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PATENT REQUEST: STANDARD PATENT/PATENT OF ADDITION

I, being the person identified below as the Applicant, request the grant of a patent to the person identified below as the Nominated Person, for an invention described in the accompanying standard complete specification.

Full application details follow.

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[54] Invention Title: SUSPENSION ARRANGEMENT

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BASIC CONVENTION APPLICATION(S) DETAILS

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CHRISTOPH PUERNER

By: 

Registered Patent Attorney

TO: THE COMMISSIONER OF PATENTS
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NOTICE OF ENTITLEMENT

I, Christoph PUERNER of Adam-Krafft-Strasse 6, D-8590 Marktredwitz, Germany, being the applicant and nominated person in respect of the attached Application, state the following -

I am the actual inventor and the person nominated for the grant of the patent of the basic application listed on the patent request form.

The basic application is the first application made in a convention country in respect of the invention.

Christoph PUERNER
By his Patent Attorneys
CULLEN & CO.


ALISON McMILLAN

Date: 8 August 1996





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- (56) Prior Art Documents
EP 102546
DE 8531386
- (57) Claim

1. A suspension arrangement for an article of furniture which includes a ^{lower} base portion and a ^{an upper} support surface portion movable relative to each other, comprising: cable hang members at suspension locations for suspending the upper support surface portion from the lower base portion, at least two said cable hang members being arranged ~~functionally~~ in series at each suspension location and the cable hang members which are arranged in series being at least approximately of the same hang member length; and means connecting together the mounting locations of the hang member ends which are remote from said support surface portion and of the hang member ends which are remote from said base portion.

22. A suspension arrangement for ~~suspendingly~~ interconnecting first and second members which are disposed one above the other and which are movable relative to each other, the suspension arrangement comprising: a plurality of cable hang members at suspension locations between said first and second members, for interconnecting said first and second members in mutually movable suspended relationship, at least first and second cable hang members being ~~disposed functionally~~ ^{arranged} in series at each suspension location, with the cable hang members which are disposed in series ~~being at least approximately of the same hang member length~~ ^{having substantially the same} length; and frame means interconnecting the mounting locations of the ends of the cable hang members which are remote from said first member and the ends of the cable hang members which are remote from the second said member.

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COMPLETE SPECIFICATION
FOR A STANDARD PATENT

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Invention Title: SUSPENSION ARRANGEMENT

The following statement is a full description of this invention,
including the best method of performing it known to me:

BACKGROUND OF THE INVENTION

The invention concerns a suspension arrangement for example for an item of furniture for sitting or resting thereon.

In this specification the expression article of furniture will be used broadly to denote an article for sitting or resting or lying thereon.

Such an article of furniture typically comprises a base portion such as a leg assembly, and a support surface portion for supporting a person sitting or lying on the article of furniture, with the support surface portion being movable relative to the base portion.

One form of suspension arrangement for an article of furniture of that kind provides that the upper support surface portion is suspended in relation to the lower base portion by cable hang members. Two or more cable hang members are arranged functionally in series at each suspension location, and the mounting locations of the ends of the respective hang members, which are remote from the support surface portion, and of the ends of the respective hang members which are remote from the base portion, are connected together. A suspension arrangement of that configuration is to be found in WO-A-86/04793. In that arrangement the cable hang members which are functionally connected in series are of different hang lengths and thus each have different fundamental or natural frequencies. That design principle is intended to ensure that, when the oscillatable system is excited with pulses of varying frequency, at least one of the cable hang members is always excited at or almost at its natural frequency in order to produce sufficient oscillation amplitudes even when weak pulses are involved.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a suspension arrangement which, while being of a compact structure, permits a very high degree of dynamic performance and thus ensures a very high level of sensitisation in relation to fine vibrations with at the same time good stabilisation and damping qualities in relation to large deflection movements.

Another object of the present invention is to provide a suspension arrangement which, while being of a simple design configuration, is versatile in use.

5 Still another object of the present invention is to provide an article of furniture such as a chair or couch which enjoys and enhanced level of comfort for the occupant.

10 According to a first embodiment of the present invention, there is provided a suspension arrangement for an article of furniture which includes a lower base portion and an upper support surface portion movable relative to each other, comprising: cable hang members at suspension locations for suspending the upper support surface portion from the lower base portion, at least two
15 said cable hang members being arranged in series at each suspension location and the cable hang members which are arranged in series being at least approximately of the same hang member length; and means connecting together the mounting locations of the hang member ends which are
20 remote from said support surface portion and of the hang member ends which are remote from said base portion.

25 According to a second embodiment of the present invention, there is provided a suspension arrangement for suspendingly interconnecting first and second members which are disposed one above the other and which are movable relative to each other, the suspension arrangement comprising: a plurality of cable hang members at suspension locations between said first and second
30 members, for interconnecting said first and second members in mutually movable suspended relationship, at least first and second cable hang members being arranged functionally in series at each suspension location, with the cable hang members which are disposed in series being
35 at least approximately of the same hang member length; and frame means interconnecting the mounting locations of the ends of the cable hang members which are remote from said first member and the ends of the cable hang members which are remote from the second said member.



In accordance with the principles of the present invention the foregoing and other objects are achieved by a suspension arrangement, for example for an article of furniture which comprises a base portion and a support surface portion which are movable relative to each other, the suspension arrangement comprising cable hang members by which the upper support surface portion is suspended from the lower base portion. At least two cable hang members are arranged functionally in series at each suspension location and the mounting locations of the hang member ends which are remote from the support surface portion and of the hang member ends which are remote from the base portion are connected together. The hang members which are disposed in series are at least of approximately the same hang length.

In a preferred feature of the invention the connection between the mounting locations of the hang member ends which are remote from the support surface portion and of the hang member ends which are remote from the base portion comprises a frame whose height corresponds to the hang member length, wherein the respective cable hang member which is fixed to the support surface portion is fixed to the top side of the frame while the respective cable hang member which is fixed to the base portion is fixed to the underside of the frame.

In a preferred embodiment of the invention the frame comprises first and second flat bar portions which are arranged at least substantially parallel one above the other and which are provided with resilient buffers such as rubber buffers. The support surface portion is connected to a hang member which is passed through an aperture in the lower bar portion and which is fixed by its other end to

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the upper bar portion. The hang member which is fixed to the base portion is passed through an aperture in the upper flat bar portion and secured by its other end to the lower flat bar portion.

In another advantageous configuration according to the invention, there is provided a plurality of mutually concentric frames which are connected together by the series-disposed cable hang members. The frames are advantageously arranged in superposed aligned relationship. The frames desirably have apertures through which the hang members are passed to the opposite side of the frame structures.

In accordance with a preferred feature of that arrangement, the frames are connected together by spring elements, for example and preferably yielding or flexible rubber buffers. Depending on the area of use, the frames may be of a triangular, quadrangular or polygonal configuration, with the hang member connections preferably being disposed in the regions of the respective corners. The frames may advantageously be of a box-like configuration with closed side walls.

In a preferred embodiment of the arrangement according to the invention, there is provided a plurality of frames of the same configuration but different cross-sections. In relation to adjacent frames, the larger frame has limb portions to which one end of a respective hang member is secured, the other end of that hang member being secured to the next smaller frame. Preferably, the hang member which is fixed to the support surface portion operatively engages the largest frame while the hang member which is fixed to the base portion is operatively connected to the smallest frame.

In another preferred embodiment, abutment elements, preferably supported balls, are operatively disposed between the members which are movable relative to each other in order to limit the deflection movement thereof.

In an advantageous embodiment of the invention the frame portions with the hang members connecting them are disposed in a housing which is

fixed to the base portion or to the support surface portion. Preferably the base portion passes at least substantially centrally through the housing. When the housing is connected to the support surface portion, provided between the base portion and the housing is a spacing to permit
5 oscillatory movement between the base portion on the one hand and the support surface portion with housing on the other hand.

In a preferred embodiment of the article of furniture, a backrest portion is fixed to the frame or corresponding connecting structure. The backrest portion is advantageously connected by way of a spring means to
10 a lower support element of the frame or other connecting structure.

Further objects, features and advantages of the present invention will be apparent from the following description of preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

15 Figure 1 is a diagrammatic view of a first embodiment of a suspension arrangement according to the invention, in an article of furniture in the form of a seat or chair,

Figure 2 is a corresponding view of a second embodiment of a suspension arrangement according to the invention having a plurality of
20 concentrically disposed frames,

Figure 3 is a plan view of the frame arrangement shown in Figure 2,

Figure 4 is a view of a third embodiment of a suspension arrangement according to the invention with a backrest, and

25 Figure 5 is a plan view of the manner of fixing the backrest shown in Figure 4.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring firstly to Figure 1, shown therein is a suspension arrangement according to the invention which is used in the context of
30 an article of furniture in the form of a seat or chair as generally identified by reference numeral 10. The article 10 comprises an upper support surface portion 12 which includes a support assembly 14 which

extends downwardly therefrom. The support surface portion 12 is suspended by means of the support assembly 14 and by way of cable hang members 16 on a lower base portion 18 in such a way as to be capable of swinging movement in relation thereto. The support assembly 14 may be of a frame-like or box-like configuration or it may comprise a plurality of support arms. At each suspension location, that is to say where a connection is provided between the upper support surface portion 12 and the base portion 18, two cable hang members 16 which are at least approximately of the same hang length are functionally connected in series. The mounting locations of the hang member ends which are remote from the support surface portion 12 and of the hang member ends which are remote from the base portion 18 are rigidly connected together by way of a frame as diagrammatically indicated at 20, the height of which corresponds to the hang length. The cable hang member 16 which is operatively secured to the support surface portion 12, by way of the support assembly 14, is swingingly attached to the top side of the frame 20, at its end which is remote from its point of attachment to the support assembly 14, while the cable hang member 16 which is fixed at one end to the base portion 18 is fixed at its other end to the underside of the frame 20. The respective cable hang members 16 are passed through apertures in the frame 20 to the respective oppositely disposed side of the frame 20.

To provide protection for the components, the frame portions with the cable hang members 16 interconnecting the various parts can be disposed in a housing which is fixed to the base portion 18 or to the support surface portion 12. The base portion 18 passes centrally through the housing, a spacing being provided between the base portion 18 and the housing to permit oscillatory movement between the support surface portion 12 with housing fixed thereto on the one hand and the base portion 18 on the other hand.

The suspension arrangement illustrated in Figure 1, in comparison with a suspension arrangement of the above-discussed prior kind, is

distinguished by affording a substantially improved oscillation characteristic, while being of a compact and simple structure. It permits a very high degree of dynamic effect, even when very fine vibrations are involved, with at the same time good stabilisation and damping qualities in relation to major deflections.

Reference will now be made to Figure 2 showing a suspension arrangement according to the invention which makes it possible to achieve an additional improvement in the oscillation characteristic of the arrangement. In the Figure 2 structure, which is diagrammatically illustrated by way of example in relation to an article of furniture in the form of a seat, the suspension arrangement comprises a plurality of mutually concentric frames 20 which are operatively connected together by cable hang members 16 which are functionally connected in series.

The connection between a support assembly 14 on the support surface portion 12 and the base portion 18 of the seat 10 is made by way of three frames 20 of the same configuration but of different cross-sections, which are arranged concentrically one within another. In relation to adjacent frames 20, in each case the smaller frame 20 has limb portions as indicated at 22, to which one end of a respective cable hang member 16 is fixed. The limb portions 22 are extended over the respective next larger frame 20 in such a way that the respective cable hang member 16 is fixed by its other end to the underside of the next larger frame 20. In this arrangement the cable hang member 16 which is fixed to the support surface portion 12 engages the top side of the largest frame 20 which, as can be seen from Figure 2, is not provided with a corresponding limb portion 22. The cable hang member 16 which is fixed to the base portion 18 is connected to the smallest frame 20. The cable hang members 16 are passed by way of respective apertures in the respective frames 20 to the respective suspension points.

A plan view of the frame configuration shown in Figure 2 is illustrated in Figure 3 which clearly identifies the spatial relationships between the frames 20 and the limb portions 22.

Referring now to Figure 4, shown therein is an embodiment of the suspension arrangement according to the invention, used once again by way of example in relation to an article of furniture in the form of a seat 10. The arrangement again comprises a frame which has first and second flat bar portions 20a and 20b which are arranged at least substantially ~~perpendicularly~~ ^{parallel} one above the other and which are connected together by resilient buffers 24, for example of rubber. A cable hang member 16 which is fixed to the support surface portion 12 is passed through an aperture in the lower flat bar portion 20a and is swingingly attached by means of its upper end to the upper flat bar portion 20b. The cable hang member 16 which is fixed to the base portion 18 is passed through an aperture in the upper flat bar portion 20b and fixed by its other end to the lower flat bar portion 20a. Disposed between the members which are movable relative to each other are abutment elements as indicated at 26, for limiting the relative movement thereof. The abutment elements 26 which are disposed between the upper flat bar portion 20b and the base portion 18, and between the lower flat bar portion 20a and the support surface portion 12, comprise mounted balls in order also to permit a lateral movement of the components.

It will be noted in relation to the article of furniture 10 shown in Figure 4 that, unlike the embodiments described above with reference to Figures 1 through 3 in which the backrest 28 of the article of furniture 20 was integrally connected to the support surface portion 12, the backrest 28 in the Figure 4 embodiment is connected by way of a spring element 30 to the lower flat bar portion 20a which thus constitutes a carrier element for the backrest 28. In comparison with conventional seats or chairs, that permits the backrest 28 to oscillate or swing in such a fashion as to be substantially decoupled from the



oscillatory movement of the support surface portion 12, thereby providing for an additional improvement in the oscillation characteristic of the seat or chair.

Figure 5 is a diagrammatic plan view illustrating the connection 5 between the backrest 28 and the flat bar portion 20a by way of the spring element 30, showing that the spring element passes between adjacent lateral portions of the upper flat bar portion 20b.

It will be noted here that the structure and mode of operation of the suspension arrangement according to the invention has been 10 described by way of example hereinbefore with reference to the accompanying drawings, in relation to an article of furniture in the form of a seat or chair. It will be appreciated that the suspension arrangement can also be used in relation to other articles of furniture for occupancy by a person such as a couch or the like, and the 15 arrangement according to the invention can also be advantageously used for example in the mounting of highly sensitive machines or items of equipment.

It will be appreciated that the above-described embodiments have been set forth solely by way of example and illustration of the 20 principles of the present invention and that various other modifications and alterations may be made therein without thereby departing from the spirit and scope of the invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A suspension arrangement for an article of furniture which includes a ^{lower} base portion and a ^{an upper} support surface portion movable relative to each other, comprising: cable hang members at suspension locations for suspending the upper support surface portion from the lower base portion, at least two said cable hang members being arranged ~~functionally~~ in series at each suspension location and the cable hang members which are arranged in series being at least approximately of the same hang member length; and means connecting together the mounting locations of the hang member ends which are remote from said support surface portion and of the hang member ends which are remote from said base portion.

2. An arrangement as set forth in claim 1 wherein said connecting means comprises a frame whose height corresponds to the hang length and which has a top side and an underside, and wherein a said cable hang member which is fixed to said support surface portion is fixed to said top side of the frame and a said cable hang member which is fixed to said base portion is fixed to said underside of the frame.

3. An arrangement as set forth in claim 1 wherein said connecting means comprises a plurality of concentric frames which are connected together by the series-disposed cable hang members.

4. An arrangement as set forth in claim 3 wherein said frames are arranged in aligned superposed relationship.

5. An arrangement as set forth in claim 3 wherein the frames have apertures therethrough, through which the respective cable hang members are passed to the respective opposite side of the respective frame.



6. An arrangement as set forth in claim 3 including spring means connecting said frames together.

5 7. An arrangement as set forth in claim 6 wherein said spring means are yielding rubber buffers.

10 8. An arrangement as set forth in claim 2 wherein said frame is of a polygonal configuration and wherein hang member connections are provided in the regions of the corners thereof.

15 9. An arrangement as set forth in claim 3 wherein said frames are polygonal and wherein hang member connections are provided in the regions of the corners thereof.

20 10. An arrangement as set forth in claim 2 wherein said frame is of a box-like configuration with closed side walls.

25 11. An arrangement as set forth in claim 3 wherein said frames are of a box-like configuration with closed side walls.

30 12. An arrangement as set forth in claim 11 comprising a plurality of frames of the same configuration but different cross-sections, wherein in relation to adjacent frames the larger frame has limb portions to which one end of a said cable hang member is fixed, said respective cable hang member being fixed by its other end to the next smaller frame.

35 13. An arrangement as set forth in claim 12 wherein the cable hang member fixed to the support surface portion ~~operatively~~ engages the largest of said frames and the cable hang member fixed to the base portion ~~is operatively connected~~ ^{engages} to the smallest of said frames.

40 14. An arrangement as set forth in claim 7 wherein said frame comprises first and second flat bar portions which are disposed at least



substantially ~~perpendicularly~~ ^{parallel} one above the other and which are connected together by said rubber buffers and which have apertures therethrough, and wherein said support surface portion is connected to one end of a said cable hang member which is passed through an aperture in the lower flat bar portion and which is fixed by its other end to the upper flat bar portion, and a said cable hang member which is fixed to the base portion is passed through an aperture in the upper flat bar portion and fixed by its other end to the lower flat bar portion.

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15. An arrangement as set forth in claim 1 and further including a housing fixed to said base portion and wherein said connecting means comprise frame means which with said cable hang members are disposed in said housing.

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16. An arrangement as set forth in claim 15 wherein said housing is carried by said support surface portion and wherein said base portion passes ~~at least substantially centrally~~ ^{the centre of} through said housing, a spacing being provided between said base portion and said housing to permit oscillatory movement between said support surface portion with housing on the one hand and said base portion on the other hand.

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17. An arrangement as set forth in claim 15 wherein said housing is carried by said base portion.

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18. An arrangement as set forth in claim 1 and further including abutment means disposed between members which are movable relative to each other.

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19. An arrangement as set forth in claim 18 wherein said abutment means comprise supported balls.

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20. An arrangement as set forth in claim 1 and further including a backrest portion carried on said connecting means.



21. An arrangement as set forth in claim 20 wherein said connecting means comprise a frame which includes a lower carrier element, and further including a spring means by way of which said backrest portion is connected to said lower carrier element.

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22. A suspension arrangement for ~~suspendingly~~ interconnecting first and second members which are disposed one above the other and which are movable relative to each other, the suspension arrangement comprising: a plurality of cable hang members at suspension locations between said first and second members, for interconnecting said first and second members in mutually movable suspended relationship, at least first and second cable hang members being ~~disposed functionally~~ ^{arranged} in series at each suspension location, with the cable hang members which are disposed in series ~~being at least approximately of the same hang length;~~ ^{having substantially the same} and frame means interconnecting the mounting locations of the ends of the cable hang members which are remote from said first member and the ends of the cable hang members which are remote from the second said member.

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23. In an article of furniture a suspension arrangement as set forth in claim 22.

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24. A suspension arrangement substantially as herein described with reference to any one or more of the accompanying drawings.

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DATED this 7th day of December 1992

CHRISTOPH PUERNER

By his Patent Attorneys

CULLEN & CO.



ABSTRACT OF THE DISCLOSURE

A suspension arrangement for example for an article of furniture such as a chair comprising a base portion and a support surface portion movable relative thereto has cable hang members by which the support surface portion is suspended on the base portion. Two or more cable hang members are arranged functionally in series at each suspension location and the series-connected hang members are at least approximately of the same hang length. The mounting locations of the hang member ends which are opposite to the support surface portion and of the hang member ends which are opposite to the base portion are connected together by a frame structure.



Fig. 1

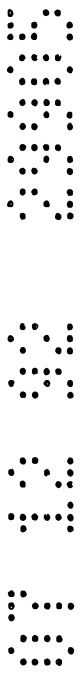
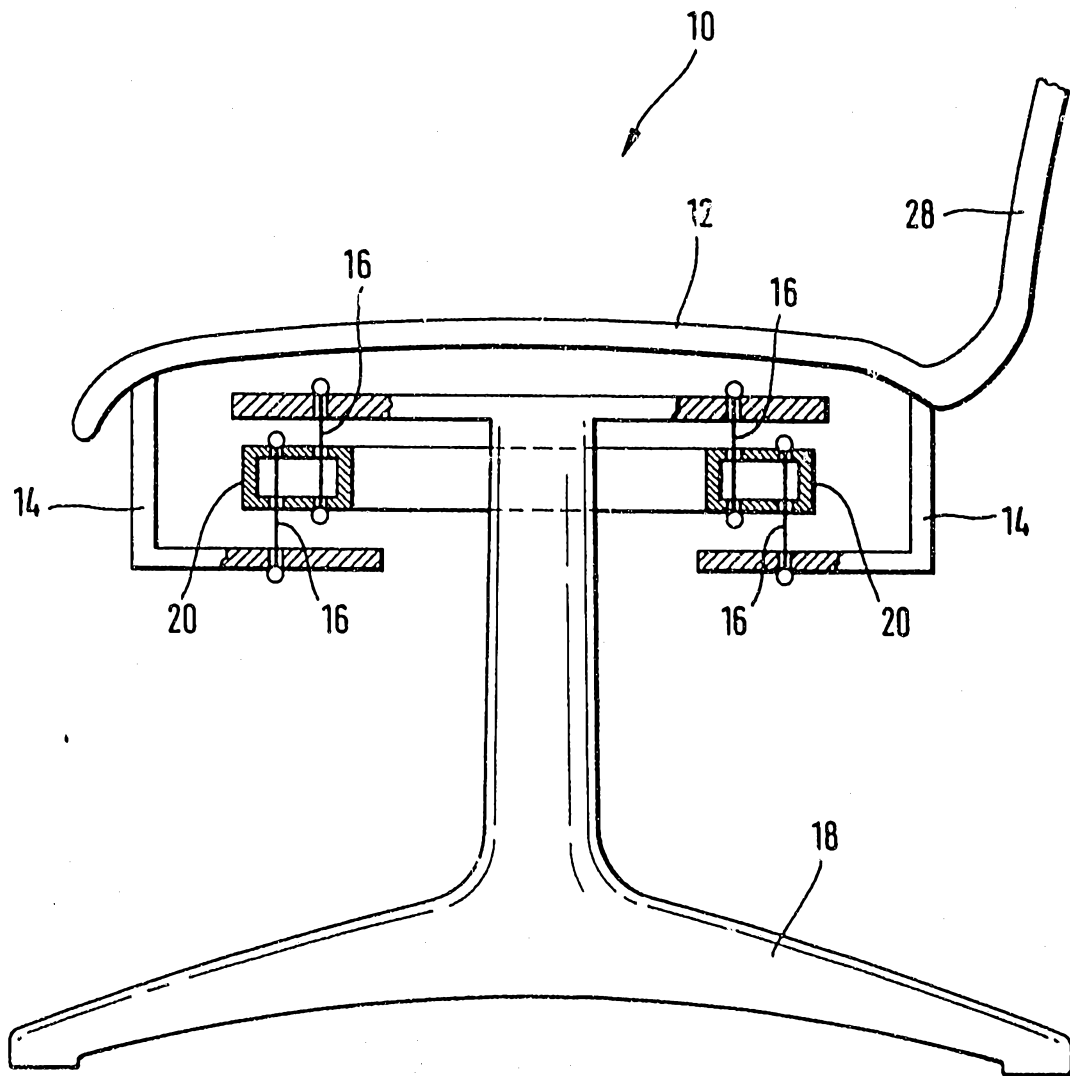


Fig. 2

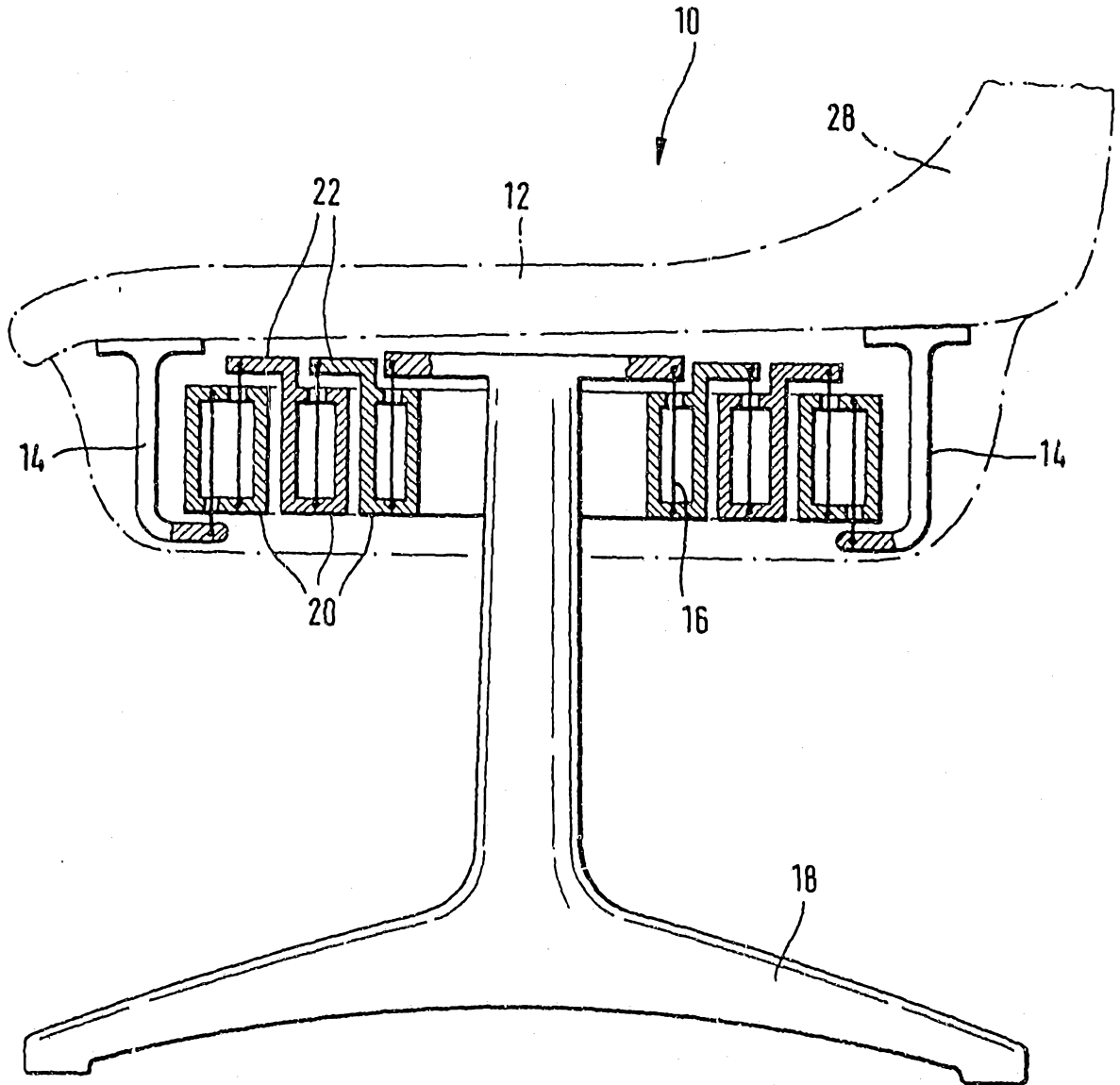


Fig. 3

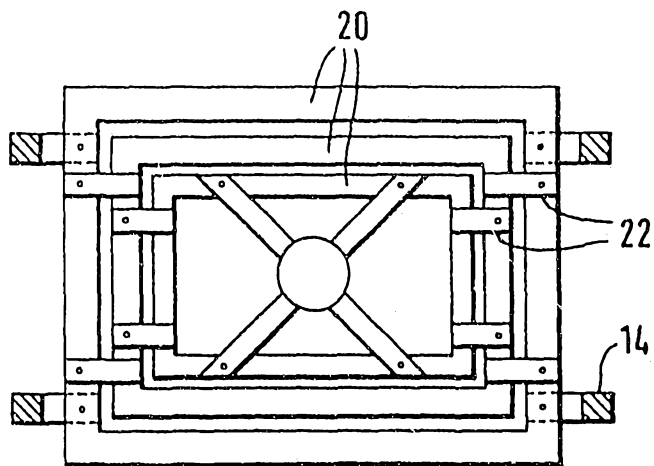
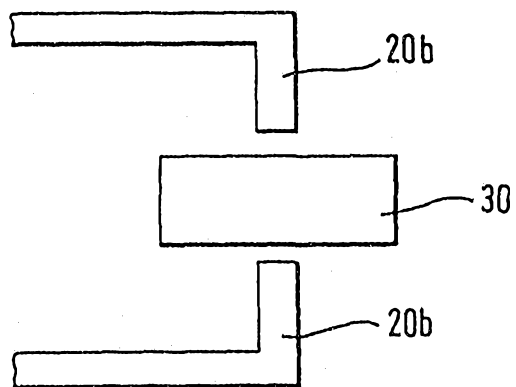


Fig. 5



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Fig. 4

