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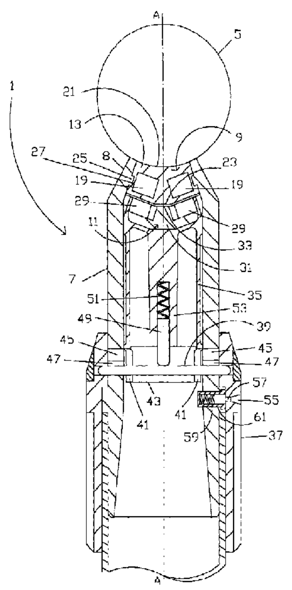

(57) Abstract: Magnetic module (1) for the magnetic anchorage to a ferromagnetic surface of another magnetic, or ferromagnetic module, whose head (3) comprises: a first multipolar magnetic stator (9) that in turn defines a multipolar magnetic anchoring surface (21); and a multipolar magnetic rotor (11), or a second multipolar magnetic stator, coaxial to and facing the first multipolar magnetic stator (9) and equipped with means for orienting the poles of the multipolar magnetic rotor (11), or second multipolar magnetic stator, in series or in parallel with respect to the poles of the first multipolar magnetic stator (9) in order to disable or enable the multipolar magnetic anchoring surface (21) of the first magnetic stator (9).

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MAGNETIC ANCHORING MODULE WITH A SYSTEM FOR ENABLING/DISABLING AND ADJUSTING THE MAGNETIC ANCHORING FORCE AND RELATED ASSEMBLIES.

The present invention refers to a magnetic module equipped with a system for enabling the magnetic force for anchoring a further magnetic, or ferromagnetic module to a ferromagnetic surface, for use in the case of the magnetic module developing a magnetic force of attraction comparable with or superior to the limit of human force. The invention refers also to assemblies obtained using these magnetic modules.

The European patent application No. EP9902040, which is the property of the present applicant, describes an assembly resulting from a combination of magnetic modules with other magnetic and/or ferromagnetic modules. The magnetic modules referred to in said application include at least one active magnetic element, i.e. an element that has two polar surfaces of opposite sign, and at least one ferromagnetic element.

One of the fundamental characteristics of the assembly described in the European patent application No. EP9902040 consists in the fact that the magnetic flux generated by the active magnetic elements involved in the anchorage between modules is at least partially short-circuited through the modules' ferromagnetic elements, and in the fact that the differences in magnetic potential produced by the active magnetic elements involved in the anchorage between modules are added together in series.

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Such an anchoring system enables a high ratio to be achieved between the anchoring force between the modules in the assembly and the weight of the assembly as a whole, thus enabling the construction of even highly-complex self-supporting lattice structures, e.g. scaffolding for theatre stage scenery, or advertising panels.

When the forces of magnetic attraction between the modules exceed a threshold of 2-3 kg, it becomes advisable – given the limit of human force, to facilitate assembly and dismantling, and for safety reasons – to provide a system capable of enabling/disabling the anchorage between the modules.

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It is therefore desirable to produce a magnetic module equipped with a system for enabling/disabling the magnetic force for anchoring the magnetic module to a ferromagnetic surface of another magnetic, or ferromagnetic module.

It is the object of the present invention to substantially overcome or at least ameliorate one or more of the disadvantages of the prior art or to meet the above desire.

Accordingly, in a first aspect, the present invention provides a magnetic module for the construction of an assembly, the module comprising:

a tubular body;

a magnetic head axially extending from an end of the tubular body, said magnetic head having a fore anchoring surface conformed for anchoring to a ferromagnetic surface, wherein the magnetic head comprises:

a multipolar magnetic stator axially arranged to the magnetic head, said multipolar magnetic stator comprising a plurality of circumferentially arranged pole members, said pole members defining a first multipolar anchoring surface at the front end, and a second multipolar surface at the rear end; a first plurality of magnets arranged between the pole members to provide alternating polarity pole faces at both of said first and second multipolar surfaces;

a multipolar rotor coaxially arranged to the multipolar magnetic stator, said multipolar magnetic rotor comprising a rear yoke and a second plurality of magnets circumferentially arranged on said rear ferromagnetic yoke, said second plurality of magnets being arranged to provide a third multipolar surface having alternating plurality pole faces facing said second multipolar rotor surface;

said multipolar magnetic rotor being rotatably supported to move between a first angular position in which each of said pole faces of the third multipolar rotor surface is facing a related pole face of the second multipolar rotor surface having a same polarity to activate the magnetic head, and a second angular position in which each of said pole faces of the third multipolar rotor surface is facing a related pole face of the second multipolar rotor surface having an opposite polarity to deactivate the magnetic head.

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In a second aspect, the present invention provides a magnetic module for the construction of an assembly, the module comprising:

a tubular body;

a magnetic head axially extending from an end of the tubular body, said magnetic head having a fore anchoring surface conformed for anchoring to a ferromagnetic surface, wherein the magnetic head comprises:

a multipolar magnetic stator and a multipolar magnetic rotor coaxially arranged to the magnetic head;

said multipolar magnetic stator comprising a first plurality of circumferentially arranged pole members defining a first multipolar anchoring surface at the front end, and a second multipolar surface at the rear end, and a first plurality of magnets arranged between the pole members to provide alternating polarity pole faces at both of said first and second multipolar surfaces;

said multipolar magnetic rotor comprising a second plurality of circumferentially arranged pole members defining a third multipolar anchoring surface at the front, and a second plurality of magnets arranged between the pole members to provide alternating polarity pole faces at said third multipolar surfaces;

said magnetic rotor being rotatably supported to move between a first angular position in which each of said pole faces of the third multipolar rotor surface is facing a related pole face of the second multipolar rotor surface having a same polarity to activate the magnetic head, and a second angular position in which each of said pole faces of the third multipolar rotor surface is facing a related pole face of the second multipolar rotor surface having an opposite polarity to deactivate the magnetic head.

In a third aspect, the present invention provides a magnetic module for the construction of an assembly of modules, the module comprising:

a tubular body;

a magnetic head axially extending from an end of the tubular body, said magnetic head having a fore anchoring surface conformed for anchoring to a ferromagnetic surface, wherein the magnetic head comprises:

a first multipolar magnetic stator axially arranged to the magnetic head, said multipolar magnetic stator comprising a plurality of circumferentially arranged pole members, said pole members defining a first multipolar anchoring surface at the front end, and a second multipolar surface at the rear end; a first plurality of magnets arranged between the pole member to provide alternating polarity pole faces at both of said first and second multipolar surfaces;

a second multipolar magnetic stator coaxially arranged to the first multipolar magnetic stator, said second multipolar magnetic stator comprising a rear ferromagnetic yoke and a plurality of magnets circumferentially arranged on said yoke, said magnets having alternating polarity to define alternating polarity pole faces facing said second multipolar rotor surface, said magnets being surrounded by respective solenoids connectable to a DC current dischange generator to reverse the alternating polarity of the magnets to activate and deactivate the multipolar magnetic head.

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A preferred form of the present invention will now be described by way of example with reference to the accompanying drawings, wherein:

Figure 1 shows a side view of a possible application of the head of a magnetic module consistent with the present invention anchored to a ferromagnetic module;

Figure 2 is a cross-section along the axis of the head illustrated in figure 1;

Figure 3 is a horizontal projection of the head illustrated in figure 1;

Figure 4 is a horizontal projection of the magnetic rotor of the head in figure 1;

Figure 5 is a side view of an assembly of modules consistent with the present invention combined with the aid of a stiffening device;

Figure 6 is a side view of a magnetic module consistent with the present invention cut through its axis;

Figure 7 is a side view of a further magnetic module consistent with the present invention cut through its axis;

Figure 8 is a side view with a partial cross-section of a magnetic module consistent with the present invention equipped with means for locking the magnetic module under tensile stress against a stiffening element in which the magnetic module is inserted;

Figure 9 is a front view with a partial cross-section of figure 8, with the magnetic rotor in the position in which the head is completely enabled; and

Figure 10 is a front view with a partial cross-section of figure 8, with the magnetic rotor in the position in which the head is disabled.

Figures 1 to 4 refer to a magnetic module 1 equipped with a head 3 that can be enabled to achieve a magnetic anchorage to the ferromagnetic surface of a spherical ferromagnetic module 5.

The head 3 of the module 1 extends in an axial direction, indicated by the line of dots and dashes A-A in figure 2, and comprises an axially hollow cylindrical ferrule 7 equipped with a tapered tip 8, a magnetic stator 9 and a magnetic rotor 11 lying opposite, coaxially and internally with respect to the ferrule 7.

The magnetic stator 9 occupies an axial position with respect to the ferrule 7, corresponding to the tip 8 of the ferrule 7, while the magnetic rotor 11 occupies a more internal axial position.

The magnetic stator 9 is composed of a main ferromagnetic element or body 13 divided radially into six identical sectors 15 by six radial grooves 17 lying at equal angles in planes passing through the axis of the head 3.

An active magnetic element, i.e. a permanent magnet 19, is attached inside each groove 17 in the main ferromagnetic body 13 of the magnetic stator 9. The permanent magnets 19 are identical and are arranged with their magnetic polarisation axis substantially parallel to the head surface 21 of the magnetic stator, while each pair of adjacent permanent magnets 19 presents a magnetic polarity of the same sign towards the ferromagnetic sector 15 it defines. The six sectors 15 of the main ferromagnetic body 13 of the magnetic stator 9 form an anchoring multipolar statoric surface 21 magnetically induced by the active magnetic elements 19 with an alternately positive and negative magnetic polarity.

The main ferromagnetic body 13 of the magnetic stator 9 may be in a single piece, as described above, or it may also be divided into completely separate sectors arranged around an angle of 360° and laterally spaced from each other in such a way as to define seats for housing the permanent magnets of the magnetic stator 9.

The multipolar head surface 21 of the main ferromagnetic body 13 of the magnetic stator 9 is aligned at the tip 8 of the ferrule 7 and composed of six polar areas with a 60° angle of aperture and a specular multipolar base surface 23.

The magnetic stator 9 can be fixed to the ferrule 7 by means of a mechanical keying between projections 25 on the ferrule 7 and corresponding recesses 27 in the magnetic stator body 9.

The magnetic rotor 11 of the head 3 comprises six identical active magnetic elements, i.e. six permanent magnets 29, and a ferromagnetic element or yoke 31 for connecting and supporting the permanent magnets 29 positioned, with respect to the permanent magnets 29, on the side opposite the magnetic stator 9.

The six permanent magnets 29 of the magnetic rotor 11 have a polarisation axis orthogonal to the statoric multipolar surface 21.

The six permanent magnets 29 of the magnetic rotor 11 are arranged at equal angles around the axis of the head 3 and with an alternating polarity so as to generate a multipolar rotoric surface 33 specular to the anchoring multipolar statoric surface 21.

The sizing of the magnetic and ferromagnetic components of the magnetic stator 9 and of the magnetic rotor 11 must be such that, when the head 3 is disabled, when every pole of the multipolar statoric surface 21 is magnetically in series with a corresponding pole of the multipolar rotoric surface 33, the magnetic rotor 11 can completely absorb the magnetic flux generated by the magnetic stator 9, short circuiting said flux completely through the ferromagnetic yoke 31 so as to leave the multipolar statoric surface 21 of the magnetic stator 9 disabled for the purposes of the anchorage of the magnetic module 1 to the ferromagnetic surface of module 5.

The ferromagnetic module 5 is hollow and its thickness must be kept to a minimum in order to increase the ratio of the magnetic anchoring force between the two modules to the weight of the two modules, nonetheless taking into account that the thickness of the ferromagnetic module 5 cannot drop below a certain value in order to guarantee the total short circuiting of the magnetic flux generated by the head 3. However, for a given extension of the multipolar statoric surface 21, a complete short circuit of the magnetic flux can be maintained by compensating for any reduction in the thickness of the ferromagnetic module 5 with an increase in the number of pairs of poles in the magnetic stator 9.

In a possible variant of the present invention, the part of the magnetic rotor corresponding to the permanent magnets 29 and the yoke 31 that connects them can be replaced by a body having the same structure as the magnetic stator 9, i.e. a main ferromagnetic body containing a set of active magnetic elements placed exactly as in the magnetic stator 9. In this case, the multipolar rotoric surface 33 is induced by the active magnetic elements of the magnetic rotor.

The magnetic rotor 11 comprises a bell 35 for guiding the rotation of the magnetic rotor 11, coaxial and internal with respect to the ferrule 7 and solidly extending to the yoke 31 for supporting the permanent magnets 29 of the magnetic rotor 11 from the yoke 31 side opposite the permanent magnets 29.

To guide the rotation of the magnetic rotor 11, the bell 35 for guiding the magnetic rotor 11 is itself guided by the inside wall of the ferrule 7.

The multipolar rotoric surface 33 and the base surface 23 of the magnetic stator 9 are each equipped with high-strength steel friction plates designed to facilitate the relative rotation between the magnetic stator 9 and the magnetic rotor 11, while offering a minimum resistance to the passage of the magnetic flux from one side to the other.

The head 3 of the magnetic module 1 comprises a cylindrical ring 37 keyed coaxially and externally to the ferrule 7 so that it can turn and slide with respect to the axis of the ferrule 7 to mechanically/manually drive the rotation of the magnetic rotor 11.

For the transmission of the rotation of the ring 37 to the magnetic rotor 11, the ring 37 diametrically supports a drive rod 39 fitted in a pair of diametrically-aligned slots 41 cut in the edge 43 at the end of the bell 35 situated axially opposite the magnetic stator 9.

The slots 41 are axially elongated so as to keep the drive rod 39 engaged but free to slide in the axial direction of the ferrule 7.

The drive rod 39 is placed across two slits 45 cut along two diametrically-opposite stretches of the circumference of the ferrule 7.

The slits 45 in the ferrule 7 also have openings in the axial direction of the ferrule 7 so as to allow for the displacement of the rod 39 and of the connected ring 37 in the axial direction of the ferrule 7.

The lip of each slit 45 in the ferrule 7 axially furthest away from the tip 8 of the ferrule 7 is shaped into a series of notches 47 cut at angular intervals diametrically opposite the notches 47 on the opposite slit.

The drive rod 39 is pressed against this lip on the slits 45 of the ferrule 7 by a stud 49, that is axially movable in a hub 53 on the guide bell 35, coaxial to the head 3 and elastically loaded by a helical spring 51 placed between the stud 49 and a shoulder inside the hub 53.

The rotation of the ring 37 can therefore be locked in steps each time the drive rod 39 snaps up against a pair of opposite notches 47 in the slits 45 of the ferrule 7. Each step in the rotation of the ring 37 corresponds to an enabling level of the head 3.

To adjust the enabling level of the head 3, the ring 37 is turned manually until an indicator arrow 69 provided on the outer surface of the ring 37 comes into line with the required enabling level 70, selected from a number of possible levels etched on the outer surface of the ferrule 7.

In the fully enabled condition of the head 3, the poles of the multipolar statoric surface 21 are faced to the poles of the same sign of the multipolar rotoric surface 33 of the magnetic rotor 11. The magnetic flux generated by the magnetic stator 9 is added to the flux generated by the magnetic rotor 11 and short-circuited through the ferromagnetic ball 5.

In the fully disabled condition of the head 3, obtained by turning the magnetic rotor 11 through 60°, the poles of the multipolar statoric surface 21 are faced to the poles of the opposite sign of the multipolar rotoric surface 33. The entire magnetic flux generated by the magnetic stator 9 is short-circuited by the magnetic rotor 11 and the differences in magnetic potential installed in the magnetic stator 9 are added in series to those of the magnetic rotor 11 through the ferromagnetic yoke 31.

In the respective angular positions between the magnetic stator 9 and the magnetic rotor 11 that go from the fully-disabled to the fully-enabled position of the head 3, a progressively increasing proportion of the flux generated by the magnetic stator 9 and by the magnetic rotor 11 is short-circuited through the ferromagnetic ball 5 so the force of anchorage between the magnetic module 1 and the ferromagnetic module 5 also increase progressively.

The head 3 of the module 1 can also have a different system for driving the rotation of the magnetic rotor 11, e.g. of electrical/mechanical type. This system comprises a hole in the ferrule and a gear ring attached coaxially and solidly to the bell of the magnetic rotor. The rotation of the rotor can be governed with the aid of an electric screwdriver with a pinion-shaped bit capable of engaging the gear ring through the hole in the ferrule.

The magnetic module 1 also comprises a safety device that prevents any accidental disabling of the head 3.

The safety device comprises a hole 55 in the ring 37 and a pawl 57 with a spring 59 that can be aligned with the hole 55 in the ring 37 in line with the position of the magnetic rotor 11 in which the head 3 is fully enabled.

The pawl 57 fits into a small cylinder 61 which is attached through the ferrule 7 and can extend due to the effect of the spring 59 into the hole 55 in the ring 37 in order to block the rotation of the ring 37. To disable or adjust the head 3 starting from the fully-enabled position simply requires the use of a pointed tool inserted in the hole 55 in the ring 37 in order to make the pawl 57 return inside its container cylinder 61, against the force of the spring 59.

Without departing from the context of the present invention, a magnetic module head can also be enabled by means of an electromagnetic system for inducing the polar inversion of the head. This simply involves replacing the previously-described magnetic rotor with a second magnetic stator identical to the above described magnetic rotor except for the fact that the permanent magnets of the second magnetic stator must have a globally lower coercivity than the permanent magnets of the first stator and must each be surrounded by a corresponding inversion solenoid. A current produced by a suitable d.c. generator is made to circulate in each solenoid in one direction or the other in order to invert the polarity of the corresponding permanent magnet. In this case, the force of anchorage is adjusted by means of current discharges of variable intensity and the safety of the head is intrinsic in that the head is only disabled by a discharge opposite to the head-enabling discharge.

Figure 5 illustrates a set of magnetic anchoring modules comprising two magnetic modules 1 anchored to a ferromagnetic module 5. If necessary, the structure can be stiffened by an angular stiffening element 65 complete with tubes 77 for coupling to the magnetic modules 1 of a type consistent with the one described in the patent application MI2001A000608, which is the property of the present applicant.

When both the heads 3 of the magnetic modules 1 are enabled, a magnetic flux circulates between the two heads 3 through the ferromagnetic ball 5; in this magnetic circuit, the differences in magnetic potential installed in the magnetic stator and rotor of each head 3 are magnetically added in series to those in the magnetic stator and rotor of the other head 3.

In general, therefore, each time an enabled head 3 of an additional magnetic module 1 is attached to the ferromagnetic module 5, there is an increase in the force anchoring the magnetic module 1 to the ferromagnetic module 5.

The module 1 can also act as a system for coupling to a stiffening element of the type described in the patent application MI2001A000608 capable of attaching the magnetic module 1 solidly to the stiffening element 65 when the magnetic module 1 is subject to a tensile stress superior to the force of magnetic attraction exerted by the magnetic module 1 in question. Said coupling system can be provided on all the magnetic modules or only on the specific magnetic modules subject to tensile stresses beyond the force of magnetic attraction that they are capable of generating.

Such a coupling system, according to a possible implementation illustrated in figures 8-10, is composed of a set of pins 71, three in this case, hinged to the circumference of the ferrule 7 and projecting radially through the thickness of the ferrule 7 so as to come up against a corresponding recess 75 in the coupling tubes 77 of the stiffening element 65 in line with the enabled condition of the head in the magnetic module 1.

The three pins 71 lie at an angular distance of 120°; they can be turned in the plane orthogonal to the axis of the ferrule 7 and they can be extended or withdrawn by sliding on corresponding cams 79 set in the outer circumference of the bell 35 that is solidly attached to the rotor 11. On placing the rotor 11 in the position coinciding with the fully-disabled condition of the head of the magnetic module 1, each pin 71 abandons its corresponding cam 79 and withdraws inside the ferrule 7, thus enabling the magnetic module 1 to slide out of the stiffening element 65.

Figure 6 shows a module 1' with two coaxial heads 3 that can be enabled independently of each other. The two heads 3 are keyed to the ends of a cylindrical connection tube 67, which could be made, for instance, of plastic or carbon fibre or aluminium.

Again in Figure 6, the magnetic stator of one of the heads 3 has a flat multipolar head surface 21 suitable for anchoring to a flat ferromagnetic surface on a magnetic or ferromagnetic module, while the magnetic stator of the other head 3 has an arched multipolar head surface 21 suitable for anchoring to a spherical magnetic or ferromagnetic module.

Of course, the shape of the multipolar head surface of the magnetic stator can be varied at will to suit the shape of the surface to anchor, and can also be varied at will in a given magnetic module comprising more than one anchoring head 3.

Figure 7 shows a structure with a magnetic module 1" that allows for the anchorage of another magnetic module.

The magnetic module 1" has only one head 3 to enable, but is equipped with a ferromagnetic element 63 at the axially opposite end to said head 3.

In this case, the outer surface of the ferromagnetic element 63 of the magnetic module 1" can be anchored by an enabled head of another magnetic module.

Of course, the invention extends to the case of anchoring the head of a magnetic module to a ferromagnetic surface even without direct contact, with a non-ferromagnetic material between them. This may be the case, for instance, if the spherical ferromagnetic module of figure 5 were coated with a non-magnetic matrix with a high friction coefficient.

In the assembly of lattice structures consistent with the present invention, it is sometimes necessary to close the structure by adding a final module between modules with a fixed distance between centres, e.g. an elongated magnetic module between two spherical ferromagnetic modules already in position with a fixed distance between them.

To facilitate said operation, especially when the modules in the structure are connected by means of stiffening elements, the connection tube on the heads of a magnetic module of the present invention, e.g. the cylindrical tube indicated by 67 in figure 6, can be equipped with a telescoping connection system between the heads.

By way of example, the connection tube 67 of figure 6 could be divided into two parts, each solidly attached to one head of the magnetic module and a central body with a telescoping movement and a longitudinal bayonet coupling could be inserted between these two separate parts. The heads of the magnetic module could thus be brought closer together to insert the magnetic module in the lattice structure, then spread further apart for its final positioning, turning the tube in order to trip the bayonet coupling. This solution can be provided as necessary on one, several or all of the magnetic modules.

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The claims defining the invention are as follows:

1. A magnetic module for the construction of an assembly, the module comprising:
a tubular body;

a magnetic head axially extending from an end of the tubular body, said magnetic head having a fore anchoring surface conformed for anchoring to a ferromagnetic surface, wherein the magnetic head comprises:

a multipolar magnetic stator axially arranged to the magnetic head, said multipolar magnetic stator comprising a plurality of circumferentially arranged pole members, said pole members defining a first multipolar anchoring surface at the front end, and a second multipolar surface at the rear end; a first plurality of magnets arranged between the pole members to provide alternating polarity pole faces at both of said first and second multipolar surfaces;

a multipolar rotor coaxially arranged to the multipolar magnetic stator, said multipolar magnetic rotor comprising a rear yoke and a second plurality of magnets circumferentially arranged on said rear ferromagnetic yoke, said second plurality of magnets being arranged to provide a third multipolar surface having alternating plurality pole faces facing said second multipolar rotor surface;

said multipolar magnetic rotor being rotatably supported to move between a first angular position in which each of said pole faces of the third multipolar rotor surface is facing a related pole face of the second multipolar rotor surface having a same polarity to activate the magnetic head, and a second angular position in which each of said pole faces of the third multipolar rotor surface is facing a related pole face of the second multipolar rotor surface having an opposite polarity to deactivate the magnetic head.

2. A magnetic module according to claim 1, wherein the multipolar magnetic rotor is angularly movable in at least one intermediate position between said first and second angular positions.

3. A magnetic module according to claim 1, wherein each magnet of the multipolar magnetic stator is arranged in a radially extending groove and has a polarisation axis crosswise extending to the groove, oriented substantially parallel to said first multipolar rotor surface.

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4. A magnetic module according to claim 3, wherein each magnet of the multipolar magnetic rotor has a polarization axis parallel to the longitudinal axis of the magnetic head.

5. A magnetic module for the construction of an assembly, the module comprising:

a tubular body;

a magnetic head axially extending from an end of the tubular body, said magnetic head having a fore anchoring surface conformed for anchoring to a ferromagnetic surface, wherein the magnetic head comprises:

a multipolar magnetic stator and a multipolar magnetic rotor coaxially arranged to the magnetic head;

said multipolar magnetic stator comprising a first plurality of circumferentially arranged pole members defining a first multipolar anchoring surface at the front end, and a second multipolar surface at the rear end, and a first plurality of magnets arranged between the pole members to provide alternating polarity pole faces at both of said first and second multipolar surfaces;

said multipolar magnetic rotor comprising a second plurality of circumferentially arranged pole members defining a third multipolar anchoring surface at the front, and a second plurality of magnets arranged between the pole members to provide alternating polarity pole faces at said third multipolar surfaces;

said magnetic rotor being rotatably supported to move between a first angular position in which each of said pole faces of the third multipolar rotor surface is facing a related pole face of the second multipolar rotor surface having a same polarity to activate the magnetic head, and a second angular position in which each of said pole faces of the third multipolar rotor surface is facing a related pole face of the second multipolar rotor surface having an opposite polarity to deactivate the magnetic head.

6. A magnetic module according to claim 1 or 5, wherein:

said magnetic head comprises a hollow ferrule coaxial to the same magnetic head, said hollow ferrule having a cylindrical inner wall; and

the magnetic rotor comprises a cylindrical guide bell, said guide bell coaxially extending inside the hollow ferrule and being rotatably guided by said cylindrical inner wall.

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7. A magnetic module according to any one of claims 1, 5 or 6 further comprising a manually actuable mechanical drive system to rotate the multipolar magnetic rotor.

8. A magnetic module according to claim 7, when appended to claim 6, wherein said drive system for the multipolar magnetic rotor comprises a cylindrical ring slidably and rotatably supported outside the ferrule, and means for transmitting the rotation of the ring to the ferrule.

9. A magnetic module according to claim 8, wherein said means for transmitting the rotation of the outer cylindrical ring comprises diametrically aligned pair of slots cut in the end edge of the bell, parallely extending to the axis of the magnetic head, and a rod attached along a diameter of the outer ring, said rod slidably engaging into said pair of slots of the cylindrical ring, and into diametrically opposite and circumferentially extending slits of the ferrule.

10. A magnetic module according to claim 9, further comprising locking means to prevent rotation of the ring, said locking means comprising a set of notches cut at angular intervals at the diametrically opposite slits.

11. A magnetic module according to claim 8, further comprising a safety device to prevent rotation of the drive ring.

12. A magnetic module according to claim 11, wherein the safety device comprises a sprung pawl, slidably supported by the ferrule in a direction orthogonal to the axis of the magnetic head, said sprung pawl engaging into a hole of the drive ring in an activated condition of said magnetic anchoring stator surface.

13. A magnetic module according to claim 12 for the construction of an assembly of modules in which use is made of a stiffening element for connection of the modules, the stiffening element comprising coupling tubes for the insertion of the magnetic head, wherein:

a set of locking pins are hinged and radially projecting through the ferrule to engage a corresponding recess in the coupling tubes of the stiffening element; and

the multipolar magnetic rotor is provided with a set of cams acting to extend said locking pins outside the ferrule into engagement with the recess in the coupling tubes in the activated condition of the magnetic head, respectively to withdraw said locking pins inside the ferrule to disengage the coupling tubes in the deactivated condition of the magnetic head.

14. A magnetic module according to claim 1 or 5, further comprising an electrical/mechanical drive system to rotate the multipolar magnetic rotor.

15. A magnetic module according to claim 14, wherein said electrical/mechanical drive system comprises a gear wheel coaxially arranged to the ferrule of the multipolar magnetic rotor and an electric screwdriver having a pinion-shaped bit to engage said gear wheel through a hole in the ferrule.

16. A magnetic module for the construction of an assembly of modules, the module comprising:

a tubular body;

a magnetic head axially extending from an end of the tubular body, said magnetic head having a fore anchoring surface conformed for anchoring to a ferromagnetic surface, wherein the magnetic head comprises:

a first multipolar magnetic stator axially arranged to the magnetic head, said multipolar magnetic stator comprising a plurality of circumferentially arranged pole members, said pole members defining a first multipolar anchoring surface at the front end, and a second multipolar surface at the rear end; a first plurality of magnets arranged between the pole member to provide alternating polarity pole faces at both of said first and second multipolar surfaces;

a second multipolar magnetic stator coaxially arranged to the first multipolar magnetic stator, said second multipolar magnetic stator comprising a rear ferromagnetic yoke and a plurality of magnets circumferentially arranged on said yoke, said magnets having alternating polarity to define alternating polarity pole faces facing said second multipolar rotor surface, said magnets being surrounded by respective solenoids connectable to a DC current dischange generator to reverse the alternating polarity of the magnets to activate and deactivate the multipolar magnetic head.

17. A magnetic module according to claim 1, 5 or 16, including a telescoping system for changing its axial length.

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18. A magnetic module according to claim 17, further comprising a bajonet coupling for connecting the telescoping system to the multipolar magnetic head.

19. A magnetic module according to claim 1, 5 or 16, wherein said multipolar anchoring surface is in the form of a flat surface.

20. A magnetic module according to claim 1, 5 or 16, wherein said multipolar anchoring surface is in the form of an arch shaped surface.

21. A magnetic module according to claim 1, 5 or 16 further comprising a multipolar magnetic head at an end of the tubular body.

22. A magnetic module according to claim 1, 5 or 16 further comprising a multipolar magnetic head at an end of the tubular body, and a ferromagnetic anchoring piece at the other end of said tubular body.

23. A magnetic module for the construction of an assembly, said module being substantially as hereinbefore described with reference to any one embodiment, as that embodiment is depicted in the accompanying drawings.

Dated 25 May, 2005
Claudio Vincentelli
Patent Attorneys for the Applicant/Nominated Person
SPRUSON & FERGUSON

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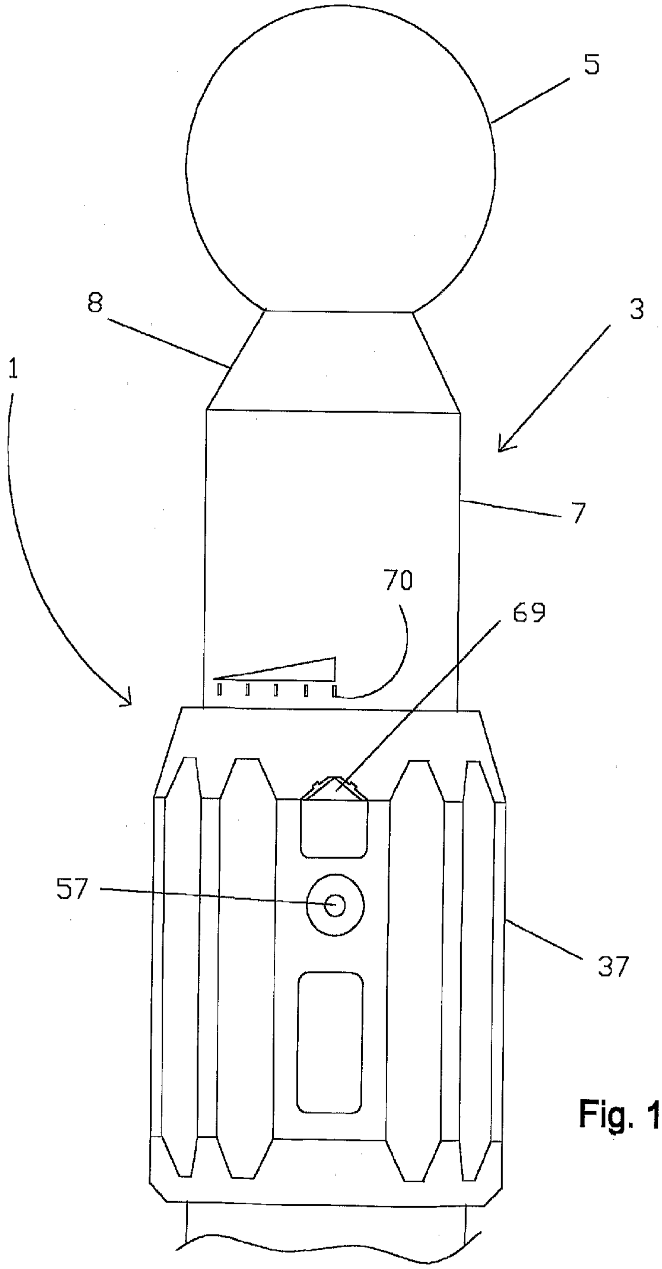

Fig. 1

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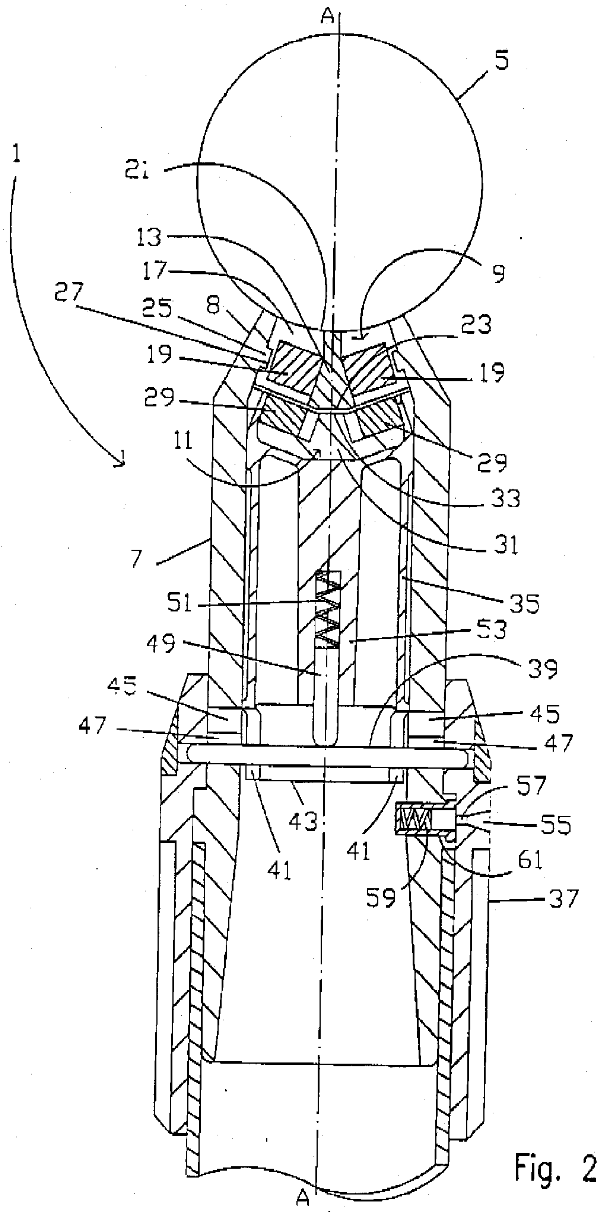

Fig. 2

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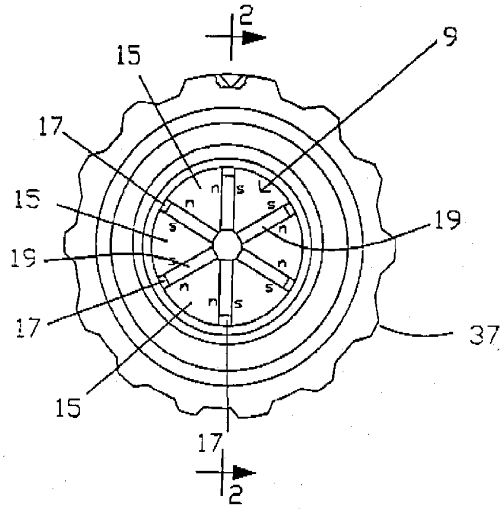

Fig. 3

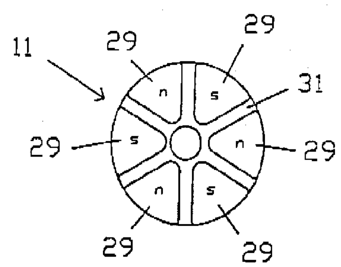

Fig. 4

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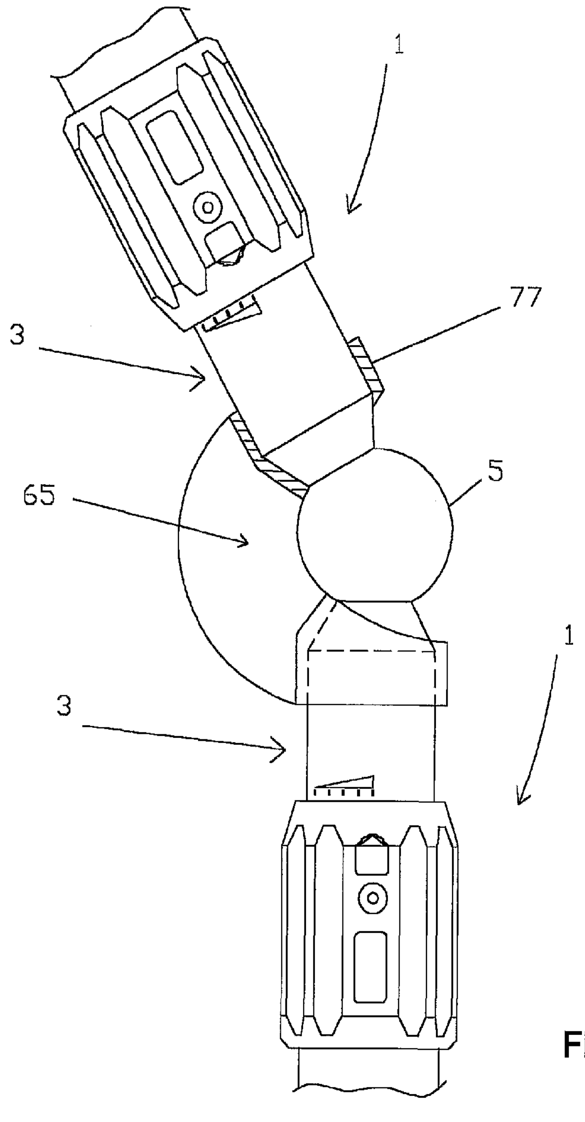

Fig. 5

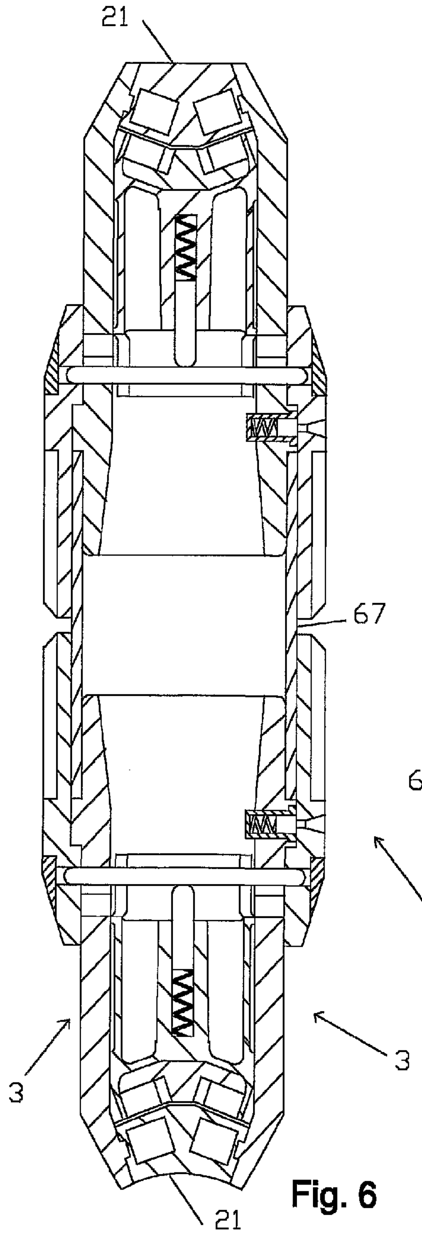

Fig. 6

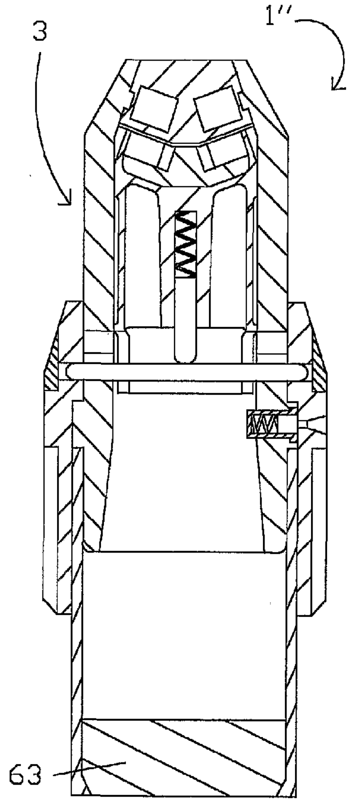

Fig. 7

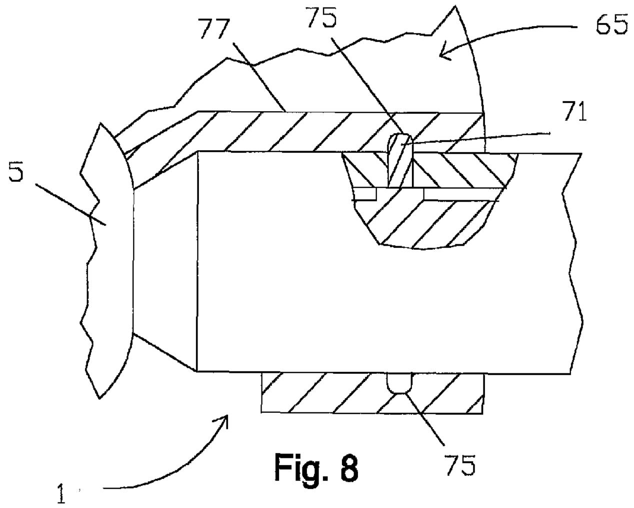

Fig. 8

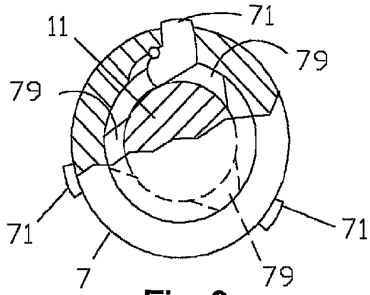

Fig. 9

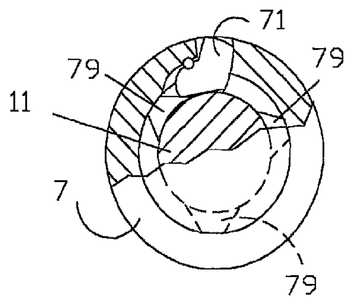

Fig. 10