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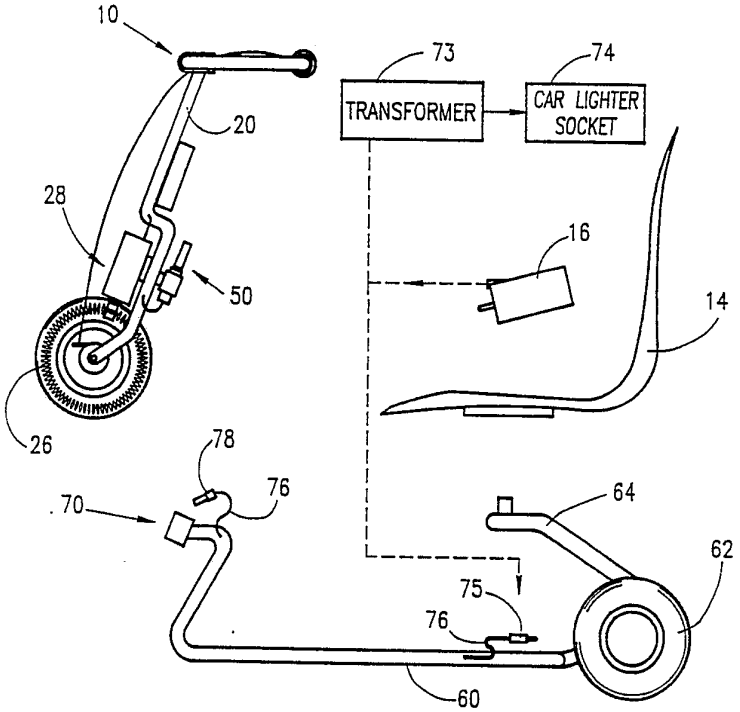
(54) Title: KNOCKDOWN ELECTRIC MOTOR-DRIVEN VEHICLE



(57) Abstract

An electrically powered vehicle comprised of a Front driving and steering unit (10) and a rear chassis unit (12). The two units are interconnected through a pin member (51) on the drive unit and a socket member (70) on the chassis unit. An electrical connector (58) mounted on the pin member interconnects with a female electrical connector (78) to provide electrical power from a battery (16) to a drive motor (28).

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KNOCKDOWN ELECTRIC MOTOR-DRIVEN VEHICLE

The present invention relates to motorized vehicles generally and more particularly to knockdown, readily assembled vehicles.

There exist a great variety of knockdown vehicles which are suitable for use, inter alia, by invalids. Examples of such vehicles are described in the following U.S. Patents: U.S. 4,947,955; 4,941,540; 4,909,525; 4,861,058; 4,825,971; 4,757,868; 4,750,578; 4,708,219; 4,570,739; 4,452,327; 3,912,032; 3,580,348; 3,506,080; 3,369,629; 3,316,993; 3,229,782.

The present invention seeks to provide an improved, motor-driven vehicle, which is readily assembled and disassembled even by users having limitations on their activity.

There is thus provided in accordance with a preferred embodiment of the present invention a motor-driven vehicle including a driving and steering unit, a chassis unit and apparatus for removable interconnection between the driving and steering unit and the chassis unit, and wherein the apparatus for removable interconnection includes a generally upward facing pin and a socket arranged to removably engage the pin from above. There is also provided in accordance with a preferred embodiment of the present

invention a motor-driven vehicle including a driving and steering unit, a chassis unit and apparatus for removable interconnection between the driving and steering unit and the chassis unit, and wherein the apparatus for removable interconnection includes a generally upward facing pin and a socket arranged to removably engage the pin, wherein the pin and the socket define mutually engaging tapered engagement surfaces.

There is also provided in accordance with a preferred embodiment of the present invention a motor-driven vehicle including a driving and steering unit, a chassis unit and apparatus for removable interconnection between the driving and steering unit and the chassis unit, and wherein the apparatus for removable interconnection includes mechanical interconnection apparatus and electrical interconnection apparatus.

In accordance with a preferred embodiment of the present invention, the apparatus for removable interconnection includes generally upward facing pin assembly including a hollow pin member having a first electrical connector located interiorly thereof; a socket arranged for removable mechanical engagement with the pin and a second electrical connector which is arranged for removable electrical connection with the first electrical connector.

Preferably, the hollow pin member is constructed to function as a guide for engagement of the second electrical connector with the first electrical connector.

In accordance with a preferred embodiment of the present invention, a part of the apparatus for removable interconnection is rotatably mounted onto the driving and steering unit. Preferably, it is the pin that is rotatably mounted onto the driving and steering unit and the socket which is rotatably mounted onto the chassis.

According to a preferred embodiment of the present invention, the chassis is constructed such that a substantial portion of the weight of a user seated thereon is applied to the socket, thereby resisting disengagement of the socket from the pin.

In accordance with a preferred embodiment of the present invention, a rechargeable battery is removably mounted onto the chassis, preferably in a recess formed in the floor of the chassis under the seat and apparatus is provided for recharging the battery directly from a cigarette lighter electrical socket in a vehicle.

Additionally in accordance with a preferred embodiment of the present invention, the chassis is formed of tubular construction so as to exhibit user sensible flexibility during normal operation.

In accordance with a preferred embodiment of the invention, the driving and steering unit includes a wheel and motor drive apparatus which directly engages the side of the wheel. In accordance with a preferred embodiment of the invention, the drive apparatus and the wheel may be configured for toothed driving engagement. In accordance with a preferred embodiment of the invention, a seat is removably mounted onto the chassis. Preferably, the seat is cantilevered with respect to part of the chassis, thus providing shock absorption.

The present invention will be understood and appreciated more fully from the following detailed description, taken in conjunction with the drawings in which:

Fig. 1 is a pictorial illustration of a vehicle constructed and operative in accordance with a preferred embodiment of the present invention;

Figs. 2A and 2B are respective generalized disassembled and assembled side view illustrations of the vehicle of Fig. 1;

Figs. 3A and 3B are generalized illustrations of apparatus for removable connection in respective disassembled and assembled conditions;

Fig. 4 is a generalized illustration of a driving and steering unit constructed for toothed driving engagement between the drive motor and the wheel;

Fig. 5 is a detailed illustration illustrating preferred toothed engagement;

Figs. 6A, 6B and 6C illustrate three steps in the assembly of the chassis onto the driving and steering unit;

Fig. 7 is a pictorial illustration of a vehicle constructed and operative in accordance with another preferred embodiment of the present invention; and

Figs. 8A, 8B and 8C illustrate three operative modes of a speed and direction control lever forming part of the apparatus of Fig. 7.

Reference is now made to Figs. 1 - 6C, which illustrate a vehicle constructed and operative in accordance with a preferred embodiment of the present invention. As seen particularly in Figs. 1, 2A and 2B, the vehicle preferably includes a driving and steering unit 10, a chassis 12, a seat 14 and a rechargeable battery 16, all of which are designed to be easily assembled and disassembled by a user, even a person with physical limitations.

The driving steering unit 10 preferably comprises a frame 20 onto which are mounted handlebars 22 and control circuitry 24. A driving and steering wheel 26 is mounted at the bottom of frame 20 and is driven by an electric motor drive assembly 28 comprising one or two electric motors which engage wheel 26. The structure and operation of the electric motor drive assembly 28 is preferably as taught in one or more of the embodiments described in applicant's copending published European Patent Application 0403978, the contents of which are hereby incorporated by reference.

In accordance with one embodiment of the invention, illustrated in Figs. 4 and 5, wheel 26 may be formed with recesses or ridges 30 for driving engagement by corresponding protrusions or recesses 32 of a drive member 34 driven by an electric motor 36. Such an arrangement may be provided on one or both sides of the wheel.

The driving and steering unit 10 also preferably includes a handbrake assembly 38 and any other suitable operator signals and controls 40.

In accordance with a preferred embodiment of the present invention, as shown in Figs. 3A and 3B, the driving and steering unit 10 includes a rotational mounting assembly 42 comprising a mounting element 44 which is fixedly mounted onto frame 20 and which is

also fixedly mounted onto the outer sleeve portion 46 of a bearing sleeve assembly 48, which may be identical to that conventionally employed for rotatably mounting the front wheel and handlebar assembly onto the frame of a conventional bicycle. The advantage of this construction is that the rotational mounting assembly 42 is sealed and thus does not tend to soil the hands or clothes of a user.

Bearing mounted within sleeve portion 46 of assembly 48 is a mounting pin assembly 50, which is threadably retained in association with sleeve portion 48 by a retaining nut 52. Assembly 50 includes a generally upstanding pin member 51 which defines a tapered generally circular upper and outer facing support surface portion 54 and thereabove, a generally cylindrical outer facing portion 56.

Pin 51 is hollow so as to accommodate one terminal of an electrical connector, preferably a male terminal 58, which is coupled via an electrical cable to circuitry 24 and to motor drive assembly 28.

Chassis 12 is preferably formed with a tubular frame 60 having a pair of wheels 62 mounted at the back and including a cantilevered seat support portion 64 located forward of the wheels 62. The structure of chassis 12 with the cantilevered seat support portion 64 is intended to provide a certain amount of shock absorption for the seat 14 due to the cantilevered construction and to direct most of the downward forces onto the forward wheel 26. A floor plate 66 is mounted onto frame 60.

Frame 60 is formed at its forward end with a connection socket 70 defining an inner tapered portion 72 which is arranged for secure removable seating against corresponding tapered surface portion 54 of pin 51 and an inner cylindrical portion 80 which is arranged for removable seating engagement with cylindrical surface 56 of pin 51.

Removably mounted onto chassis 12 at seat

support portion 64 is seat 14 and thereunder rechargeable battery or batteries 16. It is a particular feature of the present invention that the battery or batteries 16 are arranged for recharging with the use of a transformer 73 from the cigarette lighter outlet 74 of a motor vehicle, such as a car when the battery is stored therein and while the motor vehicle is in operation.

Battery 16 is also arranged for interconnection with a connector 75 of a cable 76 which is preferably threaded through frame 60 and has a forward connector 78.

It is a particular feature of the present invention that the vehicle can be easily assembled and disassembled by a user, such as an elderly person, so as to enable the vehicle to be transported in a disassembled state and even recharged in an automobile and then removed and assembled by the user.

Reference is now directed particularly to Figs. 3A, 3B and 6A - 6C, which illustrate the ease of assembly of the vehicle of the present invention. In Fig. 6A, the chassis 12, seat 14 and battery 16 are all assembled. The user then places the socket 70 over pin 51, such as tapered surface 72 seats on tapered surface 54. To establish electrical connection between the battery 16 and the driving and steering unit 10, the user inserts a connector 78, preferably a conventional female electrical connector into physical and electrical engagement with connector 58.

Normally, electrical connectors 58 and 78 as well as cable 76 provide two conductive paths connected to corresponding plus and minus terminals of the battery.

It is particularly noted that pin 51 acts as a physical guide for placement of socket 70 and also for the placement of connector 78, thus simplifying assembly particularly for a person who may have difficulties in seeing. Disassembly is achieved

preferably by reversing the assembly steps described above.

Reference is now made to Fig. 7 which is a pictorial illustration of a vehicle constructed and operative in accordance with another preferred embodiment of the present invention wherein a two-handed, bi-directional speed and direction control assembly 90 is provided on the handlebars 20. As seen with greater particularity in Figs. 8A, 8B and 8C, assembly 90 comprises a unitary handle member 82 which is typically mounted on the control screw of a potentiometer 84 such that rotation of the handle member in a first direction 86 from its nominal position shown in Fig. 8A, produces motion in a first, typically forward direction (Fig. 8B), while rotation of the handle member in an opposite direction 88 from its nominal position produces vehicle motion in a second, typically backward direction (Fig. 8C). Springs 90 and 92 are provided for returning the handle member 82 to its nominal position. The amount of rotation in a given direction determines the speed.

The provision of assembly 90 has a number of advantages which are summarized hereinbelow:

1. Both speed and direction may be controlled by either either a single hand or both hands of an operator in a single motion.

2. Dynamic braking of the vehicle can be achieved by rapid rotation of the handle member 82 in a direction relative to the nominal position opposite to its current position.

3. A single handle element provides speed control and direction selection for operation in both forward and backward directions.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described hereinabove. Rather the scope of the present invention is defined only by the claims which follow:

C L A I M S

1. A motor-driven vehicle comprising:
a driving and steering unit;
a chassis unit; and
means for removable interconnection between the driving and steering unit and the chassis unit, and wherein the means for removable interconnection includes a generally upward facing pin and a socket arranged to removably engage the pin from above.

2. A motor-driven vehicle comprising:
a driving and steering unit;
a chassis unit; and
means for removable interconnection between the driving and steering unit and the chassis unit, and wherein the means for removable interconnection includes a generally upward facing pin and a socket arranged to removably engage the pin, wherein the pin and the socket define mutually engaging tapered engagement surfaces.

3. A motor-driven vehicle comprising:
a driving and steering unit;
a chassis unit; and
a control handle assembly for controlling the direction and speed of movement of the vehicle including a single handle which is operated by either one or both hands of an operator for governing both direction and speed of movement.

4. A vehicle according to any of the preceding claims and wherein said means for removable interconnection includes a generally upward facing pin assembly including a hollow pin member having a first electrical connector located interiorly thereof; a socket arranged for removable mechanical engagement with the pin and a second electrical connector which is

arranged for removable electrical connection with the first electrical connector.

5. A vehicle according to claim 4 and wherein said hollow pin member is constructed to function as a guide for engagement of the second electrical connector with the first electrical connector.

6. A vehicle according to any of the preceding claims and wherein a part of the means for removable interconnection is rotatably mounted onto the driving and steering unit.

7. A vehicle according to claim 6 and wherein the pin is rotatably mounted onto the driving and steering unit and the socket is mounted onto the chassis unit.

8. A vehicle according to any of the preceding claims and wherein said chassis unit is constructed such that a substantial portion of the weight of a user seated thereon is applied to the socket, thereby resisting disengagement of the socket from the pin.

9. A vehicle according to any of the preceding claims and wherein a rechargeable battery is mounted onto the chassis unit and means is provided for recharging the battery directly from an automobile cigarette lighter electrical socket.

10. A vehicle according to claim 9 and wherein said means for recharging comprises 12V - 24V transformer means.

11. A vehicle according to any of the preceding claims and wherein said chassis unit is formed of tubular construction so as to exhibit user sensible flexibility during normal operation.

12. A vehicle according to any of the preceding claims and wherein said driving and steering unit includes a wheel and motor drive means which directly engages the side of the wheel.

13. A vehicle according to any of the preceding claims and wherein said motor drive means include means for direct engagement with the side of a vehicle tire forming part of the wheel.

14. A vehicle according to claim 11 and wherein said wheel and said motor drive means are configured for toothed driving engagement.

15. A vehicle according to any of the preceding claims and comprising means for removable cantilever mounting of a seat on said chassis unit.

16. A vehicle according to claim 3 and wherein said single handle is mounted onto a potentiometer.

17. A vehicle according to claim 3 or 16 and also comprising springs for urging said single handle to a nominal position.

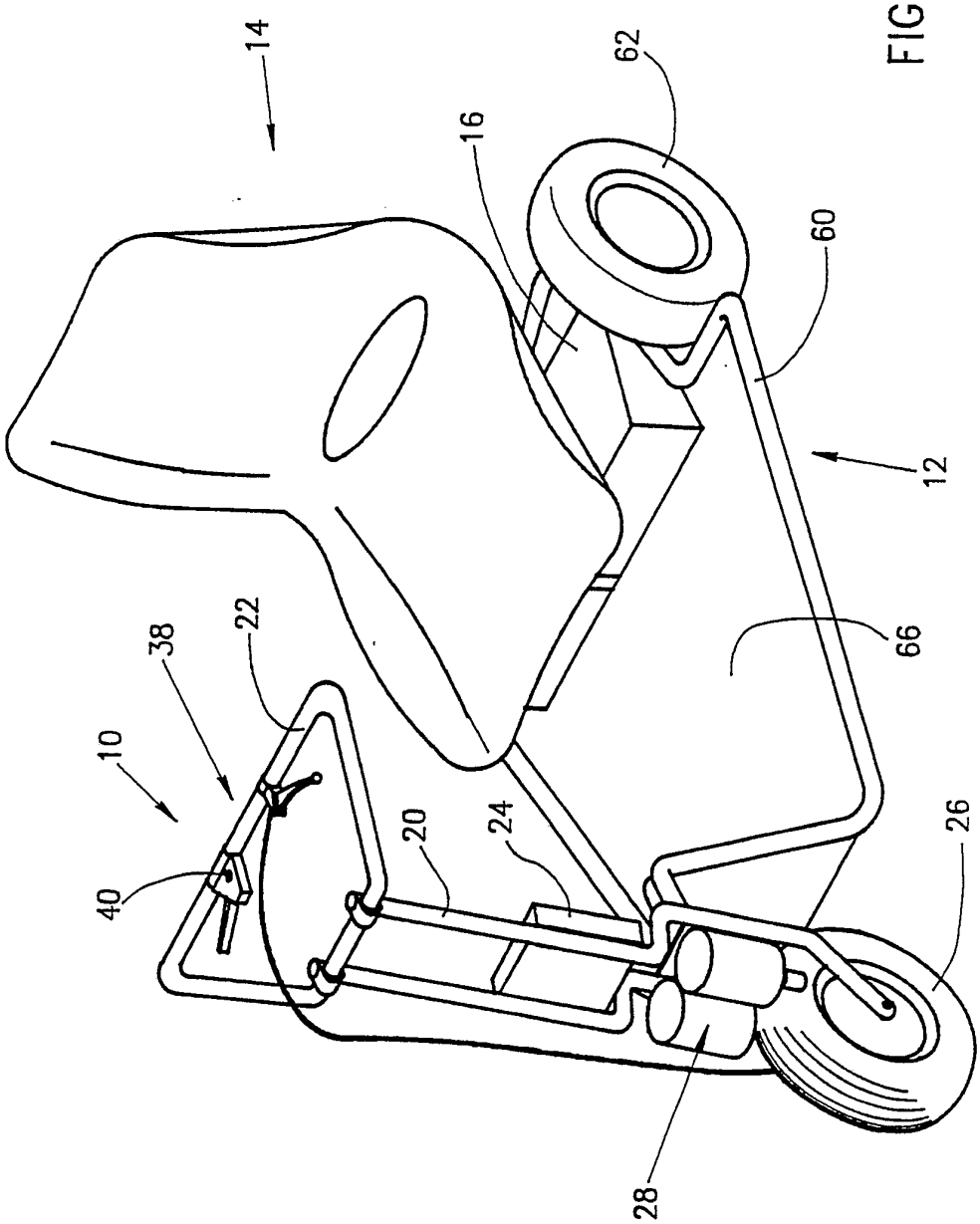
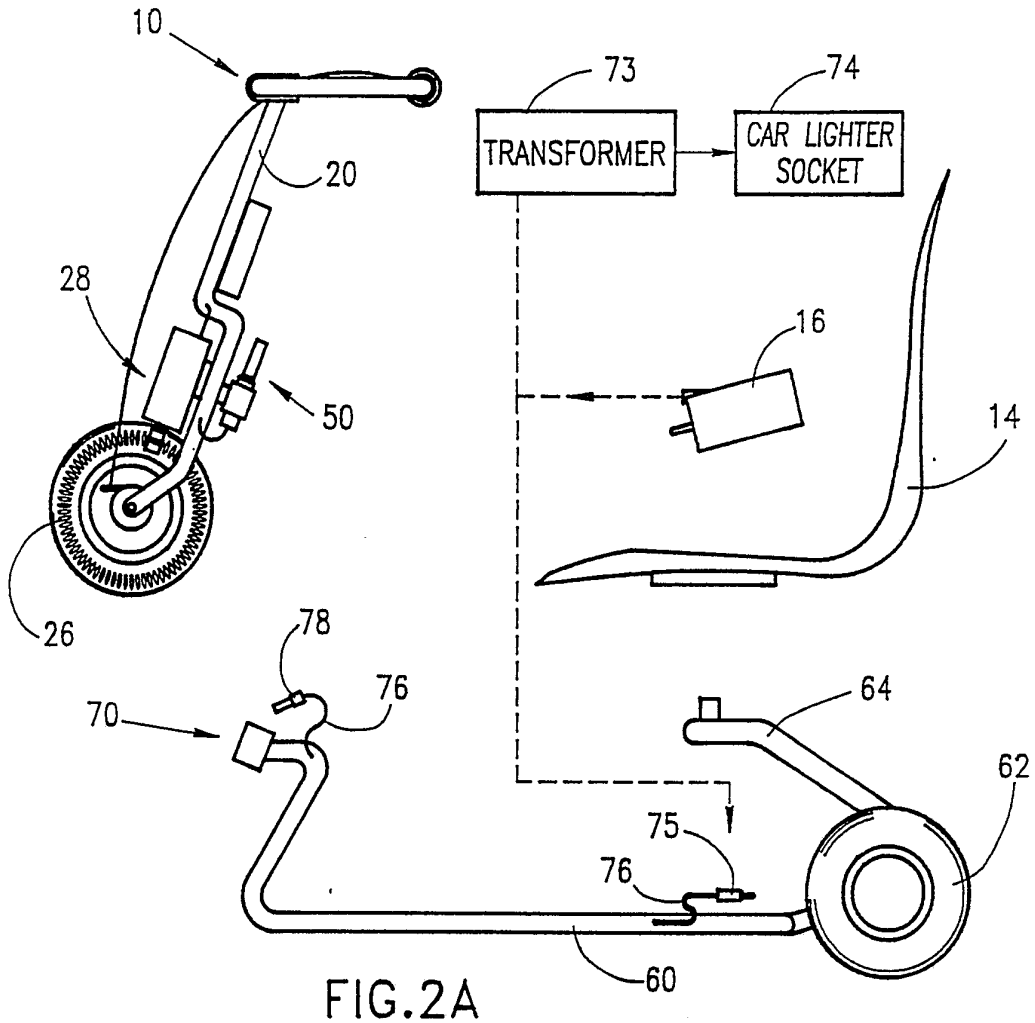


FIG. 1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73
74
TRANSFORMER
CAR LIGHTER SOCKET
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60

FIG.2A

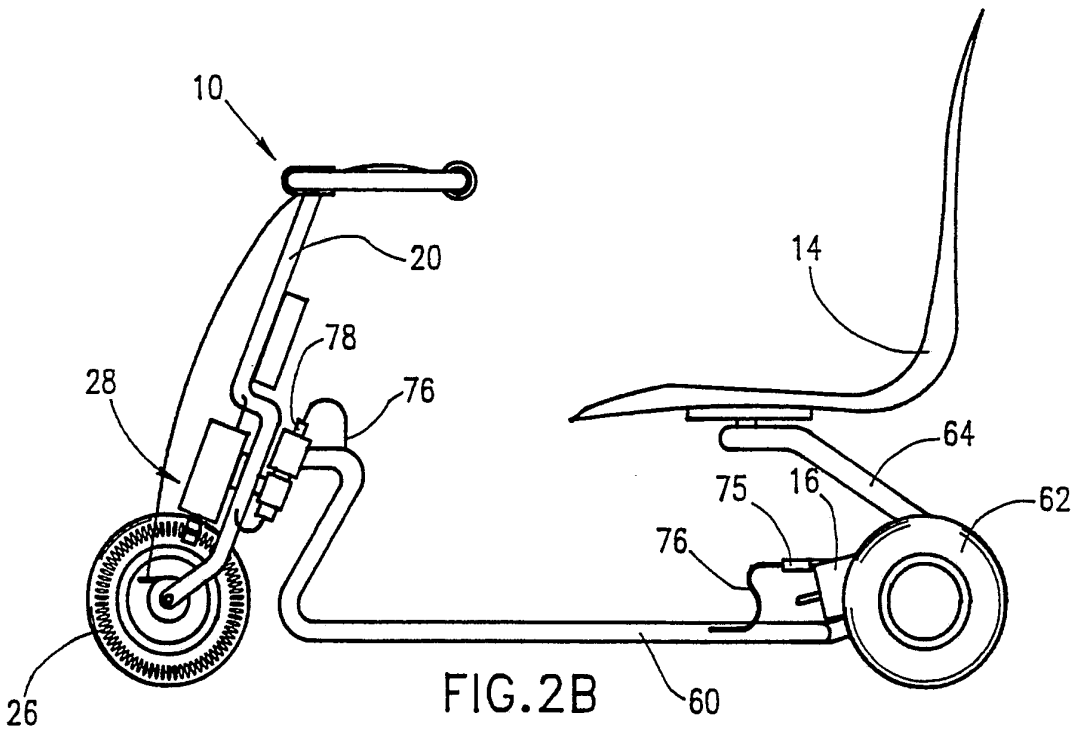
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FIG.2B

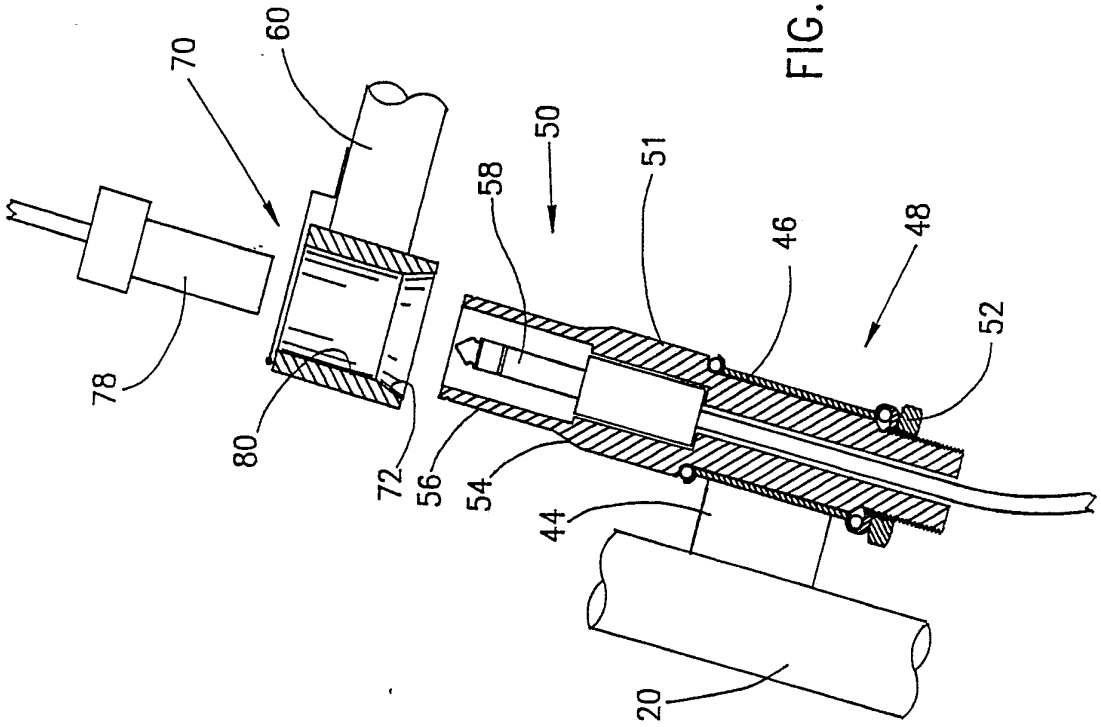


FIG.3A

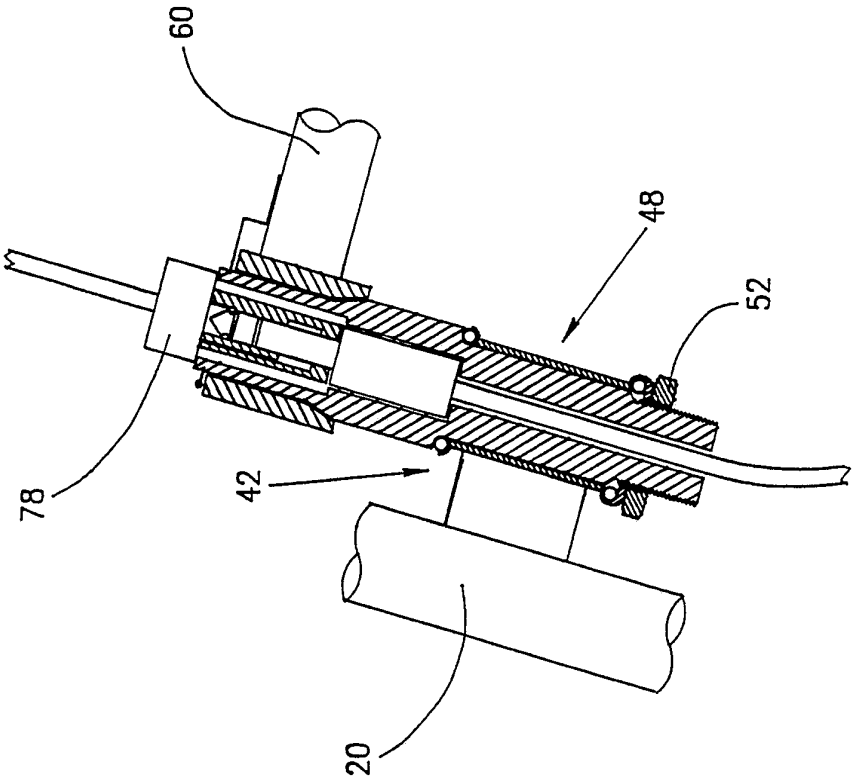


FIG.3B

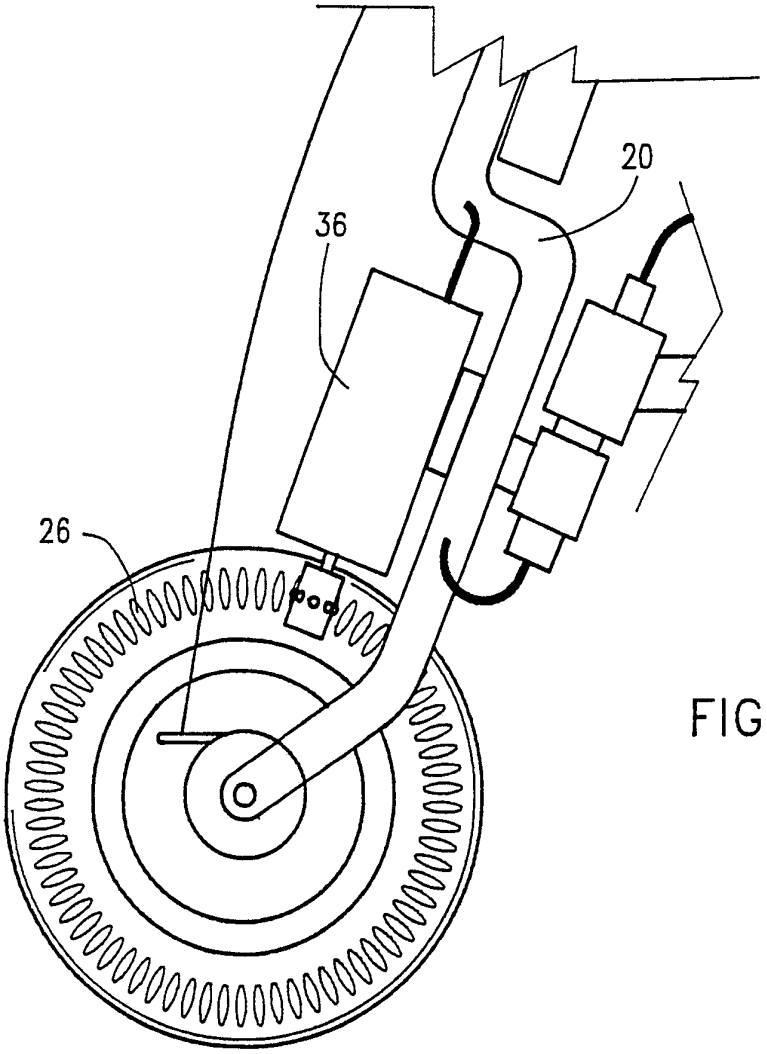


FIG.4

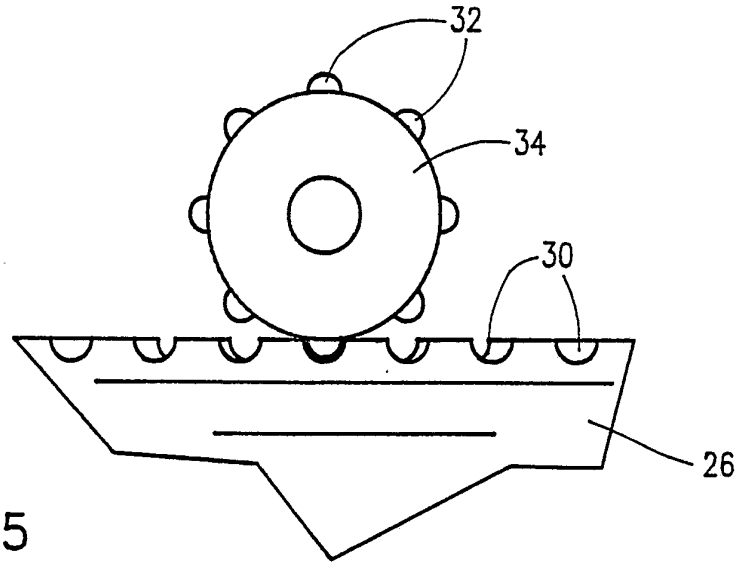
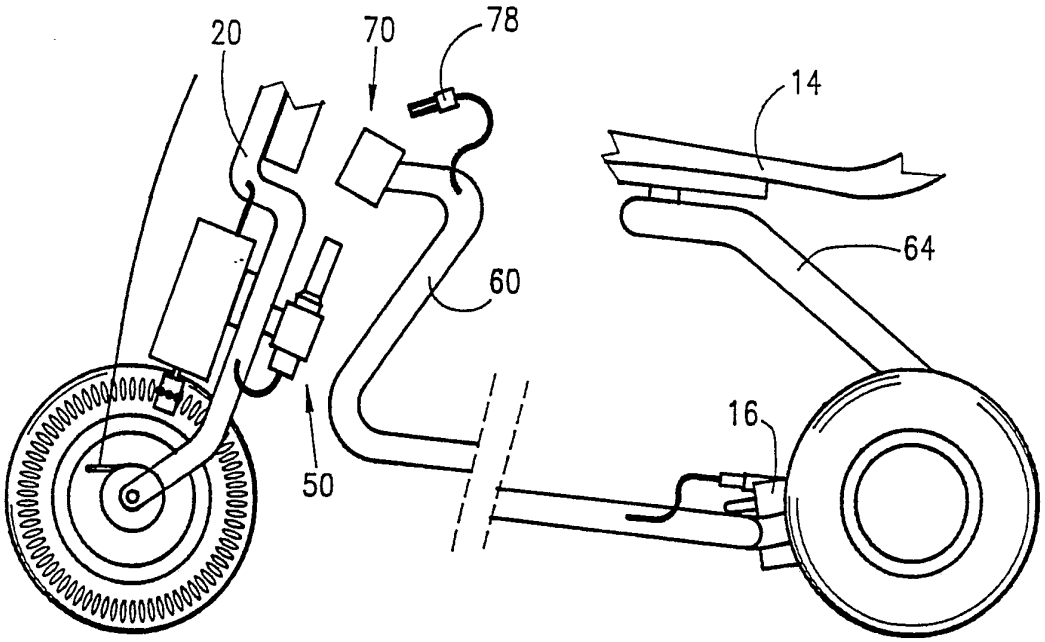


FIG.5

FIG.6A



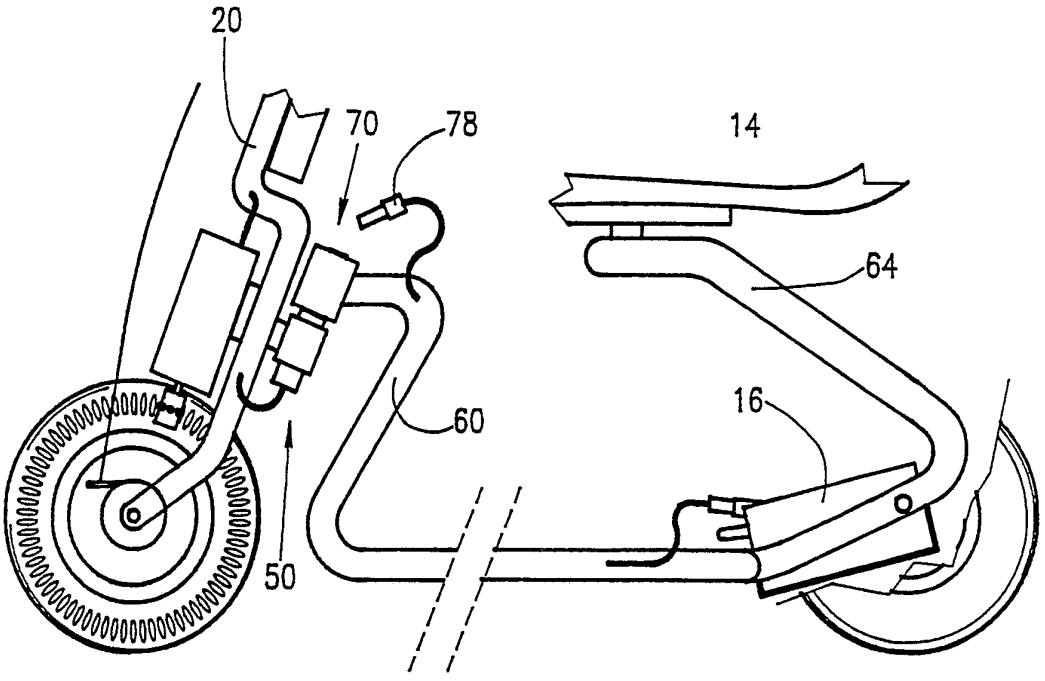


FIG.6B

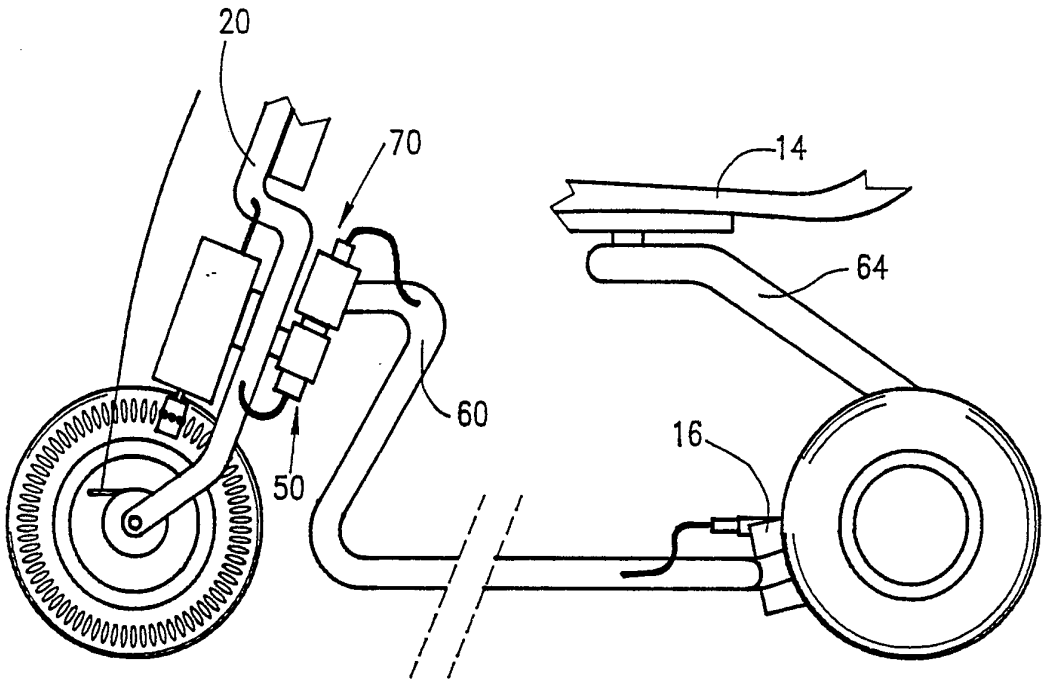


FIG.6C

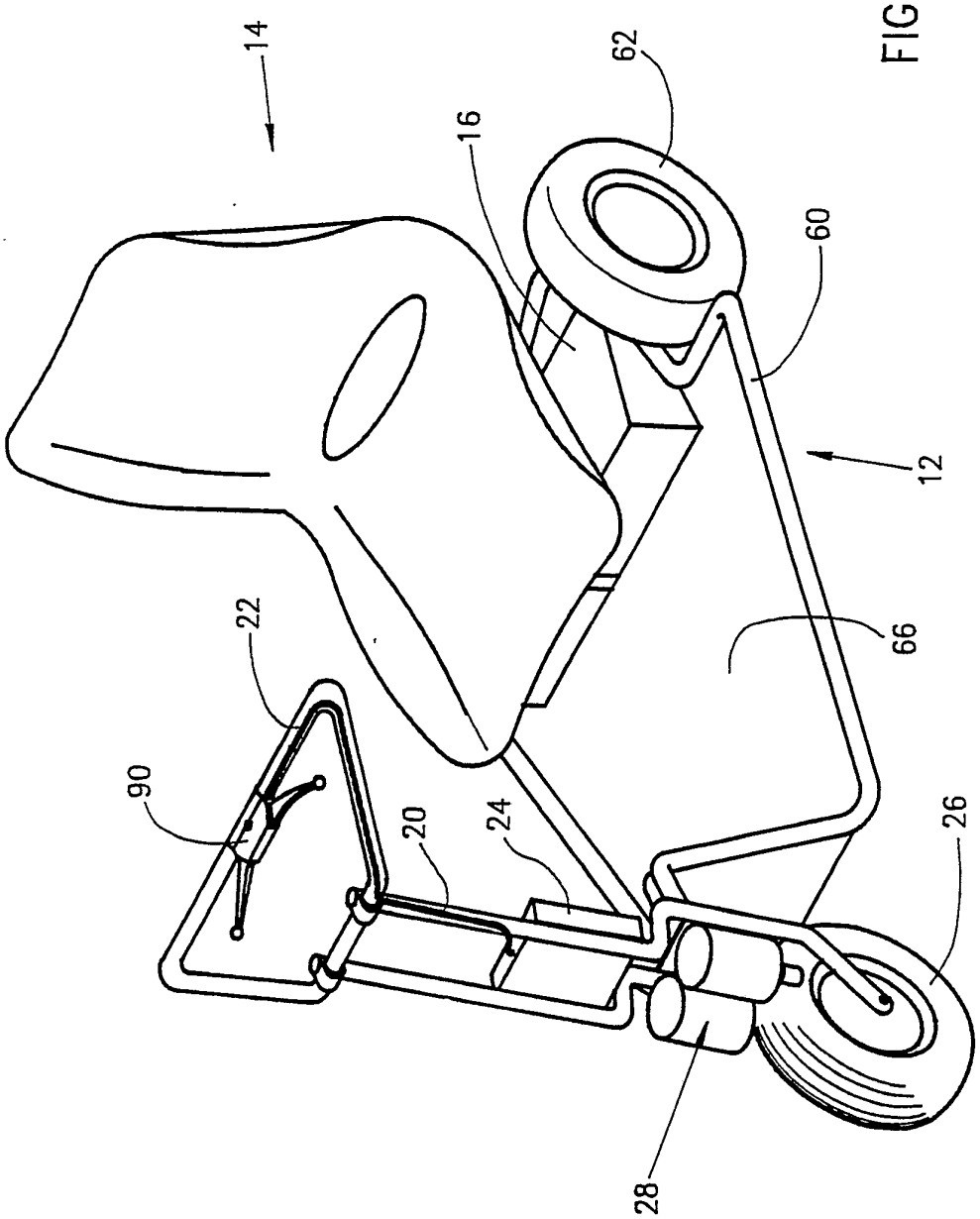


FIG.7

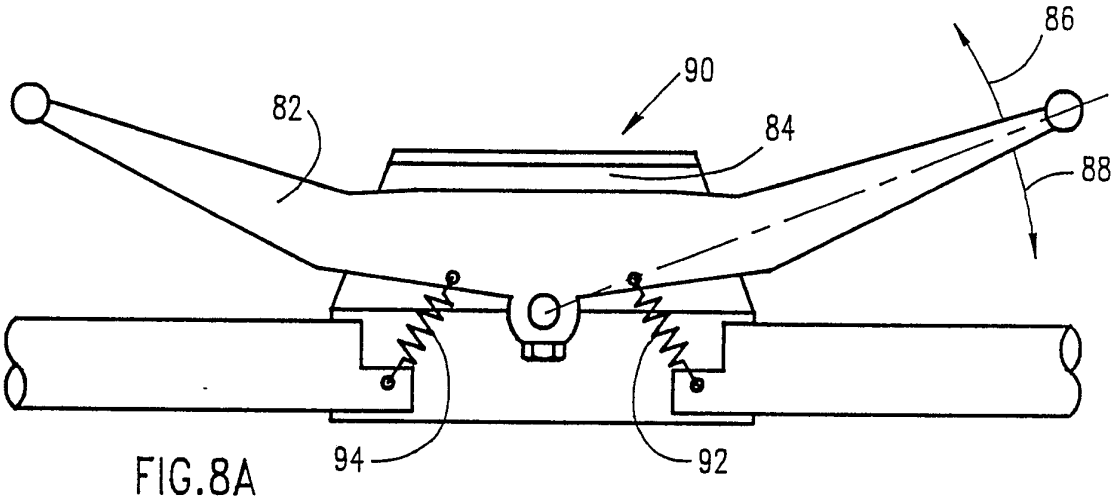


FIG.8A

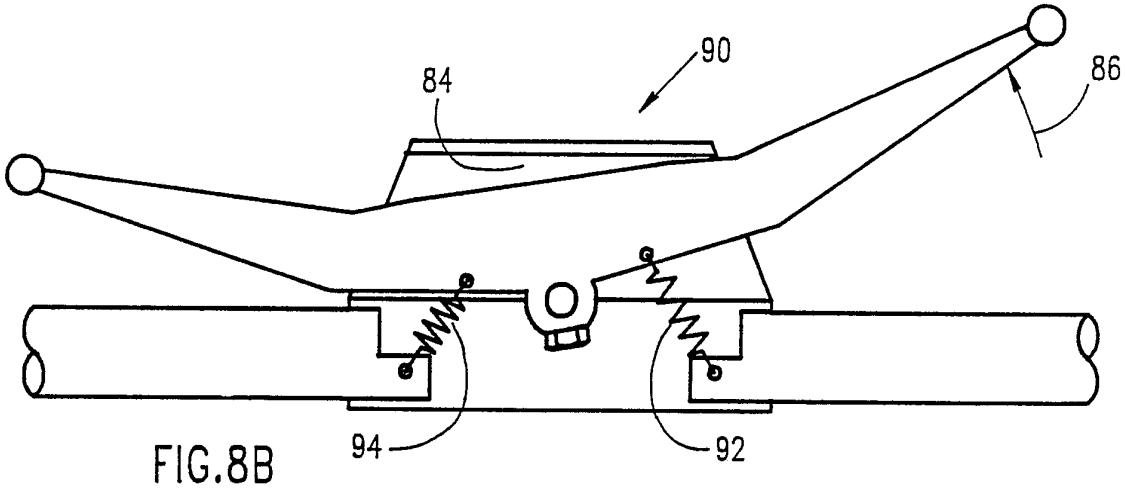


FIG.8B

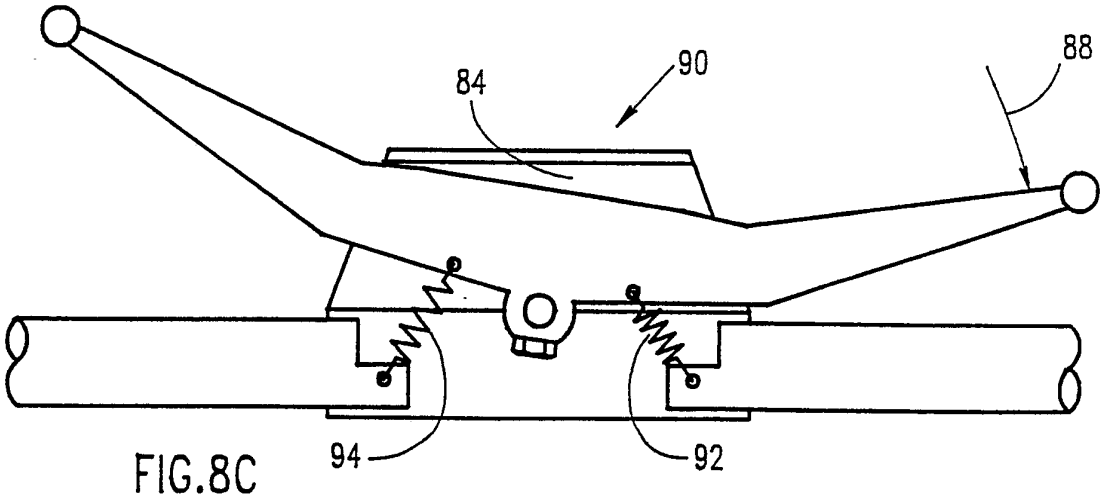


FIG.8C

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US92/04588

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :B62D 61/08, B60K 17/30
US CL :180/214, 208, 252, 65.5, 14.1, 907 280/515, 422
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)

U.S. : 180/211, 213, 210, 65.1, 16, 14.2, 14.3, 280/420, 400, 491.1. 250.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS: Searched VEHICLE and BATTERY and RECHARGE? and LIGHTER and TRANSFORMER and CIGARETTE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	US, A, 5,036,938 (Blount et al.) 06 Aug 1991 See the entire document.	3
X	US, A, 4,283,072 (Deloach, Jr.) 11 Aug 1981 See the entire document.	1,2,4,5
A	US, A, 4,683,236 (Carr et al.) 20 Jan 1987 See the entire document.	
A	US, A, 3,891,044 (Tiede) 24 June 1975 See the entire document.	
A	US, A, 2,892,506 (Slater) 30 June 1959 See col. 2 lines 10-14.	
A	US, A, 4,857,820 (Tompkins et al.) 15 Aug 1989 See col. 2 lines 31-58.	
A	US, A, 4,514,790 (Will) 30 April 1985.	
A	US, A, 4,892,166 (Gaffney) 09 Jan 1990.	
A	US, A, 4,452,327 (Mowat et al.) 05 June 1984.	
A	US, A, 3,513,926 (Paget, Jr.) 26 May 1970.	

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"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
"E"	earlier document published on or after the international filing date	"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
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
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"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 27 AUGUST 1992	Date of mailing of the international search report 04 NOV 1992
Name and mailing address of the ISA/ Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. NOT APPLICABLE	Authorized officer KEVIN HURLEY Telephone No. (703) 308-0233

Form PCT/ISA/210 (second sheet)(July 1992)★

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US92/04588

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☒ Claims Nos.: 6-15
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any addtional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention frist mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.