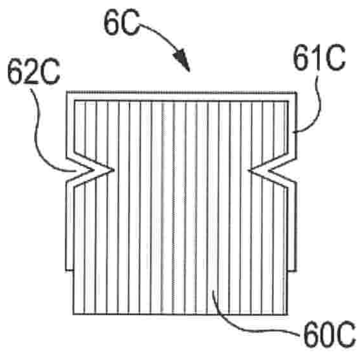


Figure 4C

Document B

Me2 Ltd – Press Release – For Immediate Circulation (August 2018)

Me2, the UK's most innovative electrification company, is proud to announce that it has recently been awarded the contract to supply the electrification project of Mains Town.

Mains Town is the latest town to decide to provide modern trams along its roads to help with urban congestion and to improve the environment.

Me2 is delighted to be able to provide its new system to Mains Town and looks forward to rolling out the system in other towns and cities across the UK and further afield.

Me2's Technical Director, Richard Trevithick, was the chief designer of the Me2 system and was the inventor of the new cable system used in the design.

The Me2 system is shown below in street view and plan view. There is also a detailed view of our superior spring system.

In particular, where possible, we have avoided the need for expensive pylons or gantries and have attached our cable supports and suspension cables to adjacent buildings. To help encourage business owners to allow us to tether our cables to their buildings we have an innovative system for hanging advertising from the cables – a win-win situation for the rate payers of Mains Town (because installation costs are reduced) and the businesses (who get extra advertising space).

Our system uses small springs at almost every support point to maintain the required tension in the cables. Because of the spacing of our attachments – we attach the cables to buildings at relatively short linear distances (shown as 'd' in the drawing) along the overhead cable – each suspension cable, and hence each of the springs, only needs to take a fraction of the weight which other systems are obliged to carry.

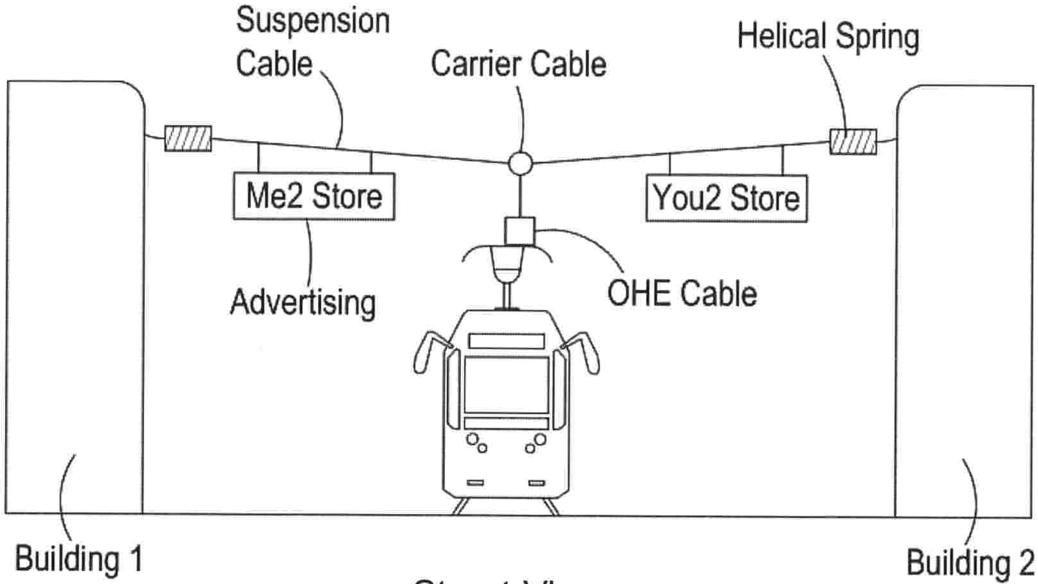
The springs are secured to the building using an anchor bolt (a static connector). Each of the springs is connected to an anchor bolt using a universal coupling, which allows for pivotal motion between the spring and the anchor bolt. This allows the system to accommodate wind motion and other forces which act on the system.

Where we do not use springs, the suspension cable is secured to the building (or other support) using an anchor bolt.

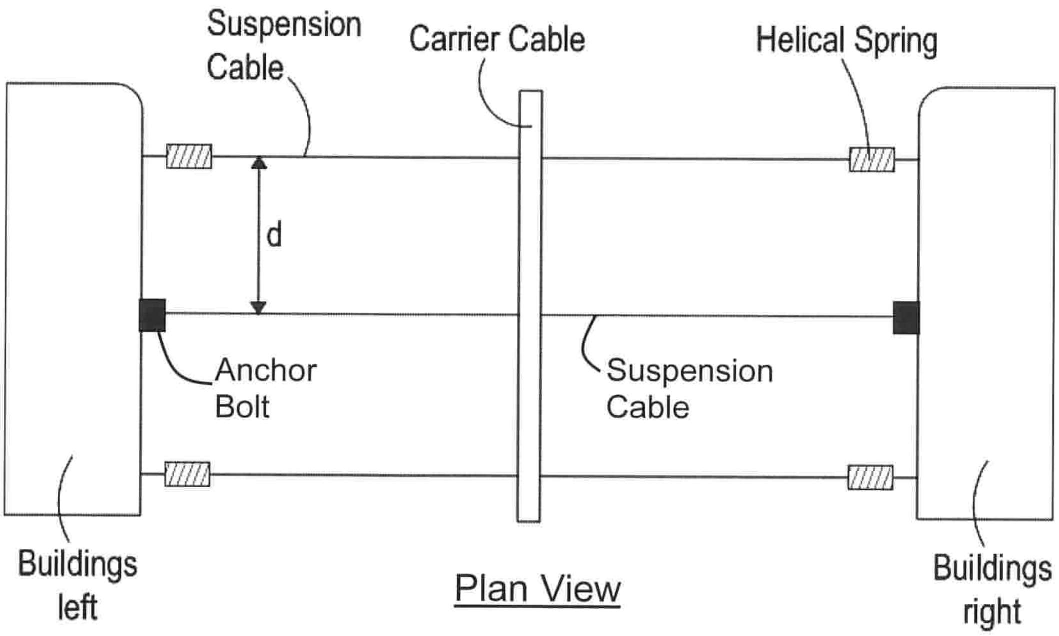
As the tramway moves to more remote locations (where buildings may not be suitably positioned), we use the existing street furniture, such as street lamps, or erect simple posts to provide the necessary supports. As with all tram systems (and as required by law), at each terminus (end) of the tramway we use a single gantry to make the electrical connection to the OHE cable. In order to make the connection robust at each of the terminal gantries, we use a suspension cable slung between the legs of the gantry under the cross member with one of our springs connecting the suspension cable to a first leg of the gantry and an anchor bolt static connection secured to the other leg of the gantry just under the cross member.

We have also developed a new coated square cable, which has significant advantages over the run-of-the-mill conventional cables.

Our approach gives significant advantages in terms of installation time and cost, both of which have been appreciated by the awarding body of Mains Town.

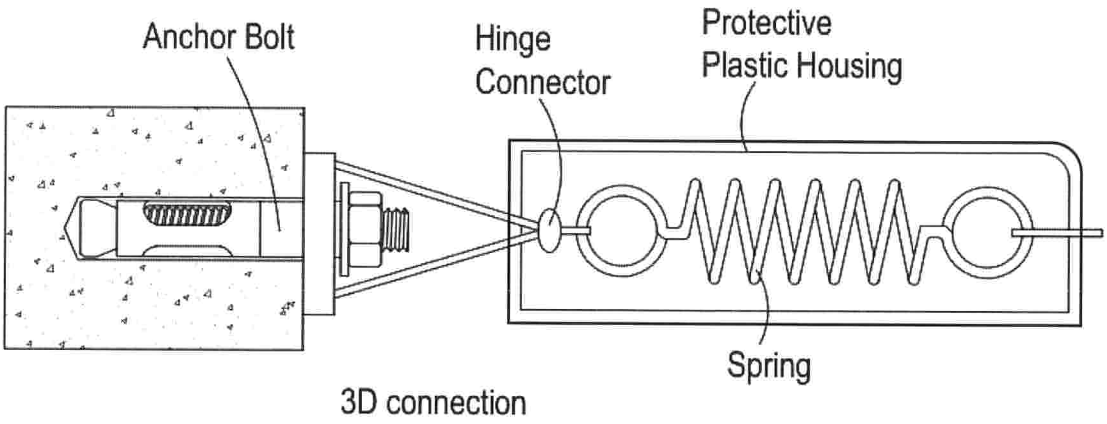


Street View



Plan View

Document B



About Me2 Limited – Me2 are the leading systems engineers for electrification of inner cities and towns to provide modern transport systems which have minimal environmental impact whilst enhancing the living experience.

For further information visit our website.

Document C

Article in *Electrical Threads*
Published January 2010

The shape of things to come

All electrical wires are circular – right? Not now after new research from the Modern University will make 'smart' clothing a reality.

Researchers from the Modern University have managed to demonstrate that threads for weaving into fabrics to make 'smart' clothing can be made more efficient by altering the cross-sectional shape of the thread.

Smart clothing has been a long-term goal of many because of the commercial potential, for example in relation to novelty or safety clothing, for example to display messages or provide lights on clothing, or even sensors. One of the principal issues in providing such functionality is the effective carrying of current whilst not interfering with the inherent flexibility of the material.

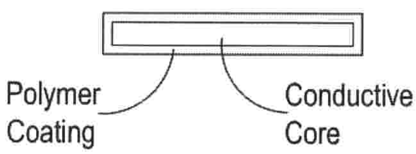
It is of course necessary to cover the thread with an insulating material to reduce short circuits and this can increase the bending resistance of the thread.

The researchers have been able to demonstrate that shaped cables can be designed and are better able to retain their insulating covers after being washed in washing machines. The researchers have also been able to show that the coating can be made thinner when the threads are shaped, which reduces the resistance to bending. The reason for this has not yet been published (there are rumours that intellectual property is behind the secrecy). In a surprising innovation, the researchers have been able to treat the conductive material in such a way that the protective coating can be removed from portions in which electrical contact is required (e.g. in selected regions or along an entire face of the thread) without compromising the coating in the other regions

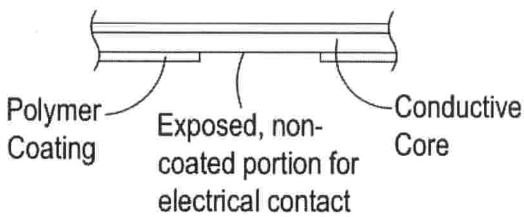
A picture of a new thread is shown below.

The new business, Cables 'n Threads Ltd, will shortly launch a low gauge (thin) conductive thread which is able to be used in functional clothing.

There is also a suggestion that thicker gauge materials for heavier duty work might also benefit from the approach.



Cross-sectional view of new coated thread



Side elevation view of new coated thread

Document D

Excerpt from *The Railwayman*, October 1980

Are Springs the Answer?

As anyone who has travelled the great railways of the world will have witnessed, there are widespread efforts to electrify railways.

As the debate about the environment continues apace, it is likely that more and more railway companies will turn away from diesel power and will look towards electrification. As we all know, although electric power is more expensive on a per mile basis (once installation and maintenance costs are factored in), diesel engines emit noxious gases and particles, which some consider to be environmentally damaging, and potentially injurious to health.

Against this backdrop, many urban train lines are now being electrified.

Because of the cost of burying electrical cables, and the risk of having them at ground level, most electrification projects use a series of pylons or (less frequently) gantries and overhead cables suspended from carrier cables. Trains then use a contact provided on the roof of the train carriage to receive the electrical power.

Clearly, from an installation cost perspective it is beneficial to have the pylons spaced as far apart as possible (fewer pylons per mile means less installation cost per mile). However, the limitation is the weight, strength and performance of the overhead cable.

Because the cables are made of metal (to provide the necessary conductivity), they are heavy, and so the longer the gap between the pylons/gantries the heavier the cable and the more likely the cable is to expand and contract due to ambient conditions.

Many of the newer urban rail installations have turned to the traditional weights to help counteract the environmental effects and to provide the required tension. Pulleys are used to convert the weight of the cable into a force acting along the overhead cable and thereby provide the required tension.

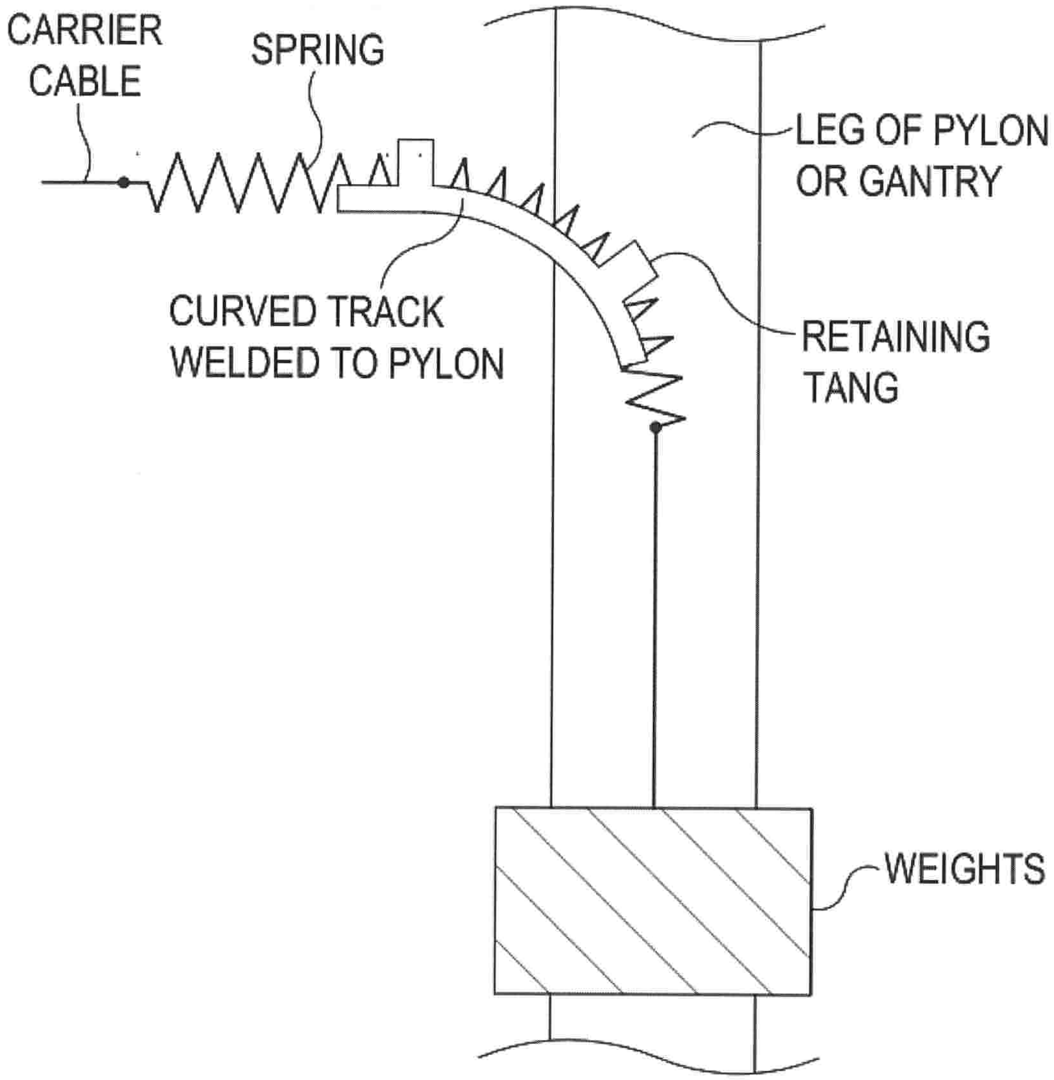
Due to the exposure of the pulley to atmospheric conditions (rain, snow, dirt, leaves, etc.) the pulley may seize up, which acts to limit the tensioning effect on the cable.

A new simple system, which has been successfully trialled in India, may provide the answer.

The system is shown below. In essence, the weight is connected to the cables via a helical spring which is bent around a curved track. The spring is chosen to be able to withstand the effect of the weights, and actually provides some resilience to environmental changes experienced by the cables, which has been found to be beneficial in very hot climates. Because there are no mechanical moving connections there is no risk of failure.

Document D

The curved track is attached to the pylon or the gantry by a simple welding process. Tangs or other abutments overlie the spring to secure it in place.



Document A

SPARE SET OF CLAIMS OF THE PATENT

1. A system for providing electrical power to a road vehicle, the system comprising at least a pair of gantries and an overhead cable supported by a carrier cable extending from the gantries at an elevated position, the gantries each having a support leg for engaging the ground either side of a road and a beam spanning the road between support legs, the overhead cable being connected or connectable to a supply of electricity, a first end of the carrier cable being rigidly secured to a first of the gantries a second end of the carrier cable being secured to the second gantry by a resilient biaser arranged to generate tension in the carrier cable.

2. A system according to Claim 1, wherein the cable has a core and a sheath, the core being formed of a first material and the sheath being formed of a second material.

3. A system according to Claim 1, wherein the resilient biaser is a spring.

4. A system according to Claim 3, wherein the resilient biaser is secured to the gantries via a flexible connector and is rigidly secured to a first end of the carrier cable.

5. A cable for carrying electricity, particularly in an overhead power system, the cable comprising a core and a sheath, the core being formed of a relatively conductive material and the sheath being formed from an elastic material, the core having a cross section which is not circular.