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(54) Title: SEGMENTED COLLECTOR SHOE ASSEMBLY

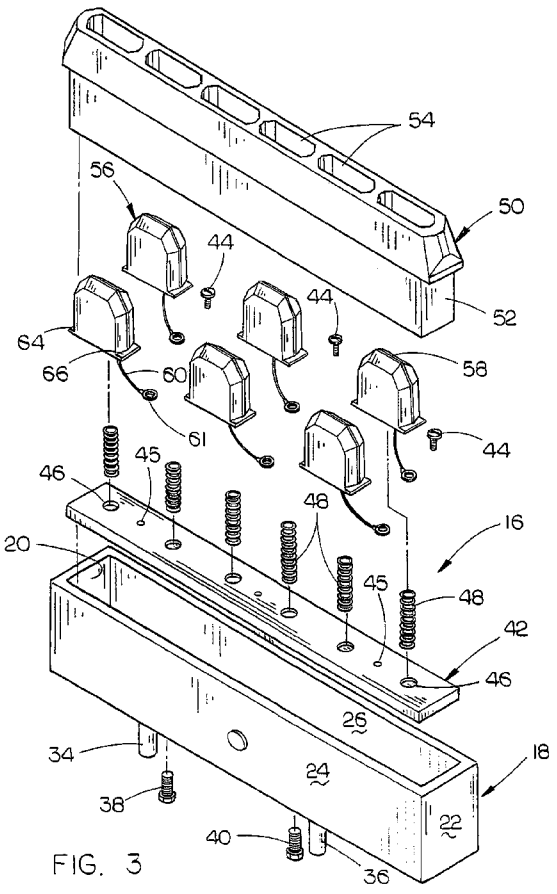

FIG. 3

(57) Abstract: A collector shoe assembly for use with an electrified conductor rail is disclosed. A support block has a plurality of collector shoe segments movably positioned therein, the outer ends of which are in engagement with the conductor rail.

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SEGMENTED COLLECTOR SHOE ASSEMBLY

BACKGROUND

A conductor rail cannot be manufactured perfectly straight and in some cases is required to be curved to follow the required path of the motorized equipment. When two rigid dissimilar surfaces are in contact, they will contact at the minimal number points to cause stability. Three points of contact are the minimum required for stability. The three points of contact are then subjected to a very high electrical current density causing each point to generate large amounts of heat. The heat then causes damage to the conductor rail and collector shoe ultimately resulting in shoe failure. This problem is particularly bad in installations where the equipment sits stationary for a period of time while drawing power.

A common current solution is to install multiple shoes along the rail to provide more points of contact to the conductor rail. This solution is undesirable because each shoe requires an additional mounting arm to be mounted to the equipment resulting in collector assemblies that grow incrementally in length for each collector that is installed. The long assemblies result in uneven load sharing between collectors. Also, the long collector assemblies reduce the amount of conductor rail length that can be used for movement because the space is occupied by collectors. Finally, the cost of the collector assembly is incrementally increased by the number of collectors installed.

Another problem with a rigid collector shoe is noted when it is used for signal or communication transmission while in motion. The three points of contact that were described above will continuously move from point to point and change along the collector shoe while the shoe is in motion along the conductor rail. Occasionally, as the collector shoe passes a joint in the conductor bar or even a spot of contamination or debris on the rail, the collector shoe resistance over the contact surface to the rail will rise to a point that the low voltage signal will not pass momentarily. This loss of signal can result in errors or faults between the equipment controls and drives. The typical solution is to install multiple shoes for redundancy. The intent being that at least one shoe will be making contact at any given time. The same undesirable characteristics of the multiple shoe solution apply to this situation as discussed hereinabove.

SUMMARY

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key aspects or essential aspects of the claimed subject matter. Moreover, this Summary is not intended for use as an aid in determining the scope of the claimed subject matter.

A segmented collector shoe assembly is described for use with an electrified conductor rail. The collector shoe assembly includes a support block. A plurality of electrical collectors are movably positioned in the support block.

BRIEF DESCRIPTION OF THE DRAWINGS

Non-limiting and non-exhaustive aspects are described with reference to the following figures, wherein like reference numerals refer to like parts throughout the various views unless otherwise specified.

Fig. 1 is a perspective view of a prior art collector shoe assembly;

Fig. 2 is a perspective view of the segmented collector shoe assembly;

Fig. 3 is an exploded perspective view of the collector shoe assembly;

Fig. 4 is a partial sectional view of the collector shoe assembly;

Fig. 5 is a partial sectional view illustrating the manner in which the collector shoe assembly is attached to a spring-loaded arm which is secured to the vehicle;

Fig. 6 is a perspective view of one form of the collector shoe segment;

Fig. 7 is a perspective view of another form of the collector shoe segment;

Fig. 8 is a partial sectional view illustrating the prior art collector shoe assembly in contact with a conductor rail; and

Fig. 9 is a sectional view similar to Fig. 8 except that the collector shoe assembly of this invention is illustrated.

DESCRIPTION

Aspects are described more fully below with reference to the accompanying figures. These aspects are disclosed in sufficient detail to enable those skilled in the art to practice the invention. However, aspects may be implemented in many different forms and should not be

construed as being limited to the aspects set forth herein. The following detailed description is, therefore, not to be taken in a limiting sense in that the scope is defined only by the appended claims.

In Fig. 1, the numeral 10 refers to a prior art collector shoe which is urged into electrical contact with an electrified conductor rail 12 such as used on mobile units or vehicles such as a trolley, crane, conveyor, hoist, train, etc. The collector shoe 10 may slidably and electrically engage the underside of the conductor rail 12 or either side thereof. The collector shoes of the prior art and the collector shoe of this invention are urged into contact with the conductor rail 12 by the prior art mounting structure or spring arm 14 which is attached to the mobile unit or vehicle in conventional fashion.

The collector shoe assembly of this invention is referred to by the reference numeral 16. Assembly 16 includes an elongated, generally rectangular-shaped housing member 18. Housing member 18 includes a first end 20, a second end 22, a first side 24, a second side 26, a closed end 28 and an open end 30. A mounting boss 32 extends outwardly from side 24 for pivotal attachment to the spring arm 14. A similar boss 33 extends outwardly from side 26 of housing member 18 for pivotal attachment to the spring arm 14.

A pair of cable lugs 34 and 36 extend inwardly through openings formed in end 28 of housing member 18 which are electrically connected to a bus bar 42 by bolts 38 and 40 respectively. The rectangular, electrically conductive bus bar 42 is positioned in housing member 18 as will be described hereinafter. Screws 44 extend downwardly through holes 45 formed in bus bar 42 as will be described hereinafter. Bus bar 42 is provided with a plurality of circular recesses 46 formed therein each of which receive one end of a spring 48.

Assembly 16 also includes a housing member 50 having an end portion 52 which is received by housing member 18 in a snap-fit manner. The lower end of end portion 52 engages bus bar 42 to maintain bus bar 42 in the position illustrated in Fig. 4. Housing member 50 has a plurality of collector shoe segment compartments 54 formed therein as seen in Fig. 3. An electrically conductive collector shoe segment 56 is movably positioned in each of the compartments 54. In Fig. 6, the segment 56 has beveled portions 56A and 56B at each of its ends and a beveled outer end 56C. The segment 56 includes a flat portion 58 as seen in Fig. 6. A flexible electrical lead 60 extends between each of the segments 56 and the bus bar 46 as seen in

Fig. 5. Each of the leads 60 has a ring connector 61 secured thereto. A rivet or screw 44 extends through a pair of ring connectors 61 to secure the same to the bus bar 46. The outer end of each of the springs 48 is received by a recess 62 in the inner end of the respective segment 56. Each of the segments 56 has laterally extending shoulders 64 and 66 to limit the outer movement of the segments with respect to the housing member 50, as seen in Fig. 5.

As stated, Fig. 6 illustrates one form of the collector shoe segment 56. In Fig. 7, a modified form of the collector shoe segment 56' is shown. Collector shoe segment 56' has beveled ends and a beveled outer end as seen in Fig. 7. Collector shoe segment 56' also has a flat surface 58' as seen in Fig. 7.

The drawings illustrate that the shoe assembly 16 has six collector shoe segments aligned in a parallel fashion for engagement with the conductor rail 14 but that number could be increased or decreased if necessary. When the spring arm 14 yieldably urges collector shoe assembly 16 into contact with the conductor rail 12, the springs 48 individually urge the associated collector shoe segment 56 into contact with the conductor rail with the flat surfaces 58 thereof being in slidable electrical engagement with the conductor rail.

The segmented collector shoe assembly of this invention is comprised of multiple, independently sprung, collector shoes as described hereinabove. The segmented collector shoes are connected together to a bus bar in the top of the shoe housing as described above. The segmented collector shoe assembly of this invention offers a solution in a package that is the same size as the prior art shoe and mounts directly to the standard arm 14. The independently sprung collector segments provide at least three points of contact each. This better distributes the electrical load over the full length of the collector shoe resulting in a lower current density at each point of contact. The lower current density results in less heat developing at each point. In preliminary testing, the segmented shoe of this invention was able to carry double the current at the same temperature as a standard shoe of the prior art.

The multiple segmented collectors of this invention provide more contact surfaces to the conductor rail creating less variability in the contact resistance along the rail. Therefore, there is less voltage fluctuation resulting in a more dependable signal. By distributing the current through additional contact points, results in less heat produced at each point. This keeps each point well below the melting point of the shoe material and prevents damage of the shoes and conductor rail.

Although the disclosure has been described in language that is specific to certain structures and methodological steps, it is to be understood that the invention defined in the appended claims is not necessarily limited to the specific structures and/or steps described. Rather, the specific aspects and steps are described as forms of implementing the claimed invention. Since many aspects of the disclosure can be practiced without departing from the spirit and scope of the invention, the invention resides in the claims hereinafter appended.

CLAIMS

1. A collector shoe assembly for use with an electrified conductor rail, comprising:

an elongated, generally rectangular support block having a first end, a second end, a first side, a second side, an inner end, and an outer end;

a generally rectangular bus bar positioned in said support block;

a plurality of electrical collector shoe segments movably positioned in said support block in a spaced-apart aligned parallel manner;

each of said collector shoe segments having an inner end, an outer end, a first end, a second end, a first side, and a second side;

said conductor shoe segments being electrically connected to said bus bar;

a spring associated with each of said collector shoe segments to yieldably urge the respective collector shoe segment outwardly from said support block so that said outer end of the collector shoe segment will be yieldably urged into sliding conductive engagement with the conductor rail.

2. The collector shoe assembly of claim 1 wherein each of said collector shoe segments has a generally rectangular cross-sectional configuration.

3. The collector shoe assembly of claim 1 wherein said outer ends of said first ends and said second ends of said collector shoe segments are beveled.

4. The collector shoe assembly of claim 1 wherein each of said collectors has a beveled outer end, a beveled first end and a beveled second end.

5. The collector shoe assembly of claim 1 wherein said support block has a plurality of spaced-apart collector shoe compartments formed therein and wherein said collector shoe segments are slidably mounted in said collector shoe compartments.

6. The collector shoe assembly of claim 1 further including structure which limits the outward movement of said collector shoe segments with respect to said support block.

7. The collector shoe assembly of claim 1 wherein each of said collector shoe segments has a quadrilateral cross-section configuration.

8. The collector shoe assembly of claim 1 wherein each of said springs is a compression spring which engages said inner end of the respective collector shoe segment.

9. The collector shoe assembly of claim 1 wherein said outer end of said support block has a plurality of spaced-apart aligned slots formed therein through which said collector shoe segments extend.

10. The collector shoe assembly of claim 1 wherein each of said slots has a rectangular configuration.

11. The collector shoe assembly of claim 1 wherein flexible leads connect said collector shoe segments to said bus bar which permit said collector shoe segments to move with respect to said support block and said bus bar.

12. The collector shoe assembly of claim 1 wherein said support block includes first and second housing members which are secured together.

13. A collector shoe assembly for use with an electrified conductor rail, comprising:

an elongated, generally rectangular first housing member having a first end, a second end, a first side, a second side, an inner end, and an open outer end;

a flat, rectangular electrically conductive bus bar positioned in said first housing member adjacent said closed inner end thereof;

at least a pair of spaced-apart cable lugs extending through said inner end of said first housing member which are electrically connected to said bus bar;

a plurality of spaced-apart springs, having inner and outer ends, positioned in said first housing member;

said inner ends of said springs being supported on said bus bar;

an elongated, generally rectangular second housing member having a first end, a second end, a first side, a second side, an inner end and an outer end; said outer end of said second housing member having a plurality of longitudinally spaced-apart openings formed therein;

said second housing member having a plurality of collector segment compartments therein which register with said spaced-apart openings in said outer end of said second housing member;

said inner end of said second housing member being selectively removably received in said open outer end of said first housing member to form a support block;

a plurality of collector shoe segments movably mounted in said support block in an aligned parallel relationship;

each of said collector shoe segments having an inner end, an outer end, a first end, a second end, a first side and a second side;

said outer ends of said springs being in engagement with said inner ends of said collector shoe segments to yieldably urge said collector shoe segments outwardly from said spaced-apart openings in said outer end of said second housing member; for engagement with the conductor rail;

each of said collector shoe segments being in electrical contact with said bus bar by means of a conductor wire extending therebetween.

14. The collector shoe assembly of claim 13 wherein each of said conductor wires is flexible.

15. The collector shoe assembly of claim 14 wherein the outer ends and said first and second ends of said collector shoe segments are beveled.

16. A collector shoe assembly, comprising:

a support block assembly;

a conductive bus coupled to a first end of the support block assembly; and

a plurality of electronic collectors movably mounted to a second end of the support block assembly to facilitate inwardly and outwardly movement of the plurality of electronic collectors with respect to the support block assembly, wherein the electronic collectors are electronically coupled to the conductive bus.

17. The collector shoe assembly of claim 16, wherein the support block includes a plurality of compartments, wherein each of the electronic collectors is movably mounted to one of the plurality of compartments.

18. The collector shoe assembly of claim 16, wherein the outwardly movement of each of the plurality of electronic collector shoes is limited with respect to the support block assembly.

19. The collector shoe assembly of claim 16, wherein each of the plurality of electronic collectors is urged away from the first end of the support block assembly.

20. The collector shoe assembly of claim 19, wherein each of the plurality of electronic collectors is urged away from the first end of the support block assembly via a biasing member.

21. The collector shoe assembly of claim 20, wherein the biasing member is oriented between the first end of the support block and a respective electronic collector of the plurality of electronic collectors.

22. The collector shoe assembly of claim 16, wherein each of the electronic collectors is electronically coupled to the conductive bus via a plurality of flexible electronic leads.

23. The collector shoe assembly of claim 16, wherein the support block assembly includes a first housing member and a second housing member.

24. The collector shoe assembly of claim 23, wherein the conductive bus is coupled to the first housing member, wherein the second housing member couples into the first housing member and engages the conductive bus.

25. A collector shoe assembly, comprising:

a support block assembly, wherein the support block assembly includes a first housing member and a second housing member coupled to the first housing member, wherein the second housing member includes a plurality of compartments;

a conductive bus coupled to the first housing member; and

a plurality of electronic collectors movably mounted to the second housing member within the plurality of compartments to facilitate inwardly and outwardly movement of the plurality of electronic collectors with respect to the support block assembly, wherein the electronic collectors are electronically coupled to the conductive bus.

26. The collector shoe assembly of claim 25, wherein the outwardly movement of each of the plurality of electronic collector shoes is limited with respect to the support block assembly.

27. The collector shoe assembly of claim 25, wherein each of the plurality of electronic collectors is urged away from a closed end of the first housing member.

28. The collector shoe assembly of claim 27, wherein each of the plurality of electronic collectors is urged away from the closed end of the first housing member via a biasing member.

29. The collector shoe assembly of claim 28, wherein the biasing member is oriented between the closed end of the first housing member and a respective electronic collector of the plurality of electronic collectors.

30. The collector shoe assembly of claim 25, wherein each of the electronic collectors is electronically coupled to the conductive bus via a plurality of flexible electronic leads.

31. The collector shoe assembly of claim 25, wherein the second housing member couples into the first housing member and engages conductive bus.

32. A collector shoe assembly, comprising:

a support block assembly, wherein the support block assembly includes a first housing member and a second housing member coupled to the first housing member, wherein the second housing member includes a plurality of compartments;

a conductive bus coupled to the first housing member;

a plurality of electronic collectors movably mounted to the second housing member within the plurality of compartments to facilitate inwardly and outwardly movement of the plurality of electronic collectors with respect to the support block assembly, wherein each of the plurality of electronic collectors is urged away from the first housing member; and

a plurality of flexible electronic leads electronically coupling the electronically conductive bus bar to each of the electronic collectors.

33. The collector shoe assembly of claim 32, wherein each of the plurality of electronic collectors is urged away from the first housing member via a biasing member.

34. The collector shoe assembly of claim 33, wherein the biasing member is oriented between the first housing member and a respective electronic collector of the plurality of electronic collectors.

35. The collector shoe assembly of claim 32, wherein the outwardly movement of each of the plurality of electronic collector shoes is limited with respect to the compartments of the second housing member.

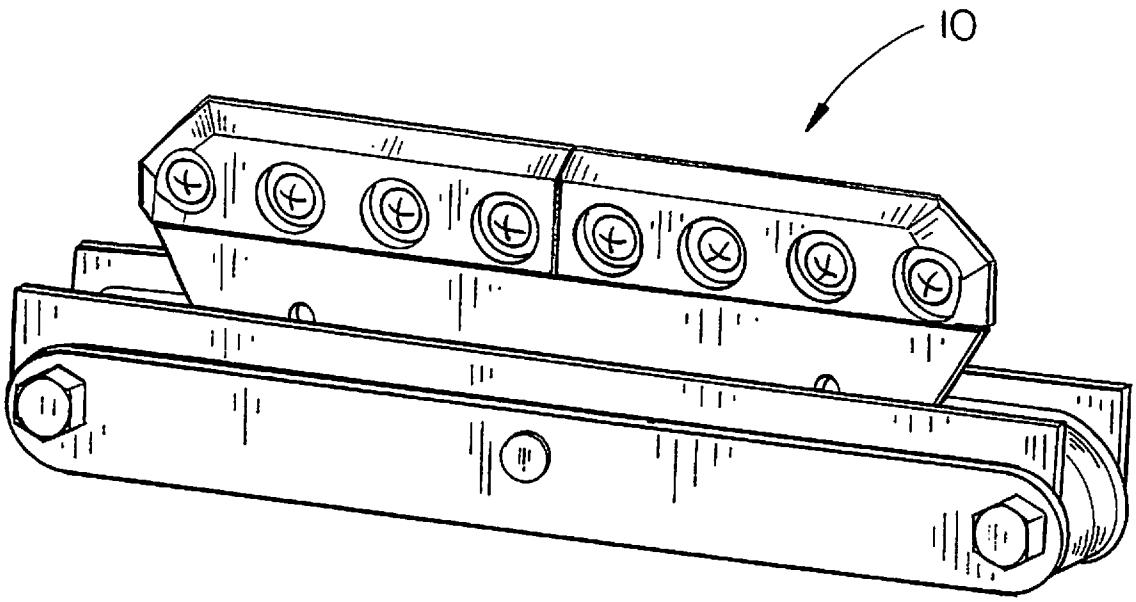

FIG. 1
(PRIOR ART)

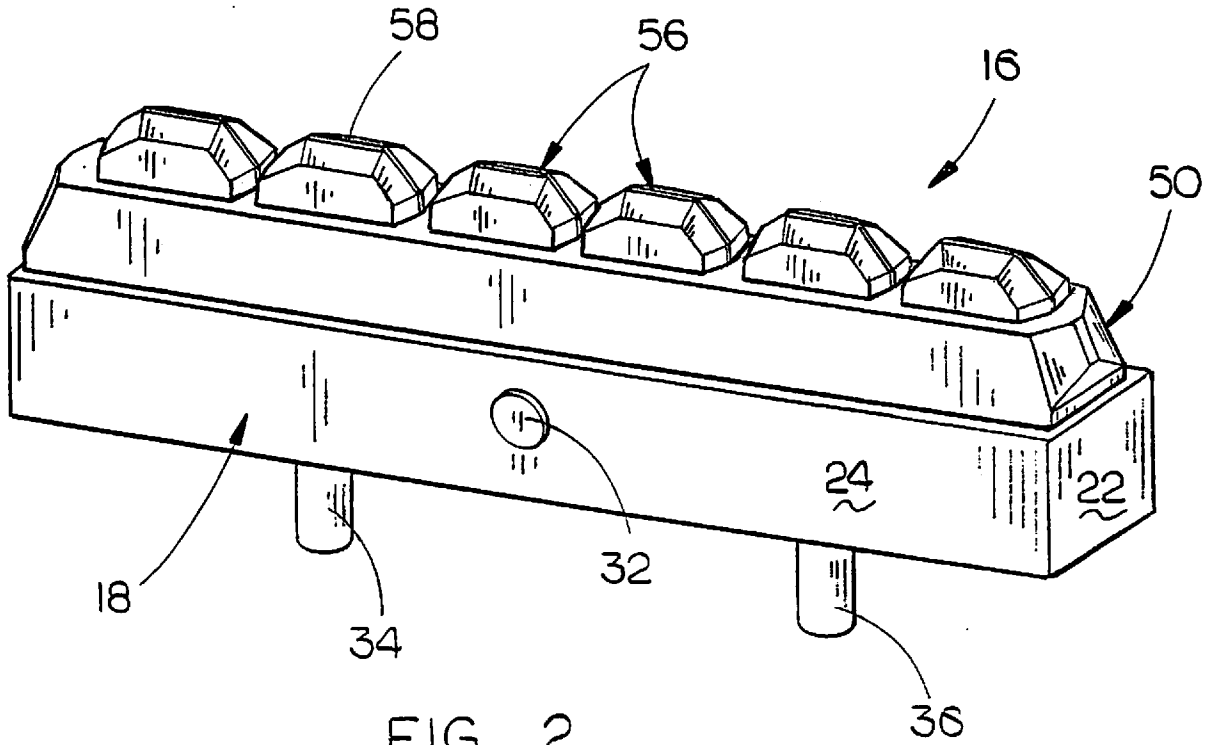

FIG. 2

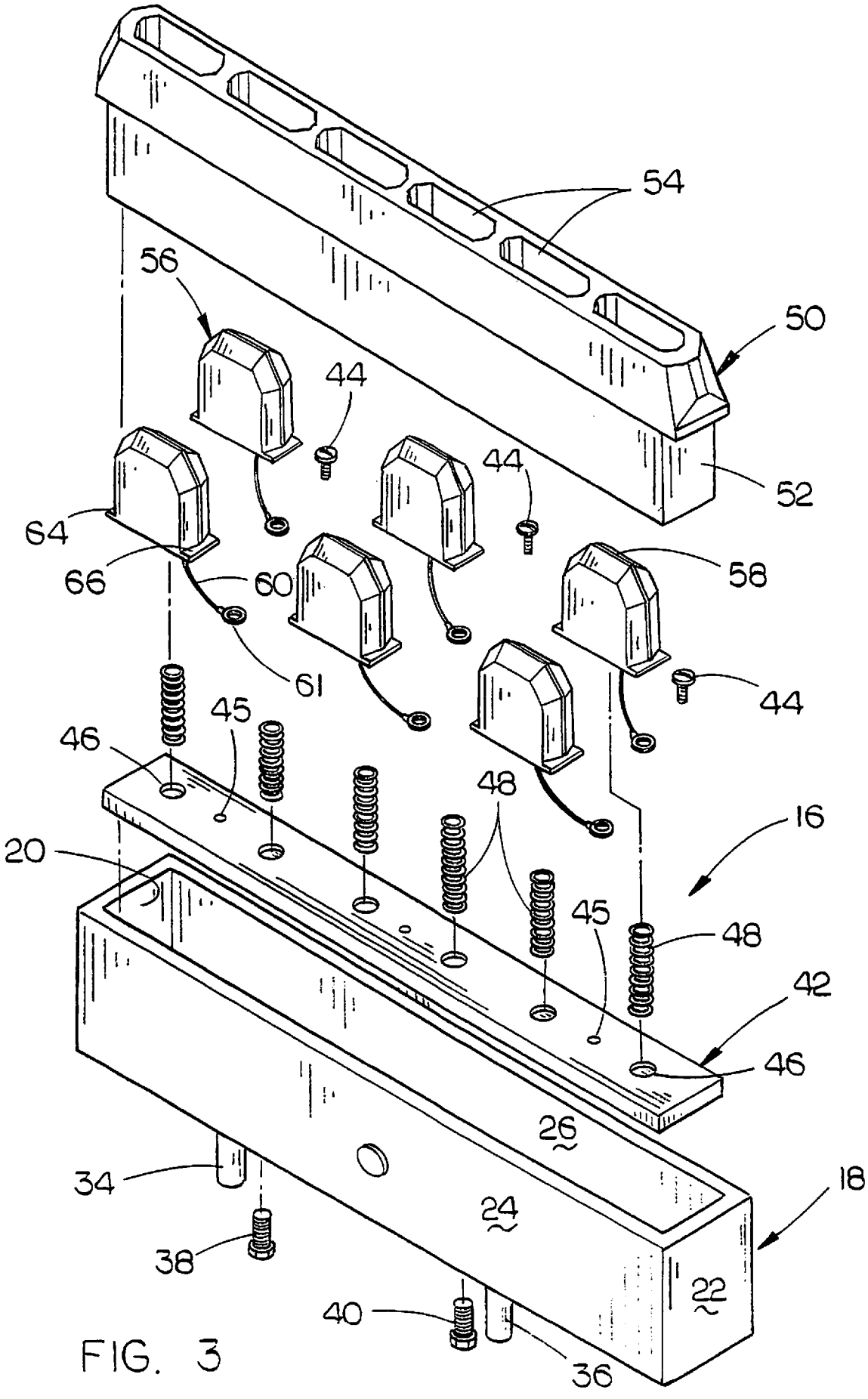
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FIG. 3

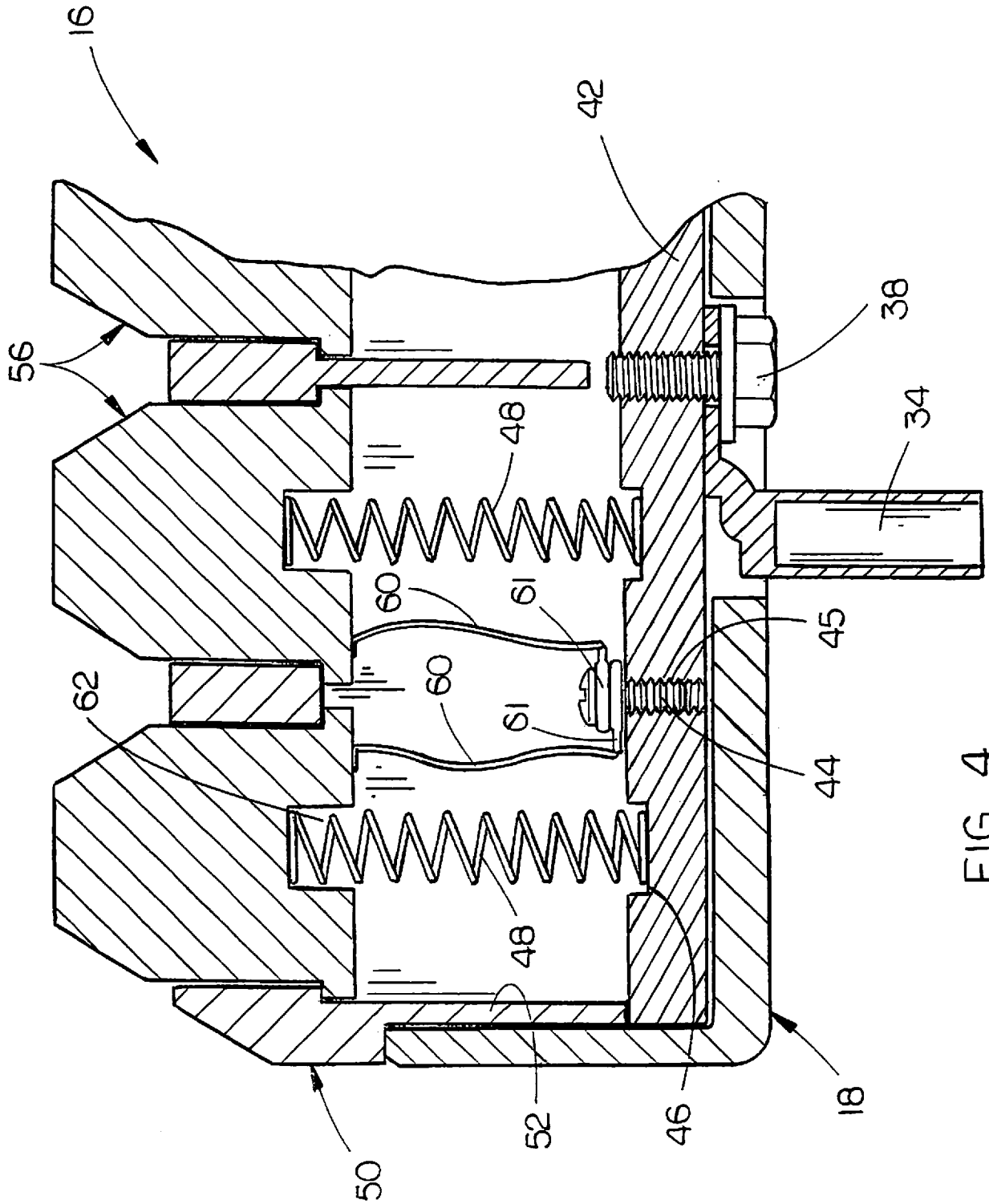

FIG. 4

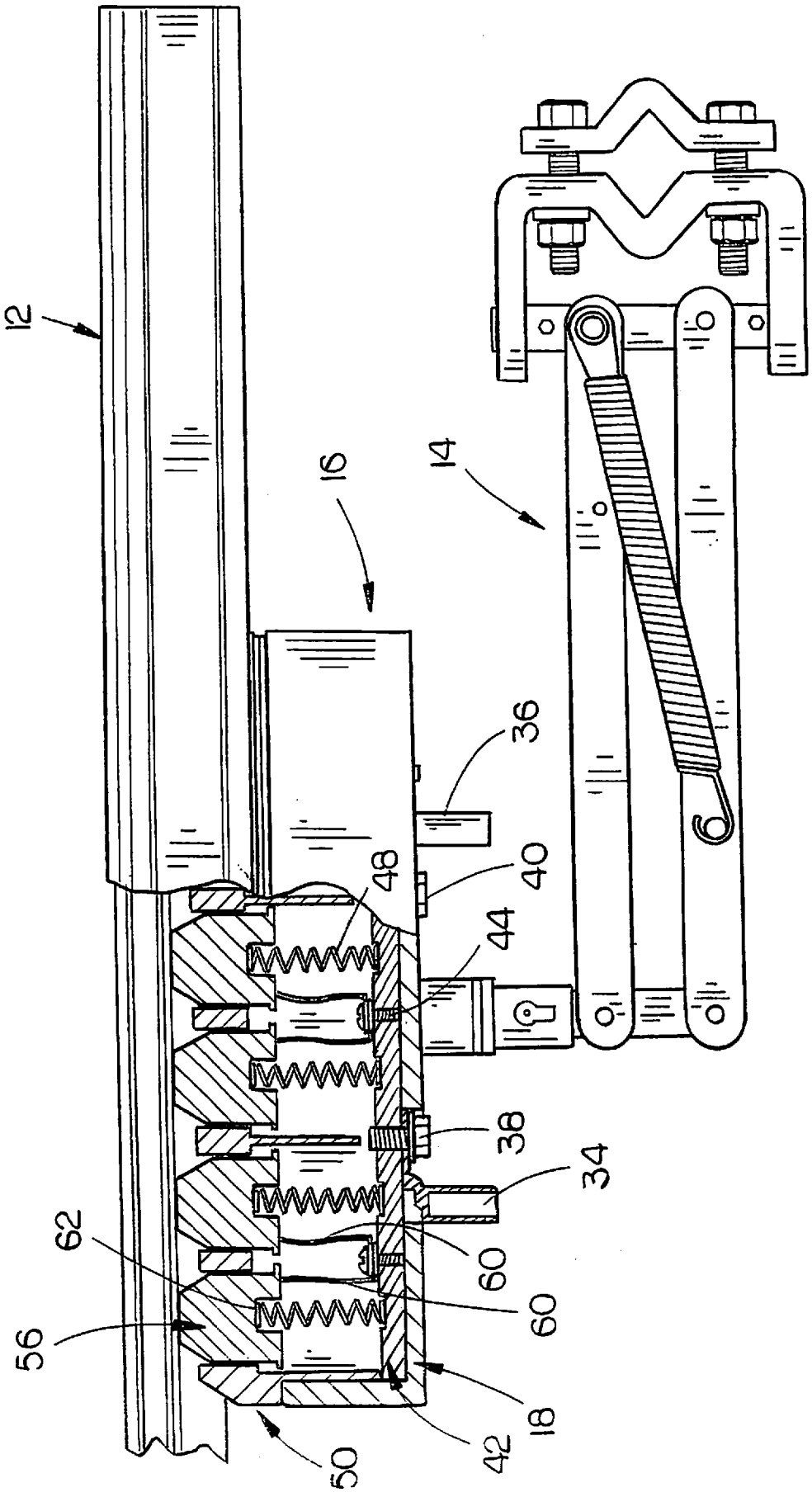

FIG. 5

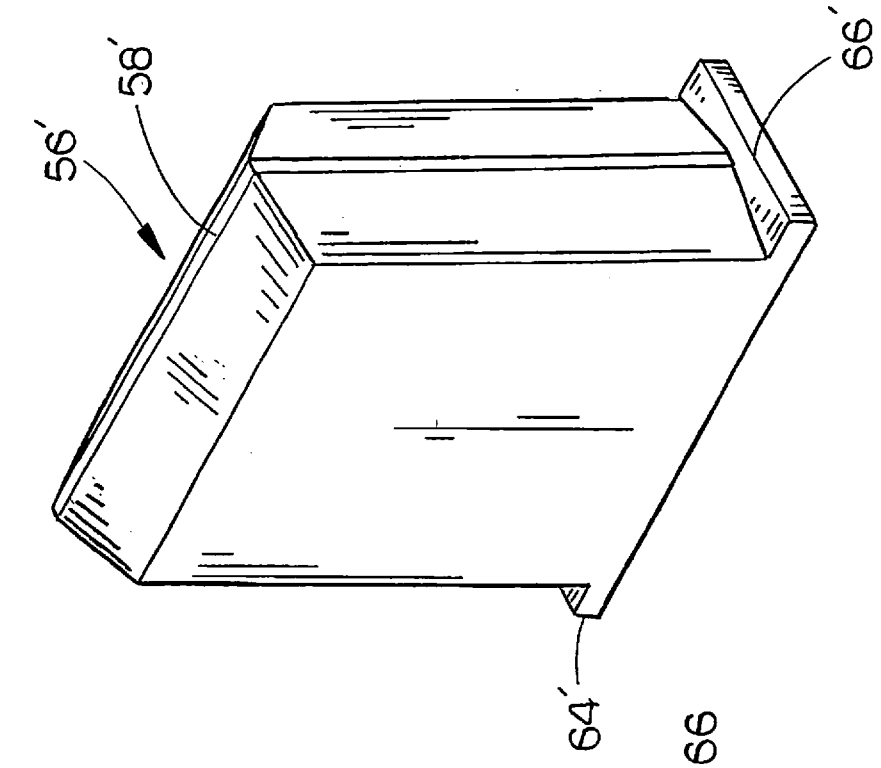

FIG. 7

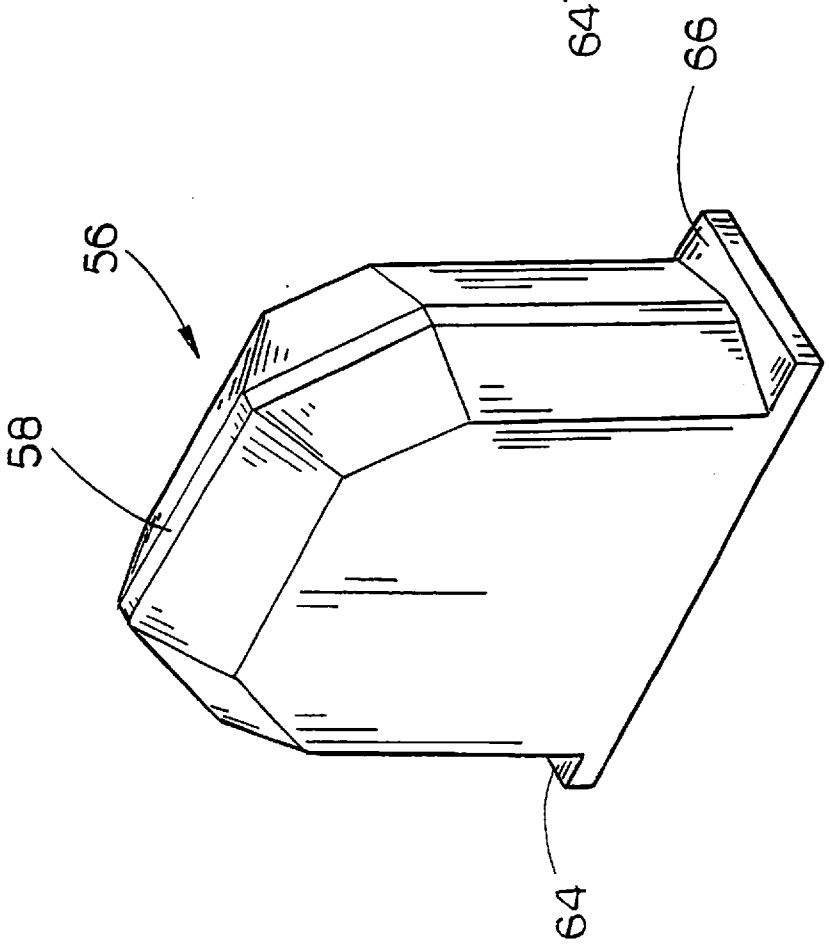

FIG. 6

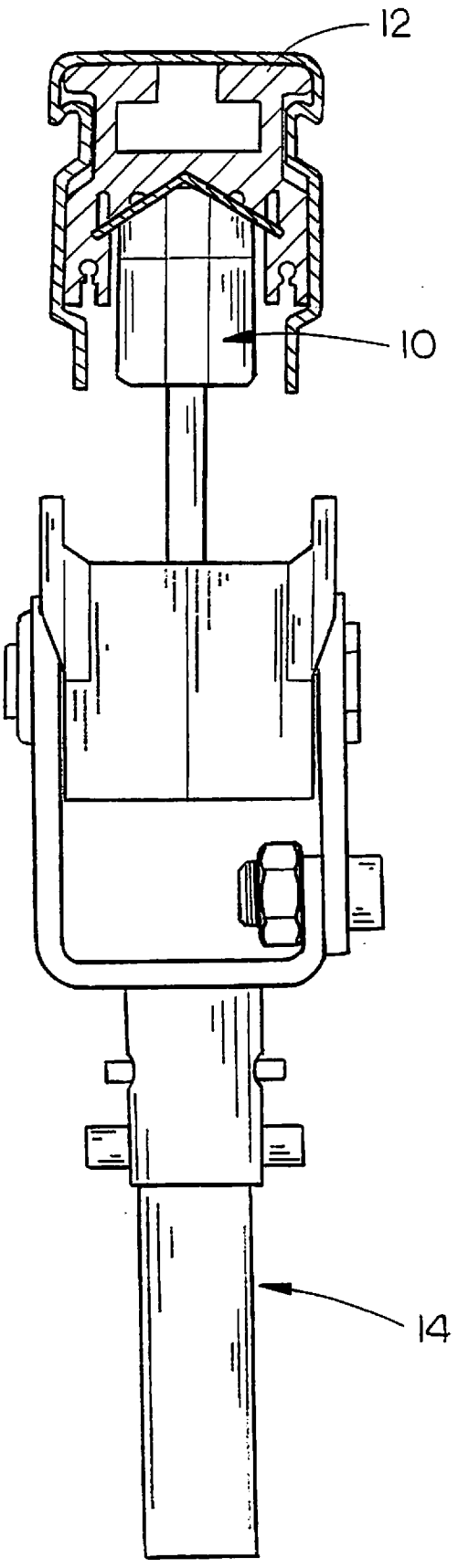

FIG. 8
(PRIOR ART)

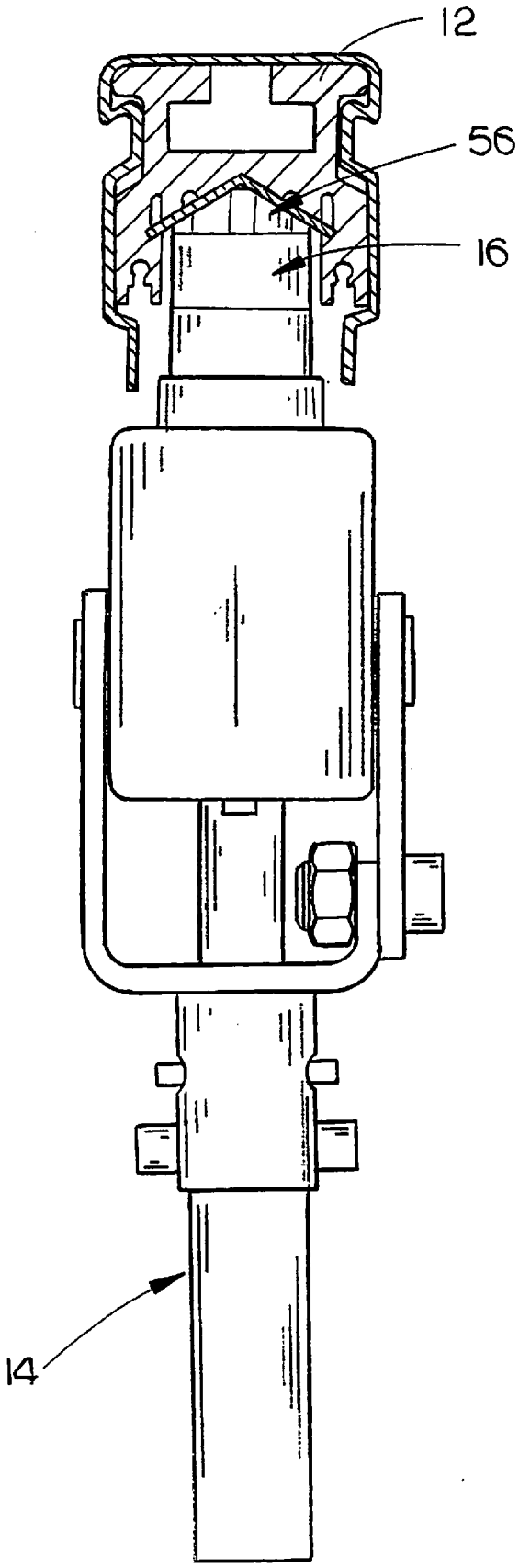

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/025536

A. CLASSIFICATION OF SUBJECT MATTER

B60L 5/08(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B60L 5/00, B60L 5/08, HB60L 5/22, B60L 5/24, H01R 41/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords:electric vehicle, electric collertor, shoe segment, busbar, spring

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009-0211861 A1 (FUMIO OKIMOTO et al.) 27 August 2009 See paragraphs [0013], [0048]-[0055] and figures 1-7.	1-2,7-8,16
Y		3-4,6,18
A		5,9-15,17,19-35
Y	JP 2003-324806 A (FURUKAWA ELECTRIC CO., LTD.) 14 November 2003 See abstract, paragraphs [0011]-[0020] and figures 1-4.	3-4
A		1-2,5-35
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☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 May 2013 (30.05.2013)	**30 May 2013 (30.05.2013)**

Name and mailing address of the ISA/KR
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Facsimile No. 82-42-472-7140

Authorized officer
PARK, Hye Lyun
Telephone No. 82-42-481-3463

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2013/025536

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