



HEAD SUSPENSION ASSEMBLY FOR A READ/WRITE HEAD

This invention relates to a head suspension assembly for a read/write head, for example as used in magnetic disk units.

Figures 1 to 3 show a head suspension assembly of a kind conventionally used in magnetic disk units. The assembly comprises a head slider 1 including a magnetic read/write head for writing and reading data. The slider 1 is flexibly mounted at the end of a support arm comprising a load beam 2 attached to a mounting plate 3 which is connected to a head actuator (not shown). A tube 5 extends along the edge of the support arm and contains a plurality of wires 4 covered with insulating material. The wires 4 are connected at the free end of the beam 2 to the read/write head on the slider 1.

A number of claws 6 clamp the tube 5 to the edge of the beam 2 and plate 3, the degree of clamping of at least one of the claws 6 (for example the claw 6 shown within the circled part of figure 1) being sufficiently strong to deform the tube 5 and clamp the wires 4 therein.

This is shown in figures 3(a) and 3(b) where the situation is shown respectively before and after clamping. Prior to clamping, the wires 4 are loosely contained in the tube 5, whereas afterwards they are clamped together so that they are frictionally engaged with each other and with the inside of the tube 5.

The purpose of this clamping is to prevent movement of the wires 4 along the tube, for example at the time of soldering their free ends to a flexible cable or other connection means at the plate 3, which may result in deformation of the loop shape of the wires at the head slider 1. If deformations arise in this loop shape, the flying height, which is the most important parameter of the head suspension assembly, will be changed. Therefore, the yield of the products using a head suspension assembly such as a magnetic disk unit will decrease.

A problem with the conventional technique in which the tube 5 is strongly clamped so as to deform it and fix the insulated wires 4 therein is that if the claw 6 is clamped too strongly a crack is generated on the tube 5 or the insulated wires 4 may be cut or short-circuited. On the



other hand, if the claw 6 is not clamped strongly enough the wires 4 are not fixed securely, with the result that they move easily.

An object of the present invention is to provide a head suspension assembly in which the wires passing through the tube may be fixed firmly against movement longitudinally of the support arm in a manner in which the above problems are avoided or mitigated.

This object is achieved by the invention claimed in claim 1.

The advantage of the invention is that the filler which occupies the space around and between the wires permits the wires to be firmly fixed in position with only a light clamping force. Nevertheless, even if excessive clamping force is used the filler will to a large extent resist excessive deformation of the tube and protect the wires against damage.

It is desirable that the tube be able to transmit light and the filler able to be cured by light at room temperature. This avoids disadvantages caused by curing of the filler by heating, for example, problems caused by gaseous materials coming out from the filler and tube by heat and becoming a contamination source for magnetic disks.

Further it avoids the tube being expanded or contracted when it is heated and allows the use of a tube material which does not need special heat resistant qualities. In addition, since the position of the filler in the tube can be checked from the outside, the portion to be clamped is known easily and accurately. Advantageously the filler is colored, so that its position in the tube can be checked much more easily.

An embodiment of the present invention will now be described with reference to the accompanying drawings, in which:

Figure 1 (previously described) shows a head suspension assembly according to the prior art;

Figure 2 is an enlarged view of part of figure 1;

Figures 3(a) and 3(b) illustrate how the wires 4 are fixed in the tube 5 in the prior art assembly of figures 1 and 2;



Figure 4 is a side view illustrating how the wires 4 are fixed in the tube 5 according to the embodiment of the invention;

Figure 5 is a plan view, partially in cross-section, of the tube and wires of figure 4; and

Figure 6 is a cross-sectional view of figure 4.

Apart from the manner of clamping the wires 4 in the tube 5 the construction of the head suspension assembly according to the embodiment of the invention can be the same as described in relation to figure 1. Therefore, figure 1 and the related description can be taken to represent the embodiment of the invention as well as the prior art apart from the details of the clamping.

The embodiment of the invention differs from the prior art by the method of clamping the wires 4 and tube 5, as shown in figures 4 to 6 which are enlarged views of the part of the assembly which is circled in figure 1. In particular, a filler 7 is introduced into the part of the tube 5 to be clamped and the insulated wires 4 are firmly fixed by lightly clamping the part of tube 5 containing the filler 7 with a securing means such as the claw 6.

Any kind of tube material may be used which is resistant to clamping, and in the present embodiment Teflon (a brand name of E. I. du Pont de Nemours and Co.) is used which is also transparent to light. Moreover, any kind of filler can be used which does not corrode the tube 5 and insulated wires 4 but preferably a liquid material which can be cured by light at room or moderate temperatures. In the present case a liquid plastics material which can be cured by ultraviolet light at room temperature is used.

In manufacturing the assembly according to the embodiment of the invention, the filler 7 is introduced into the tube 5 by pouring it into the tube from the open end of the tube at room temperature after the wires 4 have been inserted into the tube. When the filler is dripped into the open end, the filler penetrates into the tube into the space around and between the wires 4 by capillary action. Therefore, the filling work is very simple. The filling can be performed more quickly by introducing the filler into the tube under pressure.

When the liquid filler has been introduced into the tube it is irradiated by ultraviolet light at room temperature. Since the tube transmits ultraviolet light, the filler in the tube is thereby cured. The part of the tube 5 which contains the filler is then lightly clamped by the claw 6 to the edge of the plate 3 of the head suspension assembly.

Since the tube 5 is transparent or semi-transparent, the position of the filler 7 therein is readily seen and therefore the process of clamping the tube in the correct place is easy. Moreover, if, as preferred, the cured filler does not adhere to the tube, a fine adjustment can be made to the position of the cured filler in the tube prior to clamping the tube so that the loop shape of the wires at the head slider 1 of the head suspension assembly can be optimized and it is possible to design precisely the flying height.

Thus, using the present invention, the loop shape of the wires at the read/write head of the head suspension assembly may be kept constant at all times because the wires do not move even if they are pulled strongly in order to connect the other end of the wires to a flexible cable by soldering or the like.

Moreover, problems caused in the conventional method, that is, a difficulty in fixing the wires securely without damaging the tube or breaking or short-circuiting the wires may be mitigated.

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CLAIMS

1. A head suspension assembly comprising a support arm carrying a read/write head and, extending along and clamped to the support arm, a tube containing a plurality of insulated wires connected to the head, wherein a filler is introduced into the space around and between the wires in a part of the tube and the part of the tube containing the filler is clamped to the support arm.
2. A method of manufacturing a head suspension assembly as claimed in claim 1, wherein the filler is introduced as a curable liquid into the tube followed by curing of the filler in situ.
3. A method of manufacturing a head suspension assembly as claimed in claim 1, wherein the tube can transmit light and the filler is introduced as a light-curable liquid into the tube followed by curing of the filler in situ.
4. A method as claimed in claim 2 or 3, wherein the cured filler does not adhere to the inside of the tube.

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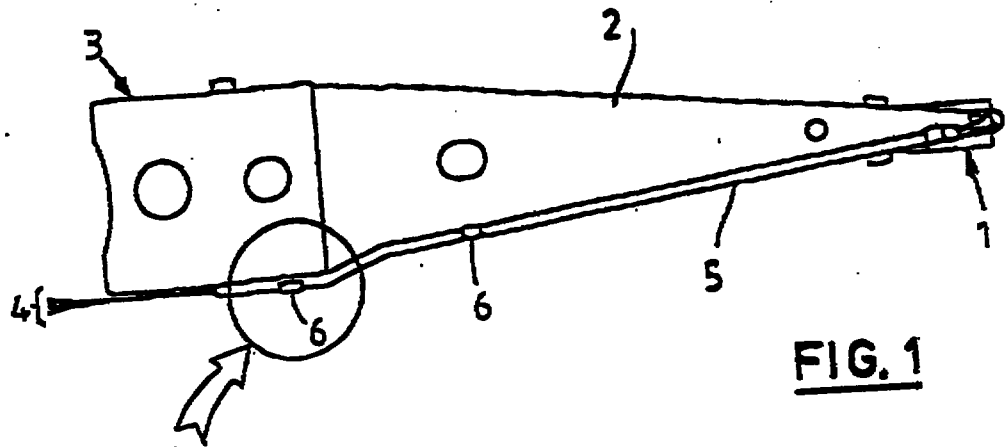


FIG. 1

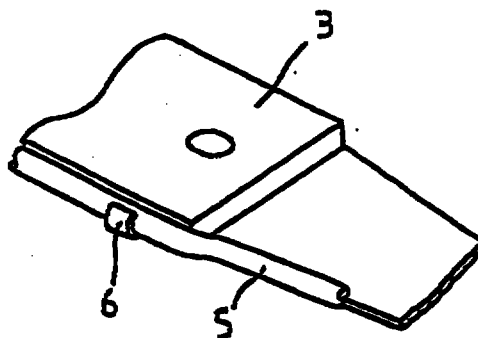


FIG. 2

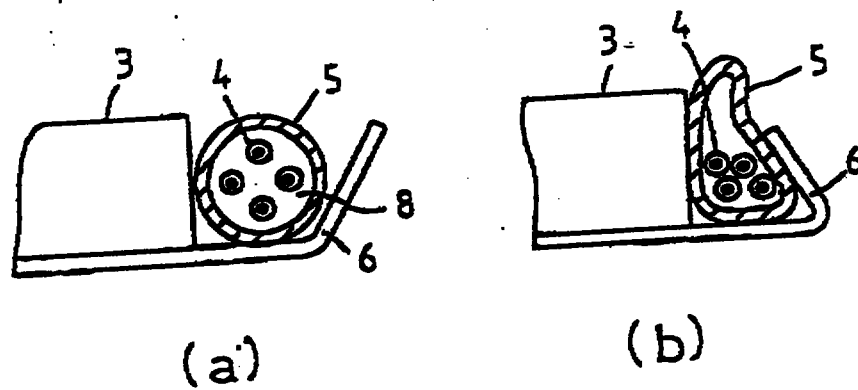


FIG. 3

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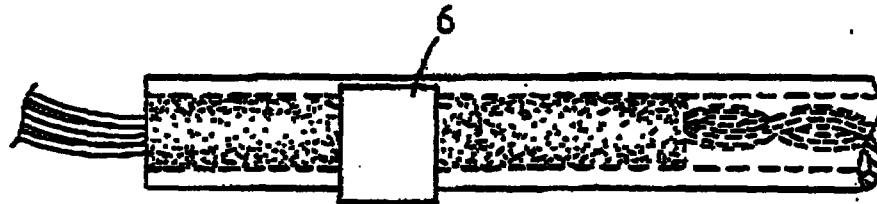


FIG. 4

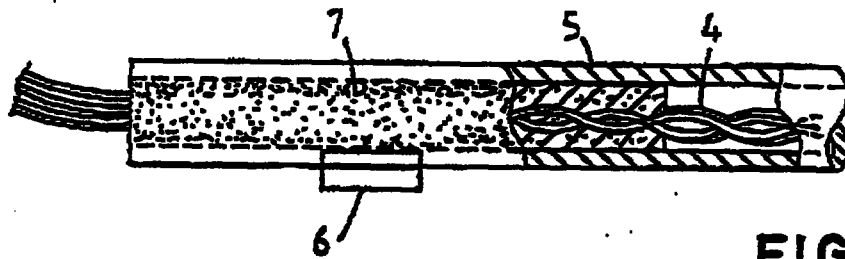


FIG. 5

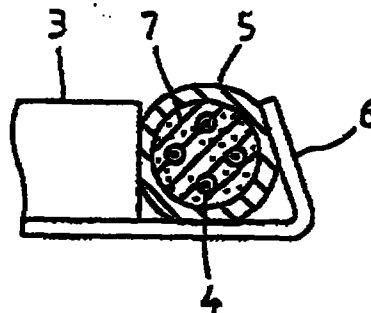


FIG. 6

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HEAD SUSPENSION ASSEMBLY FOR A READ/WRITE HEAD

ABSTRACT

A head suspension assembly comprises a support arm 3 carrying a read/write head and, extending along and clamped to the support arm, a tube 5 containing a plurality of insulated wires 4 connected to the head. A filter 7 is introduced into the space around and between the wires 4 in a part of the tube and the part of the tube containing the filler is clamped by a claw 6 to the support arm. The filler prevents the wires breaking at the point of clamping.

Fig. 6

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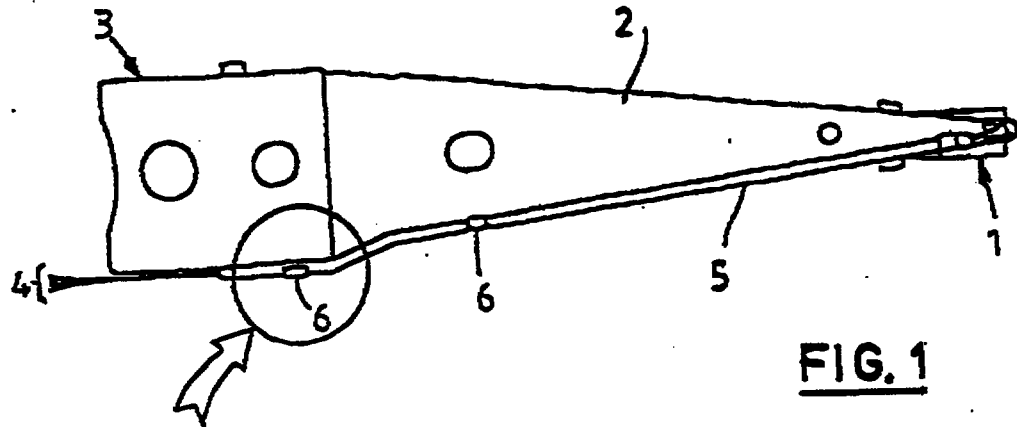


FIG. 1

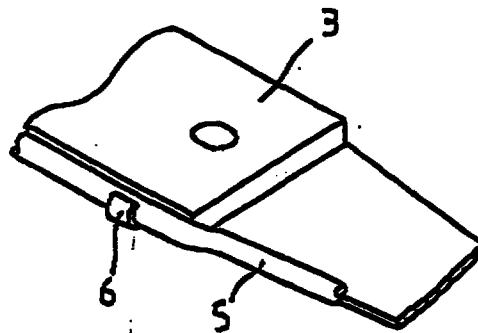


FIG. 2

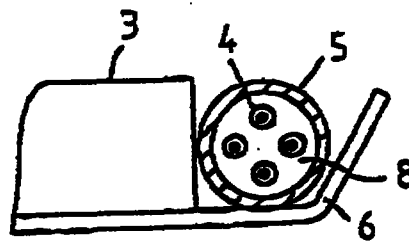


FIG. 3 a

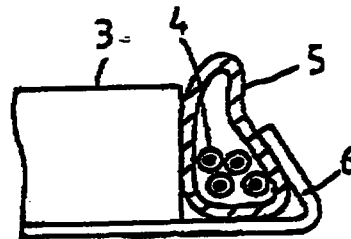


FIG. 3 b

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HEAD SUSPENSION ASSEMBLY FOR A READ/WRITE HEAD

This invention relates to a head suspension assembly for a read/write head, for example as used in magnetic disk units.

Figures 1 to 3 show a head suspension assembly of a kind conventionally used in magnetic disk units. The assembly comprises a head slider 1 including a magnetic read/write head for writing and reading data. The slider 1 is flexibly mounted at the end of a support arm comprising a load beam 2 attached to a mounting plate 3 which is connected to a head actuator (not shown). A tube 5 extends along the edge of the support arm and contains a plurality of wires 4 covered with insulating material. The wires 4 are connected at the free end of the beam 2 to the read/write head on the slider 1.

A number of claws 6 clamp the tube 5 to the edge of the beam 2 and plate 3, the degree of clamping of at least one of the claws 6 (for example the claw 6 shown within the circled part of figure 1) being sufficiently strong to deform the tube 5 and clamp the wires 4 therein.

This is shown in figures 3(a) and 3(b) where the situation is shown respectively before and after clamping. Prior to clamping, the wires 4 are loosely contained in the tube 5, whereas afterwards they are clamped together so that they are frictionally engaged with each other and with the inside of the tube 5.

The purpose of this clamping is to prevent movement of the wires 4 along the tube, for example at the time of soldering their free ends to a flexible cable or other connection means at the plate 3, which may result in deformation of the loop shape of the wires at the head slider 1. If deformations arise in this loop shape, the flying height, which is the most important parameter of the head suspension assembly, will be changed. Therefore, the yield of the products using a head suspension assembly such as a magnetic disk unit will decrease.

A problem with the conventional technique in which the tube 5 is strongly clamped so as to deform it and fix the insulated wires 4 therein is that if the claw 6 is clamped too strongly a crack is generated on the tube 5 or the insulated wires 4 may be cut or short-circuited. On the

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other hand, if the claw 6 is not clamped strongly enough the wires 4 are not fixed securely, with the result that they move easily.

An object of the present invention is to provide a head suspension assembly in which the wires passing through the tube may be fixed firmly against movement longitudinally of the support arm in a manner in which the above problems are avoided or mitigated.

This object is achieved by the invention claimed in claim 1.

The advantage of the invention is that the filler which occupies the space around and between the wires permits the wires to be firmly fixed in position with only a light clamping force. Nevertheless, even if excessive clamping force is used the filler will to a large extent resist excessive deformation of the tube and protect the wires against damage.

It is desirable that the tube be able to transmit light and the filler able to be cured by light at room temperature. This avoids disadvantages caused by curing of the filler by heating, for example, problems caused by gaseous materials coming out from the filler and tube by heat and becoming a contamination source for magnetic disks.

Further it avoids the tube being expanded or contracted when it is heated and allows the use of a tube material which does not need special heat resistant qualities. In addition, since the position of the filler in the tube can be checked from the outside, the portion to be clamped is known easily and accurately. Advantageously the filler is colored, so that its position in the tube can be checked much more easily.

An embodiment of the present invention will now be described with reference to the accompanying drawings, in which:

Figure 1 (previously described) shows a head suspension assembly according to the prior art;

Figure 2 is an enlarged view of part of figure 1;

Figures 3(a) and 3(b) illustrate how the wires 4 are fixed in the tube 5 in the prior art assembly of figures 1 and 2;

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Figure 4 is a side view illustrating how the wires 4 are fixed in the tube 5 according to the embodiment of the invention;

Figure 5 is a plan view, partially in cross-section, of the tube and wires of figure 4; and

Figure 6 is a cross-sectional view of figure 4.

Apart from the manner of clamping the wires 4 in the tube 5 the construction of the head suspension assembly according to the embodiment of the invention can be the same as described in relation to figure 1. Therefore, figure 1 and the related description can be taken to represent the embodiment of the invention as well as the prior art apart from the details of the clamping.

The embodiment of the invention differs from the prior art by the method of clamping the wires 4 and tube 5, as shown in figures 4 to 6 which are enlarged views of the part of the assembly which is circled in figure 1. In particular, a filler 7 is introduced into the part of the tube 5 to be clamped and the insulated wires 4 are firmly fixed by lightly clamping the part of tube 5 containing the filler 7 with a securing means such as the claw 6.

Any kind of tube material may be used which is resistant to clamping, and in the present embodiment Teflon (a brand name of E. I. du Pont de Nemours and Co.) is used which is also transparent to light. Moreover, any kind of filler can be used which does not corrode the tube 5 and insulated wires 4 but preferably a liquid material which can be cured by light at room or moderate temperatures. In the present case a liquid plastics material which can be cured by ultraviolet light at room temperature is used.

In manufacturing the assembly according to the embodiment of the invention, the filler 7 is introduced into the tube 5 by pouring it into the tube from the open end of the tube at room temperature after the wires 4 have been inserted into the tube. When the filler is dripped into the open end, the filler penetrates into the tube into the space around and between the wires 4 by capillary action. Therefore, the filling work is very simple. The filling can be performed more quickly by introducing the filler into the tube under pressure.

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When the liquid filler has been introduced into the tube it is irradiated by ultraviolet light at room temperature. Since the tube transmits ultraviolet light, the filler in the tube is thereby cured. The part of the tube 5 which contains the filler is then lightly clamped by the claw 6 to the edge of the plate 3 of the head suspension assembly.

Since the tube 5 is transparent or semi-transparent, the position of the filler 7 therein is readily seen and therefore the process of clamping the tube in the correct place is easy. Moreover, if, as preferred, the cured filler does not adhere to the tube, a fine adjustment can be made to the position of the cured filler in the tube prior to clamping the tube so that the loop shape of the wires at the head slider 1 of the head suspension assembly can be optimized and it is possible to design precisely the flying height.

Thus, using the present invention, the loop shape of the wires at the read/write head of the head suspension assembly may be kept constant at all times because the wires do not move even if they are pulled strongly in order to connect the other end of the wires to a flexible cable by soldering or the like.

Moreover, problems caused in the conventional method, that is, a difficulty in fixing the wires securely without damaging the tube or breaking or short-circuiting the wires may be mitigated.

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CLAIMS

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2. A method of manufacturing a head suspension assembly as claimed in claim 1, wherein the filler is introduced as a curable liquid into the tube followed by curing of the filler in situ.
3. A method of manufacturing a head suspension assembly as claimed in claim 1, wherein the tube can transmit light and the filler is introduced as a light-curable liquid into the tube followed by curing of the filler in situ.
4. A method as claimed in claim 2 or 3, wherein the cured filler does not adhere to the inside of the tube.

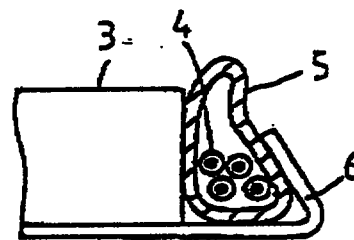
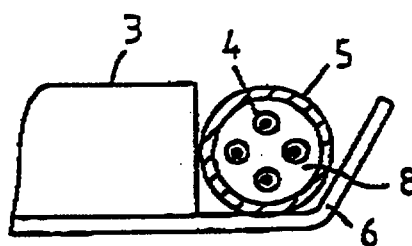
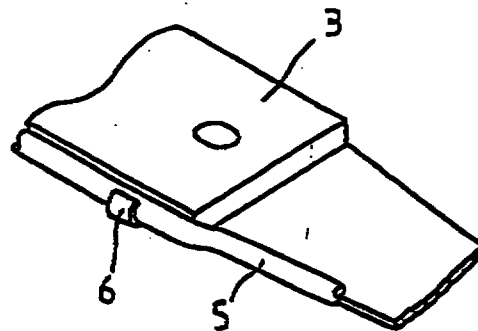
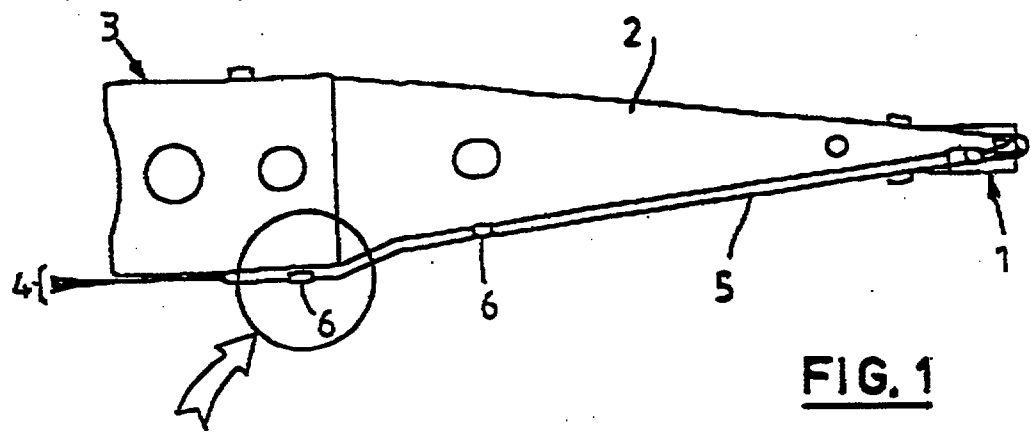


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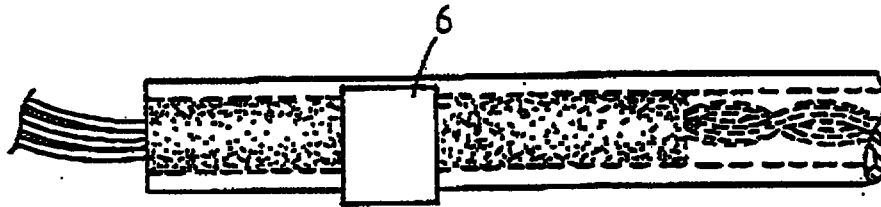


FIG. 4

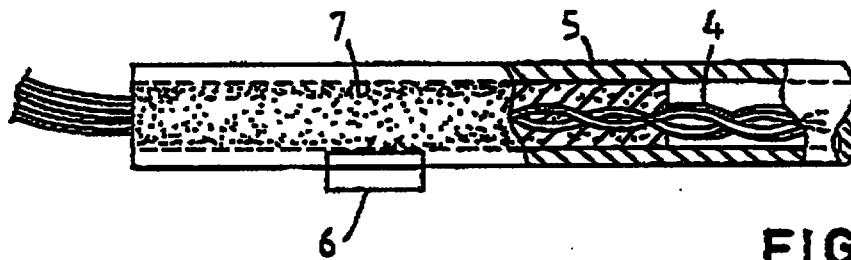


FIG. 5

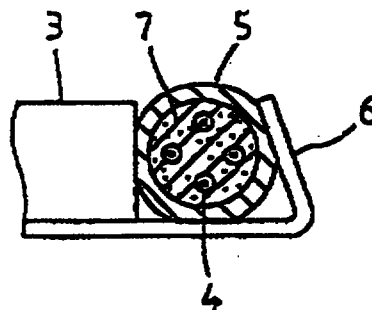


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HEAD SUSPENSION ASSEMBLY FOR A READ/WRITE HEAD

ABSTRACT

A head suspension assembly comprises a support arm 3 carrying a read/write head and, extending along and clamped to the support arm, a tube 5 containing a plurality of insulated wires 4 connected to the head. A filter 7 is introduced into the space around and between the wires 4 in a part of the tube and the part of the tube containing the filler is clamped by a claw 6 to the support arm. The filler prevents the wires breaking at the point of clamping.

Fig. 6

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